IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 25, Issue 7 Ser. 1 (July. 2026), PP 20-26
www.iosrjournals.org

Comparison Of Prevalence And Determinants Of Glaucoma In Rural And Urban Communities In Abia State.

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Abstract
Introduction: *Glaucoma is one of the leading causes of irreversible blindness worldwide, and this is not as good for people of African Descent. Understanding the factors associated with glaucoma in particular places is important to public health action to lower blindness.*
Method: *The study evaluated the prevalence and Knowledge of glaucoma among rural and urban dwellers in Abia State, Nigeria, using a community-based cross-sectional study conducted among 468 adults, of which 234 of the respondents were chosen from the rural area and the urban area, respectively. Glaucoma was diagnosed based on clinical eye examination, and relevant information was obtained by an interviewer-administered structured questionnaire.*
Results: *Data were analyzed with the use of descriptive statistics, chi-square tests, and logistic regression with statistical significance at $p < 0.05$.*
The results indicated that glaucoma was more prevalent in rural communities than in urban communities. The prevalence was 11.0% in the rural area as compared with 4.7% in the urban area, and this was statistically significant. Urban residents were also more knowledgeable and aware of glaucoma compared to rural residents. Important predictors of glaucoma were living in a rural area, age 60 years and above, family history of glaucoma, hypertension, and use of unprescribed eye drops. Higher education decreased the risk of glaucoma.
Conclusion: *The study highlights the need for health education, screening in the community, and improved access to affordable eye care, particularly in rural communities.*
Keywords: *Glaucoma, prevalence, determinants, rural-urban comparison, eye health, community-based study.*
Date of Submission: 26-06-2026 Date of Acceptance: 06-07-2026

I. Introduction:

Glaucoma is a group of diseases with multifactorial aetiology, all presenting with a characteristic optic neuropathy that is chronically progressive. The emphasis is on the death of retinal ganglion cells and the loss of their axons.(Lia, 2018) The optic nerve is made up of axons emerging from the retinal ganglion cells, which exit the eye through the lamina cribrosa. Increased intraocular pressure leads to decreased retrograde axoplasmic flow and thus leads to death of the retinal ganglion cells due to deprivation of neurotrophic factors (Si et al., 2025). Prevalence of glaucoma has been widely studied locally and internationally due to the marked effect of glaucoma on vision, and these studies have led to a better understanding of the public health impact of the disease. There exist regional and racial differences in the prevalence of glaucoma, which may be explained by genetic and possibly environmental differences (Kapetanakis, 2016; Kreft, 2019). Nigeria has a high age-specific prevalence of glaucoma in adults aged 40 years and above. This implies that glaucoma has an earlier age at onset when compared to Caucasians and Asians, and this may also explain its more aggressive course in Nigerians. (On behalf of the Nigeria National Blindness and Visual Impairment Study Group et al., 2015) The prevalence of glaucoma varies within tribes as shown by the Nigerian National Blindness survey that reported the Igbo tribe as having the highest prevalence in Nigeria. Gender differences in glaucoma prevalence have also been reported and findings have not been consistent. While some studies have found a higher prevalence in males (36%) compared to females(kapetanakis, 2016; kelly, 2019) another study found a higher prevalence of primary open angle glaucoma in females (Cassard, 2012).

Education plays a role in shaping health outcomes. It has been shown that low educational qualification is associated with lower socioeconomic status and lower levels of health literacy, which in turn can affect

glaucoma outcome. (Cutilli, 2018; Mottus, 2014) The nature of the community where an individual resides, such as urban, semi-urban, rural, affects access to glaucoma care, as this is due to the unique characteristics of each of settlements. These settlements differ in the availability of eye care services, the availability of eye care providers, and how much information the inhabitants have about eye health. (stagg, 2022)

A surge in the global burden of blindness and visual loss has been observed in spite of advances in healthcare (Lijuan et al., 2025), with glaucoma as one of the leading causes of irreversible blindness (On behalf of the Nigeria National Blindness and Visual Impairment Study Group et al., 2016). Blindness from glaucoma cannot be cured, but can be prevented by early detection and treatment. Reducing blindness from glaucoma may be achieved by ensuring optimal treatment of those who are able to reach the health facilities, improving awareness, and enhancing community approaches for early detection of glaucoma.(kyari, 2017)

Considering the disproportionately high prevalence of glaucoma in Nigeria, there is still paucity of data on comparing prevalence and determinants of glaucoma in rural and urban communities, despite the fact that such information may help in developing targeted interventions on glaucoma blindness prevention by ensuring equity in distribution of eye care services. The study provides valuable insights which policy makers and public health experts will use to come up with specific interventions aimed at reducing glaucoma blindness.

