

Original Research Article

Socio-demographic factors influencing to glaucoma related blindness among patients attending eye clinic at Kenneth Matiba Eye and Dental Hospital, Murang'a County, Kenya

Violet Wanjiru Ndung'u^{1*}, Violet Maritim², John Kariuki²

¹Department of Community Health, Epidemiology and Biostatistics, Mount Kenya University (MKU), Thika, Kenya

²School of Public Health, Mount Kenya University (MKU), Thika, Kenya

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*Correspondence:

Dr. Violet Wanjiru Ndung'u,

E-mail: violet.wanjiru@live.com

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ABSTRACT

Background: Glaucoma, a leading cause of blindness, affects 76 million people worldwide, projected to reach 111.8 million by 2040. It causes 15% of global blindness, with 600,000 people losing sight annually. Risk factors include age, gender, education, income, and family history. In Kenya, glaucoma affects 4.3% of the population, accounting for 23% of blindness, with low surgical feasibility despite increasing healthcare access.

Methods: This study used an analytical cross-sectional design, combining quantitative (interviewer-administered questionnaires) and qualitative (Key Informant Interviews) methods to collect data from 187 glaucoma patients at Kenneth Matiba Eye and Dental Hospital between July and September 2024. Ethical approval was obtained, and systematic random sampling was used. Quantitative data were analyzed with SPSS v29, while qualitative data were analyzed thematically. Reliability testing showed a Cronbach Alpha of 0.810. Statistical significance was set at $p < 0.05$.

Results: At least 120 (64.2%) of respondents had visual impairment related to glaucoma of which 46 (38.3%), 34 (28.3%) and 17 (14.2%) had moderate impairment, mild impairment and complete blindness. Age between 30-39 years (OR: 7.958, $p=0.032$), unemployment ($p=0.027$), and lack of health insurance (OR: 5.525, $p=0.014$), income levels of <Ksh 10,000 (OR: 12.708, $p=0.028$), and family history of glaucoma (OR: 5.919, $p=0.012$) were factors associated with glaucoma blindness.

Conclusions: The study highlighted the link between visual impairment and social determinants, showing healthcare disparities tied to income, insurance, geography, and family history. It emphasizes the need for a multifaceted approach to prevention and treatment.

Keywords: Blindness, Eyecare access, Glaucoma, Health disparities, Socioeconomic impact

INTRODUCTION

Glaucoma is a group of disease characterized by progressive optic neuropathy and visual field defect.¹ According to WHO model on blindness, glaucoma accounts for an estimated that there were 76 million people with glaucoma worldwide, projected to increase to 111.8 million in 2040.² Fifteen percent of worlds blindness is attributed due to glaucoma and around

600,000 people go blind annually thus glaucoma is second to cataract as a leading cause of blindness.³ By 2040, this figure is expected to increase to 111.8 million. 15% of blindness worldwide is caused by glaucoma, which causes 600,000 people to lose their sight annually. This places glaucoma behind cataracts as the most common cause of blindness.³ Glaucoma-related blindness varies significantly between developed and developing countries due to differences in healthcare access,

awareness, and early diagnosis. A recent study in China reported a glaucoma prevalence of 3.6% among adults aged 50 years and older, with 5.9% of these cases resulting in blindness.⁴ In Japan, the prevalence of primary open-angle glaucoma (POAG) was found to be 3.7% in individuals aged 40 and above, with 7.1% of cases progressing to blindness.⁵ In United Kingdom revealed a glaucoma prevalence of 2.1% in adults over 40 years, with 10.3% of cases leading to blindness in at least one eye.⁶ In Germany, the prevalence of POAG was reported at 2.79% among adults aged 35-74 years, with 5.2% of cases resulting in blindness.⁷

Age, gender, education, income, and family history are critical factors influencing the risk of glaucoma-related blindness globally. Age is one of the most significant determinants, with studies showing that individuals over 60 are at a markedly higher risk of developing glaucoma, with prevalence rates doubling every decade after 40.⁸ In countries like the USA, Canada, and Ethiopia, the aging population faces a greater risk of late-stage diagnosis and blindness due to the cumulative effects of the disease, compounded by limited access to care in developing countries.^{9,10} Similarly, in Asian countries like China and Nepal, the prevalence of glaucoma increases with age, contributing to higher blindness rates.^{11,12} Gender differences also play a significant role, with men in the UK and Norway more likely to develop glaucoma earlier and progress to blindness compared to women.¹³ In contrast, in Turkey, India, and African nations like South Africa, women are more likely to experience blindness due to socio-cultural and economic barriers, including limited access to healthcare.^{14,15}

