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Visually significant cataract and associated factors among older people attending a community ophthalmic service in central Gondar Zone, Northwest Ethiopia: a cross-sectional study

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Abstract

Objective: In this study, we aimed to determine the prevalence of visually significant cataract and associated factors among older people attending community ophthalmic services in the central Gondar Zone, Northwest Ethiopia.

Methods: We conducted a community outreach-based cross-sectional study among adults aged ≥40 years in the central Gondar Zone from 30 May to 15 June 2021. We used systematic random sampling to select study participants. Interviewer-administered questionnaires and ocular examinations were performed and the data recorded. We applied binary logistic regression to identify factors associated with visually significant cataract.

Results: A total of 821 participants were included, with median age 57 years. The prevalence of visually significant cataract was 29.1% (95% CI: 26.1–32.0). Age ≥80 years (adjusted odds ratio [AOR] = 16.9; 95% CI: 7.5–38.4), rural residence (AOR = 1.7; 95% CI: 1.02–2.7), unmarried status (AOR = 1.9; 95% CI: 1.2–3.2), illiteracy (AOR = 2.9; 95% CI: 1.4–6.1), unemployed

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status (AOR = 1.7; 95% CI: 1.1–2.7), and sunlight exposure ≥5 hours per day (AOR = 1.6; 95% CI: 1.04–2.4) were significantly associated with visually significant cataract.
Conclusion: In this study, visually significant cataract was found to be high, which requires immediate public health intervention.

Keywords
Visually significant cataract, older people, central Gondar zone, Northwest Ethiopia, community ophthalmic service, public health

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Introduction

According to the World Health Organization (WHO), cataract is defined as clouding of the lens of the eye that prevents clear vision.[1] Globally, cataract is the leading cause of avoidable blindness, and 65.2 million people are visually impaired owing to cataract.[2] The burden of cataract is higher in older populations, with 15.2 and 78.8 million people aged ≥50 years who are blind or have moderate to severe visual impairment owing to cataract, respectively.[3]

A systematic review showed that cataract is a public health problem in Sub-Saharan Africa, accounting for more than 46% of cases of blindness.[4] In Ethiopia, cataract is the main cause of blindness and low vision, contributing to 49.9% of blindness and 42.3% of low vision cases.[5] Community and institutionally based studies conducted in Ethiopia have revealed that the prevalence of cataract ranges from 9.7% to 57%.[6–8]

Evidence shows that cataract is associated with older age, female sex, diabetes, sunlight exposure, smoking, and low socioeconomic status.[8–11] Individuals with visually significant cataract experience deterioration of visual acuity, loss of contrast sensitivity, difficulty with glare, and altered color discrimination. These conditions affect patients' ability to perform daily tasks, leading to reduced quality of life.[12–14] Studies conducted in different countries have reported that the cost of treatment, distance to eye care services, waiting until the cataract is mature, fear of cataract surgery, lack of awareness about cataract, lack of an escort, and perception of no need for cataract surgery are the main barriers to treating cataract.[15–20]

Despite cataract being a public health problem in Ethiopia and a common finding in clinical practice and at community eye care services, there is little evidence on the magnitude and associated factors of visually significant cataract in the country, and that which is available is outdated. In addition, none of the available evidence covers our study area. Thus, the main objective of this study was to determine the prevalence and associated factors of visually significant cataract among older people attending community ophthalmic services in central Gondar Zone, Northwest Ethiopia, 2021. This study will provide new information for stakeholders to design appropriate strategies and mobilize resources to reduce the burden of visually significant cataract in Ethiopia.

Methods

Study design and area

We conducted a community outreach-based cross-sectional study among older people in

Chuahit and Tekledingay in the central Gondar Zone of Northwest Ethiopia from 30 May to 15 June 2021. Tekledingay is a town in Lay Armachiho district, 767 kilometers from Addis Ababa. Chuahit is a town in Dembiya district and is located 783 kilometers from Addis Ababa. According to a University of Gondar Tertiary Eye Care and Training Center report, 293,927 individuals received eye care services in outreach programs from 2008 to 2019. Services included cataract extraction, trichiasis surgery, refraction with optical correction, and medical therapy.

