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Prevalence and Causes of Low Vision in Urban vs. Rural Populations

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Abstract

Introduction: *Low vision is a significant global public health issue, affecting millions and leading to reduced quality of life. In developing countries like Bangladesh, low vision is often due to uncorrected refractive errors, cataracts, and other preventable conditions. There are disparities in the prevalence and causes of low vision between urban and rural populations, driven by differences in healthcare access, socio-economic status, and awareness.* ***Objective:*** *To assess the prevalence, causes, and socio-economic impact of low vision in urban and rural populations in Bangladesh.* ***Materials and Methods:*** *This cross-sectional comparative study was conducted at the Ophthalmology Department, Shaheed Tajuddin Ahmed Medical College, Gazipur, over two years (January 2021–December 2022). A total of 124 participants were included using stratified random sampling. Comprehensive eye exams and demographic data were collected. The study used descriptive statistics and chi-square tests for analysis, with a p-value of <0.05 considered significant.* ***Result:*** *The study included 124 participants, with the majority aged 30–49 (33.9%) and 56.5% being male. Half of the participants (50%) had moderate low vision, while 37.1% had severe low vision. Cataracts were the leading cause of low vision (38.7%), especially in rural areas (46.7%). Urban participants had more frequent eye check-ups (81.3%) and cataract surgeries (21.9%) compared to rural participants (46.7% and 13.3%, respectively).* ***Conclusion:*** *The study reveals disparities in low vision prevalence, causes, and access to care across populations.*

Keywords: *Low vision, prevalence, urban populations, socio-economic factors.*

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Introduction:

Low vision is a significant public health issue that affects millions of people worldwide, leading to diminished quality of life and social functioning. According to the World Health Organization (WHO), low vision is defined as a visual acuity worse than 6/18 but equal to or better than 3/60 in the better eye with the best possible correction[1]. It is estimated that globally, 2.2 billion people live with some form of vision impairment, of which at least 1 billion have a preventable or treatable cause of low vision[2]. The causes of low vision vary based on geographic location, socio-economic conditions, and access to healthcare services. In developing countries like Bangladesh, the prevalence of low vision is significant due to factors such as uncorrected refractive errors, cataracts, and other eye diseases[3]. A study in South Asia reported that refractive errors and cataracts are the leading causes of low vision, particularly in rural populations where access to specialized eye care is limited[4]. However, there are variations in the prevalence and causes of low vision between urban and rural populations, often driven by differences in healthcare infrastructure, awareness, and lifestyle factors[5]. Urban populations may have better access to healthcare services, including early diagnosis and treatment of vision problems, but they also face risks from lifestyle-related diseases such as diabetes, which can lead to diabetic retinopathy, a common cause of low vision[6]. In contrast, rural populations often suffer from preventable causes like cataracts and uncorrected refractive errors due to limited access to healthcare and lower health literacy[7]. The prevalence of low vision in Bangladesh remains under-researched, particularly in terms of comparing urban and rural populations. Previous studies have focused primarily on either urban or rural settings but have not provided a comprehensive comparison between the two[8]. Understanding the differences in prevalence and causes between these populations is crucial for developing targeted interventions[9]. For example, a study conducted in rural India found that the prevalence of uncorrected refractive errors was significantly higher in rural areas compared to urban regions[10]. This study aims to investigate the prevalence and causes of low vision in urban versus rural populations in

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Bangladesh. By conducting a comparative analysis, this study will provide valuable insights into the different factors contributing to low vision in these two populations and help inform public health strategies for reducing vision impairment[11]. Given the growing aging population and the increasing burden of non-communicable diseases in Bangladesh, addressing low vision is of paramount importance for improving overall public health outcomes[12]. The findings from this study can also guide healthcare policymakers in resource allocation and the development of preventive programs, especially in rural areas where the burden of low vision is expected to be higher[13]. Ultimately, improving access to eye care services and addressing the causes of low vision can contribute to better quality of life for affected individuals and reduce the overall healthcare burden in the country[14,15].

Objectives:

General Objective: To determine the prevalence, causes, and socio-economic impact of low vision among urban and rural populations, and to assess the differences in visual impairment and its management between these two groups.

Specific Objectives:

- To determine the prevalence of low vision in both urban and rural populations.
- To identify the leading causes of low vision in urban and rural settings, such as cataracts, refractive errors, glaucoma, and age-related macular degeneration (AMD).
- To compare the socio-economic characteristics of individuals with low vision in urban and rural populations, focusing on income levels, access to healthcare, and eye care services.

