Self reported fall and associated factors among adult people with visual impairment in Gondar, Ethiopia.

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Abstract

Background

Fall is one of the most common and potentially disabling issues among people with visual impairment. Fall is a major public health problem and the leading cause of unintentional injury, disability and premature death worldwide. Several population based studies have reported poor vision as a frequent risk factor for falls yet large number of studies failed clarify the role of visual impairment in falls. Ethiopia lacked estimates of falls among both normal sighted and visual impaired persons. Therefore, this study aims to determine the prevalence of and visual related factors, other factors associated with falls among adult people with medically diagnosed visual impairment.

Methods

An institutional based cross-sectional study was conducted among visually impaired adults who were attended ophthalmology clinic in University of Gondar comprehensive specialized hospital. Data was collected by interview methods using structured questionnaire, patient record review and physical measurement. A bivariate and multivariable binary logistic regression model analysis was used to identify factors associated with fall. Adjusted Odds Ratio with corresponding 95% Confidence Interval was computed to show the strength of association.

Results

A total of 328 adults with visual impairment participated in the study (97.3% response rate). The age of the participants ranged from 25 to 89 years with mean age of (56.46±14.2 years). The overall cumulative prevalence of self-reported fall among adults with visual impairment was 26.8% with 95%CI (22.0-31.4). The major associated factors of fall identified by multivariate analysis were fear of falling; some concerned: (AOR, 4.12; 95%CI, 1.44-11.76), very concerned fear (AOR, 10.03;
Conclusion

A moderate self-reported prevalence with high rate of fall related injuries was reported adult people with visual impairment participants in this study. The results indicate that strategies to provide fall prevention environment should be developed to reduce this impact of visual impairment and reduce fall and fall related injuries.

Background

Visual impairments have a drastic impact on the physical, psychological, and socio-economically development of individuals and societies[1]. Visual impairment is more prevalent in low and middle income countries (LMICs), about 80% - 90% of the world’s visually impaired people live in LMICs[2]. In Sub-Saharan African countries, including Ethiopia, visual impairment occurred on average in 70 million people[3]. Falls are one of the most common leading cause of unintentional injury and premature death among people with visual impairment[4]. A fall is defined as an event which results in a person coming to rest inadvertently on the ground or floor or other lower level[5].

Globally, falls are a major public health problem. An estimated 646 000 fatal falls occur each year, making it the second leading cause of unintentional injury death, after road traffic injuries[6]. In all regions of the world, fall-related death rates are highest among people with visual impairment and adults over the aged of 50 years. Falls can lead to moderate to severe injuries, fear of falling, loss of independence, and death[7, 8].

The most common factors that may influence fall are age, sex, severity of visual impairment, body mass index, psychosocial, physical environment, depression,
Decreased vestibular reflexes, decreased muscle strength, increasing postural sway, concurrent medical issues fear of fall and pre-existing medical co morbidities directly increases the incidence of falls[9-11].

Our extensive search revealed several population based studies have reported poor vision as a frequent risk factor for falls yet large number of studies lacked clarity on the role of visual related clinical characteristics in falls. Ethiopia lacked estimates of falls among both normal sighted and visual impaired persons. Knowing visual impaired people are at high risk of fall and understanding of factors associated with in this population living in LMICs like Ethiopia is crucial. This study is a preliminary attempt to determine the burden of fall and associated factors among adult people living with visual impairment in Ethiopia. Therefore; this study aims to determine the prevalence and visual related factors, other factors associated with falls among Adult people with medically diagnosed visual impairment in Ethiopia.

Methods

Study design, setting, and participants

An institutional based cross-sectional study was conducted from January to June 2018 among adults with visual impairment who were attending ophthalmology clinic in University of Gondar comprehensive specialized hospital, North West Ethiopia. The study was done at the tertiary eye clinic in the unit of University of Gondar comprehensive specialized hospital. This eye care center provides a comprehensive clinical and community eye health services for eight zones and serves as a major referral center for 14 million people living in North West Ethiopia. It is estimated that a minimum of 4720 patients utilize different eye care service per year. Based on the 2016 population estimate of Gondar city administration bureau had a total
population of 335,000. The study area is geographically a challenging mountain terrain and unsafe sometimes even for normal-sighted people and hazardous for susceptible people like older, physical challenged and people with visual impairment.

Adults with Visual impairment, those who can walk independently with or without mobility aids, aged≥ 18 years with no other hearing disability were included in this study.