Education level affects awareness and treatment outcomes. In high-income countries like the USA and Israel, higher educational attainment correlates with better knowledge of glaucoma, leading to earlier detection.⁷ However, in countries such as Namibia and Egypt, lower education levels contribute to delayed diagnosis and poor treatment adherence, increasing blindness risk.^{4,9} Income status is closely tied to access to healthcare, with individuals in high-income countries more likely to receive regular eye exams and timely treatment.¹³ In contrast, income disparities in countries like Mexico and India prevent lower-income populations from accessing necessary glaucoma care, exacerbating the risk of blindness.¹⁶ Family history is a well-established risk factor for glaucoma. Awareness of this hereditary risk leads to earlier detection in countries like the UK and Norway, but in places like India and Kenya, low awareness results in delayed diagnosis and higher blindness rates.^{14,17} In spite of the public health campaigns by both the Ministry of Health and non-governmental agencies against blindness in Kenya, glaucoma remains a challenge to the public health program. In Kenya glaucoma is estimated to affect 4.3% of population and accounts for 23% of all blindness, which is a major concern for the country.¹⁸ With increasing longevity worldwide, glaucoma blindness is

likely to increase further. However, despite the rapid increase in the availability of quality services, surgical feasibility is still low in Kenya.

METHODS

This was an analytical cross-sectional design adopting both quantitative methods (issuing interviewer-administered questionnaires to glaucoma patients seeking services at Kenneth Matiba Eye and Dental hospital) and qualitative methods (use of Key informant interviews (KII) among healthcare staff from the health facility) with the data collection done between July 2024 to September 2024 after ethical approval from MKU, permit from National Council of Science and Technology (NACOSTI) and permission from Murang'a County's Ministry of Health and Ministry of Education. Systematic random sampling method was used among 187 respondents. The study included glaucoma patients visiting eye clinic at Kenneth Matiba Eye and Dental hospital who consent to participate in the study. Further, it excluded patients who were not willing to consent and take part in the study voluntarily and Glaucoma patients who were on an emergency medical care. Interviewer-administered structured questionnaires were used to collect quantitative data while Key Informant Guide was used to collect qualitative. A pretest was conducted at Thika Level 5 Hospital with Cronbach Alpha Reliability Coefficient test revealed that reliability results for the questionnaire as an instrument for socio-demographic factors was 0.810. Quantitative data was analyzed using statistical package for social science (SPSS) version 29.0. Descriptive data was presented using frequencies, percentages, means and standard deviation while inferential statistics used chi-square test to measure association between independent and dependent variables. P values less than 0.05 were considered statistically significant. In accordance with the research objectives, the qualitative data collected from KI inform of participant notes (responses) were manually cleansed and coded according to themes drawn from the responses (thematic analysis). The quantitative data were further supported by the results, which were presented in narrative form.

RESULTS

Socio-demographic characteristics of study respondents

The respondents' age ranged from 15 years to 83 years, the mode was 52 years, median 54 years and the mean age was 54.5±5.09. The findings showed that most of respondents 64 (34.2%) were 60 years and above with 54 (28.9%), and 10 (5.3%) were between 50-59 years and less than 30 years respectively. In addition, slightly more than half 100 (53.5%) were females with further, 100 (53.5%) being in marital union, 74 (39.6%) were never married and 7 (3.7%) were widowed during the study period (Table 1). Further, 19 (10.2%) of respondents had no formal education with most 85 (45.5%) of respondents had tertiary level of education and 46 (24.6%) had

secondary level of education. Most of respondents 111 (59.3%) were participating in income generating activities of which 35 (18.7%) being formally employed and 76 (40.6%) were self-employed. Further, 121 (64.7%) had a monthly income of less than Ksh 30,000 of which 35 (18.7%) had a less than Ksh 10,000 average monthly income. Slightly less than half of the respondents 89 (47.6%) had no family history of glaucoma, 97 (51.9%) of respondents were residing in rural areas with 51 (27.3%), and 39 (20.9%) were residing in urban and peri-urban areas respectively (Table 1).

