JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

DOI: https://doi.org/10.61919/39qkaq96

Original Article

Prevalence of Low Vision and Blindness Among Students in Government Institute for Visually Impaired Children, Peshawar, Khyber Pakhtunkhwa

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"Cite this Article" **Received**: 16 January 2026; **Accepted**: 15 March 2026; **Published**: 30 March 2026
Author Contributions: Concept: MIK, AA; Design: MIK, AAs; Data Collection: AA, AN, QJ, SSK, KB; Analysis: MIK, AAs; Drafting: MIK, AA, AN, QJ, SSK, KB, AAs.. **Ethical Approval**: Rehman Medical Institute, Peshawar, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: NA

ABSTRACT

Background: Students enrolled in schools for visually impaired children may have varying degrees of residual vision, but institution-specific evidence from Khyber Pakhtunkhwa is limited. Objective: To determine the prevalence of moderate low vision, severe low vision, blindness, and normal visual acuity among students enrolled at the Government Institute for Visually Impaired Children, Peshawar, and to describe associated visual-function and rehabilitation indicators. Methods: This descriptive cross-sectional study included 106 students selected through an institution-based convenience approach. Assessments included unaided and best-corrected visual acuity recorded in logMAR units, pinhole response, visual-field extent, colour vision, spectacle use, low-vision-device use, and family history. Visual status was classified according to the visual-impairment framework applied in the study. Data were analysed descriptively using IBM SPSS Statistics version 25.0, and prevalence estimates were presented with 95% confidence intervals. Results: Blindness was present in 75 students (70.8%; 95% CI: 61.5%–78.6%), severe low vision in 14 (13.2%), moderate low vision in 11 (10.4%), and normal visual acuity in six (5.7%). Twenty-five students (23.6%) had moderate or severe low vision, whereas only 11 (10.4%) used a low-vision device. At least 14 of the 25 students with low vision (56.0%) were not using such a device. A positive family history was reported by 52.8%, and 59.4% had a both-eye visual-field extent of 40° or less. Conclusion: Blindness predominated, but a clinically important proportion retained measurable vision. Comprehensive assessment and individualized low-vision and educational services are required.
Keywords: Blindness; Low Vision; Visual Impairment; Visual Acuity; Visual Fields; Assistive Devices; Rehabilitation.

INTRODUCTION

Visual impairment is an important public-health concern that encompasses limitations in visual acuity, visual field, contrast sensitivity, colour perception, and other visual functions required for independent daily activities. Its severity ranges from moderate visual impairment to blindness and may substantially restrict educational participation, social development, mobility, and future employment opportunities (1,2). Globally, billions of people experience some degree of vision impairment, with a considerable proportion of cases remaining preventable, treatable, or amenable to rehabilitation through timely detection, refractive correction, medical or surgical management, and low-vision services (2,3).

The burden of visual impairment is disproportionately concentrated in low- and middle-income countries, where access to comprehensive ophthalmic assessment, treatment, assistive devices, and rehabilitation services remains limited (4). In Pakistan, blindness and low vision continue to represent substantial health challenges, particularly in populations with restricted access to specialist eye-care services. Previous national and regional investigations have identified avoidable and potentially treatable ocular conditions as important contributors to visual impairment, emphasizing the need for early detection and appropriate referral pathways (5,6). Childhood visual impairment is especially consequential because affected children may live for many years with functional limitations that influence literacy, psychosocial development, independence, and economic productivity.

Studies conducted among school-aged children have reported considerable variation in the prevalence and causes of visual impairment across different geographical and socioeconomic settings. Research from Tanzania identified low vision among schoolchildren and highlighted congenital and developmental ocular abnormalities as important causes (7). Studies from Ethiopia have similarly demonstrated that visual-acuity impairment among children is influenced by access to eye-care services, socioeconomic conditions, and uncorrected ocular problems (8). Population-based research among preschool children in Beijing found that visual impairment was frequently associated with potentially correctable causes, reinforcing the importance of early screening and intervention (9).

Children enrolled in schools for the visually impaired constitute a particularly important population because institutional placement may not always reflect their current level of visual function. Investigations from India and other countries have shown that some students classified educationally as blind retain measurable residual vision and may benefit from spectacles, optical devices, environmental modifications, or structured low-vision rehabilitation (10–12). Appropriate assessment has enabled some students to use enlarged or standard print, improve classroom participation, and reduce exclusive dependence on Braille. Similar studies in Nigeria and other settings have demonstrated that systematic ophthalmic evaluation can identify unmet treatment and rehabilitation needs among students attending specialized schools (13).

