International Journal of Ophthalmology & Visual Science
2026, Vol. 11, No. 1, pp. 9–17
https://doi.org/10.11648/j.ijovs.20261101.12

Research Article

Pattern of Refractive Errors in Association with Strabismus Among Paediatric Patients (6-18 Years) Attending Ophthalmology Outdoors in BSMMU Hospital, Bangladesh

Syed Mohammad Didarul Alam[1], Mohammad Mizanur Rahman[2, 3, *], Aysha Siddika Mukta[4], Shams Mohammed Noman[1], Md Zahangir Alam[5], Mohd Zaki Awg Isa[2, 6]

[1]Department of Ophthalmology, Bangladesh Medical University (BMU) Hospital, Dhaka, Bangladesh
[2]MSU Center of Excellence for Vision and Eye Care, Management and Science University, Shah Alam, Malaysia
[3]Faculty of Health and Life Sciences, Management and Science University, Shah Alam, Malaysia
[4]Department of Ophthalmology, Shimane University Hospital, Shimane, Japan
[5]Fashion Eye Hospital and Institute, Dhaka, Bangladesh
[6]Department of Optometry and Vision Science, Management and Science University, Shah Alam, Malaysia

Abstract

Background: Strabismus, a common ocular disorder among children, often coexists with refractive errors. Understanding the pattern of refractive errors in pediatric patients with Strabismus is crucial for effective clinical management. Since depth perception and binocular vision develop during the first six years, early detection and correction of refractive errors are essential to appropriate care. Methods: A hospital-based, retrospective cross-sectional association study was conducted among 235 pediatric patients attending BSMMU (Jan 2021 - Dec 2022), considering demographic characteristics and strabismus type, pre-treatment and post-treatment refractive errors. Analysis was implemented with SPSS v23, and $p \leq 0.05$ was considered statistically significant. Results: In this study (n=235), the mean age was 12.49±3.51 years. Refractive errors were myopia (25.5%), astigmatism (53.2%), hypermetropia (9.4%), and combined >10%. Strabismus was reported in 21.7% (31.4% esotropia, 68.6% exotropia). Myopia was higher in 12-16 years, and hypermetropia and astigmatism in 6-11 years ($p<0.001$). Girls had a higher prevalence of Strabismus, and boys had a higher prevalence of myopia and astigmatism. Hypermetropia showed a statistically significant association with the presence of strabismus (OR 2.8, $p = 0.026$), whereas myopia was less frequently observed among children with strabismus (OR = 0.39, $p = 0.033$). Conclusion: Nearly one-fourth of children with Strabismus were associated with refractive errors; astigmatism was the most frequently observed refractive error among children with strabismus. Regular screening, early interventions, and a holistic approach—including affordable care, parental awareness, parental education, and psychosocial support- are the key to better children's visual, educational, and social development.

Keywords

Refractive Error, Amblyopia, Strabismus, Esotropia, Exotropia

*Correspondence: Mohammad Mizanur Rahman (mohd_mizanur@msu.edu.my)

Received: 23 January 2026; **Accepted:** 5 February 2026; **Published:** 12 March 2026

1. Introduction

Refractive errors and strabismus are the most common causes of vision problems in children around the world. They remain an important public health problem [1-3]. Strabismus can cause deficiency of fusional and stereoscopic ability, often associated with refractive errors such as myopia, hypermetropia, and astigmatism, which makes diagnosis and treatment more difficult [2, 4]. Children who don't receive support with vision problems may not do well in school, may have difficulty with physical and social activities, and may even suffer from mental health problems, such as low self-esteem and withdrawal from the community [5-7]. These findings emphasize the importance of early detection and management of eye diseases in children.

The prevalence of refractive errors in children is approximately 10-50% worldwide and may vary with the geographic location, age, and socio-economic status [8-13, 30]. Estimates of strabismus prevalence also differ across studies: some authors report prevalence ranging from 2 to 5% in school-aged South Asian children [10], while others observe varying estimates depending on the sample characteristics and the definition of the disease [10, 14, 15]. These inconsistencies contribute to the controversy about which types of ametropia are related to which types of strabismus and the roles of genetic and environmental influences on the progression of disease [12, 16]. Timely diagnosis is important, since uncorrected RE can lead to amblyopia, a treatable cause of visual impairment and lifelong decrement in visual functioning [4, 7, 17].

In countries like Bangladesh, including low- and middle-income countries (LMICs), children with vision problems mostly go undiagnosed and untreated because of lack of awareness, poor school-based screening services, and socio-economic influence [8, 14, 18, 19]. The absence of disease and epidemic history complicates health care plans and resource allocation. Previous studies have explored the distribution of refractive errors and the prevalence of strabismus in different populations; however, little is known about the comorbid occurrence of these disorders among children in Bangladesh and its compounded impact on visual function and quality of life [8, 11, 19]. In addition, the contradictory findings with certain types of refractive errors in the causation of strabismus require confirmation [15, 16].

