

## A COMPARATIVE ANALYSIS OF GLAUCOMA-RELATED KNOWLEDGE AND AWARENESS AMONG THE URBAN AND RURAL POPULATION OF BIHAR

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### Abstract

**Background:** Glaucoma, a progressive optic nerve disease, is the foremost cause of preventable blindness worldwide. In India, the prevalence of glaucoma among adults over 40 is between 2.7% and 4.3%. Although it shows no symptoms in the early stages, prompt detection and treatment are crucial to avoid blindness. The situation is worsened by limited awareness and the absence of screening initiatives, particularly in underserved areas such as Bihar. This study intends to evaluate and contrast glaucoma awareness and knowledge between urban and rural communities in Bihar. **Materials and Methods:** This cross-sectional, hospital-based study was conducted at a tertiary care hospital in Bihar between September 2023 and August 2024. It included 809 patients attending the ophthalmology outpatient department, aged over 18 and without a glaucoma diagnosis. Participants were classified into urban and rural groups. Data collection involved a validated questionnaire assessing demographic characteristics, awareness, and knowledge of glaucoma. Statistical analyses, including Chi-square and Student's t-tests, were applied to identify significant statistical differences. **Result:** Urban respondents showed significantly higher awareness of glaucoma (25.9%) than rural respondents (19.9%). Education was a critical determinant of awareness in both groups ( $p < 0.05$ ). However, knowledge about glaucoma's irreversible nature, risk factors, and treatment goals was low across both populations. Urban participants were better informed about glaucoma's progression and association with intraocular pressure than their rural counterparts. **Conclusion:** The study underscores critical gaps in glaucoma awareness and knowledge in Bihar. Urban populations exhibited marginally better awareness, but misconceptions about the disease's irreversibility and treatment objectives persist. Tailored health education programs and enhanced access to screening are essential to mitigate the burden of glaucoma. Prioritising awareness initiatives in rural regions can ensure equitable eye health outcomes.

## INTRODUCTION

Glaucoma is a group of chronic progressive eye diseases caused by damage to the optic nerve due to increased intraocular pressure.<sup>[1]</sup> It is the second most common cause of preventable blindness after cataracts but the most common cause of irreversible blindness.<sup>[2]</sup> More than 11 million people across India are suffering from glaucoma, and epidemiological studies on glaucoma involving adults aged 40 years and above have estimated glaucoma prevalence between 2.7 and 4.3% among Indians.<sup>[3]</sup> As glaucoma shows no early signs and symptoms, it is only diagnosed at a later stage, resulting in significant eye damage.<sup>[2]</sup> It has been seen that lack of awareness and absence of proper screening tools contribute to the

failure of diagnosis or delayed diagnosis of cases, ranging from 50% to 90%.<sup>[4]</sup>

Based on the time of occurrence of glaucoma, it is classified into two types – congenital and acquired. Based on the mechanism by which aqueous outflow is hampered by the anterior chamber angle configuration, as devised by Barkan, glaucoma is divided into angle-closure or open-angle.<sup>[5]</sup> Any abnormality of the outflow can raise the intraocular pressure (IOP), leading to glaucoma. It has also been observed that almost 75% of cases of glaucoma are primary open-angle glaucoma.<sup>[6]</sup>

Several factors can increase the risk of developing primary open-angle glaucoma (POAG). These include ageing, older individuals being more susceptible, and race, as African-American, Afro-

Caribbean, and West African individuals are about four times more likely to develop POAG. A family history of glaucoma also plays a significant role; for example, the Rotterdam Eye Study found that having a first-degree relative with glaucoma increases the risk by 9.2 times.<sup>[7,8]</sup> Other contributing factors include elevated intraocular pressure (IOP), near-sightedness (myopia), thin corneas, low ocular blood flow (low ocular perfusion pressure), and certain health conditions, such as type 2 diabetes. Lifestyle and medication use also matter; long-term use of corticosteroids, oral contraceptives, smoking, and migraines have all been linked to a higher risk.<sup>[4,7,8]</sup> Being a silent thief of sight, the occurrence of glaucoma and blindness resulting from this imposes a substantial social and economic burden on the patient and their families. It also reduces the overall quality of life and increases the recovery cost, affecting a nation's economic development. Glaucoma can only be prevented by early detection and timely intervention.<sup>[2]</sup>

