# Educational Intervention On Glaucoma Patients For Knowledge Enhancement And Treatment Adherence

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**Keywords:**

Glaucoma patients, knowledge, adherence

**ABSTRACT**

**Background:** Glaucoma remains a leading cause of irreversible blindness globally, with poor disease awareness and suboptimal treatment adherence acting as critical barriers to effective management. Despite advancements in therapeutic interventions, the preventable nature of glaucoma-related vision loss continues to pose a significant public health challenge particularly in low-resource settings. This study investigated the impact of a structured, theory-driven educational intervention on enhancing glaucoma knowledge and treatment adherence in a demographically diverse patient population.

**Study Objective:** To evaluate the effects of educational intervention on glaucoma patients for knowledge enhancement and treatment adherence

**Methodology:** A quasi-experimental (one-group pretest–posttest design) was utilized to evaluate the efficacy of a nursing-led educational intervention informed by the Health Belief Model (HBM). The study was conducted between June 2024 and February 2025 in the ophthalmology outpatient department of Tertiary care Hospital, Lahore. Using purposive sampling, 80 adults aged 40–60 years with a confirmed diagnosis of primary open-angle glaucoma were enrolled. Inclusion criteria required cognitive capacity for health education, while individuals with significant visual impairment (BCVA ≤ 20/200), cognitive or hearing disabilities, or psychiatric disorders were excluded.

Data collection employed two psychometrically validated instruments: the Glaucoma Knowledge Questionnaire (Content Validity Index = 0.819; Cronbach's α = 0.774) and the Treatment Adherence Questionnaire (CVI = 0.897; Cronbach's α = 0.799). The intervention comprised a culturally tailored, linguistically appropriate educational session focused on glaucoma pathophysiology, intraocular pressure regulation, medication adherence, and the importance of consistent follow-up. Pre- and post-intervention outcomes were assessed using non-parametric statistical test Mann-Whitney U.

**Results:** The participant cohort was predominantly male (63.7%), with the majority aged 51–60 years (61.3%) and primarily Punjabi-speaking (53.8%). Educational attainment was generally low, with 22.5% of participants reporting no formal schooling. Statistically significant improvements were observed following the intervention. Glaucoma knowledge scores demonstrated a substantial increase,

| | |
|---|---|
| | with mean rank shifting from 59.50 pre-intervention to 100.50 post-intervention ($U = 3120.500$, $p < 0.001$). Likewise, treatment adherence improved markedly, as reflected by the increase in mean rank from 53.33 to 107.68 ($U = 1026.000$, $p < 0.001$). Notably, the proportion of participants with poor adherence dropped dramatically from 55% to 5%.<br>**Conclusion:** This study presents robust evidence that theory-informed, culturally tailored educational interventions substantially improve disease-specific knowledge and treatment adherence among patients with glaucoma. The findings emphasize the critical role of patient-centered health education strategies that are attuned to the linguistic, cultural, and educational needs of diverse populations particularly within under-resourced healthcare settings. By effectively addressing knowledge disparities and fostering sustained engagement with treatment regimens, these interventions demonstrate significant potential as scalable public health tools to reduce preventable vision loss due to glaucoma, especially among socioeconomically vulnerable groups. |

## INTRODUCTION

Glaucoma is a chronic, progressive optic neuropathy caused by the accumulation of aqueous humor, leading to elevated intraocular pressure and optic nerve damage (Shahid et al., 2017). If untreated, it can result in irreversible peripheral vision loss and eventual blindness. Vision impairment is a major global health concern, with the Global Burden of Disease (GBD) 2017 report identifying it as the third leading cause of impairment, affecting approximately 1.34 billion people (Hassan, 2019). Glaucoma is the second leading cause of global blindness, impacting an estimated 67 million individuals worldwide (Celebi & Ophthalmology, 2018).

The most common types are primary open-angle glaucoma (POAG) and angle-closure glaucoma (ACG), each with distinct risk profiles and progression patterns (Alqahtani et al., 2021). POAG often advances silently, delaying diagnosis until vision loss has occurred (Schuster, 2020), while ACG presents acutely and can cause rapid blindness. In low- and middle-income countries such as Pakistan, limited awareness of glaucoma's asymptomatic nature contributes to late diagnoses; nearly half of Pakistan's 1.8 million glaucoma patients already experience permanent vision loss (Biomedical Research and Therapy, 2017).