Sample size determination and sampling procedure

The sample size was determined using a single population proportion formula using the EpilInfo™ version7.1 Stat calc program based on the assumptions of 50% prevalence, a 95% level of confidence and 5% margin of error and 10% non-response rate. Every day about 40 to 60 patients visit ophthalmology clinic for visual care and consultation. So, the sample were taken from a relatively small population (N = 1500), the final derived sample size was 337 with 10% non response rate.

The study participants were recruited by using Systematic random sampling technique by arranging the patients based on their chart number selected in Kth interval every day. The first patient was selected randomly by a lottery method, and the next patient was interviewed every fourth interval.

The operational definition:

Self-reported fall in the past 12 months was defined as an event which results in person coming to rest unintentionally on the ground or other lower level, not a result of acute illness, at least once in the past 12 months [12]. Visual impairment; significant loss of vision on which Snellen’s chart reading is less than 6/12 to no
light perception, Mild visual impairment; presenting with a visual acuity of less than 6/12(20/40) greater than or equal to 6/18(20/60). Moderate visual impairment; presenting with visual acuity of less than 6/18(20/60) to greater than or equal to 6/60(20/200) and Severe visual impairment is presenting with visual acuity of less than 6/60(20/200) to no light perception[13]

Study procedure

This cross-sectional study was approved by the Gondar University School of Medicine research and ethical review committee (SOM2310706). After providing a verbal account and explaining about this study to the care givers and visually disabled participants, all study subjects signed the written informed consent statement. A structured data collection questionnaire was developed based on extensive review of different literature[14-17]. The questionnaire was initially prepared in English and then translated to Amharic and back to English to check the consistency of the questions and correction were made accordingly. The questionnaire included domains like; socio-demographic characteristics, behavioral characteristics, physical measurements, visual related characteristics, medical co morbidity, and fall related characteristics. In addition the medical charts of the participants were reviewed to extract additional information’s. The questionnaires were orally administered to each patient individually during interview by four trained ophthalmic nurses and the responses of the patient were recorded in the data collection sheet. Factors related to visual impairment, visual acuity measurement, Snellen’s E chart measurement, and medical eye screening reports evaluated by optometrist on the day of data collection was recorded by the data collector. Counter checking of daily filled questionnaire and regular supervision was done by MG and BJ. To minimize the possible response bias; the questions were
read loud in a quiet ambiance following which the participants were told to repeat the question to assure reception of question clearly. Care was taken by data collectors to simplify the questions as much as possible, accompany care givers during self-reporting and explanations were given whenever question arose.

Data processing and analysis

Data were checked for completeness and entered into EPI-Info version 7.1 and then exported to IBM SPSS version 20 statistical software for coding, recoding, storing and further analysis. Descriptive statistics like frequencies, percentages, means, and standard deviations were used for all participant characteristics and factors associated with falls. With self-reported falls in the past 12 months (categorized as: yes versus No) as dependent variable, logistic regression analyses was done to determine the association with different independent variables.

Independent variables included in the regression models were, socio-demographic characteristics (age, gender, residence, marital status, level of education, occupation, income), physical measurements (height, weight, BMI), Behavioral factors (alcohol drink, smoking, physical exercise), Psychosocial factors (fear of falling, social support, depression), Vision related factors (mild vision impairment, moderate vision impairment, severe vision impairment), current level of mobility, comorbid, drug in-take, place of fall, and activity during fall. Multiple regression and interaction terms were employed to examine potential association. Variables were entered into the model using forced entry and categories were used as covariates for detailed analyses. Results were considered statistically significant when 95% confidence intervals not containing unity (equal to p-value < 0.05) for both main effects and interaction terms. Initially, bivariate analyses were conducted and independent variables that were found statistically significant were fitted into
multivariate analysis. The variables were entered into the multivariate model using the backward stepwise (likelihood ratio) method.

Results

**Socio-demographic characteristics**

A total of 328 participants consented and completed the questionnaire with the response rate of 97.3%. This is more than that of the power calculated sample size (n = 307). Nine adults with visual impairment who were selected as sample could not participate in the study due to unwillingness, incomplete medical chart and refusing to take visual acuity taste. The mean age of participants was (56.46 ±14.2) years. About 57.6% respondents were males and 8.8% rural dwellers. More than half of the participants (59.1%) reporting to have no formal schooling, 44.2% were farmers followed by housewife (30.2%). The mean body mass index of the participants’ was 19.94 kg/m² (±2.15). Nearly two third of the participant 70.4% had normal range of BMI (18.5 to 24.9). More than two third of participants 80.8% were able to walk independently without mobility aid (Table1).