Table 1: Socio-demographic characteristics of study respondents.

Characteristics		Frequency	Percent
Age group	<30 years	10	5.3
	30-39 years	19	10.2
	40-49 years	40	21.4
	50-59 years	54	28.9
	≥ 60 years	64	34.2
Gender	Male	87	46.5
	Female	100	53.5
Marital status	Single	74	39.6
	Married	100	53.5
	Divorced/ separated	6	3.2
	Widowed	7	3.7
Level of education	No formal education	19	10.2
	Primary	37	19.8
	Secondary	46	24.6
	Tertiary	85	45.5
Employment status	Employed	35	18.7
	Self-employed	76	40.6
	Unemployed	61	32.6
	Retired	15	8.0
Level of income	<Ksh 10,000	35	18.7
	Ksh 10,000-19,999	50	26.7
	Ksh 20,000-29,999	36	19.3
	Ksh 30,000-39,999	34	18.2
	Ksh 40,000-49,999	23	12.3
	≥ Ksh 50,000	9	4.8
Family history	Yes	64	34.2
	No	89	47.6
	Unsure	34	18.2
Residence	Rural	97	51.9
	Urban	51	27.3
	Peri-urban	39	20.9

Glaucoma related blindness

Out of 187 respondents, most of respondents 66 (35.3%) had been living with glaucoma between 1-2 years with 37 (19.8%) and 25(13.4%) for more than 5 years and less than 1 years respectively. Additionally, 120(64.2%) of respondents had visual impairment related to glaucoma of which 46 (38.3%), 34 (28.3%) and 17 (14.2%) had moderate impairment, mild impairment and complete blindness (Table 2).

Table 2: Glaucoma related blindness.

Characteristics	Frequency	Percent	
Duration living with glaucoma	< 1 year	25	13.4
	1-2 years	66	35.3
	3-5 years	59	31.6
	> 5 years	37	19.8
Vision impairment	Yes	120	64.2
	No	67	35.8
Vision impairment extent	Mild impairment	34	28.3
	Moderate impairment	46	38.3
	Severe impairment	23	19.2
	Complete blindness	17	14.2

Responses suggest that glaucoma-related blindness is a significant concern, with most cases of blindness observed in older adults who delayed seeking treatment. Many informants noted that blindness tends to occur gradually but can escalate if patients do not adhere to prescribed care. Both genders are affected, though older men seem more susceptible. The disease often progresses undetected due to the silent nature of glaucoma.

“Glaucoma-related blindness is common here, especially in those who come to the clinic only after the disease has advanced. Men are slightly more affected than women, often because they delay seeking medical attention. Blindness can be quite severe if not managed early” (KII 4).

“Blindness from glaucoma is sadly frequent, often due to late diagnosis. Most affected patients are aged 60 and above. They might come to the clinic too late or find it hard to stick to follow-ups. In some cases, blindness occurs over a year or two if patients do not stay on their medication” (KII 5).

“Many patients come when vision loss is already advanced. The blindness is often permanent and tends to be severe because the disease progresses quietly. Without early screening, patients only realize there's a problem when vision is already affected” (KII 6).

Socio-demographic factors influencing glaucoma related blindness

Analysis of visual impairment across demographic and socioeconomic factors revealed significant associations. Age emerged as a crucial factor, with all age groups showing significant relationships to visual impairment compared to those aged ≥ 60 years, particularly notable in the 30-39 years group (OR: 7.958, $p=0.032$). Socioeconomic factors played a substantial role, with unemployment showing significance compared to retired individuals ($p=0.027$), and lack of health insurance demonstrating increased odds of visual impairment (OR: 5.525, $p=0.014$). Income levels below Ksh 30,000 were

significantly associated with visual impairment, with the strongest correlation observed in the lowest income group of <Ksh 10,000 (OR: 12.708, $p=0.028$). Geographic factors were also influential, as rural residents showed nearly six times higher odds of visual impairment compared to peri-urban residents (OR: 5.813, $p=0.016$), and distance from healthcare facilities (6-10 km) demonstrated significance ($p=0.042$). Family history of glaucoma emerged as another significant factor, with affected individuals showing about six times higher odds of visual impairment (OR: 5.919, $p=0.012$). Notably, factors such as gender, marital status, and education level did not show significant associations with visual impairment (Table 3).