Study population and sampling

All individuals aged ≥40 years who attended community ophthalmic services were the source population and all individuals aged ≥40 years who attended the selected community ophthalmic services sites were the study population.

All adults aged ≥40 years who attended the selected community ophthalmic service sites during the study period were included in the study. Eligible adults with an active ocular infection and ocular injury at presentation were excluded from the study.

The sample size was determined using the single population proportion formula, with an expected proportion of visually significant cataract of 50%, 95% confidence level, and 5% desired precision, a design effect of 2, and 10% non-response rate. According to these parameters, the final calculated sample size was 845.

A multistage sampling technique was used to select the study sample. Using a simple random sampling technique, two catchment districts with community ophthalmic services were selected from among nine catchment districts in the central Gondar Zone. Proportional allocation was applied to the selected community ophthalmic service sites to select the study sample. Through systematic random sampling, 821 study participants were selected from a total of 3500 older people who attended the community ophthalmic service sites during the data collection period.

Operational definitions

A cataract was defined as any opacity of the crystalline lens in the pupillary area. In this study, visually significant cataract was defined as having a cataract in one or both eyes with visual acuity less than or equal to 6/60 in the cataractous eye, and cataract as the primary cause of visual impairment in that eye.

Post-operative visual acuity was categorized as normal (visual acuity ≥6/18), borderline (visual acuity <6/18 to ≤6/60), or poor (visual acuity <6/60), according to the WHO criteria for postoperative visual acuity.[21]

In this study, smokers were defined as individuals who smoked at least one cigarette per day.

Regarding awareness about cataract, participants who responded "yes" to the question "Have you ever heard about cataract?" were considered to be aware of cataract. Participants who responded "yes" to the question "Have you ever heard about cataract surgery?" were considered to be aware of cataract surgery.

Participants who were exposed to sunlight for 5 hours or more per day were considered exposed whereas those with sunlight exposure less than 5 hours per day were considered non-exposed.

Study participants' age groupings were categorized as 40–49, 50–59, 60–69, 70–79, and ≥80 years.[8] Current marital status was categorized as unmarried (single, divorced, or widowed) and currently married.

Data collection procedures

Four trained, senior optometrists participated in the data collection. Data were

collected using a pre-tested, structured questionnaire combined with an ocular examination. The questionnaire covered sociodemographic characteristic, behavioral factors, medical and ocular history, and barriers to the uptake of cataract surgery. A history of diabetes and hypertension were assigned for participants who had a confirmed previous diagnosis of diabetes or hypertension and were presently taking the respective medications.

Visual acuity was tested in each eye using the Snellen eye chart at 6 meters. A pen torch, 2.5× magnifying loupe, and direct ophthalmoscope were used to detect the presence of cataract and to confirm cataract as the primary cause of vision loss.

Data quality assurance and analysis

Data quality was controlled using a pre-tested structured questionnaire. Data collectors received training and an optometrist provided supervision during data collection. The completeness of the data was checked onsite during the data collection and data entry period by the principal investigators.

After data collection, the collected data were coded and entered into EPI Info version 7 and then exported into IBM SPSS version 20 for analysis (IBM Corp., Armonk, NY, USA). Descriptive statistics such as mean, median, and frequency were calculated. Additionally, the analysis was performed using binary logistic regression.

All variables with a P-value <0.2 in the bivariable analysis were entered into a multivariable binary logistic regression model to determine statistically significant predictors for the occurrence of visually significant cataract. The strength of association was computed with an adjusted odds ratio (AOR) with a 95% confidence interval (CI). Multicollinearity was checked using variance inflation factor and tolerance. The fitness of the model was assured using the Hosmer–Lemeshow goodness-of-fit test. Variables with a P-value < 0.05 in multivariable binary logistic regression were considered statistically significant.