The main purpose of this research is to assess the occurrence of refractive errors associated with strabismus in a sample of children aged 6-18 who visited the BSMMU Hospital in Dhaka, Bangladesh. We aim to delineate the features of refractive errors in children with strabismus and investigate the distribution of refractive error types and their associations with strabismus among pediatric patients. This study adds to the contextual evidence about the frequency and cause of pediatric ocular morbidities in Bangladesh. It will be useful for complete planning, including early diagnosis and a comprehensive program of clinical care and public health that will improve child and ocular health.

2. Materials and Methods

Study Design and Setting: A hospital-based, retrospective cross-sectional association study was conducted at the Departments of Ophthalmology and Community Ophthalmology, Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital, Dhaka, Bangladesh, over the period from January 2021 to December 2022.

Study population and sampling: A total of children aged 6-18 years with ocular refraction errors presented to BSMMU Hospital were included in the study. The participants were selected by purposive sampling. Strabismus was clinically assessed by an ophthalmologist and categorized as esotropia or exotropia. Only non-paralytic strabismus associated with refractive errors was included in the analysis. Children with paralytic, sensory, or syndromic strabismus, as well as those with known neurological or developmental disorders, were excluded based on clinical history and examination findings. Other etiological subtypes, such as sensory or amblyopia-related strabismus, were not separately classified, which may introduce residual confounding. The inclusion criteria required participants to be aged between 6 and 18 years, while the exclusion criteria included having a history of congenital ocular disorders, systemic illnesses, ptosis, paralytic squint, thyroid gland disorders, tumors of the eye or brain, previous eye surgeries, severe syndromes, or cerebral palsy.

Sample size: With a calculated prevalence of pediatric vision impairment of 3.7%, a total sample size of 384 participants was planned using a single population proportion formula with a 95% confidence level and precision of 5-10%. However, only 235 eligible participants were enrolled due to time limitations and the availability of complete clinical records during the predefined study period. A post hoc power analysis was not performed; therefore, the reduced sample size may have limited the statistical power of the study, particularly for subgroup analyses such as strabismus subtypes.

Variables: Socio-demographic factors, including age and gender, as well as clinical presentations such as refraction status and strabismus assessment, occur frequently. Clinical variables included refractive status and strabismus assessment as documented in patient records.

Data collection: Data were collected using a structured data collection form based on patients' medical records. Demographic information and previous ophthalmic history were recorded at each visit. All included children underwent orthoptic evaluation and cycloplegic refraction using cyclopentolate 1% eye drops, which were performed by a qualified optometrist. Completed case files were cross-checked and verified by two independent ophthalmic personnel to ensure data accuracy.

Data analysis: Quantitative data were analyzed using Statistical Package for the Social Sciences (SPSS) version 23 and Microsoft Excel. Descriptive statistics were used to summarize demographic and clinical characteristics. Univariate and

bivariate analyses were performed, and results were presented in tables and figures. A p-value ≤ 0.05 was considered statistically significant.

Ethical consideration: The study received approval from the institutional review board. An informed guardian approves the consent of all the individuals who took part. This study was carried out in compliance with the Helsinki Declaration.

Data availability: The information is available from the corresponding author upon reasonable request, including the data and protocols. No genitive artificial intelligence GenAI tool software is not used for data collection. Data researchers do not use GenAI functions; usual statistical tools and format software are used.

3. Results

3.1. Demographic Characteristics

3.1.1. Gender Distribution

The gender distribution among children with refractive error was 54.9% male and 45.1% female (Figure 1).

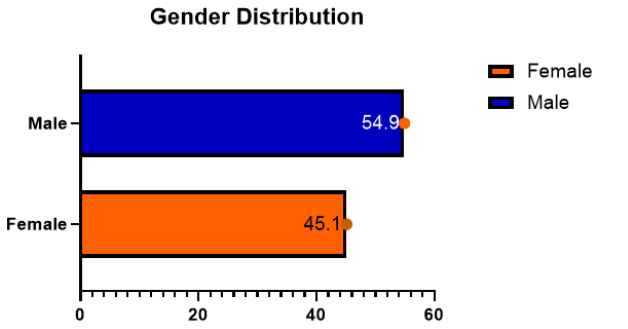

Figure 1. *Gender distribution of children with refractive errors (N = 235)*

3.1.2. Age Distribution

The age distribution of children with refractive errors is shown in Table 1. The majority of youngsters (40.9%) were aged between 6 and 11 years, followed by the 12 to 16 years' age group (39.1%). The mean age of the participants was 12.49 ± 3.51 years, with a median of 12 years (range: 6-18). Table 1 presents the distribution of children with refractive defects by age. The majority (40.9%) of the youngsters were aged 6 to 11 years, followed by the 12 to 16 years' age group (39.1%). The mean age of the participants was 12.49 ± 3.51 years, with a median of 12 years (range: 6-18).

