Original Research Article

Prevalence and causes of visual impairment and blindness among school children in Muzaffarabad, Pakistan

Abdul Rauf Awan[1]*, Junaid Jamshed[1], Muhammad Mushtaq Khan[1], Zahid Latif[2]

[1]Department of Public Health, Faculty of Health and Medical Sciences, [2]Department of Zoology, Faculty of Sciences & Engineering, The University of Azad Jammu and Kashmir, Muzaffarabad, Pakistan

*Correspondence:
Abdul Rauf Awan,
E-mail: abdulraufawan01@gmail.com

ABSTRACT

Background: Vision loss in childhood has serious implications in all stages of child's growth and development. It poses social, educational and occupational challenges, with affected children being at greater risk of developing behavioral, psychological and emotional problems, lower self-esteem and poorer social integration. The aim of this study was to assess the prevalence and identify the causes of visual impairment and blindness in school children of UC Gojra, Muzaffarabad, Pakistan so that prevention strategies could be implemented.
Methods: This was a school-based descriptive cross-sectional study conducted among public and private schools. A multi-stage stratified random sampling technique was used for selecting study participants aged 5-20 years from 24 schools in Muzaffarabad. The vision of school children was examined for visual acuity using standard Snellen chart. Those participants who had visual acuity of <6/18 in either eye underwent a more detailed ophthalmic examination to diagnose the causes of VI. An exploration of demographic variables was conducted using Chi-square test.
Results: The mean age of participants was 10±2.83. The prevalence of visual impairment was 19.6% and 2.3% for severe visual impairment. The age group most affected by VI was 11-15 years (74.2%). There were increased chances of developing VI with advancing age of the participants. Males contributed 88.7% of the cases of VI while females contributed only 11.3%. The class category 5-6 had higher percentage of VI cases (32.7%). Public schools contributed 52.8% of the cases of VI while for private schools the corresponding percentage was 47.2%. The leading cause of VI was refractive error (89.3%) followed by amblyopia (5.0%). Other causes of VI included cataract (1.2%), corneal disease (1.8%), strabismus (1.8%) and nystagmus (0.6%).
Conclusions: There is a need to implement school health policy on visual screening prior to admissions in schools and annual eye screening program for early detection and prompt treatment of eye problems among school children in Muzaffarabad.

Keywords: Visual impairment, Blindness, Prevalence, School-based, Ocular epidemiology, Muzaffarabad

INTRODUCTION

The visual system is one of the most significant sensory systems and it is the primary source of integration between individuals and the external environments. Vision is the entrance of light into the eye of an individual and interpretation of this stimulus by the brain. Vision of an individual is said to be impaired when visual pathway function is disturbed. According to the World Health Organization, visual acuity of <6/18 is classified as normal vision, <6/18 but >6/60 is visual impairment (VI), and <6/60 but >3/60 is severe visual acuity impairment (SVI). Presented and best corrected visual acuity in the better eye of <3/60 is termed as blindness.[1]

It is estimated that 75-90% of all the learning in the schools comes to the children either partly or wholly through the visual pathway function. Therefore, in school

children, visual impairment can affect their school performance and many other functions such as ability to actively participate in the sports. Poor performance at schools may affect the self-confidence of the child and the future careers. It has significant social, economic and psychological implications for the children and their families. Visually impaired persons are more likely to be rejected from jobs.[2]

The principal causes of visual impairment and blindness in the world include uncorrected refractive error, un-operated cataract, glaucoma, age related macular degeneration, diabetic retinopathy, trachoma and corneal opacities. Most of the causes of visual impairment and blindness are either preventable or treatable. Globally, an estimated 19 million children are visually impaired and 1.5 million are bilaterally blind. The prevalence of blindness in children ranges from 0.3 per thousand children in the developed countries to 1.5 per thousand in the developing countries. About 90% of the world's visually impaired and blind children live in the poorest regions of Asia and Africa.[3]

The eye problem in Pakistan is the most significant public health issues. It poses huge social and economic impacts for the affected person, the society and the nation at large. A national blindness survey of Pakistan conducted in 1987-1988 revealed that the prevalence of blindness was 1.78% with 2.6 million people blind in both eyes.[4] Another study to determine the prevalence and causes of visual impairment in children with low vision found that the prevalence of visually impaired, severe visually impaired and blind were 33.8%, 27.2% and 39.0% respectively.[5] No such study has been conducted among school children in Muzaffarabad, Azad Jammu and Kashmir, Pakistan.