In a country like India, the foremost reason for having an exponential increase in cases of glaucoma is the lack of awareness regarding glaucoma in all strata of the population. It not only influences the timing of the diagnosis but also reduces the efficiency at which eye care services are utilised to treat the disease.<sup>[9]</sup>

Understanding people's awareness and knowledge about glaucoma is key to creating effective ways to educate them and improve communication. Raising awareness encourages regular eye check-ups, which can help identify the signs of glaucoma early. Literature showed that most of the data regarding awareness and knowledge of glaucoma were from southern and northern India. The lack of data from eastern India provides an unclear picture regarding the perception and awareness levels of glaucoma among these populations. Hence, this study was planned to evaluate and compare the level of awareness and knowledge regarding glaucoma between the rural and urban populations of Bihar. The goal is to develop targeted strategies to fight this vision-threatening disease.

## MATERIALS AND METHODS

The present study was planned as a cross-sectional hospital-based study at a tertiary care hospital in Bihar. It was conducted from September 2023 to August 2024. Patients attending ophthalmology OPD were recruited and sorted into Urban and rural subgroups based on their place of residence. Inclusion criteria included patients over 18 years of age who were not diagnosed with glaucoma or receiving any treatment. Written informed consent was obtained from all recruited patients.

The sample size required for this study was determined using the formula  $N = Z^2 * P * (1 - P) / E^2$ . In this equation, "N" represents the sample size, "Z" denotes the standard normal deviation, typically set at 1.96 for a 95% confidence interval, "P" indicates the assumed prevalence, and "E" signifies the

acceptable margin of error. Given the limited literature on glaucoma-related knowledge in eastern India, a prevalence of 50% (P-value = 0.5) was utilised to maximise variability. The acceptable margin of error (E) was set at 5% (P-value = 0.05). Subsequently, applying these values to the formula yielded an initial sample size estimation of approximately 384 participants.

A structured questionnaire with close-ended items was developed in English and translated into Hindi to ensure a better understanding of the questions. It was then validated by an expert peer group consisting of an ophthalmologist and a public health expert from another institute to ensure its accuracy and relevance. A pilot study was also conducted, collecting responses from 20 patients, and the final questionnaire was further modified and revalidated based on the responses.

The questionnaire was given to the patients just after their registration at the ophthalmology OPD. The questionnaire had three parts. The first part consisted of demographic data related to family and personal medical history. The second part consisted of the awareness levels regarding glaucoma. It was assessed by the question – "Have you ever heard of the term 'Glaucoma'?" The third part was about the details of the knowledge and was for only those respondents who were aware of the term 'glaucoma'. This part was assessed by questions related to the cause of glaucoma, different types, clinical presentation, risk factors, association with high IOP, changes in the visual field and treatment options for glaucoma. Optometrists and MBBS interns were always available at the OPD to assist patients during the data collection.

The data was entered into Microsoft Excel and expressed as mean, proportion and percentage. For quantitative data, the Chi-square test/Fisher's exact test was applied, and for continuous data, the Student's t-test was applied, wherever applicable. All the relevant data was stored securely to maintain confidentiality. The identification of the volunteers was not revealed anywhere.

## RESULTS

The socio-demographic data presented in [Table 1] highlighted the differences between urban and rural respondents. The rural group has a slightly older average age (45.4 years) compared to the urban group (41.7 years). Gender distribution was similar, with males forming the majority in both groups. Rural respondents tend to have lower educational attainment, with 18.45% lacking formal education compared to 9.32% in urban areas. Rural occupations predominantly included farming (36.17%), whereas urban respondents engaged more in business (22.42%) and services (14.36%). These contrasts illustrate disparities in education and employment patterns, reflecting the differing socioeconomic dynamics of urban and rural communities.

[Table 2] highlighted the health disparities between urban and rural groups regarding co-morbidities and family history of glaucoma. Urban respondents reported higher rates of diabetes (18.39%) and hypertension (23.17%) than their rural counterparts (15.78% and 19.66%, respectively). Conversely, rates of COPD and kidney diseases were comparable across groups. A notable gap existed in the family history of glaucoma, with urban individuals at 4.03% versus 2.18% in rural areas, reflecting potential genetic and environmental influences.