Table 3: Socio-demographic factors influencing glaucoma related blindness.

Variables		Visual impairment		OR	95% CI	P value
		Yes N (%)	No N (%)			
Age	<30 years	8 (80.0)	2 (20.0)	3.852	0.515-28.822	0.038
	30-39 years	12 (63.2)	7 (36.8)	7.958	1.189-13.245	0.032
	40-49 years	19 (47.5)	21 (52.5)	4.229	0.622-18.768	0.041
	50-59 years	36 (66.7)	18 (33.3)	2.893	0.456-18.366	0.017
	≥ 60 years	45 (70.3)	19 (29.7)	Ref		
Gender	Male	55 (63.2)	32 (36.8)	1.261	0.615-2.584	0.098
	Female	65 (65.0)	35 (35.0)	Ref		
Marital status	Single	60 (69.0)	27 (31.0)	0.957	0.256-1.086	0.530
	Married	60 (60.0)	40 (40.0)	Ref		
Level of education	No formal education	12 (63.2)	7 (36.8)	1.768	0.263-11.879	0.557
	Primary	25 (67.6)	12 (32.4)	1.838	0.318-2.208	0.721
	Secondary	27 (58.7)	19 (41.3)	1.247	0.449-1.598	0.608
	Tertiary	56 (65.9)	29 (34.1)	Ref		
Employment status	Employed	23 (65.7)	12 (34.3)	0.762	0.165-0.741	0.102
	Self-employed	51 (67.1)	25 (32.9)	0.489	0.266-0.901	0.122
	Unemployed	34 (55.7)	27 (44.3)	2.021	0.725-5.633	0.027
	Retired	12 (80.0)	3 (20.0)	Ref		
Family history of glaucoma	Yes	39 (60.9)	25 (39.1)	5.919	1.466-23.894	0.012
	No	59 (66.3)	30 (33.7)	0.626	0.237-1.651	0.344
	Unsure	22 (64.7)	12 (35.3)	Ref		
Residence	Rural	65 (67.0)	32 (33.0)	5.813	3.309-10.210	0.016
	Urban	36 (70.6)	15 (29.4)	1.652	1.135-6.812	0.087
	Peri-urban	19 (48.7)	20 (51.3)	Ref		
Healthcare facility distance	<1 km	8 (57.1)	6 (42.9)	0.874	0.216-3.528	0.380
	1-5 km	45 (60.8)	29 (39.2)	1.057	0.237-4.704	0.051
	6-10 km	24 (63.2)	14 (36.8)	1.900	0.454-7.946	0.042
	> 10 km	43 (70.5)	18 (29.5)			
Health insurance	Yes	76 (68.5)	35 (31.5)	Ref		
	No	44 (57.9)	32 (42.1)	5.525	1.259-10.063	0.014
Income	< Ksh 10,000	22 (62.9)	13 (37.1)	12.708	0.971-26.398	0.028
	Ksh 10,000-19,999	33 (66.0)	17 (34.0)	9.303	1.715-18.036	0.020
	Ksh 20,000- 29,999	22 (61.1)	14 (38.9)	7.646	1.636-21.933	0.039
	Ksh 30,000-39,999	23 (67.6)	11 (32.4)	7.610	1.600-16.478	0.052
	Ksh 40,000-49,999	12 (52.2)	11 (47.8)	2.969	1.570-20.417	0.059
	$\geq$ Ksh 50,000	8 (88.9)	1 (11.1)	Ref		

The informants commonly indicated that glaucoma patients vary widely in demographics, but trends include a higher prevalence among older adults, particularly those over 50 years. Both genders are affected, although there's a slight predominance of male patients. Many patients have a low level of education and limited economic resources, which might contribute to delayed healthcare-seeking and medication non-adherence.

"Most of our glaucoma patients are older adults, especially those aged 50 and above. We do see a few younger patients, but they are rare. Generally, we see more men than women. Many patients are from low-income backgrounds, which affects their ability to seek timely treatment and adhere to medication" (KII 1).