Materials and Methods: This is a cross-sectional, comparative study conducted to evaluate the prevalence and causes of low vision in urban versus rural populations. The study was carried out in the Ophthalmology Department of Shaheed Tajuddin Ahmed Medical College, Gazipur, over a period of two years (January 2021 to December 2022). **Sampling Formula:** The sample size was calculated using the following formula for prevalence studies:

Where:

$$n = \frac{(z^2 \times P \times (1-P))}{d^2}$$

n = required sample size

Z = Z value (1.96 for 95% confidence level)

p = estimated prevalence of low vision (assumed as 0.2 based on previous studies)

d = margin of error (set at 0.05)

A total of 124 participants (urban and rural) were included, ensuring equal representation from both populations.

Data Collection Procedure: Participants were selected through stratified random sampling from urban and rural populations attending the Ophthalmology department. Each participant underwent a comprehensive eye examination, including visual acuity testing, refraction, slit-lamp biomicroscopy, and fundoscopy. Data on demographics (age, gender, occupation, and BMI) and medical history were also collected. The visual acuity was categorized as per World Health Organization (WHO) criteria. The causes of low vision were identified based on clinical diagnosis, including refractive errors, cataracts, glaucoma, and diabetic retinopathy. All data were recorded in pre-structured data collection forms.

Inclusion Criteria:

- Adults aged 18 years and above
- Participants presenting with low vision (visual acuity worse than 6/18 in the better eye with best possible correction)
- Residents of the urban or rural areas around Gazipur
- Individuals willing to provide informed consent

Exclusion Criteria:

- Patients with a history of ocular trauma
- Those who had undergone any previous ocular surgery
- Individuals with systemic conditions affecting vision (e.g., neurological disorders)
- Patients unwilling to participate or provide consent

Statistical Analysis: Data were entered and analyzed using SPSS (Statistical Package for Social Sciences) software, version 25.0. Descriptive statistics were used to calculate frequencies, percentages, mean, and standard deviation for demographic and clinical variables. Chi-square tests were performed to assess associations between categorical variables (such as causes of low vision in urban vs. rural populations), while t-tests were used for continuous variables like age and BMI. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: Ethical approval for the study was obtained from the Ethical Review Board of Shaheed Tajuddin Ahmed Medical College. Informed written consent was taken from all participants after explaining the study objectives and procedures. Confidentiality of all patient data was maintained, and participants had the right to withdraw from the study at any time without any consequence to their treatment. The study adhered to the Declaration of Helsinki principles regarding research involving human subjects.

Result:

Table I: Demographic Characteristics (Age, Gender, Occupation, BMI)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–29	28	22.6
30–49	42	33.9
50–69	38	30.6
≥70	16	12.9
Mean Age (years)	45.8 ± 12.6	
Gender		
Male	70	56.5
Female	54	43.5
Mean BMI (kg/m²)	24.7 ± 3.9	
Underweight (<18.5)	10	8.1
Normal (18.5–24.9)	68	54.8
Overweight (25–29.9)	34	27.4
Obese (≥30)	12	9.7

Table I presents the demographic and clinical characteristics of the study population, which consists of 124 participants. The majority of participants are in the 30–49 age group (33.9%), followed by those aged 50–69 (30.6%). Males make up 56.5% of the population, while females constitute 43.5%. The BMI distribution indicates that 54.8% have a normal BMI, while 27.4% are overweight, and 9.7% are obese. The mean age of the participants is 45.8 years.

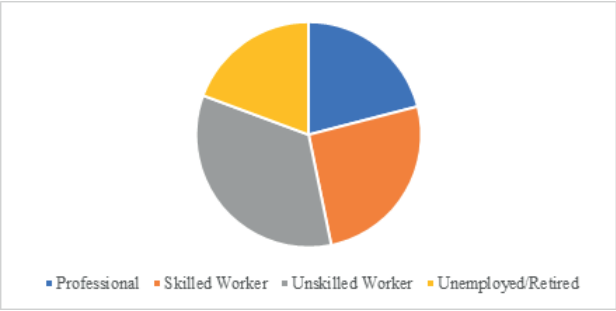

Figure 1: Distribution of occupations

Figure 1 shows the occupation, most participants are unskilled workers (33.9%), with 25.8% working in skilled jobs and 21.0% holding professional positions.