Table 1: Socio-demographic characteristics of adults living with visual impairment in Gondar, University Specialized Referral Hospital, 2018 (n = 328).
| Variables       | Frequency | Percent (%) |
|-----------------|-----------|-------------|
| **Sex**         |           |             |
| Male            | 189       | 57.6        |
| Female          | 139       | 42.4        |
| **Age in years**|           |             |
| 18-44           | 78        | 23.8        |
| 45-64           | 144       | 43.9        |
| ≥65             | 106       | 31.5        |
| **Residence**   |           |             |
| Urban           | 135       | 41.2        |
| Rural           | 193       | 58.8        |
| **Marital status** |         |             |
| Not married     | 10        | 3.0         |
| Married         | 261       | 79.6        |
| Divorced        | 31        | 9.5         |
| Windowed        | 26        | 7.9         |
| **Occupation**  |           |             |
| House wife      | 99        | 30.2        |
| Farmer          | 145       | 44.2        |
| Civil servant   | 29        | 8.8         |
| Merchant        | 32        | 9.8         |
| Retired         | 16        | 4.9         |
| Others*         | 7         | 2.1         |

*labour workers, students

**Vision specific characteristics of the participants**

Overall, more than one third 133(40.5%) of the participants were diagnosed with mild visually impaired with Snell’s E-chart reading. Of the participants 63(19.3%) were diagnosed to have sever visual impairment with presenting visual acuity (<6/60 to no light perception). The most common cause of visual impairments in this study participant was glaucoma (46.6%) (table 2)

Table 2: Vision specific characteristics of the participant in Gondar University
The prevalence of fall and its description among adults with visual impairment

In this study 26.8% participants reported to sustained fall in the previous 12 months among which 14.8% reported more than one fallen. Among the fallers 19.1% reported to have used assistive devices during the time of fall. Among the fallers the prevalence of fall in young adults 18–44 years was (18.2%), middle-adults aged 45–64 years was 34(38.6%) and older adult aged above 64 years was
The highest prevalence of fall was reported by adult diagnosed with glaucoma and cataract 37(42.1%), 21(23.8%) respectively. Among the participant who reported fall 63(70.8%) had experienced one or more fall related injuries (Table 3).

Table 3: The self-reported prevalence of fall among adults with visual impairment in Gondar University Specialized Referral Hospital, 2018
| Variables                      | Sex                          | Residence          | Age in years | BMI in kg/m2                           | Marital status                      | Self-reported fear of fall | Severity of impairment  |
|--------------------------------|------------------------------|--------------------|--------------|----------------------------------------|-------------------------------------|---------------------------|--------------------------|
|                                |                              |                    |              |                                        |                                     |                           |                          |
|                                | Yes, n (%)                   | No, n (%)          |              |                                        |                                     |                           |                          |
| Sex                            | Male                         | 46(52.3)           | 143(59.6)    |                                        |                                     |                           |                          |
|                                | Female                       | 42(47.7)           | 97(40.4)     |                                        |                                     |                           |                          |
| Residence                      | Urban                        | 45(51.1%)          | 90(37.5)     |                                        |                                     |                           |                          |
|                                | Rural                        | 43(48.9%)          | 150(63.5)    |                                        |                                     |                           |                          |
| Age in years                   |                              |                    |              |                                        |                                     |                           |                          |
|                                | 18-44                        | 16(18.2)           | 62(30.2)     |                                        |                                     |                           |                          |
|                                | 45-64                        | 34(38.6)           | 110(45.8)    |                                        |                                     |                           |                          |
|                                | >64                           | 38(43.2)           | 68(28.3)     |                                        |                                     |                           |                          |
| BMI in kg/m2                   | Under weight (<18.5)         | 27(30.7)           | 52(21.7)     |                                        |                                     |                           |                          |
|                                | Normal (18.5-24.9)           | 55(62.5)           | 176(73.3)    |                                        |                                     |                           |                          |
|                                | Over weight (25-29.9)        | 6(6.8)             | 7(2.9)       |                                        |                                     |                           |                          |
| Marital status                 | Single not married           | 4(4.5)             | 8(3.3)       |                                        |                                     |                           |                          |
|                                | Married                      | 60(68.2)           | 201(83.7)    |                                        |                                     |                           |                          |
|                                | Divorced                     | 8(9.1)             | 23(9.7)      |                                        |                                     |                           |                          |
|                                | Windowed                     | 16(18.2)           | 8(3.3)       |                                        |                                     |                           |                          |
| Self-reported fear of fall     | Not concerned                | 8(9.1)             | 115(47.9)    |                                        |                                     |                           |                          |
|                                | Somewhat concerned           | 26(29.5)           | 81(33.7)     |                                        |                                     |                           |                          |
|                                | Very concerned               | 54(61.4)           | 47(19.4)     |                                        |                                     |                           |                          |
| Severity of impairment         | Mild visual impairment       | 18(20.4)           | 115(47.9)    |                                        |                                     |                           |                          |
|                                | Moderate visual impairment   | 39(43.3)           | 93(38.7)     |                                        |                                     |                           |                          |
|                                | Severe visual impairment     | 31(35.3)           | 32(13.3)     |                                        |                                     |                           |                          |
Factors associated with self-reported fall

