



Research Article

Glaucoma Awareness and Associated Factors in an Eye Hospital in Khartoum, Sudan

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Abstract

Background: Glaucoma is one of the leading causes of irreversible blindness worldwide and its early detection and management can reduce the prevalence of visual impairment. The present study aims to assess the level of awareness about glaucoma in patients and co-patients attending an eye hospital in Khartoum State, Sudan.

Methods: A cross-sectional study was conducted from June to December 2021 on a convenience sample of 220 participants aged 18 to 71. Data were collected using a standardized research tool, summarized numerically (mean, standard deviation, median) and graphically (frequency tables) through SPSS 23, and their reliability was measured through Cronbach's Alpha tests before generating the scores of knowledge and awareness. A logistic regression analysis assessed the factors associated with glaucoma awareness.

Results: Glaucoma awareness was low (9.1%), despite its presence in 3.2% of the study population, highlighting a significant knowledge gap. Awareness of glaucoma was strongly associated with the knowledge that glaucoma is the leading cause of blindness ($P = 0.004$) and patients with glaucoma ($P = 0.02$). Despite their contribution to the model prediction based on eight explanatory variables, education level and area of residence were not statistically significant ($P < 0.05$).

Conclusion: This study showed that awareness about glaucoma was low among the Sudanese population. Therefore, it appeals to health authorities and eye care professionals, in partnership with their communities, to promote information about glaucoma to prevent blindness and improve the quality of life of those affected.

Keywords: glaucoma, public health, awareness, irreversible blindness, visual impairment

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1. Introduction

Glaucoma is a major cause of irreversible blindness worldwide and is characterized as a group of ocular disorders including raised intraocular pressure (IOP) and progressive and asymptomatic optic nerve atrophy [1, 2]. There are two major types of glaucoma: primary-open angle (POAG) and closed-angle glaucoma (CAG). POAG is the most frequent type of glaucoma and has a high prevalence in the African population, needing proper and immediate long-term care prevention and treatment [2–4]. Global estimates of visual impairment show glaucoma to be responsible for about 8% of blindness worldwide [5]. Tan et al. found that approximately 34% of patients with glaucoma experienced significant visual loss because of their late diagnosis due to a lack of community awareness about the consequences of this disorder [6, 7]. Although Glaucoma can affect anyone, some can be predisposed to this condition due to factors such as their family history, advanced age, African race, being male, systematic vascular diseases, blunt ocular trauma, uveitis, chronic use of steroids, diabetes, high hyperopic refractive errors, thin corneal thickness, and low body mass index [1, 8, 9].

Quigley and Broman have reported approximately 60.5 million people with glaucoma in 2010 and predicted the figure to increase to 79.6 million by 2020. They concluded that glaucoma is the second leading cause of blindness universally, disproportionately affecting women and the Asian population [10]. A geographical variation in the burden of glaucoma was reported by various authors [10, 11]. In African Americans, 1 out of 50 aged 40 years and older had glaucoma, one million of whom were not aware of their condition [11]. While developing countries harbored about

90.0% of preventable blindness, Africa accounted for 15% of blindness due to glaucoma [3, 5]. More specifically in Sudan, glaucoma was the first cause of irreversible blindness and the second cause of preventable blindness after cataracts [12, 13].

Previously published studies reported that eye care services in underdeveloped countries are low. At the same time, the number of individuals who have bilateral blindness due to glaucoma is projected to increase [1, 13, 14]. Many authors reported an increased awareness of the effect of glaucoma on patients' quality of life (QOL). Numerous investigators have assessed QOL in glaucoma patients and shown the disease's significant effects on their lives [15, 16]. Early detection and timely treatment significantly prevent blindness from glaucoma [17, 18]. Community knowledge, attitudes, and awareness regarding glaucoma are significant in identifying undetected cases and improving treatment compliance. Implementing a screening program for those at risk and encouraging people to seek regular eye examinations and take their prescribed medication are some of the methods of glaucoma prevention, which are also strongly connected to people's level of awareness about the disease [18–20].

Many previously published studies have assessed the level of people's awareness about glaucoma, with the number ranging from 8.3% (North Indian rural areas) to 74.0% (Ghana) [21–26]. These studies revealed some of the factors affecting people's knowledge of glaucoma such as their level of education, family history of glaucoma, age, economic status, sex, type of occupation, chronic diseases like diabetes and hypertension, and having eye examinations. Studies conducted in Sudan about this topic have been few and have had many limitations. Since glaucoma commonly affects African people and Sudan is a part of this

community, raising awareness about the early diagnosis and treatment of glaucoma and the importance of regular eye examination could reduce the severe effects of this condition on the Sudanese community. Thus, the present study aimed to assess the awareness of glaucoma among patients and co-patients attending an eye hospital in Khartoum State to raise the community's awareness of glaucoma.