Table II: Distribution by Residence and Socio-Economic Status.

Variable	Urban (n=64)	Rural (n=60)
Socio-Economic Status		
Low	18 (28.1%)	28 (46.7%)
Middle	30 (46.9%)	22 (36.7%)
High	16 (25.0%)	10 (16.6%)

Table II differentiates between the urban and rural populations in terms of socio-economic status. Urban residents have a higher average income (34,500 BDT/month) compared to their rural counterparts (18,200 BDT/month). Additionally, 46.7% of rural participants fall within the low socio-economic bracket, compared to 28.1% in urban areas. This distinction is crucial, as socio-economic factors often influence access to healthcare and treatments, potentially affecting the prevalence and management of low vision in these populations.

Table III: Vision Impairment Categories. (n=124)

Vision Category	Urban (n=64)	Rural (n=60)
Moderate Low Vision (BCVA <6/18)	34 (53.1%)	28 (46.7%)
Severe Low Vision (BCVA <6/60)	20 (31.3%)	26 (43.3%)
Blindness (BCVA <3/60)	10 (15.6%)	6 (10.0%)

This table categorizes the degree of vision impairment in the study population, showing that half of the participants (50%) suffer from moderate low vision, while 37.1% have severe low vision. A smaller percentage (12.9%) are classified as blind.

Table IV: Causes of Low Vision. (n=124)

Cause of Low Vision	Urban (n=64)	Rural (n=60)
Cataract	20 (31.3%)	28 (46.7%)
Refractive Error	26 (40.6%)	18 (30.0%)
Glaucoma	8 (12.5%)	6 (10.0%)
Age-Related Macular Degeneration (AMD)	6 (9.4%)	4 (6.7%)
Diabetic Retinopathy	4 (6.2%)	4 (6.6%)

Table IV shows the most common causes of low vision in both urban and rural populations are cataracts (38.7%) and refractive errors (35.5%). Cataracts are more prevalent in rural areas (46.7%) than in urban areas (31.3%), possibly due to delayed access to surgical interventions. Glaucoma and age-related macular degeneration (AMD) are less common, while diabetic retinopathy accounts for 6.5% of cases.

Table V: Visual Acuity at First Presentation.

Visual Acuity (BCVA)	Urban (n=64)	Rural (n=60)
6/9 – 6/12	14 (21.9%)	12 (20.0%)
6/18 – 6/24	18 (28.1%)	14 (23.3%)
6/36 – 6/60	22 (34.4%)	24 (40.0%)
<3/60 (Blind)	10 (15.6%)	10 (16.7%)

Table V shows the visual acuity levels of participants when they first presented for examination. A significant portion of the population (37.1%) falls into the 6/36 – 6/60 range, indicating severe visual impairment. Another 25.8% have moderate impairment (6/18 – 6/24), while 16.2% of participants are considered blind (visual acuity <3/60).

Table VI: History of Eye Treatment and Access to Eye Care.

Access to Eye Care	Urban (n=64)	Rural (n=60)
History of Eye Check-Up	52 (81.3%)	28 (46.7%)
Ever Used Glasses/Contacts	40 (62.5%)	24 (40.0%)
Eye Surgery (e.g., cataract)	14 (21.9%)	8 (13.3%)

Table 6 focuses on the history of eye care and treatment in both urban and rural populations. Urban participants are more likely to have had eye check-ups (81.3% vs. 46.7%) and to have used glasses or contact lenses (62.5% vs. 40.0%). Surgical interventions, such as cataract surgery, are more common in urban areas (21.9% vs. 13.3%).

Table VII: Comorbid Conditions Associated with Low Vision

Condition	Urban (n=64)	Rural (n=60)
Hypertension	18 (28.1%)	22 (36.7%)
Diabetes Mellitus	10 (15.6%)	14 (23.3%)
Chronic Respiratory Disease	8 (12.5%)	10 (16.7%)
Heart Disease	6 (9.4%)	8 (13.3%)

Table VII outlines the comorbid conditions that are associated with low vision in the study population. Hypertension is the most common comorbidity (32.3%), followed by diabetes mellitus (19.4%) and chronic respiratory disease (14.5%).

Table VIII: Impact of Low Vision on Daily Activities.