Those participants who had reported some concerned about fear of falling were 4.12 times more likely getting fall as compared to participants not concerned fear of falling (AOR, 4.12; 95%CI, 1.44–11.76). Similarly, respondents those who had reported that they were very worry about fear of falling were 10.03 times more likely to fall as compared to participant had not concerned fear of falling (AOR, 10.03; 95%CI, 3.03–33.21).

The odds of having fall were 4.63 times higher among people who had taken one or more medication as compared to those who were counterpart (AOR, 4.63; 95% CI 2.14-10.00).

Visually impaired people who had depression were 3.46 times more likely to develop fall as compared to the counterpart (AOR, 3.46; 95% CI 1.11–10.79) (Table 4).

Table 4: Factors associated with fall among adults with visual impairment in Gondar University Specialized Referral Hospital, 2018,(n = 328).
| Variables                  | Self-reported fall | COR (95%CI) | AOR (95%CI) |
|---------------------------|-------------------|-------------|-------------|
|                           | Yes | No   |             |             |
| Age(years)                |     |      |             |             |
| 18-44                     | 16  | 62   | 1.19(0.61-2.34) | 0.39(     |
| 45-64                     | 34  | 110  | 2.17(1.09-4.27) * | 0.37(     |
| >64                       | 38  | 68   | 1.00        | 1.00(     |
| Residence                 |     |      |             |             |
| Urban                     | 45  | 90   | 1.00        | 1.00(     |
| Rural                     | 43  | 150  | 0.57(0.35-0.94) * | 0.69(     |
| Fear of falling           |     |      |             |             |
| Not at all concerned      | 8   | 115  | 1.00        | 1.00(     |
| Somewhat concerned        | 26  | 81   | 4.49(1.94-10.43) ** | 4.12(     |
| Very concerned            | 54  | 47   | 16.08(7.11-36.4) ** | 10.0(     |
| Sleep disturbance         |     |      |             |             |
| No                        | 48  | 203  | 1.00        | 1.00(     |
| Yes                       | 40  | 37   | 4.57(2.67-7.89) * | 1.62(     |
| Depression                |     |      |             |             |
| No                        | 76  | 230  | 1.00        | 1.00(     |
| Yes                       | 12  | 10   | 3.6(1.51-8.74) ** | 3.46(     |
| Severity of visual impairment |     |      |             |             |
| Mild                      | 18  | 115  | 0.16(0.08-0.33) * | 1.01(     |
| Moderate                  | 39  | 93   | 0.43(0.23-0.79) * | 1.11(     |
| Severe                    | 31  | 32   | 1.00        | 1.00(     |
| Medication intake         |     |      |             |             |
| No                        | 32  | 190  | 1.00        | 1.00(     |
| Yes                       | 56  | 50   | 6.65(3.89-11.35) ** | 4.63(     |
| Diabetes mellitus         |     |      |             |             |
| No                        | 74  | 234  | 1.00        | 1.00(     |
| Yes                       | 14  | 6    | 7.38(2.42-19.88) * | 1.64(     |
| Hypertension              |     |      |             |             |
| No                        | 72  | 231  | 1.00        | 1.00(     |
| Yes                       | 16  | 9    | 5.7(2.42-13.45) * | 1.85(     |

Note: *variables significant with p-value ≤ 0.01; ** variables significant with p-value ≤ 0.05; 1=reference category; COR= crude odds ratio; AOR= adjusted odds ratio; CI= 
Discussion

The findings of this study showed that the overall prevalence of fall among visually impaired adult people were 26.8% with 95%CI (22.0–31.4). This implies that falls were public health problem, common reason for hospital trip in fall related fracture, injuries and the main cause of disability among visually impaired people. This finding in lines with the study conducted in USA, 28.9% [18], Salisbury, Maryland, 27.8% [19], Cape town, South Africa, 26 % [20] and Ibadan, Nigeria 23% [21]. In this study the prevalence of fall increased with age in 18–44 years aged group the prevalence of fall was 18.2% in young adult 45–64 years 38.6% and in older adult age greater than 64 years 43.2%. Similarly the study conducted in Latino, USA the prevalence of fall 18% in 18–44 years age, 21% in 45–64 years and 35% in older adults age greater than 64 years [9]. This could be due to physiological change related to age, when the age was increased severity of visual impairment increased, muscle and bone become deteriorated and weak so easily vulnerable for fall and fall related injuries [22].