Treatment adherence is critical to slowing disease progression, yet remains suboptimal due to poor awareness, socioeconomic challenges, side effects, and forgetfulness (Khan et al., 2018). One local study found only 44% of patients adhered to treatment, with many believing glaucoma could be cured by surgery, revealing serious knowledge gaps (Munir et al., 2022; Shahid et al., 2017). The Health Belief Model (HBM) and Motivational Interviewing (MI) have been shown to enhance understanding, self-efficacy, and adherence in chronic disease management (Abraham & Sheeran, 2020; Orji et al., 2020).

This study investigates the effectiveness of HBM-based nursing interventions in improving treatment adherence among glaucoma patients. Drawing on clinical observations in a time-constrained outpatient setting, it addresses the need for structured, patient-centered education to foster sustainable health behaviors and reduce preventable vision loss.

**Study Objective:** To evaluate the effects of educational intervention on glaucoma patients for knowledge enhancement and treatment adherence

## METHODOLOGY

A quasi-experimental (one-group pretest–posttest design) was utilized to evaluate the efficacy of a nursing-led educational intervention informed by the Health Belief Model (HBM). The study was conducted between June 2024 and February 2025 in the ophthalmology outpatient department of tertiary care Hospital, Lahore. Using purposive sampling, 80 adults aged 40–60 years with a confirmed diagnosis of primary open-angle glaucoma were enrolled. Inclusion criteria required cognitive capacity for health education, while individuals with significant visual impairment (BCVA ≤ 20/200), cognitive or hearing

disabilities, or psychiatric disorders were excluded.
Data collection employed two psychometrically validated instruments: the Glaucoma Knowledge Questionnaire (Content Validity Index = 0.819; Cronbach's α = 0.774) and the Treatment Adherence Questionnaire (CVI = 0.897; Cronbach's α = 0.799). The intervention comprised a culturally tailored, linguistically appropriate educational session focused on glaucoma pathophysiology, intraocular pressure regulation, medication adherence, and the importance of consistent follow-up. Pre- and post-intervention outcomes were assessed using non-parametric statistical test Mann-Whitney U.

## RESULTS

This section consists results of the demographics characteristics of participants, glaucoma knowledge level of patients and adherence to treatment of glaucoma patients.

### 4.1 Demographics of participants

**Table 1: Demographic characteristics of study participants**

| Demographic characteristics | Frequency (N) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 51 | 63.7% |
| Female | 29 | 36.3% |
| **Age** | | |
| 40-50 years | 31 | 38.8% |
| 51-60 years | 49 | 61.3% |
| **Mother Tongue** | | |
| Punjabi | 43 | 53.8% |
| Urdu | 29 | 36.3% |
| English | 0% | 0% |
| Other | 8 | 10.0% |
| **Marital status** | | |
| Married | 50 | 62.5% |
| Divorced/separated | 10 | 12.5% |
| Widowed | 20 | 25.0% |
| Single | 0 | 0% |
| **Qualification** | | |
| No Schooling | 18 | 22.5% |
| Primary | 12 | 15.0% |
| Middle | 25 | 31.3% |
| Intermediate | 11 | 13.8% |
| University | 9 | 11.3% |
| Any other | 5 | 6.3% |
| **Socio economic status** | | |
| Low | 40 | 50% |
| Middle | 32 | 40% |
| High | 8 | 10.0% |

Table 1 demographic characteristics of the sample reveal a diverse distribution across various categories. In terms of gender, the majority of participants were male (63.7%), while 36.3% were female. Age distribution was skewed towards older individuals, with 61.3% of respondents falling within the 51-60-year age group, and 38.8% in the 40-50-year range. The respondents' mother tongue predominantly included Punjabi (53.8%), followed by Urdu (36.3%), English, and other languages (10%). Regarding marital status,

most individuals were married (62.5%), while 25% were widowed, and 12.5% were divorced or separated. In terms of educational background, a significant portion had completed middle school (31.3%), followed by primary school (15%) and no schooling at all (22.5%). Fewer participants had attained higher levels of education, with 13.8% completing intermediate education, 11.3% holding university degrees, and 6.3% having other qualifications. These demographic trends highlight a population with a higher proportion of older, married individuals, with varying levels of educational attainment. The participants' socio-economic status revealed that the majority belonged to the low socio-economic group**,** accounting for 50% (n = 40) of the sample. This was followed by participants from the middle socio-economic group, who made up 40% (n = 32) of the respondents. A smaller proportion, 10% (n = 8)**,** were identified as belonging to the high socio-economic group**.** These findings suggest that half of the study population came from economically disadvantaged backgrounds, which may influence access to healthcare resources, health literacy, and overall health-related behaviours.