Information about prevalence and causes of visual impairment and blindness is scare in this particular region of the country. However, this was the first study to determine the prevalence and causes of visual impairment and blindness among school students in Union Council Gojra district Muzaffarabad, Pakistan. The information from this study will be used to plan strategies in order to prevent and control unnecessary visual impairment and blindness among school children so that they can attain full potential in their life and corresponding economic benefits to the country.

METHODS

Study setting and duration

The study was conducted among school children of UC Gojra, Muzaffarabad from March to December, 2015. Muzaffarabad is the capital city of the State of Azad Jammu and Kashmir having a population approximately 0.5 million. Primary and secondary education in the city is served by public and private schools. The eye care services in the public sector are restricted to only one tertiary health center in the whole city of Muzaffarabad. Private eye clinics are mainly located in the commercial city centers and operate on a commercial basis.

Study design and population

This was a school-based descriptive cross-sectional design. The study population included school children aged 5-20 years attending public and private schools in UC Gojra, Muzaffarabad. The 22 private schools had an enrollment of 10,055 children while the 16 public schools had 9,637 children (19,692 in total). The study population was consisted of 725 participants.

Study size calculation

The sample size for this study was calculated using the formula: $N=(Z)^2 (1.0-p) (p)/(b)^2$, where N is the minimum sample size, Z=1.96 for a 95% of confidence interval (CI), p is the anticipated population prevalence (assumed to be 10.0%), b is the desired error bound accepted as 0.05. A design effect (b) of 2.0 and 10% contingency factor to account for attrition was also considered. The total number of participants was therefore 725.

Sampling procedure

The study participants were selected using multi-stage stratified random sampling. Schools were stratified by five existing educational administrative areas. About 50% of both public and private schools from each area were sampled through simple random sampling using random numbers table. Ten public and fourteen private schools with a total population of 9,845 (including 5,027 from public and 4,818 from private schools) were sampled. Each school was then assigned a separate sample that was proportional to its population size. The sample proportional to population size was calculated by dividing total number of the participants by 9,845 and multiplying by 725 (sample size of the study). The sample of the school was distributed equally among the ten classes and the individual participants were selected from the roll call registers of each class by systematic random sampling. The first participant however, was selected using simple random sampling. Those participants who for any reason were absent from school were replaced by the next student in the roll call register.

Examination procedures

The visual acuity impairment of all the sampled children in the 24 public and private schools of UC Gojra, Muzaffarabad was tested by the trained research assistants. The examination team included an ophthalmologist, an optometrist, a field assistant, an ophthalmic technologist and a principal investigator. Prior to field operation, the examination team was properly trained by the investigator on how to conduct examination procedures in the field and was informed about the purpose of the study. All the sampled children

were examined for the period of 2-5 days in every school. Visual acuity was measured at a 6 meter or a 20 feet distance by an ophthalmic technologist using standard logarithmic chart that was retro-illuminated along with tumbling-E optotypes. Those children with presenting or best corrected visual acuity <6/18 in the better eye were subjected to further examination. Refraction was done by an optometrist and clinical examination was performed by an ophthalmologist. The detailed examination included visual acuity with pinhole, cycloplegic refraction for the refractive errors, external ocular examination using natural light and torch, fundoscopy with the help of an ophthalmoscope, and estimation of the visual fields using confrontation method. Causes of visual acuity impairment and blindness among children were established mainly by the physical examination of the children using standard methods and equipment and studying medical history of the children.

Ethical consideration

The study was approved by the Ethical Research Board (ERB) of the University of Azad Jammu and Kashmir. General consent for study participants was sought from the District Education Officer. The principals of all the selected schools were informed about aims and objectives of the study and an informed consent was signed on the behalf of participants. School authorities contacted the parents and guardians of all the participants to obtain verbal consent before examination. Additionally, participant's acceptance was also sought before examination. All information collected was treated with confidentiality. The study findings will be disseminated to the respective schools, District Education Officer and District Health Office. The study participants were treated for minor ailments and referred appropriately where necessary.