2. Materials and Methods

A cross-sectional study using a convenient sample was conducted between June and December 2021 at Al-Neelain University Eye Hospital, Gabra, Khartoum, Sudan, to collect data and assess the level of awareness of glaucoma and associated factors.

2.1. Inclusion and exclusion criteria

The study included 220 adult patients or co-patients, both genders, aged 18–71, attending the eye hospital during the study period, able to understand the survey language, and providing informed consent. Exclusion criteria included individuals of other nationalities, medical students or practitioners, and those who declined or withdrew their consent.

2.2. Data collection and analysis

Data were collected through a pretested standardized research tool developed in Arabic for easy understanding of the research variables. The information collected included the characteristics of the patients and their knowledge, practice, and management of glaucoma. Data were computerized through the Statistical Package

for Social Sciences (SPSS) 23, Chicago, IL, USA. Descriptive statistics were performed to summarize the data numerically and graphically. The reliability of the responses of the participants was assessed through a Cronbach's Alpha test before creating the score of knowledge. Association among categorical variables was determined through chi-square tests. A binary logistic regression was performed to determine the relationship between awareness of glaucoma and associated factors. All statistical tests were considered statistically significant ($P < 0.05$).

3. Results

3.1. Characteristics of the participants and their knowledge of glaucoma

Of the 220 participants, the majority (84.5%) lived in Khartoum State while the remaining (15.5%) were from Blue Nile, El Gezira, Kassala, River Nile, Southern Darfur, Southern Kordofan, and White Nile (Figure 1). They were predominately male (68.6%) within the age range of 18–71 years, with an average age of 36 and a mean of 47.4 ± 11.3 years. Overall, 119 (54.2%) had received college or other higher education, and only 10 (4.5%) had not attended formal schooling, as shown in Table 1.

The majority of the participants (75.9%) had heard about glaucoma as an eye disorder, while the rest (24.1%) reported that they had not heard about glaucoma. Of those who knew about glaucoma, 150 (89.8%) reported getting the information from television, 37 (22.2%) from eye care professionals, 36 (21.6%) from patients with glaucoma, 34 (20.4%) from the radio, and 22 (13.2%) from magazines. Other sources of knowledge were the internet (8.4%) and posters or leaflets (1.6%). One male patient had heard about glaucoma from his child and another on "the street."

Participants were asked whether they knew about the symptoms of glaucoma. The majority (78.6%) responded with a “no” and the rest (21.4%) reported that they knew the signs of glaucoma. However, almost half (48.2%) of the participants knew that glaucoma can happen without symptoms (asymptomatic), as shown in Table 1. The patients were then asked if they had glaucoma at the time of data collection. Most participants (96.8%) responded with a no, as they attended the hospital for other conditions, and only 7 (3.2%) respondents were glaucoma patients. Of the 220 patients, 28 (12.8%) had a family history of glaucoma, whereas 140 (63.6%) and 52 (23.6%) respectively did not have or did not know about a family history of glaucoma.

3.2. Risk factors associated with glaucoma reported by the study participants

Participants were asked to provide the risk factors of glaucoma using four items. The answers to each of the three items (hereditary, diabetes, and cataract) were coded as “yes,” “no,” and “do not know.” The fourth item related to the age group at risk of glaucoma had four mutually exclusive answers which were “children,” “youth,” “over 40 years,” and “do not know.”

Figure 2 compares the glaucoma risk factors as reported by the participants – 50 (22.7%) participants reported that glaucoma can be hereditary, 68 (30.9%) reported that diabetes can lead to glaucoma, and 67 (30.5%) thought that cataracts may cause glaucoma. More than half of the participants (151 or 68.6%) identified those over 40 years of age as having a higher risk of developing glaucoma.

The consistency of answers to the four items mentioned earlier was tested through a Cronbach's

Alpha test, which showed its validity between 0.70 and 0.95. We found a value of Cronbach's Alpha of 0.73, meaning that these responses were consistent and reliable. Based on the Cronbach's Alpha test results, the four items were recoded into a new variable labeled “knowledge of risk factors.” This variable was obtained by summing up the four items by coding the correct answers to each item as “1” and the wrong responses as “0.” Consequently, the awareness of risk factors scores ranged from 0 to 4 with a mean score of 1.5 ± 1.3 . Using this score, two categories were created: those who reported all four items marked as “knew the risk factors of glaucoma,” and others who marked as “did not know the risk factors.” Overall, 20 participants (9.1%) knew the risk factors of glaucoma and 200 participants (90.9%) did not.