[Table 3] illustrates the association of glaucoma awareness with socio-demographic factors in urban and rural populations. Gender did not significantly influence awareness in either group ( $p = 0.620$  for urban,  $p = 0.447$  for rural). Education level showed varying significance; in both urban and rural groups, lower education correlated with less awareness ( $p=0.048$  and  $p < 0.005$ ). In urban areas, education approached significance ( $p = 0.055$ ). Occupation was significant in urban groups ( $p = 0.007$ ), with unemployed individuals showing lower awareness, whereas no significant correlation was observed in rural groups ( $p = 0.186$ ). These findings highlight education and occupation as critical determinants of glaucoma awareness, particularly in urban settings, emphasising the need for targeted educational interventions to improve awareness in diverse populations.

[Table 4] evaluated knowledge and awareness of glaucoma among urban and rural populations. In

urban areas, 25.94% recognised the term "glaucoma," slightly higher than the rural figure of 19.9%, though this difference was not statistically significant ( $p=0.124$ ). Urban respondents (65.05%) were significantly more aware that glaucoma was an eye disease than rural ones (35.37%), with a  $p$ -value of 0.003. Understanding the anatomical impact of glaucoma showed limited awareness across both groups, with most unable to identify the optic nerve as the affected site.

Regarding risk factors, urban participants (50.49%) were more aware of the association between high intraocular pressure (IOP) and glaucoma than rural ones (37.8%) ( $p=0.035$ ). The urban population also better understood that glaucoma progressed over time (55.34% vs. 39.02%,  $p=0.024$ ). Both groups exhibited limited awareness about the inheritance of glaucoma and its asymptomatic nature.

Misconceptions persisted in both settings. About 45% in each group believed glaucoma damage was reversible, and many thought it could be cured (39.8% urban, 39.02% rural). A substantial number were unaware that treatment aimed to delay progression and reduce IOP.

Overall, urban participants generally displayed better awareness about glaucoma compared to their rural counterparts, particularly regarding its nature, progression, and risk factors. However, gaps in understanding about its irreversibility and treatment purposes highlighted the need for broader educational initiatives across both populations.

**Table 1: Socio-demographic criteria of the respondents.**

Variables	Urban Group	Rural group
Age (years)	41.7 ± 9.2	45.4 ± 11.9
Gender		
Male	223 (56.17%)	241 (58.5%)
Female	174 (43.83%)	171 (41.5%)
Education		
No formal education	37 (9.32%)	76 (18.45%)
Primary education	54 (13.6%)	82 (19.90%)
Secondary education	109 (27.46%)	124 (30.1%)
Higher Secondary	73 (18.39%)	61 (14.8%)
Graduate	69 (17.38%)	36 (8.74%)
Post-graduate	55 (13.85%)	33 (8.01%)
Occupation		
Unemployed	31 (7.81%)	42 (10.19%)
Retired	105 (26.45%)	67 (16.26%)
Farmer	23 (5.79%)	149(36.17%)
Business	89 (22.42%)	35 (8.49%)
Day labor	32 (8.1%)	31 (7.52%)
Service holder	57 (14.36%)	26 (6.31%)
Homemaker	41 (10.33%)	47 (11.4%)
Others	19 (4.78%)	15 (3.64%)

**Table 2: Presence of co-morbidities / family history of glaucoma in both groups of respondents**

Co-morbidities	Urban	Rural
Diabetes	73 (18.39%)	65 (15.78%)
Hypertension	92 (23.17%)	81 (19.66%)
COPD	21 (5.29%)	23 (5.58%)
Kidney diseases	13 (3.27%)	16 (3.88%)
Thyroid disorders	27 (6.8%)	21 (5.1%)
Neurological disorders	18 (4.5%)	13 (3.15%)
Family history of glaucoma	16 (4.03%)	09 (2.18%)