The reporting of this study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) cross-sectional reporting guidelines.[22]

Ethical approval

This study was conducted in accordance with the principles laid down in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethical Review Board of the University of Gondar, College of Medicine and Health Sciences, School of Medicine. Written informed consent was obtained from all study participants after explaining the purpose of the study. Participants were informed about their right to withdraw from the study at any time during the interview and examination. The selected study participants received no incentive and were not exposed to any risk. The privacy and confidentiality of study participants were ensured by avoiding the use of personal identifiers in data collection tools, and the data were locked with a password.

Study participants with significant visual impairment owing to lens-induced and post-operative complications were immediately referred to the University of Gondar tertiary eye care and training center for further investigation and management.

Results

A total of 821 adults participated in this study, with a response rate of 97.2%. The age range for participants was 40 to 91 years, and 486 (59.2%) were men. Among the total study participants, 508 (61.9%) were rural dwellers and 665 (81%) were

married. Seventy-four percent of study participants were illiterate (Table 1).

Among the total, 47 (5.7%) and 40 (4.9%) participants had a known history of hypertension and ocular injury, respectively. Most (68.8%) study participants had never had an eye examination in their lifetime (Table 2).

The overall prevalence of cataract in this study was 37.1% (95% CI: 34.1–40.2) and the prevalence of visually significant cataract was 29.1% (95% CI: 26.1–32.0). Among the 821 study participants, 79 (9.6%; 95% CI: 7.4–11.8) had a history of prior cataract surgery. Among 79 patients who had undergone prior cataract surgery, 27 (34.2%) had poor visual acuity (Table 3).

Visually significant cataract was more prevalent in participants aged ≥80 years (57.8%), those living in a rural area (37.8%), and among men (29.6%) (Table 4).

In bivariable logistic regression analysis, age, residence, marital status, educational status, occupational status, monthly income, health insurance, sunlight exposure, use of spectacles, history of eye examination, and history of prior cataract surgery were positively associated with visually significant cataract. However, multivariable binary logistic regression analysis indicated that age, residence, marital status, educational status, occupational status, and sunlight exposure were significantly associated with visually significant cataract, as detailed below (Table 5).

According to AOR values, the risk of developing visually significant cataract for those participants aged 60–69, 70–79, and ≥80 was 8.2 times (95% CI: 4.3–15.8), 13.7 times (95% CI: 6.9–27.2), and 16.9 times (95% CI: 7.5–38.4) greater, respectively, than the risk among participants aged 40–49 years ($P < 0.0001$).

Participants with rural residences were 1.7 times more likely to develop visually significant cataract than urban residents (95% CI: 1.02–2.7; $P = 0.04$). Participants who were unmarried were 1.9 times more likely to develop visually significant cataract than their married counterparts (95% CI: 1.2–3.2; $P = 0.008$).

The odds of visually significant cataract were 2.9 times higher for illiterate participants as compared with participants who were literate (95% CI: 1.4–6.1; $P = 0.004$). Unemployed participants were 1.7 times more likely to have visually significant

Table 1. Sociodemographic and economic characteristics of study participants attending community ophthalmic services in central Gondar Zone, Northwest Ethiopia (N = 821).

Variable	Frequency	Percent
Age (years)		
40–49	254	31.0
50–59	185	22.5
60–69	162	19.7
70–79	156	19.0
≥80	64	7.8
Sex		
Male	486	59.2
Female	335	40.8
Residence		
Rural	508	61.9
Urban	313	38.1
Current marital status		
Currently unmarried	156	19.0
Currently married	665	81.0
Educational status		
Illiterate	607	73.9
Literate	214	26.1
Occupational status		
Employed	527	64.2
Unemployed	294	35.8
Monthly income (Ethiopian birr)		
≤1000	402	49.0
1001–2000	247	30.0
≥2001	171	21.0
Health insurance		
Yes	288	35.1
No	533	64.9
Had an escort		
Yes	680	82.8
No	141	17.2

Table 2. Past ocular history and behavioral characteristics of older people attending community ophthalmic services in central Gondar Zone, Northwest Ethiopia (N = 821).