3.3. Glaucoma management from the perspective of the study population

The participants were asked four questions. The first question related to whether glaucoma is treatable. The respondents answered “yes,” “no,” and “do not know.” The second and third questions were about self-prevention from developing glaucoma and performing regular ophthalmological follow-ups. Those two questions were answered as “yes” or “no.” Those who replied with a “no” to having regular follow-ups were asked to provide the reasons.

Of the 220 participants, 110 (50.0%) responded that glaucoma has a treatment whereas 31 (14.1%) believed the opposite (Table 2). The majority (75.5%) of the participants did not know how to prevent the development of glaucoma and more than half (65.5%) of them did not have a regular ophthalmological checkup. For 28 (19.6%) participants, the lack of health services in their area

Table 1: Characteristics of the study population and their knowledge about glaucoma ($n = 220$).

Variable	Number	%
Age (in yrs; $n = 220$)		
18–35	109	49.5
≥ 36	111	50.5
Median	36	
Min–Max	18	71
Gender ($n = 220$)		
Male	151	68.6
Female	69	31.4
Education level ($n = 220$)		
College and above	119	54.2
High school	63	28.6
Primary school	28	12.7
Illiterate	10	4.5
Residence ($n = 220$)		
Khartoum	186	84.5
Other states	34	15.5
Family history of glaucoma		
Yes	28	12.8
No	140	63.6
Do not know	52	23.6
Knowledge of glaucoma signs/symptoms ($n = 220$)		
Yes	47	21.4
No	173	78.6
Glaucoma could be asymptomatic ($n = 220$)		
Yes	59	26.8
No	55	25.0
Do not know	106	48.2
Having or not from glaucoma ($n = 220$)		
Yes	7	3.2
No	213	96.8

of residence and for 19 (13.3%) financial barriers to accessing health services were the challenges for a regular checkup. More than half of the participants (58.0%) reported having an eye check when needed.

An awareness score for the management of glaucoma was created. First, the first three questions were recoded as “1” when the respondents replied “yes” and any other responses (do not know and no) were coded as “0.” The obtained

awareness score related to the management of glaucoma ranged from 0 to 3. This score was grouped into “aware” and “not aware.” The respondents who scored 3 out of 3 for the three questions were the “aware” group and the “not aware” were those with less than 3. Overall, 12 (5.5%) participants were aware that glaucoma can be managed, whereas 208 (94.5%) were classified as not aware (Table 2).

Table 2: Treatment and awareness about the management of glaucoma (*n* = 220).

Variable	Number	%
Glaucoma has treatment (<i>n</i> = 220)		
Yes	110	50.0
Do not know	79	35.9
No	31	14.1
Know how to prevent glaucoma (<i>n</i> = 220)		
No	166	75.5
Yes	54	24.5
Regular routine eye exam (<i>n</i> = 220)		
No	144	65.5
Yes	76	34.5
Reasons for not doing routine eye exams regularly (<i>n</i> = 143)		
Just in need	83	58.0
No services in the area	28	19.6
Lack of economic resources	19	13.3
Others	13	9.1
Awareness of glaucoma management (<i>n</i> = 220)		
Not aware	208	94.5
Aware	12	5.5
Awareness toward glaucoma (<i>n</i> = 220)		
Unaware	200	90.9
Aware	20	9.1

Table 3: Logistic regression model predicting awareness based on characteristics and history of chronic disease.

Variable	B	Wald	df	P-value	Odds Ratio	95% CI for OR	
						Lower	Upper
Age	0.024	1.336	1	0.248	1.024	0.984	1.066
Gender	0.462	0.721	1	0.396	1.587	0.546	4.611
Residence	-0.273	0.138	1	0.71	0.761	0.18	3.216
Education level	0.032	0.01	1	0.922	1.032	0.549	1.942
Having glaucoma	-1.964	3.971	1	0.046	0.14	0.02	0.968
Having diabetes	-0.62	1.068	1	0.301	0.538	0.166	1.744
Glaucoma can lead to blindness	2.276	8.084	1	0.004	9.734	2.028	46.729
Family history of glaucoma	0.047	0.005	1	0.942	1.048	0.294	3.745
constant	-0.493	0.025	1	0.873	0.611		

3.4. Relationship between awareness of glaucoma and knowledge and practices

Awareness of glaucoma was studied as a binary variable. It combined two variables: (i) being aware

of risk factors and (ii) knowing that glaucoma can be managed. In conclusion, 20 (9.1%) participants were aware, and 200 (90.9%) were unaware of glaucoma (Table 2).

