

Prevalence and causes of visual impairment and blindness among primary schoolchildren in Herat, Afghanistan

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Abstract

Childhood visual impairment and blindness (VI&B) significantly affects socioeconomic status and health of an individual in adult age. The prevalence and etiology of VI&B in children varies considerably around the world and across different studies. This study aims to identify the prevalence and causes of VI&B among schoolchildren in Herat, Afghanistan. This school-based cross-sectional study was conducted through a stratified cluster sampling on schoolchildren of both sexes aged between 7 and 15 years, between September and December 2021. Visual acuity of study participants was assessed using standard Snellen chart. Participants with VI&B were further assessed for identification of etiology. Data was analyzed in IBM SPSS Statistics (version 27). A total of 8930 schoolchildren, comprising 4366 (48.9%) boys and 4564 (51.1%) girls with a mean age of 10.1 ± 2.3 years were examined. The prevalence of VI&B in the worst eye was 5.2% (5.0% VI and 0.2% blindness). Of the 4366 boys in this study, 228 (5.2%) had VI, while 17 (0.4%) had blindness, while of the 4564 girls in this study, 211 (4.6%) had VI and 4 (0.1%) had blindness in the worst eye. Refractive error was the principle cause of VI&B in 334 (72.6% of the visually-impaired and 3.6% of the overall sample population). This is the first comprehensive study that reports the prevalence and causes of VI&B in schoolchildren in Afghanistan. The prevalence of VI&B among participants was high in Herat, and the principle cause was uncorrected refractive error.

Keywords: Prevalence, visual impairment, blindness, schoolchildren, Herat, Afghanistan

INTRODUCTION

Normal vision is essential for performing daily activities. Visual impairment and blindness (VI&B) negatively impact on social, recreational, educational and physical functioning and tasks of everyday life (Swenor et al., 2020). According to the World Health Organization (WHO), in 2021, at least 2.2 billion people suffered from near or distance visual impairment (VI) in the world (World Health Organization, 2021a). In Afghanistan, in 2021, over 1.5 million people had VI, 400,000 were blind and approximately 25,000 people had lost vision (World Health Organization, 2021b).

The prevalence of VI&B among children has considerable geographical variation. The lowest prevalence of VI among schoolchildren (5-15 years old) has been reported from South Africa (1.4%; Naidoo et al., 2003), while the highest prevalence was reported from Nepal (18.6%; Sapkota et al., 2008). Variation in the prevalence of VI&B in different studies may probably be due to several factors such as ethnicity, population characteristics, socioeconomic, environment, and study methodology (Pi et al., 2012). Several studies have reported uncorrected refractive error as the leading cause of VI&B in schoolchildren (Ahmed et al.,

2020; Ezegwui et al., 2021; Pi et al., 2012; Sapkota et al., 2008; Wadhvani et al., 2021). The prevalence of refractive error as the cause of VI&B varies from 16.3% in Saudi Arabia (Sharma et al., 2020), to 94.2% in Bhutan (Sharma et al., 2020). Other less common causes of VI&B in schoolchildren include strabismus, amblyopia, corneal opacity, cataract, and glaucoma (Ezegwui et al., 2021; He et al., 2014; Kedir and Girma 2014; Panda et al., 2019; Pi et al., 2012).

In children, VI&B pose a huge public health, economic, social and cultural challenge in the world. Early onset VI in children can lead to delayed cognitive, emotional, social, language and motor development, leading to serious consequences (World Health Organization, 2021a).

Data on the prevalence of VI&B among children in Afghanistan is very scarce. Only two population-based studies from Kabul and Nangarhar, and a school-based survey from Herat are available (Abdianwall & Dogan, 2018, Niazi & Hossaini, 2017; Sapkota et al., 2021). The current study aims to determine the prevalence and causes of VI&B among primary schoolchildren in Herat, Afghanistan.

MATERIALS AND METHODS

Study design, setting, and duration

This school-based cross-sectional study was conducted between September and December 2021, among primary schoolchildren in Herat city of Afghanistan.

Sample size

According to Herat Department of Education, in 2021, a total of 117,693 children were studying in primary schools of Herat city. The minimum sample size was estimated at 8,880 schoolchildren, with a 99% confidence interval, and 95% confidence level, using the raosoft sample size calculator.