**Table 3: Association of awareness of glaucoma with socio-demographic factors**

Variables	Urban Group			Rural group		
	Aware	Unaware	p-value	Aware	Unaware	p-value
Gender						
Male	60 (26.9%)	163 (73.1%)	0.620	51 (21.25%)	190 (78.75%)	0.447
Female	43 (24.71%)	131 (75.29%)		31 (18.13%)	140 (81.87%)	
Education						
No formal education	9	28	0.048	8	68	<0.005
Primary education	9	45		10	72	
Secondary education	21	88		20	104	
Higher Secondary	23	50		19	42	
Graduate	20	49		11	25	
Post-graduate	21	34		14	19	
Occupation						
Unemployed	2	29	0.007	8	34	0.186
Retired	33	82		11	56	
Farmer	2	21		27	122	
Business	26	63		12	23	
Day labor	11	21		6	25	
Service holder	24	33		9	17	
Homemaker	11	30		7	40	
Others	3	16		2	13	

p<0.05 is statistically significant

**Table 4: Assessment of knowledge and awareness regarding glaucoma**

	Urban	Rural	Chi-square	p-value
Know the term glaucoma				
Yes	103 (25.94%)	82 (19.9%)	4.18	0.04
No	294 (74.06%)	330 (80.1%)		
Aware that glaucoma is an eye disease				
Yes	67 (65.05%)	29 (35.37%)	16.11	<0.005
No	36 (34.95%)	53 (64.63%)		
Altered anatomical site in glaucoma				
Retina	3 (2.91%)	2 (2.44%)	0.356	0.637
Optic nerve	34 (33.01%)	27 (32.93%)	0.435	0.732
Cornea	2 (1.94%)	10 (12.19%)	3.172	0.036
Don't know	64 (62.13%)	42 (52.44%)	1.452	0.176
The existence of different types of glaucoma				
Yes	24 (23.30%)	18 (21.95%)	0.603	0.739
No	12 (11.65%)	7 (8.54%)		
Don't know	67 (65.05%)	57 (69.51%)		
Glaucoma can occur without symptoms				
Yes	29 (28.16%)	28 (34.15%)	3.044	0.218
No	17 (16.50%)	19 (23.17%)		
Don't know	57(55.34%)	35 (42.68%)		
Glaucoma is more common in people above 60 years				
Yes	40 (38.83%)	32 (39.02%)	1.897	0.387
No	29 (28.16%)	21 (25.61%)		
Don't know	34 (33.01%)	29 (35.37%)		
High IOP, family history and advanced age are glaucoma risk factors				
Yes	43 (41.75%)	38 (46.34%)	0.395	0.821
No	31 (30.10%)	23 (28.05%)		
Don't know	29 (28.15%)	21 (25.61%)		
Associated with high IOP				
Yes	52 (50.49%)	31 (37.80%)	3.845	0.279
No	21 (20.39%)	22 (26.83%)		
Not always	17 (16.5%)	13 (15.85%)		
Don't know	13 (12.62%)	16 (19.52%)		
The visual field is affected				
Yes	39 (37.86%)	24 (29.27%)	1.663	0.435
No	33 (32.04%)	32 (39.02%)		
Don't know	31 (30.10%)	26 (31.71%)		
Glaucoma progresses over time				
Yes	57 (55.34%)	32 (39.02%)	12.328	0.002
No	26 (25.24%)	41 (50.0%)		
Don't know	20 (19.42%)	9 (10.98%)		
Glaucoma causes blindness				
Yes	49 (47.58%)	39 (47.56%)	0.720	0.700
No	28 (28.17%)	26 (31.71%)		
Don't know	26 (24.25%)	17 (20.73%)		
Glaucoma can be cured				
Yes	41 (39.80%)	32 (39.02%)	4.927	0.085

No	47 (45.63%)	28 (34.15%)		
Don't know	15 (14.56%)	22 (26.83%)		
Purpose of treatment of glaucoma				
Regain vision	36 (34.95%)	30 (36.59%)	1.712	0.634
Delay progression	28 (27.18%)	22 (26.83%)		
Stop progression	23 (22.33%)	13 (15.85%)		
I don't know	16 (15.53%)	17 (20.73%)		
Glaucoma treatment reduces IOP				
Yes	51 (49.51%)	40 (48.78%)	0.301	0.860
No	42 (40.78%)	32 (39.02%)		
Don't know	10 (9.71%)	10 (12.20%)		
Glaucoma damage is reversible				
Yes	47 (45.63%)	37 (45.12%)	5.435	0.066
No	39 (37.86%)	40 (48.78%)		
Don't know	17 (16.50%)	5 (6.10%)		
Glaucoma is inherited				
Yes	31 (30.1%)	35 (42.68%)	3.5	0.174
No	42 (40.78%)	30 (36.59%)		
Don't know	30 (29.12%)	17 (20.73%)		