Accurate classification of visual function is therefore essential for matching students with appropriate educational and rehabilitative services. Students with profound or irreversible visual loss may require comprehensive Braille-based instruction and orientation and mobility training, whereas those with residual functional vision may benefit from optical magnification, enhanced contrast, enlarged print, electronic assistive technology, and individualized visual rehabilitation. Comprehensive assessment may also identify students whose central visual acuity is within the normal range but who require further evaluation for visual-field defects, ocular disease, functional limitations, or educational-placement needs.

Despite the importance of these assessments, evidence concerning the distribution of low vision and blindness among students attending institutions for visually impaired children in Khyber Pakhtunkhwa remains limited. The absence of institution-specific data restricts planning for optometric screening, low-vision rehabilitation, assistive-device provision, and individualized teaching strategies. Therefore, this study aimed to determine the prevalence of moderate low vision, severe low vision, blindness, and normal visual acuity among students enrolled at the Government Institute for Visually Impaired Children, Peshawar, Khyber Pakhtunkhwa. It also described spectacle use, low-vision-device use, visual-field status, colour vision, family history of visual impairment, and visual-acuity findings to support evidence-based eye-care and educational planning.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted over three months at the Government Institute for Visually Impaired Children, Peshawar, Khyber Pakhtunkhwa. The target population comprised students enrolled at the institute during the study period. An institution-based convenience sampling approach was used, with all available enrolled students considered for participation. Students who were absent during the data-collection period or unwilling to cooperate with the assessment procedures were excluded. The final sample comprised 106 students.

Permission to conduct the study and collect data was obtained from the administration of the institute. Ethical approval was granted by the Research Ethics Committee of Rehman Medical Institute before commencement of data collection. Participation was voluntary, and information obtained during the assessments was handled confidentially and used solely for research purposes.

Data were collected by the research team using a structured questionnaire and standardized clinical assessment form. The questionnaire recorded age group, family history of visual impairment, spectacle use, and use of low-vision aids or devices. Visual assessment included unaided distance visual acuity, best-corrected visual acuity, pinhole visual acuity, visual-field assessment, and colour-vision testing. Visual acuity was recorded in logarithm of the minimum angle of resolution units. Unaided acuity was assessed separately for the right eye and left eye and binocularly. Best-corrected visual acuity was subsequently documented for each eye and binocularly after application of the available optical correction. Pinhole testing was performed to determine whether visual acuity improved with reduction of peripheral light rays, and the result was recorded as improvement or no improvement.

Visual-field findings were recorded separately for the right eye, left eye, and both eyes and grouped according to the measured field extent as 0–20°, 21–40°, 41–60°, or 61–90°. Colour vision was categorized as normal trichromacy, protanopia, tritanopia, or not testable. Students who could not reliably complete colour-vision testing were retained in the descriptive analysis and reported as a separate category rather than being excluded from the study.

The primary outcome was visual-impairment category based on the best-corrected visual acuity of the better-seeing eye. Participants were classified according to the World Health Organization visual-impairment framework adopted in the study as having normal vision, moderate low vision, severe low vision, or blindness. The classification was based on the recorded logMAR value after optical correction. The secondary outcomes included distributions of unaided and best-corrected visual acuity, pinhole response, visual-field extent, colour-vision status, spectacle use, low-vision-device use, and family history of visual impairment.

Completed data forms were reviewed for completeness before entry. Data were entered and analysed using IBM SPSS Statistics version 25.0. As the study was designed to estimate and describe the distribution of visual impairment within a single institutional population, analysis was limited to descriptive statistics. Categorical variables were summarized as frequencies and percentages. Visual-acuity values and visual-field categories were presented as frequency distributions. All calculations used the total number of assessed students as the denominator, except where an outcome was categorized as not testable. No inferential comparisons or causal associations were undertaken.

RESULTS

A total of 106 students were included in the analysis. The largest age group was 11–15 years, comprising 50 participants (47.2%), followed by 16–20 years with 36 participants (34.0%) and 5–10 years with 19 participants (17.9%). One participant (0.9%) was aged 21–25 years. A positive family history of visual impairment was reported by 56 participants (52.8%). Spectacles were used by 40 participants (37.7%), whereas 11 participants (10.4%) used a low-vision aid or device (Table 1).