Variable	Frequency	Percent
History of diabetes mellitus		
Yes	27	3.3
No	794	96.7
History of hypertension		
Yes	47	5.7
No	774	94.3
History of ocular injury		
Yes	40	4.9
No	781	95.1
History of eye examination		
None	565	68.8
Within the past 2 years	173	21.1
More than 2 years earlier	83	10.1
Use of spectacles		
Yes	49	6.0
No	772	94.0
History of ocular self-medication		
Yes	46	5.6
No	775	94.4
Use of traditional medication		
Yes	24	2.9
No	797	97.1
Sunlight exposure (hours per day)		
<5	493	60.0
≥5	328	40.0
Smoking cigarettes		
Yes	6	0.7
No	815	99.3

cataract than those who were employed (95% CI: 1.1–2.7; P < 0.01).

Participants who were exposed to sunlight ≥5 hours per day were 1.6 times more likely to have visually significant cataract than those with <5 hours per day of sunlight exposure (95% CI: 1.04–2.4; P = 0.03) (Table 5).

The main barriers to treating cataract reported by study participants were the cost of cataract surgery (30.1%) followed by waiting until the cataract is mature (25.5%) and distance to eye care services (14.7%) (Table 6).

Table 3. Prevalence of cataract, visually significant cataract, and prior history of cataract surgery among older people attending community ophthalmic services in central Gondar Zone, Northwest Ethiopia (N = 821).

Characteristic	Frequency	Percent
Cataract in either eye		
Yes	305	37.1
No	516	62.9
Laterality of cataract (n = 305)		
Unilateral	81	26.6
Bilateral	224	73.4
Visually significant cataract in either eye		
Yes	239	29.1
No	582	70.9
Laterality of visually significant cataract (n = 239)		
Unilateral	65	27.2
Bilateral	174	72.8
History of prior cataract surgery		
Yes	79	9.6
No	742	90.4
Laterality of prior cataract surgery (n = 79)		
Unilateral	53	67.1
Bilateral	26	32.9
Presenting visual acuity (PVA) with prior cataract surgery		
Normal vision (PVA ≥ 6/18)	27	34.2
Borderline (PVA < 6/18 to ≤ 6/60)	25	31.6
Poor vision (PVA < 6/60)	27	34.2
Awareness about cataract (n = 305)		
Yes	127	41.6
No	178	58.4
Awareness about cataract surgery (n = 305)		
Yes	127	41.6
No	178	58.4

Discussion

In the current study, the overall prevalence of cataract among adults aged ≥40 years was 37.1% (95% CI: 34.1–40.2). This result was higher than the prevalence in studies conducted in Abeshge and Kebena districts in central Ethiopia (9.7%),[6] Merhabete in North Shoa, Ethiopia (11.4%),[7] Nigeria (19.8%),[23] India

Table 4. Age-, sex-, and residence-specific prevalence of cataract and visually significant cataract among older people attending community ophthalmic services in central Gondar Zone, Northwest Ethiopia.

Variable	Visually significant cataract (n = 239) Frequency (%)	Cataract (n = 305) Frequency (%)	Prior cataract surgery (n = 79) Frequency (%)
Age (years)			
40–49	15 (5.9)	20 (7.9)	2 (0.8)
50–59	34 (18.4)	52 (28.1)	6 (3.2)
60–69	68 (42.0)	88 (54.3)	21 (13.0)
70–79	85 (54.5)	103 (66.0)	32 (20.5)
≥80	37 (57.8)	42 (65.6)	18 (28.1)
Sex			
Male	144 (29.6)	177 (36.4)	52 (10.7)
Female	95 (28.4)	128 (38.2)	27 (8.1)
Residence			
Rural	192 (37.8)	237 (46.7)	59 (11.6)
Urban	47 (15.0)	68 (21.7)	20 (6.4)

(24.9%),[24] Sweden (29.2%),[11] Poland (12.1%),[25] and China (23.1%).[26] This discrepancy could be attributed to differences in sociodemographic characteristics of the study populations as well as differences in study settings and availability and accessibility of cataract surgical services in the study areas. However, the prevalence in our study was lower than those in reported in Debre Markos Hospital, Ethiopia (57%),[8] Tamil Nadu (62.8%),[27] and Russia (44.6%).[28] These differences might be owing to variations in the study populations, sample sizes, and study areas. For instance, most participants in studies conducted in Tamil Nadu and Russia were aged ≥50 years. With increased age, the occurrence of cataract also increases. Moreover, the study in Tamil Nadu was conducted in a rural community and most participants were women. Evidence shows that the burden of cataract is more prevalent among rural residents and women owing to limited access to cataract surgical services and poor awareness about cataract and its management.