$p < 0.05$  is statistically significant

## DISCUSSION

Glaucoma, which is an irreversible and asymptomatic eye condition, can lead to irreversible blindness and can only be prevented by early diagnosis and treatment. Our cross-sectional study analysed the level of knowledge and awareness regarding glaucoma in urban and rural populations. This study included 397 and 412 respondents from urban and rural areas, respectively. The age of the respondents in both groups was comparable ( $41.7 \pm 9.2$  years vs  $45.4 \pm 11.9$  years in urban vs rural, [Table 1]). Both population groups showed more male respondents in the study population [Table 1]. Interestingly, 4.03% and 2.18% of our study respondents from urban and rural populations had a family history of glaucoma. Our study found that only 26% and 20% of urban and rural respondents were aware of the term glaucoma. Of them, 65% of the urban and 35% of the rural population were aware that glaucoma is an eye disease. It was found that respondents from the urban population were significantly more aware than their counterparts from the rural population [Table 1]. It was surprising that the level of awareness in our population was a bit low when compared to other studies held in neighbouring countries like Bangladesh.<sup>[2,10]</sup> Another study by Tenkir et al. reported a lower awareness (only 2.4% of respondents were aware) of glaucoma in Ethiopians compared to ours.<sup>[11]</sup> Other Indian studies, done by Ramesh et al. and Mridula et al., reported lower awareness levels amongst their study population in different parts of south India.<sup>[12,13]</sup> This varying degree of awareness could be attributed to varying levels of healthcare infrastructure, the influence of public health awareness programs, and their penetration in different areas of a country. Our study found that only 2% of the urban and 10% of the rural population aware of glaucoma knew the exact anatomical site where the abnormality occurs due to the disease. The difference in this knowledge was statistically significant [Table 4]. Studies by Sultana et al. and Bacerril et al reported a similar

trend of knowledge regarding this among their study population.<sup>[2,14]</sup>

This study found that the respondents' education was a major factor that drove the knowledge regarding glaucoma among the study participants of both groups. Participants with higher educational qualifications were statistically significantly more aware of the disease, irrespective of their residential area. Multiple studies in both north and south Indian settings supported our findings that educational status plays an important role in awareness and knowledge about glaucoma.<sup>[15,16]</sup>

Our study observed that less than 50% of urban and rural respondents had adequate knowledge of glaucoma's signs, symptoms and complication details [Table 4]. Though the differences among both groups were non-significant, it was surprising that despite reasonable awareness levels, a significant gap in understanding glaucoma persists among patients of any geographical area.

In our study, the primary source of glaucoma awareness was doctors or hospitals (62.3%), followed by family members with glaucoma and mass media (17.3% and 9.2%). Conversely, in southern India, TV and magazines were the most common sources, with family members with glaucoma ranking second. Surveys of the German population revealed that friends were the leading source of awareness (38%), surpassing physicians (16%), a pattern also noted in urban South Indian populations.<sup>[16-18]</sup>

Our study provides valuable insights into glaucoma awareness and knowledge in the population of Bihar. The comparative findings highlight the importance of designing tailored awareness campaigns and enhancing access to eye care services, considering regional differences and unique socioeconomic factors influencing awareness. Our analysis found no significant gender-based differences in glaucoma awareness, which was in contrast to findings observed by other Indian studies.<sup>[12,19]</sup> Urban residents demonstrated a higher awareness of glaucoma than their rural counterparts. Additionally,

education-level occupations were strongly linked to awareness, reflecting the population's demographic characteristics.

## CONCLUSION

Our study underscores the critical gaps in glaucoma awareness and knowledge, particularly among the urban and rural populations of economically weaker areas of Bihar. While a portion of the population is aware of glaucoma, their understanding of this vision-threatening condition remains alarmingly limited. Tailored health education and public health initiatives, such as targeted awareness campaigns and screening programs, are essential for reaching underserved populations and promoting better eye health. Early detection through improved awareness is vital for preventing irreversible blindness and mitigating the economic burden associated with glaucoma. Moreover, interventions that reinforce attitudes and influence behaviours toward managing glaucoma risks are urgently needed to address this significant public health challenge effectively.

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