II. Methods

Study Design. A cross-sectional comparative study.

Study Area. The study was carried out in Abia State, which is located in the South-East geopolitical zone. It has boundaries with Enugu, Ebonyi, Cross river Akwa Ibom, Rivers, and Anambra state. Has a population of about 3.7 million according to 2023 estimates, and the major language spoken is Igbo. A population of 20,000 and above in addition to basic social and physical infrastructure, is the description of an urban area in Nigeria. Based on the above definition, the local government areas in Abia were split into 5 urban and 12 rural local government areas.

Study Population. The study population comprised of adults aged 40 years and above residing in selected rural and urban communities in Abia State who meet the eligibility criteria for participation in the study.

Inclusion and Exclusion Criteria.
Inclusion Criteria.
1. Adults aged 40 years and above
2. Residents who have lived in the area for at least one year.
3. Residents who give consent willingly to participate in the study

Exclusion Criteria
1. Residents who are unable to complete the examination process
2. Residents who have preexisting ocular conditions such as trauma, infection, or surgery.

Sample size Calculation

$$N = \frac{[A+B]^2 \times [(p1 \times (1-p1)) + (p2 \times (1-p2))]}{[p1-p2]^2}$$

Where N = the sample size required in each group
A represents 5% significance level; i.e. 1.96
B represents the desired power, 80%=0.84
p1 = first proportion
p2 = second proportion
p1-p2 = size of the difference of clinical importance
(p1) 4% (0.04)(Garudari et al., 2010)
(p2) 1.6% (0.0016) (Garudari et al., 2010)

p1-p2 = 0.04-0.0016=0.0384

$$N = \frac{(1.96 + 0.84)^2 \times [0.04(1-0.04)] + [0.0016 (1-0.0016)]}{(0.0384)^2}$$

$$\frac{7.84 \times (0.0384 + 0.001597)}{0.00147}$$

0.3136/0.00147= 213.33
Allowing for attrition rate of 10%, sample size will then be 234 in each group making a total of 468 samples.

Sampling Method.

The sampling method used for the study was a Multi-stage sampling technique. Abia State is divided into 5 urban and 12 rural local government areas.

Stage 1 (Stratification into rural and urban): One urban (Umahia North) and one rural (Ikwuano) local government was selected by balloting
Stage 2 (Selection of wards): By balloting select one ward from urban (Umuahia urban I) and one ward from rural (Oboro III) local government areas
Stage 3 (Selection of Community): Select one community each from the urban (Umuahia) and rural (Nnono) ward
Stage 4: Selection of Participants by systematic sampling, where sampling fraction was determined

Data Collection

Data was collected using a pre-tested, structured interviewer-administered questionnaire. The questionnaire had 4 sections. Section A contained information on socio-demographics, section on clinical examination and diagnosis, section C contained information on knowledge of glaucoma, and section D contained information on the risk factors of glaucoma. Data was collected over a period of four months July to October 2025.

Data Analysis.

Data collected from the study were entered into Microsoft Excel, cleaned, and exported to the Statistical Package for Social Sciences (SPSS) version 25 for analysis. Descriptive statistics were used to calculate the prevalence of glaucoma in each study group. The findings were presented using frequencies and percentages. The Chi-square test was used to compare the prevalence of glaucoma between rural and urban respondents. descriptive statistics were used to summarize the distribution of identified risk factors using frequencies and percentages. The Chi-square test was used to compare categorical risk factors between rural and urban respondents. Furthermore, binary logistic regression analysis was performed to examine the association between potential risk factors and glaucoma and to identify the independent determinants of glaucoma in the study population. Adjusted odds ratios with 95% confidence intervals were reported, and statistical significance was set at $p < 0.05$.

Ethical Consideration.

Ethical approval for the study was obtained from the Ethics Committee of the School of Public Health, University of Port Harcourt, as well as from the Research and Ethics Committee of the Federal Medical Centre, Umuahia, before the commencement of data collection

III. Results

Sociodemographic characteristics of study participants

A total number of 468 participants were studied, 234 from the rural community and 234 from the urban community.