Sampling strategy

In 2021, there were 103 primary schools in Herat, of which 20 were randomly selected (10 males primary schools and 10 females primary schools). A stratified multi-stage cluster sampling was employed to select samples. From each school, one class from each grade was selected randomly (if the school had more than one class for each grade), and all students enrolled in that class were included in the study.

Visual acuity examination

Visual acuity (VA) was examined by two ophthalmic nurses, under daylight illumination, using standard Snellen chart (Matronix India Corporation, India). Each student was placed at 6-meter distance from the chart, and the VA of each eye was measured separately, with the fellow eye being occluded. In case the student was wearing spectacles, the VA was assessed while wearing the spectacles as well. The VA was classified as normal, mild VI, moderate VI, severe VI and blindness, as per the WHO guideline (World Health Organization, 2021a). Cases with VI&B were referred to Herat Ophthalmic Center for further examination.

Follow-up examination

Follow-up examination was conducted at Herat Ophthalmic Center to determine the causes of VI&B. The anterior segment of the eye was examined by an ophthalmologist under a slitlamp biomicroscopy (Sun Kingdom, China). Posterior segment was examined with a fully-dilated pupil, using slitlamp biomicroscopy and a 90-diopter aspheric lens (Opticlear, India). The Ophthalmologist assessed the patient for the presence of strabismus, cataract, glaucoma, corneal opacities and Bitot's spots; and for symptoms such as itching, burning sensation, dryness, redness, watering, and headache. The presence of refractive error was assessed by a registered optic technician using a RM-800 Auto Refractometer (Topcon, Japan) objectively; and a trial frame lens set (Joyfay, Turkey) and the Snellen chart (Matronix India Corporation, India), subjectively. Ocular motility was examined using a hand torch. Findings were recorded in a specific form, designed for this project. Approximately 2% of students with normal VA were randomly referred by ophthalmic assistants for further ocular and refractive assessment; all these students were reported normal in the follow-up examination.

Data analysis

Data were recorded in IBM SPSS Statistics (version 27). Categorical variables are presented as numbers and percentages. Continuous variables are shown as mean \pm standard deviation (SD). A Chi-square test was employed to assess the association between categorical variables. Statistical analyses were performed by setting the significance level to 0.05.

Ethic consideration

Prior to the commencement of the project, the study protocol was reviewed and approved by the Human Ethics Committee of Herat University (Approval number #200221). A written informed consent was obtained from students' guardians prior to the assessment of VA and acquisition of data. Privacy and confidentiality of information was maintained throughout the study.

RESULTS

Participants' characteristics

A total of 8930 schoolchildren comprising 4366 (48.9%) boys and 4564 (51.1%) girls were included in this study. The overall mean age of participants was 10.1 ± 2.3 years. **Table 1** displays the number of study participants according to sex, age and class.

Prevalence of visual impairment and blindness

Of the 8930 participants in this study, 8470 (94.8%) had a normal vision in their right eyes, while 8507 (95.3%) had a normal vision in their left eyes. **Table 2** shows the number of study participants according to sex, laterality of the eye and categories of VA. As it can be seen in **Table 2**, of the 4366 boys in this study, 228 (5.2%) had VI, while 17 (0.4%) had blindness in their right eyes. Concerning the left eye, 222 (5.1%) had VI, while 9 (0.2%) had blindness.

Table 1. The number and percentages of study participants according to sex, age and class

	Boys		Girls		Total		p value*
	n	%	n	%	n	%	
Age (years)							
7	434	9.9	1001	22.0	1435	15.9	<0.001
8	416	9.5	712	15.6	1128	12.6	
9	456	10.4	632	13.8	1088	12.1	
10	684	15.7	563	12.3	1247	14.1	
11	575	13.2	585	12.8	1160	13.0	
12	784	18.0	727	15.9	1511	16.9	
13	568	13.0	283	6.2	851	9.6	
14	449	10.3	61	1.4	510	5.8	
Total	4366	100.0	4564	100.0	8930	100.0	
Classes (grades)							
1	660	15.1	806	17.7	1466	16.4	<0.001
2	685	15.7	724	15.9	1409	15.8	
3	712	16.3	848	18.6	1560	17.4	
4	762	17.5	899	19.7	1661	18.6	
5	813	18.6	606	13.3	1419	15.9	
6	734	16.8	681	14.9	1415	15.9	
Total	4366	100.0	4564	100.0	8930	100.0	

n: number; %: percentage;

* The results of Chi-square assessment

Table 2. Number and percentages of study participants according to sex, laterality of the eye and categories of visual acuity.