However, our study found to be lower when compared to studies conducted in USA 57.9% [23] and Sweden 38 % [24]. This difference might be due to the difference in study area, methodology and the severity of visual impairments in participant. The study that were conducted in Sweden was community-based survey and most of the participants were had mild visual impairment and older age because the life expectancy among developed country were high but our study was institutional based and the possible reason might be the difference in sample size and variability of the study participant.
However, this finding is higher than other studies conducted elsewhere, in Malay, Singapore14.7%[25]; in Blue Mountain eye study, Australia16.1%[26], and in prospective longitudinal study in Hong Kong, China 19.3%[27]. The possible reason for this discrepancy might be the difference in sample size, study design, methods and economical and lifestyle variation. The other possible reason might be variation in rate of eye care service and health related facility.

The study revealed that fear of falling was an independent predictor of feature falling. This finding was supported with Salisbury, Maryland study[4, 19]. This suggests that fear of falling is not just an acute outcome that results from a fall; rather, it is likely recognition of being at risk and fear of falling leads fall and vice versa. This could be due to fear of falling develop activity limitation, decrease the quality of life of the individual, loss of confidence, depression, result institutionalization and decrease physiological function leads to high risk of fall and falling[28].

Taking one or more medication was also found to be one of the factors associated with fall among visual impairment people in this study. This finding was supported by the study done in Salisbury, Maryland[19], and another cross sectional study found that medication were significantly associated with fall among older adult[29]. Adverse effect of the medications, drug-drug interaction, metabolic effect of the drug on the body and some antidepressants and antipsychotics can also cause fall secondary to orthostatic hypotension. In addition drug that reduces the blood pressure or slows the heart can cause falls[29, 30].

This study showed that depression contributes to fall risk is consistent with the documented association between depression and disability and depressive symptoms were associated with a two-fold risk of an adverse fall event during the...
patient’s episode of care. The findings suggested that depression prevention is an appropriate target for fall prevention intervention[8, 31]. This could be depression causes dependence, social exclusion and decrease functional mobility and antidepressant drug causes fall among depressant.

Generally, the finding indicates that a moderate self-reported prevalence falls with high rate of fall related injuries was reported by people with visual impairment participants in this study. The results indicate that strategies to provide fall prevention environment should be developed to reduce this impact of visual impairment and reduce fall and fall related injuries among visually impaired adults. Fear of falling, medication and depression were the main determinant of fall among adult people with visual impairment. For the benefits of future researches there are some noteworthy limitations. First, falls were self-reported with recall period of 12 months and potential recall bias was minimized by excluding participants with mild cognitive impairment. Second, confounders, unmeasured or unknown factors (societal or lifestyle) could have influence on the findings.

List of abbreviation

AOR = Adjusted Odds Ratio, BMI = Body Mass Index, CI = Confidence Interval, COR = Crude Odds Ratio, CSA = Central Statistical Agency, CVD = Cardio Vascular Disease, DM = Diabetes’ Mellitus, FMOH = Federal Minster of Health, HTN = Hypertension, LMIC = Lower and Middle-Income Countries, OR = Odds Ratio, TBI = Traumatic Brain Injuries, UOGH = University of Gondar Hospital, USA = United State of America, VI = Visual Impairment, and WHO = World Health Organization.

Declarations
Ethics approval and consent to participate

Ethical clearance was obtained from the ethical review committee of the University of Gondar, College of Medicine and Health Sciences, from the school of medicine. After informing the purpose, benefits, risk, the confidentiality of the information and the voluntary nature of participants in the study, consent were obtained from each of the participants, for participants with severe visual impairment and illiterate the consent form was read for them. Name and personal identifiers were not included in the questionnaire. The Participants involvements in the study were on a voluntary basis and respondents were informed to refuse or stop at any point of the interview.

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Consent for publication

Not applicable

Authors' contributions

MG wrote the proposal, coordinated the data collection activity, analyzed the data and drafted the paper. BJ, AM, GJ, and KS revise the proposal and participated in the data collection, analysis and manuscript writing. All authors read and approved the final manuscript.

Availability of data and material

Data will be available upon request from the corresponding author.

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**Competing interests**

Authors declare that they have no conflict of interest.

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