Table 1: Average age of study participants

Variables	Location	N	Mean	SD	t-value	df	p-value	Remark
Age (years)	Rural	234	46.23	12.41	3.276	298	0.001	Significant
	Urban	234	40.82	11.58				

Table 2: Sociodemographic characteristics of study participants

Variable	Category	Rural LGA n (%)	Urban LGA n (%)
Sex	Male	108 (46.2)	104 (44.4)
	Female	126 (53.8)	130 (55.6)
Occupation	Farmers	106 (45.3)	0 (0.0)
	Traders	59 (25.2)	71 (30.3)
	Civil servants	19 (8.1)	78 (33.3)
	Artisans	0 (0.0)	40 (17.1)
	Unemployed	35 (15.0)	25 (10.7)
	Others	15 (6.4)	20 (8.6)
Level of education	No formal education	28 (12.0)	12 (5.1)
	Primary education	70 (29.9)	43 (18.4)
	Secondary education	94 (40.2)	95 (40.6)
	Tertiary education	42 (17.9)	84 (35.9)
Marital status	Single	37 (15.8)	54 (23.1)
	Married	165 (70.5)	161 (68.8)
	Divorced/Widowed	32 (13.7)	19 (8.1)

Religion	Christian	168 (71.8)	202 (86.3)
	Traditional religion	56 (23.9)	20 (8.5)
	Muslim	10 (4.3)	12 (5.1)

Key: n = frequency, % = percentage

Table 1 shows the average age in the rural group to be 46.23± 12.41 and the average age at in the urban group was 40.82±11.58. Table 2 shows the sociodemographic characteristics of study participants. There was no sex variation between the rural group (male 46.2%; female 53.8%) and urban group (male 44.4%; female 55.6%) The rural had mostly farmers (45.3%) while the urban had more of civil servants (33.3%) and traders (30.3%). There was a higher proportion of unemployed in the rural (15.0%) compared to the urban (10.7%). The proportion of those who had secondary education was almost equal in rural (40.2%) and urban (40.6%)

Prevalence of glaucoma

Prevalence of glaucoma in the rural community was 11.0% while that of urban community was 4.7% and this was found to be statistically significant ($x^2 = 7.62$; p = 0.006; C.I 1.4-1.6)

Glaucoma Status	Urban n (%)	Rural n (%)
Glaucoma present	11(4.7)	25 (11)
Glaucoma absent	223 (95.3)	209 (89)

Table 3: Prevalence of glaucoma in urban and rural communities

Variable	Response	Rural (%)	Urban (%)	χ^2	p-value	95% CI
Prevalence of Glaucoma	Glaucoma	11.0	4.7	7.62	0.006	1.4–6.1
	No Glaucoma	89.0	95.3	—	—	—

Key: n = Frequency, % = percentage

Table 4: Comparison of risk factors of glaucoma among respondents in rural and urban LGAs of Abia State

Risk factor	Response	Rural (%)	Urban (%)	χ^2	p-value
Family history of glaucoma	Yes	13.7	19.7	2.50	0.110
Hypertension	Yes	26.5	33.8	3.10	0.078
Diabetes mellitus	Yes	11.5	16.7	2.20	0.130
History of eye trauma	Yes	8.1	9.8	0.27	0.600
Use of unprescribed eye drops	Yes	23.9	28.6	1.15	0.280
Regular physical exercise	Yes	47.9	53.0	1.05	0.310
Access to eye care	Yes	34.2	74.4	65.20	<0.001

Key: n = Frequency, % = percentage, χ^2 = chi square

Table 4 shows a comparison of selected risk factors of glaucoma among the respondents of rural and urban LGAs of Abia State. Family history of glaucoma was reported by 13.7% of the respondents in the rural LGA and 19.7% of the respondents in the urban LGA. Hypertension was reported by 26.5% and 33.8% of the rural and urban respondents, respectively, while diabetes mellitus was reported by 11.5% and 16.7% of respondents in the rural and urban LGAs, respectively.

The table also shows that the history of eye trauma was reported by 8.1 per cent of respondents in the rural LGA and 9.8 per cent in the urban LGA. Use of unprescribed eye drops was reported by 23.9% of rural people and 28.6% of urban people. In addition, an average of 47.9 percent of the respondents reported regular physical exercise in rural LGA and 53.0 percent in the urban LGA. Access to eye care was reported by 34.2% of the people of the rural LGA, compared with 74.4% in the urban LGA.