Table 1. *Distribution of children with refractive error according to Age (N=235).*

Age (years)	Frequency (n)	Percentage (%)
6-11	96	40.9
12-16	92	39.1
17-18	47	20.0
Mean ± SD	12.49 ± 3.51	—
Median (range)	12 (6-18)	—

Notes: N = total number of participants; n = number of participants in each age group; percentages calculated as n ÷ N × 100; SD = standard deviation; median (range) represents central tendency and spread.

3.2. Presenting Complaints

Table 2. *Distribution of presenting complains of children with refractive errors (N=235).*

Presenting Complains (multiple responses)	Frequency (N=235)	Percentage (%)
Difficulty of vision	189	81.8%
Headache	108	46.8%
Watering	64	27.7%
Itching	58	25.1%

Presenting Complains (multiple responses)	Frequency (N=235)	Percentage (%)
Eyeache	45	19.15%
Deviation of eye	27	11.5%
Redness	18	7.8%
Burning Sensation	14	6.1%
Discharge	10	4.3%
Photophobia	06	2.6%
Foreign body sensation	01	0.4%

Note: *Data were as expressed frequency and percentage* Participants could report more than one complaint; percentages do not sum to 100. N = total participants; n = number reporting each complaint

The presenting complaints of children with refractive problems are encapsulated in Table 2. A predominant 81.8% of children exhibited visual impairment, followed by headaches at 46.8% and lacrimation at 27.7%.

3.3. Types of Refractive Errors

The percentage of children with myopia was 25.5%. Over fifty percent, specifically 53.2%, of the children had astigmatism. Only 9.4% experienced hypermetropia, while over 10% had mixed refractive defects (Figure 2).

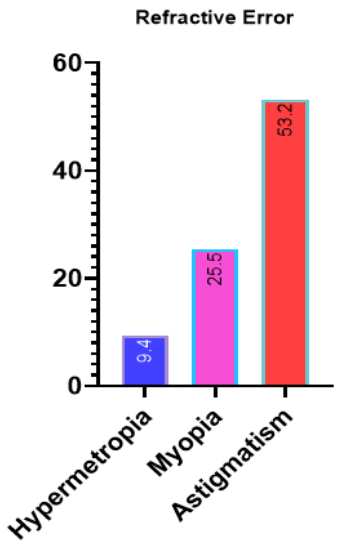

Figure 2. *Distribution of types of refractive errors among children (N=235).*

3.4. Strabismus

3.4.1. Prevalence

Strabismus was observed in 21.7% of children with refractive errors (Figure 3).

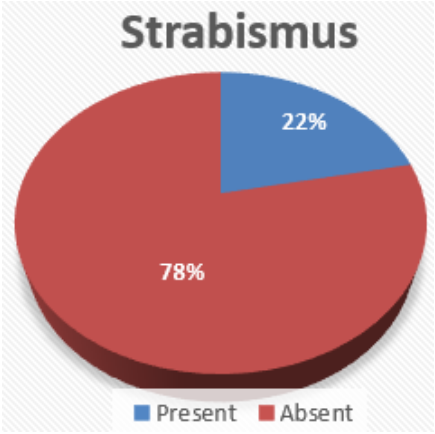

Figure 3. *Distribution of strabismus among children with refractive errors (N = 235).*

3.4.2. Subtypes

Among children with strabismus, 31.4% showed esotropia, while 68.6% had exotropia (Figure 4).

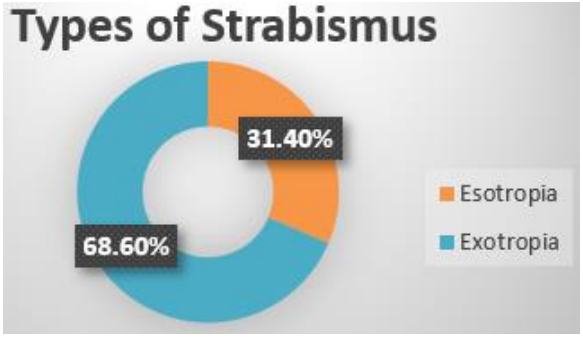

Figure 4. *Distribution of strabismus subtypes among children with strabismus (n = 51).*

3.4.3. Distribution by Age

The distribution of strabismus by age group is illustrated in Table 3. Strabismus was most common in children aged 6 to 11 years; the correlation between age and strabismus was not statistically significant (p = 0.527).