Laterality	Boys		Girls		Total		p value*
	n	%	n	%	n	%	
Right eye							
Normal	4121	94.4	4349	95.3	8470	94.8	0.035
Mild VI	84	1.9	132	2.9	216	2.4	
Moderate VI	134	3.1	68	1.5	202	2.3	
Severe VI	10	0.2	11	0.2	21	0.3	
Blindness	17	0.4	4	0.1	21	0.2	
Total	4366	100.0	4564	100.0	8930	100.0	
Left eye							
Normal	4135	94.7	4372	95.8	8507	95.3	0.031
Mild VI	84	1.9	118	2.6	202	2.3	
Moderate VI	127	2.9	57	1.2	184	2.1	
Severe VI	11	0.3	8	0.2	19	0.2	
Blindness	9	0.2	9	0.2	18	0.2	
Total	4366	100.0	4564	100.0	8930	100.0	

n: number; %: percentage;

* The results of Chi-square assessment

Of the 4564 girls in this study, 211 (4.6%) had VI and 4 (0.1%) had blindness in their right eyes. For the left eye, 183 (4.0%) had VI, and 9 (0.2%) had blindness in their left eyes.

Causes of visual impairment and blindness

Of the 460 schoolchildren with VI&B in their worse eye (right eye), 334 (72.6%) had a type of refractive error, while 126 (27.4%) were suffering from other visual threatening diseases.

Table 3 displays the number and percentages of study participants according to the causes of VI&B.

Table 3. Number and percentages of participants according to the causes of VI and blindness

Causes of visual impairment and blindness	n	%*	%†
Refractive error causes			
Mild myopia	136	29.6	1.5
Moderate myopia	64	13.9	0.7
High myopia	3	0.7	0.0
Mild hyperopia	34	7.4	0.4
Moderate hyperopia	10	2.2	0.1
Astigmatism	22	4.8	0.2
Myopic astigmatism	31	6.7	0.3
Hyperopic astigmatism	34	7.4	0.4
Non-refractive error causes			
Strabismus	45	9.8	0.5
Amblyopia	31	6.7	0.3
Cataract	7	1.5	0.1
Trauma	6	1.3	0.1
Glaucoma	2	0.4	0.0
Corneal opacity	1	0.2	0.0
Others	34	7.4	0.4
Total	460	100.0	5.2

n: number

* percentage calculated from participants with visual impairment and blindness

† percentage of calculated from all study participants

Accompanying signs and symptoms

Table 4 displays the accompanying signs and symptoms of participants with VI&B. Ocular itching was the most prevalent (30.7%) and dryness was the least prevalent (0.9%) symptoms.

DISCUSSION

This study assessed the prevalence and causes of VI&B among primary schoolchildren in Herat, Afghanistan. VI&B are uncommon in children compared to adults; however, they may lead to significant social, economic, and public health disabilities in adult age (World Health Organization, 2021a). Therefore, knowledge about magnitude and etiology of VI&B in a community is essential for a proper and timely management of these diseases.

Table 4. Accompanying clinical presentations in study participants with VI and blindness

Signs and symptoms	n	%*
Itching	141	30.7
Burning	133	28.9
Headache	54	11.7
Ocular Pain	22	4.8
Photophobia	14	3.0
Dry Eye	4	0.9

n: number; %: percentage

* Percentage calculated from participants with VI and blindness

This study found that the overall prevalence of VI was 4.9% in the right eye and 4.6% in the left eye. This finding is in alignment with the results of similar studies from India (5.9%, 5.0%) and Ethiopia (5.3%; Abayo et al., 2021; Dandona et al., 2002; Wadhvani et al., 2021); slightly higher than that of Ethiopia (3.5% and 3.9%), Malaysia (3.5%), Iran (3.8%), Nepal (2.9%), South Africa (2.7%), and Kenya (2.4%; Bezabih et al., 2017; Farhana and Rahim n.d.; Fotouhi et al., 2007; Kedir and Girma 2014; Muma and Obonyo 2020; Naidoo et al., 2003; Pokharel et al., 2000); but significantly lower than that of Malaysia (17.1%), Chile (15.8%), China (12.8%, 12.2% and 7.7%), Denmark (10.50%), India (9.0%), and Ethiopia (8.7% and 8.0%; Cui et al., 2021; Goh et al., 2005; Maul et al., 2000; Merrie et al., 2019; Murthy et al., 2002; Pi et al., 2012; Sandfeld et al., 2007; Zelalem et al., 2019; Zhao et al., 2000). The variation in the prevalence of VI between different studies may be attributed to several factors, such as study design, and population characteristics including ethnicity, socioeconomic and access to healthcare facilities (Pi et al., 2012).