Pilot study

A pilot study was carried out to ensure familiarity of the research team with all aspects of the study protocol in a realistic clinical or field setting and to identify the problem areas requiring immediate action before implementation of the final study. The pilot study was conducted in a representative school sample that was not included in the final study. During the pilot study both clinical and field procedures were performed according to the study protocol. Based on the findings and experience of the pilot study, some remedial actions and trainings were adopted as necessary.

Data management and analysis

Data was cleaned, entered and coded in the Excel Microsoft Corporation 2007 program and then exported to SPSS version 20.0 for final analysis. The independent variables in this study were age, gender, class category and type of school. The dependent variables in this study were visual impairment and blindness. The results were

presented in tables and figures. Descriptive statistics such as frequency, percentage, mean, median and standard deviation were used to describe and summarize the data. Chi-square test was used to determine relationships between visual impairment and socio-demographic characteristics of the participants. A p value of <0.05 was accepted as level of statistical significance.

RESULTS

Socio-demographic characteristics

A total number of 725 participants were initially included in this study. The age of the participants ranged from 5 to 20 years. Mean age of the participants was 10 years, median was 11 years and standard deviation was 2.83. The age groups most represented were 11-15 and 5-10 years at 59.3% and 37.8% respectively. The age groups least represented were 15+ years at 2.9%. There were 559 male participants representing 77.1% and 166 female participants representing 22.9% of the sample. Among participants, 365 (50.3%) were from private schools and 360 (49.7%) were from public schools. Class categories of 9-10 and 7-8 had highest percentage of the participants at 22.8% and 21.1% respectively. This was followed by class categories of 5-6 and 3-4 at 20.0% and 18.6% respectively. The lowest percentage was among class category of 1-2 at 17.5% (Table 1).

Table 1: Socio-demographic characteristics of the participants (n=725).

Characteristics	Frequency (N)	Percentage (%)
Age (in years)		
5-10	274	37.8
11-15	430	59.3
15+	21	2.9
Mean=10, SD=2.83, Median=11, Range=5-20		
Gender		
Male	559	77.1
Female	166	22.9
School type		
Public	360	49.7
Private	365	50.3
Class category		
1-2	127	17.5
3-4	135	18.6
5-6	145	20.0
7-8	153	21.1
9-10	165	22.8

Prevalence of visual impairment and blindness

The study showed that 21.9% of the total participants had visual acuity impairment. Of the participants, 19.6% were visually impaired and 78.1% of them were normal. About 2.3% of the participants had severe visual impairment.

However, there was no case of blindness in this study (Table 2).

Table 2: Prevalence of visual impairment and blindness (n=725).

Visual acuity (VA)	Frequency (N)	Percentage (%)
6/6-6/18 normal	566	78.1
<6/18-6/60 visual impairment (V.I)	117	19.6
<6/60-3/60 severe visual impairment (S.V.I)	42	2.3
<3/60 blind	0	0
Total	725	100.0

Patterns of visual impairment among children

The pattern of visual acuity impairment was sought among age, gender, type of school and class category. The age group most affected by visual impairment was 11-15 years at 74.2% followed by age group of 5-10 years at 22.0%. The percentage of visual impairment increased with advancing age of the participants. The difference in age distribution of visual impairment was statistically significant (p=0.001). The percentages of visually impaired male and female participants were 88.7% and 11.3% respectively. The difference in distribution of visual impairment among gender was statistically significant (p=0.001). Public schools had higher percentage of visual impairment at 52.8% than private schools at 47.2%. However, the difference in the visual impairment among public and private schools was not statistically significant (p=0.365). The class category 5-6 contributed 32.7% of the visual impairment cases while class category 7-8 contributed 22.6%. Lower class categories had lower percentage of the visual impairment. The difference in distribution of visual impairment by class category was significant (p=0.001). The patterns of visual acuity impairment were explained in Table 3.
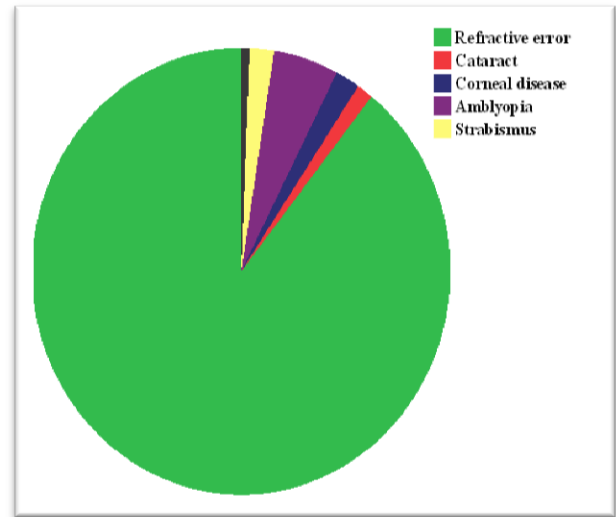

Figure 1: Causes of visual acuity impairment.