The prevalence of visually significant cataract in this study was 29.1% (95% CI: 26.1–32.0), which was lower than that reported in South Africa (44%).[29] This might be attributable to characteristics of the study population and study setting. The study in South Africa was conducted in a remote rural community with limited access to cataract surgical services. However, our prevalence was remarkably higher than the rates reported in Singapore (10.6%),[30] Sri Lanka (14.6%),[31] Indigenous Australia (4.2%),[32] and the United States (1.92%).[33] The possible reasons for the different findings include the availability and accessibility of eye care services that provide cataract surgery and differences in the operational definition of cataract.

In the current study, the prevalence of visually significant cataract was significantly associated with age and increased with older ages. For instance, participants aged ≥60 years were 8.2 times more likely to have visually significant cataract. This finding is supported by studies done in Debre Markos Hospital, Ethiopia,[8] Kenya,[34] South Africa,[29] Sri Lanka,[31] Indigenous Australia,[32] and Russia.[28] With older age, oxidative damage to the lens protein could increase

Table 5. Factors associated with visually significant cataract among older people attending community ophthalmic services in central Gondar Zone, Northwest Ethiopia (N = 821).

Variables	Visually significant cataract		COR (95% CI)	AOR (95% CI)	P-value
	Yes	No			
Age (years)					**<0.0001**
40–49	15	239	1.00	1.00	
50–59	34	151	3.6 (1.9–6.8)	3.1 (1.6–6.0)	
60–69	68	94	11.5 (6.3–21.2)	8.2 (4.3–15.8)	
70–79	85	71	19.1 (10.4–35.1)	13.7 (6.9–27.2)	
≥80	27	37	21.8 (10.6–44.9)	16.9 (7.5–38.4)	
Residence					**0.04**
Rural	192	316	3.4 (2.4–4.9)	1.7 (1.02–2.7)	
Urban	47	266	1.00	1.00	
Current marital status					**0.008**
Currently unmarried	58	98	1.6 (1.1–2.3)	1.9 (1.2–3.2)	
Currently married	181	484	1.00	1.00	
Educational status					**0.004**
Illiterate	226	381	9.2 (5.1–16.5)	2.9 (1.4–6.1)	
Literate	13	201	1.00	1.00	
Occupational status					**<0.01**
Employed	141	386	1.00	1.00	
Unemployed	98	196	1.4 (1.1–1.9)	1.7 (1.1–2.7)	
Monthly income (Ethiopian birr)					**0.26**
≤1000	156	246	5.4 (3.2–9.2)	0.7 (0.3–1.4)	
1001–2000	65	182	3.1 (1.7–5.4)	0.9 (0.5–2.0)	
≥2001	18	154	1.00	1.00	
Health insurance					**0.37**
Yes	102	186	1.6 (1.2–2.2)	1.2 (0.8–1.7)	
No	137	396	1.00	1.00	
Sunlight exposure (hours per day)					**0.03**
<5	116	377	1.00	1.00	
≥5	123	205	2.0 (1.4–2.6)	1.6 (1.04–2.4)	
Use of spectacles					**0.27**
Yes	4	49	1.00	1.00	
No	235	537	4.9 (1.8–13.8)	2.0 (0.6–6.6)	
History of eye examination					**0.56**
None	143	422	1.00	1.00	
Within past 2 years	70	103	2.0 (1.4–2.9)	1.2 (0.7–1.9)	
More than 3 years earlier	26	57	1.3 (0.8–2.2)	0.8 (0.4–1.7)	
History of prior cataract surgery					**0.39**
Yes	43	36	3.3 (2.1–5.3)	1.3 (0.7–2.5)	
No	196	546	1.00	1.00	

CI, confidence interval; COR, crude odds ratio; AOR, adjusted odds ratio.

owing to prolonged sunlight exposure and a reduced level of antioxidant nutrients.[35]

The prevalence of visually significant cataract was higher among rural residents (37.8%) than urban ones (15%). Rural residents were 1.7 times more likely to have visually significant cataract than those with urban residence. A study in India[36]

Table 6. Barriers to uptake cataract surgery among study participants with visually significant cataract, Northwest Ethiopia (N = 239).