Table 1. Participant Characteristics and Vision-Aid Use

Characteristic	n (%)
Age group, years	
5–10	19 (17.9)
11–15	50 (47.2)
16–20	36 (34.0)
21–25	1 (0.9)
Family history of visual impairment	
Positive	56 (52.8)
Negative	50 (47.2)

Characteristic	n (%)
Spectacle use	
Yes	40 (37.7)
No	66 (62.3)
Low-vision aid or device use	
Yes	11 (10.4)
No	95 (89.6)

Values are presented as n (%). N=106.

Blindness was identified in 75 participants, corresponding to a prevalence of 70.8% (95% CI: 61.5%–78.6%). Severe low vision was present in 14 participants (13.2%; 95% CI: 8.0%–21.0%), moderate low vision in 11 participants (10.4%; 95% CI: 5.9%–17.6%), and normal visual acuity in six participants (5.7%; 95% CI: 2.6%–11.8%). Collectively, 25 participants (23.6%) had moderate or severe low vision, while 31 participants (29.2%) were not classified as blind (Table 2).

Table 2. Distribution of Visual-Impairment Categories

Visual-impairment category	n (%)	95% CI
Moderate low vision	11 (10.4)	5.9–17.6
Severe low vision	14 (13.2)	8.0–21.0
Blindness	75 (70.8)	61.5–78.6
Normal visual acuity	6 (5.7)	2.6–11.8
Total	106 (100.0)	—

CI: confidence interval. Wilson 95% confidence intervals are reported. Percentages total 100.1% because of rounding.

The median unaided both-eye visual acuity was 2.5 logMAR (IQR: 1.3–3.2), with values ranging from 0.1 to 3.5 logMAR. The median best-corrected both-eye visual acuity was also 2.5 logMAR, with an IQR of 1.0–2.9 and a range of 0.0–3.5 logMAR. Visual acuity of 1.0 logMAR or better was recorded in 26 participants (24.5%) during unaided assessment and in 31 participants (29.2%) during best-corrected assessment. Visual acuity of 2.5 logMAR or worse was recorded in 59 participants (55.7%) during unaided assessment and 54 participants (50.9%) during best-corrected assessment (Table 3).

Table 3. Summary of Unaided and Best-Corrected Both-Eye Visual Acuity

Visual-acuity assessment	Median (IQR), logMAR	Range, logMAR	≤1.0 logMAR, n (%)	≥2.5 logMAR, n (%)
Unaided visual acuity	2.5 (1.3–3.2)	0.1–3.5	26 (24.5)	59 (55.7)
Best-corrected visual acuity	2.5 (1.0–2.9)	0.0–3.5	31 (29.2)	54 (50.9)

IQR: interquartile range; logMAR: logarithm of the minimum angle of resolution.

Visual-field extent was concentrated within the 21–40° and 41–60° categories. In the both-eye assessment, 41 participants (38.7%) had a visual-field extent of 21–40°, 37 (34.9%) had a field extent of 41–60°, 22 (20.8%) had a field extent of 0–20°, and six (5.7%) had a field extent of 61–90°. Similar distributions were observed in the right and left eyes (Table 4).

Table 4. Distribution of Visual-Field Extent

Visual-field extent	Right eye, n (%)	Left eye, n (%)	Both-eye assessment, n (%)
0–20°	24 (22.6)	24 (22.6)	22 (20.8)
21–40°	37 (34.9)	39 (36.8)	41 (38.7)
41–60°	39 (36.8)	37 (34.9)	37 (34.9)
61–90°	6 (5.7)	6 (5.7)	6 (5.7)
Total	106 (100.0)	106 (100.0)	106 (100.0)

Values are presented as n (%).

When the visual-field categories were combined, 61 participants (57.5%; 95% CI: 48.0%–66.5%) had a right-eye field extent of 40° or less, while 63 participants (59.4%; 95% CI: 49.9%–68.3%) had a left-eye field extent of 40° or less. In the both-eye assessment, 63 participants (59.4%; 95% CI: 49.9%–68.3%) had a visual-field extent of 40° or less, and 100 participants (94.3%; 95% CI: 88.2%–97.4%) had a field extent of 60° or less (Table 5).