Overall, the table indicates that the percentages of responses indicating these risk factors were generally higher in the urban LGA than in the rural LGA. However, out of all the risk factors compared, only access to eye care showed a significant difference between the rural and urban LGAs ($x^2 = 65.20$, $p < 0.001$).

Table 5: Determinants of glaucoma

Variable	β	Std. Error	Wald χ^2	p-value	AOR	95% CI
Residency (Rural vs Urban)	0.69	0.33	4.38	0.036	2.00	1.05–3.80
Age (≥60 yrs)	0.88	0.30	8.60	0.003	2.42	1.34–4.37
Sex (Male)	0.14	0.29	0.24	0.62	1.15	0.65–2.03
Education (≥Secondary)	-0.71	0.28	6.43	0.011	0.49	0.28–0.85

Family History	1.40	0.38	13.58	<0.001	4.05	1.95–8.41
Hypertension	0.54	0.26	4.31	0.038	1.72	1.03–2.88
Diabetes	0.37	0.32	1.35	0.25	1.45	0.76–2.78
Eye Trauma	0.60	0.35	2.96	0.085	1.82	0.92–3.61
Unprescribed Eye Drops	0.77	0.30	6.60	0.010	2.17	1.21–3.88
Access to Eye Care	-0.44	0.27	2.66	0.103	0.64	0.38–1.10
Constant	-3.02	0.68	19.8	<0.001	-	-

*$p < 0.05$ indicates statistical significance.

Model Summary

Observations: 468 (Rural = 234; Urban = 234)
-2 Log Likelihood = 312.47
Cox & Snell $R^2 = 0.19$
Nagelkerke $R^2 = 0.32$
Hosmer–Lemeshow Test $\chi^2 = 5.87$, $p = 0.55$ (Model fits the data well)
Classification Accuracy = 89.1%

Table 5 presents the logistic regression analysis of the determinants of glaucoma in the rural and urban communities of Abia State. Residence was a significant determinant of glaucoma, with respondents who lived in rural areas having twice the odds of having glaucoma compared with those who lived in urban areas (AOR = 2.00, 95% CI: 1.05-3.80, p = 0.036). Age was also a significant determinant, whereby respondents aged 60 years and above were about 2.4 times more likely to have glaucoma compared to younger respondents (AOR = 2.42, 95% CI: 1.34-4.37, p = 0.003).

Sex did not play an important role in determining glaucoma (AOR = 1.15, 95% CI: 0.65-2.03, p = 0.620). Education, however, was significantly associated as those respondents with at least a secondary level of education had lower odds of glaucoma compared with those with a lower educational attainment (AOR = 0.49, 95% CI: 0.28-0.85, p = 0.011). Family history was a strong determinant of glaucoma with the odds of glaucoma in affected respondents being about four times higher than those without a family history of glaucoma (AOR = 4.05, 95% CI: 1.95-8.41, p < 0.001).

Hypertension was also an important determinant since respondents with hypertension had 1.72 times higher odds of glaucoma when compared with those without hypertension (AOR = 1.72, 95% CI: 1.03-2.88, p = 0.038). Glaucoma did not significantly relate to diabetes (AOR = 1.45, 95% CI: 0.76- 2.78, p = 0.250). Likewise, glaucoma was not statistically significantly related to eye trauma (AOR = 1.82, 95 percent confidence interval: 0.92-3.61, p = 0.085).

Use of unprescribed eye drops was a significant determinant of glaucoma, with respondents who used such eye drops having about two times the odds of glaucoma as compared to those who did not (AOR = 2.17, 95% CI: 1.21-3.88, p = 0.010). Table 3 does not show significantly a relationship between access to eye care and glaucoma (AOR = 0.64, 95% CI: 0.38-1.10, p = 0.103).

Overall, the table shows that residence, age, educational level, family history, hypertension, and use of unprescribed eye drops were significant determinants of glaucoma in the study population.