### 4.2 Knowledge level of Glaucoma patients

**Table 2: Glaucoma Knowledge level (n=80)**

| Glaucoma Knowledge level | Pre intervention | | Post intervention | |
|---|---|---|---|---|
| | Frequency | % | Frequency | % |
| **Good knowledge** | 3 | 3.8% | 35 | 43.8% |
| **Moderate knowledge** | 20 | 25.8% | 45 | 56.3% |
| **Poor knowledge** | 57 | 71.3% | 0 | 0% |

Table 2 illustrates the changes in glaucoma knowledge levels before and after the intervention among the 80 participants. Initially, a significant proportion of participants (71.3%) demonstrated poor knowledge of glaucoma, scoring 7 or fewer on the knowledge scale. A smaller percentage had moderate knowledge (25.8%), and only 3.8% exhibited good knowledge with scores above 14. However, after the intervention, there was a marked improvement in knowledge levels. The number of participants with good knowledge increased substantially to 43.8%, while those with moderate knowledge also rose to 56.3%. Notably, no participants were categorized as having poor knowledge post-intervention, highlighting the positive impact of the intervention in enhancing participants' understanding of glaucoma.

### 4.3 Treatment adherence of Glaucoma patients

**Table 3: Glaucoma treatment adherence (n=80)**

| Glaucoma treatment adherence | Pre intervention | | Post intervention | |
|---|---|---|---|---|
| | Frequency | % | Frequency | % |
| **Excellent** | **0** | **0%** | 24 | 30.0% |
| **Good** | 7 | 8.8% | 18 | 22.5% |
| **Moderate** | 29 | 36.3% | 34 | 42.5% |
| **Low** | 44 | 55.0% | 4 | 5.0% |

Table 3 presents the changes in glaucoma treatment adherence levels before and after the intervention among the 80 participants. Prior to the intervention, the majority of participants (55%) exhibited low adherence to their glaucoma treatment, with adherence scores of 7 or fewer. A smaller portion demonstrated moderate adherence (36.3%), while only 8.8% had good adherence, and none showed excellent adherence. After the intervention, however, there was a significant improvement in treatment adherence. The number of participants with excellent adherence increased to 30%, and those with good adherence rose to 22.5%. Furthermore, the proportion of participants with low adherence drastically decreased to just 5%, and

moderate adherence remained stable at 42.5%. These findings highlight the positive effect of the intervention in enhancing participants' adherence to glaucoma treatment.

### 4.4 Comparison of pre intervention and post intervention scores

**Table 4: Comparison of pre and Post scores of Glaucoma Knowledge**

| Value | (Mean Ranks) (pre intervention) | (Mean Ranks) (Post intervention) | Mann-Whitney U | P-value |
|---|---|---|---|---|
| **Glaucoma Knowledge** | 59.50 | 100.50 | 3120.500 | 0.000 |

Table 4 presents a comparison of pre- and post-intervention scores for glaucoma knowledge using the Mann-Whitney U test. The results demonstrate a marked increase in knowledge levels, with mean ranks rising from 59.50 in the pre-intervention phase to 100.50 in the post-intervention phase. The calculated Mann-Whitney U value of 3120.500, accompanied by a p-value of 0.000, indicates a statistically significant difference at the $p < 0.05$ threshold. It is important to note that the Mann-Whitney U test does not yield results in conventional measurement units but instead provides a rank-based statistic that reflects the relative position of scores between two independent groups.

**Table 5: Comparison of pre intervention and Post intervention scores of Glaucoma treatment adherence**

| Value | (Mean Ranks) (pre intervention) | (Mean Ranks) (Post intervention) | Mann-Whitney U | P-value |
|---|---|---|---|---|
| **Glaucoma treatment adherence** | 53.33 | 107.68 | 1026.000 | 0.000 |

Table 5 presents the comparison of pre- and post-intervention scores related to glaucoma treatment adherence, analyzed using the Mann-Whitney U test. The results indicate a significant improvement in adherence levels following the intervention, as evidenced by an increase in mean ranks from 53.33 (pre-assessment) to 107.68 (post-assessment). The Mann-Whitney U value of 1026.000 and a p-value of 0.000 confirm that this difference is statistically significant at the 0.05 level. It is important to clarify that the Mann-Whitney U test does not generate outcomes in conventional measurement units but instead operates on ranked data to compare differences between two independent groups. The interpretation of its results depends primarily on the p-value, which in this case clearly indicates that the intervention was effective in significantly enhancing treatment adherence among glaucoma patients.