Table 5. Secondary Analysis of Visual-Field Restriction

Assessment	Visual-field extent ≤40°, n (%)	95% CI	Visual-field extent ≤60°, n (%)	95% CI
Right eye	61 (57.5)	48.0–66.5	100 (94.3)	88.2–97.4
Left eye	63 (59.4)	49.9–68.3	100 (94.3)	88.2–97.4
Both-eye assessment	63 (59.4)	49.9–68.3	100 (94.3)	88.2–97.4

CI: confidence interval. Wilson 95% confidence intervals are reported.

Table 6. Pinhole Response and Colour-Vision Findings

Assessment	Category	n (%)
Pinhole response, right eye	No improvement	106 (100.0)
Pinhole response, left eye		106 (100.0)
Pinhole response, both-eye assessment		106 (100.0)
Colour vision, total sample	Trichromacy	86 (81.1)
	Protanopia	2 (1.9)
	Tritanopia	1 (0.9)
	Not testable	17 (16.0)
Colour vision, testable participants	Trichromacy	86/89 (96.6)
	Colour-vision deficiency	3/89 (3.4)

Values are presented as n (%) or n/N (%).

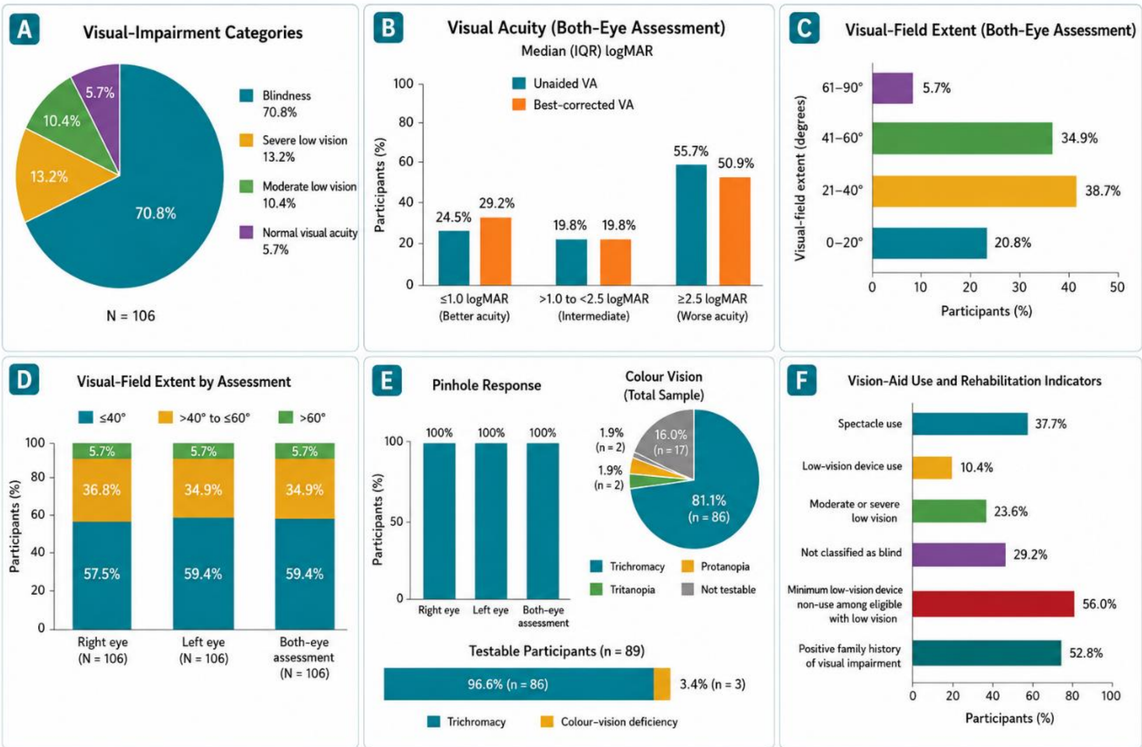

Figure 1 presents the distribution of visual impairment and related functional findings among 106 students. Blindness was the predominant category, affecting 70.8% of participants, while 13.2% had severe low vision, 10.4% had moderate low vision, and 5.7% had normal visual acuity. Both unaided and best-corrected visual acuity had a median of 2.5 logMAR, although the proportion with acuity of 1.0 logMAR or better increased from 24.5% to 29.2% after correction, while the proportion with acuity of 2.5 logMAR or worse decreased from 55.7% to 50.9%. In the both-eye visual-field assessment, 38.7% had a field extent of 21–40°, 34.9% had 41–60°, 20.8% had 0–20°, and 5.7% had 61–90°; overall, 59.4% had a field extent of 40° or less. No participant showed improvement with pinhole testing. Colour-vision testing identified trichromacy in 81.1% of the total sample and in 96.6% of the 89 testable participants, while 3.4% of those tested had a colour-vision deficiency. Spectacles were used by 37.7% of participants, but only 10.4% used a low-vision device; 23.6% had moderate or severe low vision, at least 56.0% of those with low vision were not using such a device, and 52.8% reported a positive family history of visual impairment.