Table 3: Patterns of visual impairment among participants (n=159).

Variables	Visual impairment		X^2	df	P value
	N	%			
Age (in years)					
5-10	35	22.0			
11-15	118	74.2	21.588	2	0.001*
15+	6	3.8			
Gender					
Male	141	88.7	15.459	1	0.001*
Female	18	11.3			
School type					
Public	84	52.8	0.821	1	0.365
Private	75	47.2			
Class category					
1-2	8	5.0			
3-4	28	17.6			
5-6	52	32.7	34.951	4	0.001*
7-8	36	22.6			
9-10	35	22.1			

*Statistically significant.

Causes of visual impairment

Visual acuity impairment was caused by different types of factors. Ocular assessment of the participants showed that refractive error was the leading cause of visual impairment in this study, which accounts for 89.31% of the total causes. Other causes of visual impairment cataract (1.26%), corneal disease (1.89%), amblyopia

(5.03), strabismus (1.89%) and nystagmus (0.63%). The causes of visual impairment were shown in Figure 1.

DISCUSSION

This study aimed to access the prevalence and causes of visual impairment and blindness among school children in UC Gojra District Muzaffarabad, Pakistan. The total prevalence of visual impairment in this study was 21.9%, which is comparable to that reported in Pakistan[6] and India but lower than the prevalence of visual impairment in Afghanistan and Egypt.[7-9] The prevalence of visual impairment in this study was higher than that reported in Brazil.[10] This may be due to difference in sample size, age-group studied, research methodologies adopted and geographical area.

The age group that most affected by visual impairment in this study was 11-15 years at 74.2%. There were higher chances of developing visual impairment with increasing age of the study participants. The finding was consistent with a study conducted in China.[11] This age group usually suffers varying but significant degrees of poor health, nutritional deficiencies and morbidity that clearly impede effective learning and realization of the full productive potential. It is time when refractive error usually manifests. The leading cause of visual acuity impairment in this study was refractive error.

There was significant difference in the distribution of visual impairment and gender in this study. Males were found to be more affected by visual impairment than females. This finding was comparable with a study conducted in India reporting that males were also more affected by visual impairment at 31.60% than females at 22.20%.[12] The use of eye care services could be unequal between males and females at this stage and it can be a subject for further research.

In this study, public schools contributed 52.8% of the cases of visual impairment while for private schools, this was 47.2%. This finding was in an agreement with a study conducted in Kenya.[13] This could be better explained by the fact that participants from public schools had lower family income and hence majority of the participants are not able to purchase spectacles. On the other hand, participants from private schools had higher family income and hence they are more likely to purchase spectacles.

The class category most affected in this study by visual impairment was class 5-6 and difference in the distribution of visual impairment by class category was found significant. Participants of the age group 11-15 years that was most affected by visual impairment are usually study in this class category. This finding was consistent with a study conducted in Ethiopia.[14] The difference in the class can be explained by the time used to seek medical and surgical interventions to treat eye

problems that resulted in visual impairment and blindness.

Refractive error was responsible for 89.31% cases of visual impairment in this study. The other causes of visual impairment were cataract (1.26%), corneal disease (1.89%), amblyopia (5.03), strabismus (1.89%) and nystagmus (0.63%). This finding was in agreement with similar studies conducted in Malaysia where 87.0% cases of visual impairment were due to refractive error.[15] In Nepal, it was reported that refractive error was responsible for 93.3% cases of visual impairment among school children.[16] This shows the significance of accurate refraction among children with impaired vision and also indicates that, even in the absence of a special eye care services, many eye units can help children with low vision by providing them accurate refraction services.