Our results also show that the prevalence of blindness was 0.2% in the right eye and 0.2% in the left eye. This is unlike the results of similar studies conducted in Ethiopia (1.6% and 1.1%) and India (0.4%) with a higher prevalence of blindness in their study population (Berhane et al., 2008; Wadhvani et al., 2021; Zelalem et al., 2019).

This study revealed a significant association between VA and the age of study participants. This is consistent with similar studies conducted in Ethiopia, China, the USA, and Somalia, (Ahmed et al., 2020; Pi et al., 2012; Tarczy-Hornoch et al., 2013; Zelalem et al., 2019). Similarly, the association between VA and the sex of the study participants was significant in this study. This is similar to the findings of studies in Ethiopia (Bezabih et al., 2017). However, it is in contradiction to the findings of several studies that reported an insignificant association between VA and the sex of schoolchildren (Ahmed et al., 2020; Pi et al., 2012; Zelalem et al., 2019).

Our results also revealed a significant association between prevalence of VI&B and the grades in which schoolchildren

studied. This finding is in line with a Nigerian study in which significant difference was observed in distribution of VI&B across classes (Ezegwui et al., 2021). However, a study from Somalia found no significant association between VI&B across classes of schoolchildren (Ahmed et al., 2020). The difference between our results and findings of some relevant studies may be attributed to study design, sample size, definition of VI&B and population characteristics.

This study showed that refractive error was the cause of VI&B in approximately three-quarters of cases (72.6%). This is similar to the findings of studies from China (78.0%), Somalia (76.8%), Brazil (76.8%), India (75.7%; Ahmed et al., 2020; Cui et al., 2021; Salomao et al., 2008; Wadhvani et al., 2021); but significantly lower than other similar studies from Bhutan (94.20%), Nepal (93.3%), Malaysia (92.2%), and China (89.48%, 86.08%; Farhana & Rahim n.d.; He et al., 2014; Pi et al., 2012; Sapkota et al., 2008; Sharma et al., 2020). However, studies from Kenya (62.0%), Malaysia (47.7%), and Nigeria (33.3%) reported a considerably lower prevalence of refractive error among visually-impaired study participants (Ezegwui et al., 2021; Farhana & Rahim n.d.; Muma & Obonyo, 2020). Among sampled population, the overall prevalence of refractive error in this study was 3.6%, which is consistent with the 3.4% prevalence of refractive error in Nigeria, (Maduka-Okafor et al., 2021), higher than 2.1% reported from Nigeria (Ezegwui et al., 2021), but considerably lower than 4.6% reported from Brazil (Salomao et al., 2008). Of different types of refractive error in our sampled population, myopia accounted for most cases (2.2%), astigmatism for 0.9% and hyperopia for 0.5%.

The overall 5.2% VI&B in this study highlights its significance as a public health issue in Herat city as the study location and Afghanistan as a whole. Data suggests that immediate, timely and appropriate interventions are required to tackle this phenomenon in the country. Given the considerable impact VI&B has on economy, and the fact that Afghanistan is defined as a low-to-middle income country, (World Bank, 2021) it is strictly recommended that all eye care efforts are coordinated via the National Eye Care Committee and the Ministry of Public Health.

Study strengths

This study recruited 8930 schoolchildren of Herat, Afghanistan. This is the first study to conduct a comprehensive assessment of the prevalence and causes of VI&B in Afghanistan. Data from this study provides information for policymakers and eye care practitioners to develop and implement strategies to reduce the burden of VI&B and lessen their impact on health and economy of the country in the future.

Study limitations

This study was conducted only among primary schoolchildren. It is advisable to conduct similar research among high schoolchildren as well, to better identify the

prevalence and causes of VI&B among schoolchildren as a whole. Moreover, this descriptive study did not take into account the relationship and/or the impact of sociodemographic, cultural and behavioral factors on VA and VI&B of study participants. Future research may address this gap.

Conclusion

The prevalence of VI&B among schoolchildren in Herat is high, and the principle cause was uncorrected refractive error. Given the considerable social, economic and health impact VI&B can put on children life in adult age; public health, eye care authorities and policymakers should design and implement strategies to reduce the burden of this disease in our community.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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