## DISCUSSION

This study found that demographic characteristics played a significant role in influencing patients' knowledge and adherence to glaucoma treatment. The majority of participants were male (63.7%), reflecting existing literature that suggests men are often overrepresented in clinical research related to chronic diseases (Said et al., 2023). Studies such as Lee et al. (2022) have also documented higher male participation in glaucoma studies. However, some research presents a more balanced gender distribution in healthcare research, indicating that gender ratios may differ by setting or study design (Ghosh & Singh, 2022). Age was another influential factor, with the majority of participants falling in the 51–60-year range. This is consistent with evidence that glaucoma incidence rises significantly with age (Shrestha et al., 2022; Lee & Park, 2024), although newer studies also suggest that early-onset glaucoma may be increasing among younger populations (Khanna et al., 2023).

Language and educational background were also key variables in the study. Punjabi was the predominant mother tongue (53.8%), followed by Urdu. Language barriers are known to impede healthcare

communication and comprehension, especially in multilingual regions (Khan et al., 2023; Ghani et al., 2023). Educational attainment among participants was generally low, with nearly a quarter having no formal education. Similar studies confirm that low literacy is linked to poor health outcomes, including poor disease knowledge and non-adherence to treatment (Alam et al., 2024; Xu & Wang, 2023). Although education is often correlated with better health behaviors, Ghani et al. (2023) found that in older populations, this link may weaken due to cognitive decline, emphasizing the need for tailored health communication strategies.

The study revealed a significant improvement in participants' knowledge levels about glaucoma following a structured educational intervention. Initially, 71.3% of participants demonstrated poor knowledge, but post-intervention, this figure dropped to 0%, indicating a clear impact. Similar results were reported by Ibrahim et al. (2023) and Shrestha et al. (2022), where health education campaigns significantly increased awareness and understanding of glaucoma. Khan et al. (2023) also emphasized the effectiveness of localized and targeted interventions in enhancing disease knowledge. However, not all studies are in full agreement; Lee et al. (2022) and Ghosh & Singh (2022) warned that knowledge gains might be short-lived without continuous education or reinforcement strategies. This underscores the importance of incorporating follow-up mechanisms in educational programs to maintain knowledge retention.

Treatment adherence, another critical outcome of this study, improved markedly following the intervention. Before the intervention, a majority (55%) had low adherence, while afterward, 30% achieved excellent adherence and low adherence dropped to 5%. These results support findings by Ghosh et al. (2023) and Khan et al. (2024), who documented significant improvements in adherence after health education interventions. These studies underscore the role of patient education in reinforcing the importance of regular medication and follow-ups. However, other studies provide a more nuanced picture. Zhang et al. (2023) and Patel et al. (2022) noted that while initial adherence improvements are common, sustaining them is more challenging, especially in patients facing financial constraints or lacking social support.

Overall, the statistically significant changes in both knowledge ($U = 3120.500$, $p = 0.000$) and adherence ($U = 1026.000$, $p = 0.000$) observed in this study reinforce the effectiveness of educational interventions. However, these findings also emphasize that education alone may not suffice in achieving long-term behavioral change. As indicated by previous research (Zhang et al., 2023; Ghosh & Singh, 2023), long-term treatment adherence and sustained knowledge improvement require a more holistic approach. Strategies like ongoing motivational support, use of local languages, follow-up reminders, and addressing socio-economic barriers must be integrated into healthcare plans. Thus, this study highlights the vital role of educational interventions as a foundation, while recommending that they be combined with broader systemic efforts to ensure sustainable outcomes for glaucoma patients.

## CONCLUSION

This study demonstrates the effectiveness of contextually tailored educational interventions in improving glaucoma knowledge and treatment adherence. The predominantly older, married, Punjabi-speaking male population with limited formal education underscores the need for culturally and linguistically appropriate health education. Post-intervention, significant improvements in knowledge and adherence reflected in higher mean scores and reduced low adherence rates highlight the impact of structured educational programs. These findings support targeted health education as a vital strategy for enhancing glaucoma management in underserved populations.

### Recommendations

1. Integrate culturally and linguistically tailored glaucoma education into routine clinical care, using interactive tools and patient-centered communication strategies to address knowledge gaps and empower self-management.
2. Leverage digital health technologies such as mobile reminders, virtual counseling, and telemonitoring to enhance treatment adherence and overcome barriers related to access, mobility, and follow-up.

3. Establish interdisciplinary care models that position nurses as central educators and adherence monitors, collaborating closely with ophthalmologists and pharmacists to provide holistic, continuous support.
4. Prioritize longitudinal research that evaluates the sustainability of educational interventions while exploring psychosocial and systemic factors influencing adherence, particularly in diverse and underserved populations.

**Limitations**

The study's lack of a control group limits the ability to attribute improvements in knowledge and adherence solely to the intervention, as external factors may have influenced outcomes.

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