Reason	Frequency	Percent
Cost of cataract surgery	72	30.1
Waiting until the cataract is mature	61	25.5
Distance to eye care services	35	14.7
Lack of an escort	24	10.1
One eye has adequate vision so perceives no need for treatment	19	7.9
Lack of time owing to running family business	17	7.1
Other*	11	4.6

*Includes transportation (n = 4), fear of surgery (n = 3), able to perform daily activities with the condition (n = 2), and taking traditional medicine (n = 2).

reported similar findings. Individuals living in a rural area have poorer access to cataract surgery and their activities of daily living might not require high visual acuity, leading to late presentation to eye care services and an increased burden of cataract. However, studies conducted in China[37] and Taiwan[38] reported that urbanization was a significant factor in the development of cataract. This controversial finding requires further research focused on the impact of residence on cataract development.

In our study, unmarried participants were 1.9 times more likely to have visually significant cataract than their married counterparts. This finding is in line with studies conducted in Debre Markos Hospital,[8] South Africa,[29] and multicenter studies in Kenya, the Philippines, and Bangladesh.[39] Unmarried status (widowed, divorced, and single) could lead to visually significant cataract owing to a lack of social support and having poor information concerning eye care services, including cataract surgery.[40] This finding suggests that unmarried individuals require a multidisciplinary approach to reduce the burden of cataract.

The current study findings indicated that the odds of visually significant cataract were 2.9 times greater in illiterate participants than literate ones. Studies in India,[24] Sri Lanka,[31] and Singapore[30] have reported similar findings. Illiterate individuals may have low detailed visual demands in performing daily living activities, which contributes to delayed uptake of cataract surgery. Illiterate individuals might also have poor awareness about cataract and cataract surgery, and they may have high sunlight exposure owing to working conditions.

Similarly, unemployed participants were 1.7 times more likely to have visually significant cataract than those who were employed. This result is in agreement with results of a study in South Africa.[29] Unemployed individuals might have less income and be less able to afford the costs of eye care services as well as limited access to information about cataract in the workplace.

Participants with $\geq$5 hours per day of sunlight exposure were 1.6 times more likely to have visually significant cataract than those exposed to fewer than 5 hours per day of sunlight. This finding is consistent with those of studies conducted in Taiwan,[38] Taizhou City, China,[41] and the United States.[10] Sunlight can cause cataract as a result of damage to the crystalline lens epithelium cells by triggering the release of free radicals. This finding indicates that reducing sunlight exposure through different mechanisms is important to prevent visual disability owing to cataract.

Our study findings were representative of the target population; however, the study design was cross-sectional so the actual cause of visually significant cataract could be determined according to our data. Wealth index evaluation was not used to assess the effect of income. As a result, the AOR estimation might have less predictive value.

In this study, the prevalence of visually significant cataract was high in the study population, which requires immediate public health intervention. Age, residence, marital status, educational status, occupational status, and sunlight exposure $\geq$5 hours per day were significantly associated with visually significant cataract. The main barriers to cataract surgery reported by study participants were the cost of surgery, waiting until the cataract is mature, and distance to eye care services. Our findings indicate that effort is needed to raise public awareness about cataract and its management, provide adequate cataract surgery with an affordable cost, and design appropriate strategies for the provision of regular vision screening for populations with low socioeconomic status.

Authors' contributions

MT, AK, GT, and MB contributed to the conception, acquisition, and organization of data; MT supervised data collection, data analysis, data interpretation, and developed the manuscript. All authors took part in critically revising the article for important intellectual content.

Data sharing statement

All necessary data are included in the manuscript; if needed, supporting data are available on request.

Declaration of conflicting interest

The authors declare that no conflict of interest.

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