No improvement with pinhole testing was recorded for any participant in the right-eye, left-eye, or both-eye assessments. Colour-vision testing was completed by 89 participants. Among those tested, 86 participants (96.6%; 95% CI: 90.6%–98.8%) demonstrated trichromacy, while three participants (3.4%; 95% CI: 1.2%–9.4%) had a colour-vision deficiency. The identified deficiencies included protanopia in two participants and tritanopia in one participant. Colour vision could not be tested in 17 participants (16.0%) (Table 6).

Twenty-five participants were classified as having moderate or severe low vision, whereas only 11 participants in the entire sample reported using a low-vision device. Therefore, no more than 44.0% of participants with low vision could have been device users, and at least 14 of the 25 participants with low vision (56.0%) were not using a low-vision device. The prevalence of spectacle use was 37.7% (95% CI: 29.1%–47.2%), while low-vision-device use was 10.4% (95% CI: 5.9%–17.6%) (Table 7).

Table 7. Secondary Analysis of Vision-Aid Use and Rehabilitation Indicators

Indicator	n/N (%)	95% CI
Moderate or severe low vision	25/106 (23.6)	16.5–32.5
Not classified as blind	31/106 (29.2)	21.4–38.5
Spectacle use	40/106 (37.7)	29.1–47.2
Low-vision-device use	11/106 (10.4)	5.9–17.6
Minimum low-vision-device non-use among participants with low vision	14/25 (56.0)	—
Positive family history of visual impairment	56/106 (52.8)	43.4–62.1

CI: confidence interval. Wilson 95% confidence intervals are reported.

DISCUSSION

The present study demonstrated a substantial burden of blindness among students enrolled at the Government Institute for Visually Impaired Children, Peshawar. More than two-thirds of the participants were classified as blind, while almost one-quarter had moderate or severe low vision and a small proportion had normal visual acuity according to the classification applied in the study. These findings indicate that students attending a specialized institution for visual impairment represented a clinically heterogeneous population rather than a uniform group with complete blindness.

The observed prevalence of blindness was broadly consistent with findings from schools for visually impaired children in South Asia and other low- and middle-income settings. Studies conducted in India, Nepal, Sri Lanka, Cambodia, Ghana, and Nigeria have similarly reported that blindness or severe visual impairment accounted for the majority of students enrolled in specialized schools (11,15–20). However, the proportion of students with residual vision has varied considerably across studies because of differences in admission criteria, visual-impairment definitions, age distributions, underlying ocular conditions, and access to treatment and rehabilitation services. The finding that 23.6% of participants had moderate or severe low vision was clinically important because students within these categories may retain visual function that could support print-based learning, mobility, and other educational activities when appropriate rehabilitation is available.

The presence of measurable residual vision among students attending schools for the visually impaired has been repeatedly documented. Evaluations in Indian blind schools found that some children benefited from refractive correction, optical devices, enlarged print, and structured low-vision services, enabling improved use of functional vision in educational settings (11,13–16). Similar findings have been reported in Nepal, Ghana, Nigeria, and China, where systematic assessment identified students who could potentially benefit from optical correction or low-vision rehabilitation (17,18,21–23). The current findings therefore support the importance of comprehensive visual assessment at admission and periodic reassessment during enrolment.

Only 10.4% of the total sample reported using a low-vision device. Because 25 participants had moderate or severe low vision, the available aggregate data indicated that at least 14 of these students were not using such a device. This represented a minimum non-use proportion of 56.0% among students with low vision. Previous investigations have similarly identified substantial unmet requirements for magnification, telescopic devices, enhanced illumination, contrast modification, and electronic visual aids among students in blind schools (13,14,23,26). Limited device availability, cost, inadequate professional assessment, insufficient training, and lack of follow-up may contribute to low utilization. Provision of a device alone may also be insufficient unless accompanied by individualized prescription, training, classroom integration, and periodic review.