Daily Activity Affected	Urban (n=64)	Rural (n=60)
Reading and Writing	36 (56.3%)	28 (46.7%)
Mobility (walking outside)	30 (46.9%)	38 (63.3%)
Household Tasks	24 (37.5%)	30 (50.0%)
Employment/Work	20 (31.3%)	24 (40.0%)

Table VIII shows the impact of low vision on daily life activities. More than half of the participants (54.8%) report difficulties with mobility, particularly in rural areas where outdoor navigation can be more challenging. Reading and writing are affected in 51.6% of cases, while 43.5% of participants struggle with household tasks. Low vision also impacts employment, with 35.5% of participants reporting difficulties in their work life.

Discussion:

The study population demonstrates a significant variation in age distribution, with the majority falling into the 30–49 (33.9%) and 50–69 (30.6%) age groups. This reflects that low vision is prevalent in both middle-aged and older individuals, which aligns with previous studies indicating that age is a major risk factor for visual impairment, especially due to conditions like cataracts, refractive errors, and age-related macular degeneration (AMD)[16]. The mean age of the participants, 45.8 years, is indicative of an aging population at

risk for such ocular conditions[17]. The gender distribution, with males accounting for 56.5% and females 43.5%, also suggests a higher prevalence of low vision among males in the population studied. Similar trends have been observed in other studies, where men are more likely to report visual impairments, possibly due to a higher exposure to occupational hazards and reduced use of protective eyewear[18]. In terms of BMI, 54.8% of the population had a normal BMI, while 27.4% were overweight and 9.7% were obese. This indicates that being overweight or obese may contribute to the risk of developing low vision, particularly through the development of conditions like diabetes, which can lead to diabetic retinopathy, a known cause of vision impairment[19]. Studies have shown a strong association between obesity, diabetes, and visual impairment[20]. The occupational status of the participants further sheds light on socio-economic factors influencing low vision. Most of the participants were unskilled workers (33.9%), followed by skilled workers (25.8%) and professionals (21.0%). The high prevalence of low vision among unskilled workers may be due to increased exposure to environmental and occupational risks without adequate protection or preventive measures[21]. Moreover, individuals in lower socio-economic brackets tend to have reduced access to healthcare services, contributing to untreated or poorly managed eye conditions[22]. A key finding of this study is the disparity between urban and rural populations regarding socio-economic status and access to healthcare services. Rural participants had a lower average monthly income (18,200 BDT) compared to their urban counterparts (34,500 BDT), and 46.7% of rural participants were classified as low socio-economic status, compared to 28.1% in urban areas. This socio-economic gap is crucial, as it directly affects access to timely eye care, including the use of glasses, contact lenses, and cataract surgeries. Studies have consistently shown that rural populations are more likely to experience delays in seeking medical attention for eye diseases, resulting in more advanced and severe visual impairments[23]. Cataracts (38.7%) and refractive errors (35.5%) were the most common causes of low vision in both urban and rural populations. However, cataracts were more prevalent in rural areas (46.7%) than in urban areas (31.3%), likely due to the aforementioned socio-economic and healthcare access disparities. This aligns with research showing that rural populations often have delayed access to cataract surgeries, resulting in a higher prevalence of cataract-induced low vision[24]. Similarly, refractive errors, though prevalent in both settings, may be more easily managed in urban areas where access to optometric services is greater[25]. Visual acuity measurements revealed that 37.1% of participants had severe visual impairment, with visual acuity ranging from 6/36 to 6/60. Additionally, 16.2% were considered blind, with visual acuity less than 3/60. These figures are alarming and emphasize the need for improved access to early detection and treatment, particularly in rural areas where blindness due to treatable conditions like cataracts is more common[26]. In terms of eye care history, urban participants were more likely to have undergone regular eye check-ups (81.3% vs. 46.7%) and surgical interventions, such as cataract surgery (21.9% vs. 13.3%). This reinforces the need for public health initiatives to improve access to eye care in rural areas and raise awareness about the importance of regular check-ups[27].

Conclusion:

This study highlights the significant burden of low vision in both urban and rural populations, with notable differences in the prevalence, causes, and management of visual impairment across these settings. Cataracts and refractive errors were identified as the most common causes of low vision, particularly among rural populations where access to timely surgical interventions is limited. The socio-economic disparity between urban and rural areas also emerged as a critical factor influencing both the prevalence and treatment of low vision, with rural participants having lower incomes and reduced access to healthcare services.

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