CONCLUSION

In this study, the prevalence of VI among school children was 21.9%. The age group most affected by VI was 11-15 years. Refractive error was found to be the leading cause of VI followed by amblyopia. Other causes of VI were cataract, corneal disease, strabismus and nystagmus. Prevention, early detection and prompt treatment of eye problems by regular screening of school children would reduce unnecessary visual impairment and they can attain full potential in their education course. There is a need to provide free spectacles since the majority of participants with VI had refractive error as the leading cause of impairment. The information from this study is important for the purpose of planning eye care services for the prevention of unnecessary visual impairment and blindness among school children in Muzaffarabad, Pakistan.

ACKNOWLEDGEMENTS

REFERENCES

1. Ajaiyeoba AI, Isawumi MA, Adeoye AO, Oluleye TS. Prevalence and causes of blindness and visual impairment among school children in south-western Nigeria. Int Ophthalmol. 2005;26:121-5.
2. Darge HF, Shibru G, Mulugeta A, Dagnachew YM. The Prevalence of Visual Acuity Impairment among School Children at Arada Subcity Primary Schools

in Addis Ababa, Ethiopia. J Ophthalmol. 2017;9326108:1-7.

3. Bourne RRA, Flaxman SR, Braithewaite T, Cicinelli MV, Das A, Jonas AB, et al. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic and meta-analysis. Lancet Glob Health. 2017;5(9):888-97.

4. Borurne R, Dineen B, Jadoon Z, Lee PS, Khan A, Johnson GJ, et al. The Pakistan National Blindness and Visual Impairment Survey-Research Design, Eye Examination Methodology and Results of the Pilot Study. J Ophthalmic Epidemiol. 2009;15(5):321-33.

5. Shah M, Khan M, Khan MT, Khan MY, Nasir S. Causes of Visual Impairment in Children with Low Vision. J Coll Physicians Surg Pakistan. 2011;21(2):88-92.

6. Hameed A. Screening for refractive errors and visual impairment among school children in Kohat, Pakistan. RMJ. 2016;41(4):437-40.

7. Vidya R, Kiran KG. Prevalence of Ocular Morbidities of Children in Higher Primary Schools in Rural Areas of Mangalore. Int J Community Med Public Health. 2017;4(8): 2859-63.

8. Hossaini FS, Naizi AR. A study of visual impairment among primary school children in Heart Province of Afghanistan. J Clin Exp Opthalmol. 2017;8(3):56.

9. Yamamah GAN, Alim AATA, Mostafa YS, Ahmed RAAS, Mahmoud AM. Prevalence of Visual Impairment and Refractive Errors in Children of South Sinai, Egypt. J Ophthalmic Epidemiol. 2015;22(4):246-52.

10. Salomao SR, Mitsuhiro MRKH, Belfort R. Visual impairment and blindness an overview of prevalence and causes in Brazil. Annals of Brazilian Acad Sci. 2009;81(3):539-49.

11. Pi LH, Chen L, Liu Q, Ke N, Fang J, Zhang S, et al. Prevalence of Eye Diseases and Causes of Visual Impairment in School-Aged Children in Western China. J Epidemiol. 2012;22(1):37-44.

12. Vishnuprasad R, Bazroy J, Madhanraj K, Prashanth HR, Singh Z, Samuel AK, et al. Visual impairment among 10–14‑year school children in Puducherry: A cross‑sectional study. J Family Med Primary Care. 2017;6:58-62.

13. Barasa E, Otieno SA, Karimurio J. The prevalence and pattern of visual impairment and blindness among Primary School pupils in Kitale Municipality, Kenya. J Ophthalmol Eastern Central Southern Africa. 2013;66-70.

14. Yared AW, Belaynew WT, Destaye S, Ayanaw T, Zelalem E. Prevalence of Refractive errors among School Children in Gondar Town, Northwest Ethiopia. Middle East Afr J Ophthalmol. 2012;19(4):372-6.

15. Goh PP, Abqariyah Y, Pokharel GP, Ellwein LB. Refractive error and visual impairment in school-age children in Gombak District, Malaysia. Ophthalmol. 2005;112(4):678-85.

16. Sapkota YD, Adhikari BN, Pokharel GP, Poudyal BK, Ellwein LB. The Prevalence of Visual Impairment in School Children of Upper-Middle Socioeconomic Status in Kathmandu. Ophthalmic Epidemiol. 2008;15(1):17–23.