Spectacle use was reported by 37.7% of participants, yet no improvement with pinhole testing was recorded in any assessment. This finding should be interpreted cautiously. A lack of pinhole response may reflect visual impairment arising predominantly from non-refractive ocular conditions, but pinhole testing alone cannot identify the underlying cause or exclude all refractive benefit. Furthermore, the aggregate unaided and best-corrected visual-acuity distributions showed only a modest population-level difference, and participant-level paired data were unavailable. Consequently, the proportion of individual students who improved after correction could not be determined.

Visual-field restriction was also common. In the both-eye assessment, 59.4% of participants had a reported field extent of 40° or less, and 94.3% had a field extent of 60° or less. These findings suggest that visual function in this population was not adequately characterized by central acuity alone. Students with relatively preserved acuity may still experience substantial functional impairment because of restricted visual fields, reduced contrast sensitivity, impaired adaptation, or other visual limitations. Educational placement and rehabilitation planning should therefore be based on comprehensive functional assessment rather than visual-acuity thresholds alone.

Normal visual acuity was recorded in 5.7% of participants. This finding does not necessarily establish inappropriate institutional placement because normal central acuity may coexist with significant visual-field loss, progressive ocular disease, cortical visual impairment, or other functional limitations. Nevertheless, it highlights the need for multidisciplinary reassessment to determine whether each student's educational programme corresponds to the student's current visual function. Studies from India and other regions have likewise identified students in specialized schools whose measured acuity did not meet conventional blindness thresholds, reinforcing the need for standardized admission and reassessment procedures (15,16,20–22).

A positive family history of visual impairment was reported by 52.8% of participants. This relatively high proportion may indicate a contribution from inherited ocular conditions, consanguinity-related disorders, or familial clustering of visual disease. Comparable studies of childhood blindness have identified hereditary retinal disorders, congenital anomalies, and genetically determined ocular conditions as important causes of severe visual loss (7,17–20,24,25). However, family history alone does not establish genetic causation. Detailed ophthalmic diagnosis, pedigree assessment, and genetic evaluation would be necessary to determine the contribution of inherited disease in this population.

Most participants who completed colour-vision testing demonstrated trichromacy, while colour-vision deficiency was identified in 3.4% of testable students. The relatively small number of detected abnormalities should be interpreted in relation to the 16.0% of participants who could not complete the assessment. In students with profound visual loss, inability to perform colour-vision testing may reflect reduced acuity, limited comprehension of the test, or the suitability of the instrument rather than a distinct colour-vision disorder.

The study had several strengths. It evaluated an under-researched institutional population in Khyber Pakhtunkhwa and incorporated multiple dimensions of visual function, including unaided and best-corrected visual acuity, pinhole response, visual-field extent, colour vision, spectacle use, and low-vision-device use. The analysis also provided prevalence estimates with confidence intervals and quantified the minimum level of low-vision-device non-use among students with low vision.

The findings should also be interpreted in light of important limitations. The study was conducted at a single institution and used an institution-based non-probability sampling approach, limiting generalizability to other schools or community populations. Ocular diagnoses and causes of visual impairment were not reported, preventing etiological interpretation. The exact procedures and instruments used for acuity, visual-field, colour-vision, and refraction assessment were insufficiently described. Participant-level paired measurements were unavailable, which prevented analysis of individual change between unaided and corrected acuity. Cross-tabulations between visual category, age, family history, spectacle use, and low-vision-device use were also unavailable. Functional vision, educational performance, quality of life, mobility, and device eligibility were not directly assessed.

Despite these limitations, the study identified a substantial burden of blindness together with a clinically important subgroup retaining measurable vision. The findings support routine comprehensive optometric and ophthalmic assessment, periodic reassessment, individualized educational planning, and greater integration of low-vision rehabilitation within specialized educational institutions.

CONCLUSION

Blindness was the predominant visual category among students at the Government Institute for Visually Impaired Children, Peshawar, affecting 70.8% of participants, while 23.6% had moderate or severe low vision and 5.7% had normal visual acuity under the study classification. Low-vision-device use was uncommon, and at least 56.0% of participants with low vision were not using such a device. These findings demonstrate substantial variation in visual function within the institution and support comprehensive visual assessment, periodic reassessment, and individualized rehabilitation and educational planning according to each student's functional vision.

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