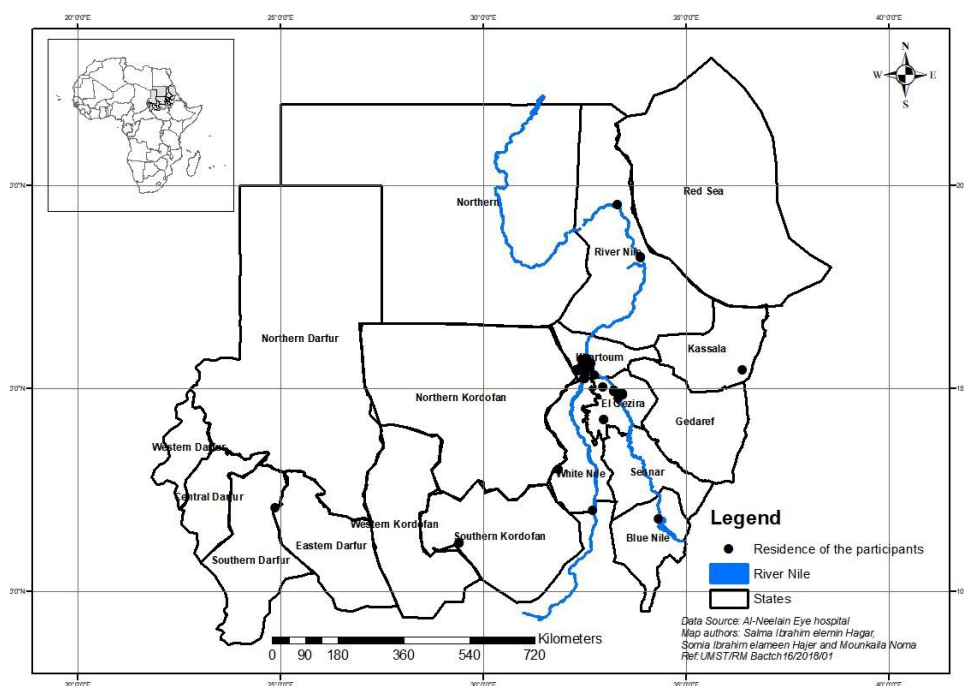


Figure 1: Geographical distribution of the study participants ($n = 220$).

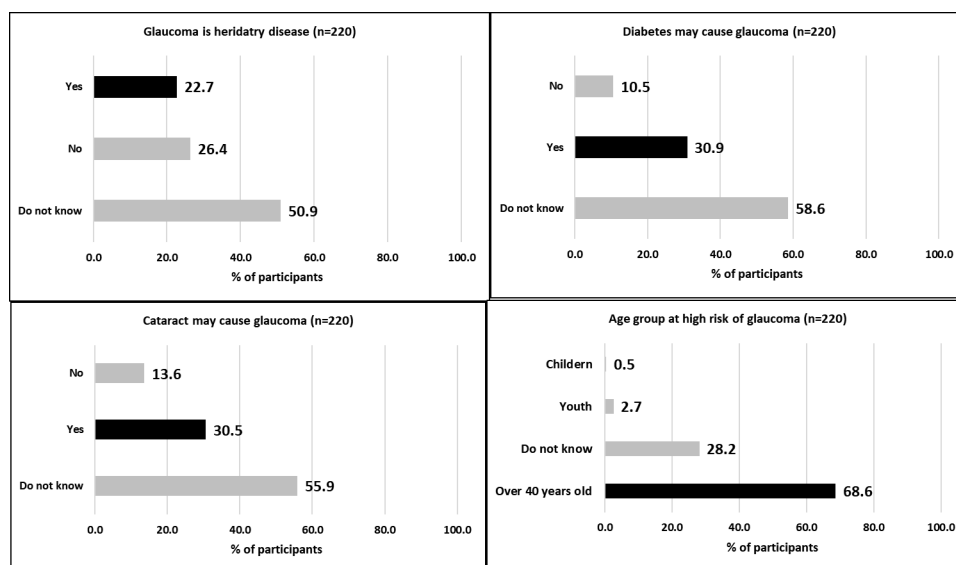


Figure 2: Glaucoma risk factors reported by the study participants ($n = 220$). The black bar indicates correct answers, and the grey bar represents wrong answers.