"The majority of patients are middle-aged and elderly, often between 45 and 70 years old. Men seem to be more affected than women, and many patients only have basic education. Socioeconomic status is a big factor; a lot of our patients come from underprivileged backgrounds and struggle to afford regular check-ups or medication" (KII 3)

"The age range is broad, but we have a large number of older patients, especially those who are retired or nearing retirement. Socioeconomic constraints are a common theme, as many cannot afford the transportation costs for follow-up appointments" (KII 5).

DISCUSSION

The study findings show both consistencies and inconsistencies with existing literature regarding socio-demographic factors associated with glaucoma-related blindness. In terms of age, the study findings align with Quigley et al, who noted increased risk with advancing age, particularly after 40 years.⁸ This is evident in the study's significant associations across age groups ($p < 0.05$), with those aged ≥ 60 years serving as the reference group. The gender distribution in the study shows slightly higher visual impairment among females (65.0%) compared to males (63.2%), which aligns with findings from Costa et al and Garg et al in Turkey and India, where women were more affected due to socio-cultural barriers.^{19,17}

Regarding education, the study's findings show varying visual impairment rates across educational levels, though without statistical significance ($p > 0.05$). This partially contrasts with Tshivhase and Khoza and Lee and Mackey, who found stronger associations between educational attainment and glaucoma outcomes.^{20,21} Income levels in the study showed significant associations with visual impairment ($p < 0.05$), particularly among lower income groups, consistent with findings by Grzybowski et al and Bastawrous et al, who identified income disparities as crucial factors in glaucoma treatment access and outcomes.^{7,18}

Family history emerged as a significant factor ($p = 0.012$) in the study, aligning with Kim et al and Althobaiti et al findings about its importance in glaucoma risk.^{6,13} The study's rural residence association with visual impairment ($OR = 5.813$, $p = 0.016$) mirrors observations by Bhowmik et al and Kariuki et al regarding rural-urban disparities in African countries.^{16,22} Healthcare accessibility, measured by facility distance, showed significance at 6-10 km ($p = 0.042$), and health insurance status was significantly associated with visual impairment ($p = 0.014$), supporting findings by Quigley et al about healthcare access impacts.⁸ The employment status findings, particularly higher risk among the unemployed ($p = 0.027$), reflect the economic challenges highlighted by Abu-Amero et al and Bhowmik et al in accessing glaucoma care.^{23,16} These patterns underscore how socio-demographic factors significantly influence glaucoma-related visual impairment, though some associations vary from global literature, possibly due to local contextual factors.

This study has few limitations. Numerous obstacles arise in research investigations, because the information being sought is confidential, some caregivers were hesitant to give information or even suppress information. To address this constraint, the researcher guaranteed respondents that the data provided will remain confidential process from proposal, data collection, analysis and production of the final report. Furthermore, after gathering the respondents' data, the researcher informed the participants that the questionnaires will be safely disposed of. Also, the researcher was faced with some difficulties in meeting the costs related to the study especially printing and stationers as well transport costs and lunch allowance to the supporters/assistants considering that the researcher was a self-sponsored student.

CONCLUSION

The study findings demonstrated that visual impairment is deeply intertwined with social determinants of health, revealing significant healthcare disparities. The strong associations between visual impairment and socioeconomic factors, particularly income levels below Ksh 30,000 and lack of health insurance, highlight systemic barriers to eye care access. Geographic location emerged as a critical factor, with rural residents facing substantially higher risks. The significant impact of healthcare facility distance suggests accessibility challenges in the current healthcare infrastructure. Furthermore, the strong correlation with family history of glaucoma indicates the importance of genetic factors and early screening. The pattern of these associations suggests that visual impairment is not merely a medical condition but a complex public health issue influenced by social, economic, and geographic factors, requiring a multifaceted approach to prevention and treatment. County health team should implement a systematic screening program for individuals with family history of glaucoma, including regular follow-ups and preventive

care. Further, collaborate with community health workers to create awareness about eye health and available services and advocate for policy changes to include comprehensive eye care coverage in basic health insurance packages. These interventions should be supported by regular monitoring and evaluation to ensure effectiveness and reach to the most vulnerable populations.

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