IV. Discussion

The average age of our study participants was statistically significant (p<0.001), the mean age in the rural area was 46.23± 12.41years while that in the urban community was 40.82±11.58 years, this higher age in the rural community may be explained by the movement of young people to the urban areas in search of greener pastures. This is similar to the average age reported by Sultana et al in Bangladesh where the average age for the urban area was 38.31±14.1 years and the average age for the rural area was reported to be 52.01±14.2 years. (Sultana et al., 2026) However, this is different from the study in Illorin which reported average age of 53.6±11.7 in the rural area and 54.3±11.7 in the urban area and the Ghana study which reported 53.2±16.3 in the rural hospital and 54.5±16.4 years in the urban hospital. (Durowade et al., 2016; Francis et al., 2014) In these studies the differences in mean age of the rural and urban settlements were not very distinct. In our study 35.9% of the urban participants had tertiary education while the highest occupation was civil service (33.3%), this was similar to the report by Violet et al in an urban setting in Nigeria where they reported 34.6% as having post-secondary education and 32.9% being civil servants. This may be because most graduates will prefer to live in the city where they can enjoy basic amenities that may not be available in the rural communities especially in Nigeria. Furthermore, most government establishments are located in the cities explaining why there are a lot of civil servants in the city. We also noted a higher proportion of unemployed participants in the rural community (15.0%) compared to the urban community (10.7%). This can be explained by the fact that the index community is an agrarian community and the seasonal pattern of agriculture which makes planting, harvesting and cultivation

happen at specific periods leaving a portion of the workforce unemployed during the off season. Furthermore, a good number of them may not consider farming an occupation but a way of life.

The prevalence of glaucoma was higher in the rural community (11.0%) compared to the urban community (4.7%), and this was found to be statistically significant (x^2 =7.62, p<0.006, 95% CI 1.4-6.1). This result is similar to that reported by Durowade et al in Illorin who found prevalence in the rural community to be 12.4% and that in the urban community to be 8.2% (Durowade et al., 2016). In a hospital-based study in Ghana, the prevalence of glaucoma in the rural hospital was 78.1% while that in the urban hospital was 50.6%. This higher prevalence values may be due to differences in methodology and possibly because it was a hospital based study. (Francis et al., 2014) Conversely, in a study in India, the prevalence in the urban community was higher (4.0%) compared to the rural community (1.6%). (Garudari et al., 2010) These figures help to buttress the disparity that exist in glaucoma prevalence as it concerns whether a community is urban or rural which can be explained by the unique characteristics of each of these environments.

Logistic regression revealed risk factors that were determinants of glaucoma to be family history (p<0.001, 95% CI 1.95-8.41), use of unprescribed eye drops (p=0.010, 95% CI 1.21-3.88) and hypertension (p=0.038, 95% CI 1.03-2.88) while establishing sociodemographic factors that were found to be determinants of glaucoma to be age (p=0.003, 95% CI 1.34-4.37), educational status (p=0.011, 95% CI 0.28-0.85) and leaving in a rural area (p=0.036, 95% CI 1.05-3.80).

Our study revealed that living in a rural area was associated with a two times higher risk of having glaucoma. From our study, a number of reasons can be deduced for this finding, which may include reduced awareness, reduced knowledge, and poor access to eye care. Onyia et al., in their study on late presentation of glaucoma, reported that living in a rural area was associated with higher odds of presenting late for glaucoma treatment. A finding they found correlated with aging because it is consistent with Igbo culture, the predominant inhabitants in the study, to retire to the village at a certain age. (Onyia et al., 2022) This finding may also imply that blindness from glaucoma may be more common among rural inhabitants, making public health interventions more relevant in our rural communities in a bid to reduce the burden of glaucoma blindness.

Recommendations

1. Strengthening of community-based glaucoma screening programmes, particularly in rural communities.
2. Policy makers to take steps to enhance access to affordable eye care services in rural communities.
3. Efforts should be made to establish effective referral linkages with the primary healthcare centres and tertiary centres for early detection and management of glaucoma.

Acknowledgements

The authors wish to thank all those who contributed directly or indirectly to the success of this research.

V. Conclusion

The findings have established that glaucoma is still an important public health problem in the study area, with notable differences between rural and urban communities. The prevalence of the rural population was more than double the prevalence of the urban population suggesting the burden of glaucoma is more intense in rural communities. Both advancing age and intraocular pressure elevation are well-established factors for glaucoma, and these differences are further supporting the increased burden of glaucoma in the rural population. Logstic regression showed that determinants of glaucoma were rural residence, advancing age, family history, hypertension and use of unprescribed eye drops.

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