A logistic regression analysis was performed to determine the awareness of the study population based on a set of eight explanatory variables. With an overall reliability of 90.9%, the model predicted glaucoma awareness. Knowing that glaucoma can lead to blindness and having glaucoma were the statistically significant contributors to

the model, with P -values of 0.004 and 0.046, respectively. Knowing that glaucoma can lead to blindness explained the awareness 9.7 times (95% OR: 2.028–46.729). Having glaucoma contributes to the model by -1.964 , which means those not having glaucoma were not aware of the condition. The other explanatory variables were

not statistically significant as shown in Table 3, but they contributed to the model. Participants living outside Khartoum State and those who reported not having diabetes were less aware of glaucoma with the contributions of -0.273 and -0.62 , respectively. The proposed model calls up a multicenter study to be validated and help establish a program to raise awareness about glaucoma.

4. Discussion

Glaucoma is a major cause of irreversible visual impairment in underdeveloped countries. Recently, the condition has been recognized as the leading cause of ocular morbidity and needs urgent attention from the government, nongovernment organizations, and eye care professionals. Increasing the awareness and improving attitudes of the community toward glaucoma could lead to seeking regular eye examinations and help with the early detection and treatment of the disorder [27]. The present study investigated the level of awareness toward glaucoma and associated factors in Sudanese people. Our findings showed that awareness of glaucoma among Sudanese people was low and was strongly associated with the knowledge that glaucoma is the leading cause of blindness ($P = 0.004$) and patients with glaucoma ($P = 0.02$). Education level and residence were not statistically significant ($P < 0.05$). Our findings revealed that 9.1% of the study participants were aware of glaucoma, higher than the reported 1.89% in North India and 0.32% in rural India [15, 28]. According to numerous studies in Nigeria, Central India, Ethiopia, Nepal, and Ghana, the level of awareness of glaucoma ranges from 15.0 to 74.0% [17–20, 22]. This difference in awareness could be due to the

education levels or the higher prevalence of glaucoma among the African population [17, 18, 22].

The level of awareness has been diversely explained by Rewri et al. and Prafulla et al. who reported that age, gender, and the presence of refractive error had no impact on glaucoma awareness. In contrast, awareness level was more significant in individuals with higher education level ($P = 0.001$) and those belonging to an upper socioeconomic class ($P = 0.05$) [19, 21]. Furthermore, Nkum et al. reported highly significant differences ($P < 0.0001$) between those who had higher education and their awareness of glaucoma despite only 27% of the participants having accurate knowledge of glaucoma [18]. In our study, a logistic regression to determine the awareness of the study population based on a set of eight explanatory variables indicated that knowing that glaucoma can lead to blindness ($P = 0.004$) and having glaucoma ($P = 0.046$) were the statistically significant contributors to the model. Residence and education level contributed to predicting awareness; however, they were not statistically significant with P -values of 0.71 and 0.992, respectively. Moreover, 84.5% of our study population were residents of Khartoum State (hosting the country's capital city) and 95.5% were educated.

This appeals to health authorities, particularly eye care practitioners, and the community to establish a country-wide health program to track and raise awareness about glaucoma. The success of such a program will depend on partnerships involving communities and partners (government, nongovernment organizations, and public and private donors). Such a partnership should be regulated by ensuring clear policy guidelines and strategies regarding glaucoma.

The findings indicate the need to raise community awareness about glaucoma and the importance of its early detection and treatment. Structured educational programs should be developed to raise awareness regarding glaucoma's effects and treatment modalities through community outreach programs, education campaigns, public media such as radio and TV, social platforms, and partnerships with local healthcare providers. Additionally, the authors propose that eye care professionals educate patients during routine eye examinations about the early diagnosis and treatment of glaucoma and the importance of regular eye examinations.

5. Limitations

This study's limitations include using a convenience sampling technique and its restriction to a single eye care hospital in Khartoum State, which may limit the generalizability of the findings. Despite a 3.2% prevalence of glaucoma in the study population, 94.5% of participants were unaware that glaucoma is a manageable condition. Additionally, conducting the study in an eye hospital means some participants might already have had a higher level of knowledge about glaucoma than the general population.

6. Conclusion

In conclusion, our study's findings revealed that the Sudanese population accessing eye care services has a very low level of awareness and knowledge about glaucoma. Thus, stakeholders such as the government, nongovernment organizations, and donors must develop a program to raise the community's awareness through the public media.

Declarations

Acknowledgments

None.

Ethical Considerations

Ethical approval was obtained from Al-Neelain University in Khartoum, Sudan, and the study was conducted according to the Declaration of Helsinki on the performance of human research. All the participants gave verbal informed consent to participate freely in the study, fully understanding that they could withdraw at any time.

Competing Interests

None declared.

Availability of Data and Material

The study data are available upon reasonable request from the corresponding author.

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None.

Abbreviations and Symbols

IOP: Intraocular pressure
POAG: Primary-open angle
CAG: Closed-angle glaucoma
QOL: Quality of life

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