Table 3. Distribution of strabismus in different age groups (N = 235).

Age (years)	Strabismus Present, n (%)	Strabismus Absent, n (%)	Total, n (%)	P value
6-11	45 (47.1)	51 (52.9)	96 (100)	
12-16	36 (39.1)	56 (60.9)	92 (100)	
17-18	15 (31.9)	32 (68.1)	47 (100)	0.527 NS
Total	96 (40.9)	139 (59.1)	235 (100)	

Notes: Chi-square test was performed to see the association between the groups. NS = non-significant. Data are expressed as frequency (n) and percentage (%).

3.5. Association of Strabismus with Refractive Errors

3.5.1. Prevalence

The relationship between strabismus and various refractive errors is illustrated in Table 4. Strabismus was observed in 11.7% of myopic children, 40.9% of hypermetropic children, 24.8% of astigmatic children, and 14.3% of children with combined refractive defects. A notable correlation was identified between the kind of refractive error and strabismus (p = 0.019).

Table 4. Distribution of strabismus in different refractive errors (n=235).

Refractive error	Strabismus Present, n (%)	Strabismus Absent, n (%)	Total, n (%)	P value
Myopia	7 (11.7)	53 (88.3)	60 (100)	
Hypermetropia	9 (40.9)	13 (59.1)	22 (100)	
Astigmatism	31 (24.8)	94 (75.2)	125 (100)	
Combined	4 (14.3)	24 (85.7)	28 (100)	0.019 S
Total	51 (21.7)	184 (78.3)	235 (100)	

Notes: Chi-square test was performed to see the association between the two groups. S=Significant. Data were expressed as frequency and percentage

3.5.2. Subtypes by Refractive Error

While esotropia predominated in 88.9% of hypermetropic children, exotropia was more prevalent in 57.1% of myopic and 87.1% of astigmatic children (Figure 5). The correlation between strabismus subtype and refractive error was considerable ($p < 0.001$). Exotropia is more prevalent in myopia and astigmatism, whereas esotropia is predominant in hypermetropia.

3.6. Association Between Refractive Errors and Strabismus

Univariate regression analysis indicated that hypermetropia was significantly associated with the presence of strabismus (OR = 2.8, 95% CI: 1.130-7.034, p = 0.026), whereas myopia was less frequently observed among children with strabismus (OR = 0.393, p = 0.033) (Table 5).

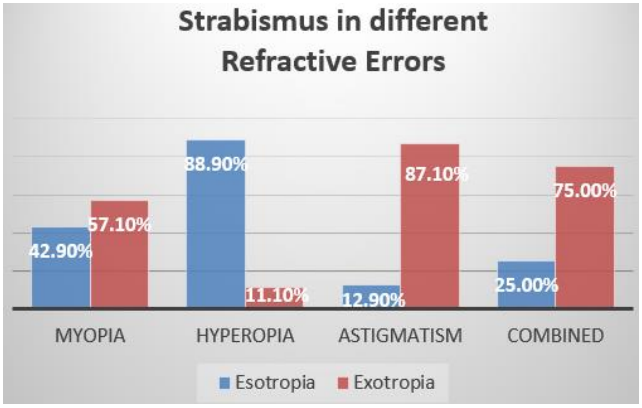

Figure 5. *Distribution of different strabismus in different refractive errors (n=51).*

Table 5. *Odds ratios showing the association between refractive errors and strabismus (N = 235).*

Refractive Error	OR	95% CI Lower	95% CI Upper	P value
Myopia	0.393	0.167	0.928	*0.033*^{s}
Hypermetropia	2.819	1.130	7.034	*0.026*^{s}
Astigmatism	1.484	0.789	2.792	*0.221*^{NS}
Combined	0.567	0.187	1.717	*0.316*^{NS}

Note: Univariate regression analysis to determine the odds of the presence of strabismus. NS= non-significant; S= significant. Data were expressed as an odds ratio and 95% CI

4. Discussion

The results of our study show that childhood vision disorders (RE and strabismus) are still pervasive among this group of pediatric patients. Although the observed frequency aligns with previous studies, direct comparison with population-based studies should be interpreted cautiously due to the hospital-based design of the present study [1, 2, 11]. Strabismus was also detected at a significant frequency, which paralleled previous findings of a 2-5% prevalence as reported among school-aged children in South Asian populations [17, 18]. Crucially, the present study points to the fact that these vision disorders are not only related to ophthalmic issues but also have an impact on the physical and psychosocial levels.

The prevalence rates observed in this hospital-based cohort are broadly comparable with those reported in similar clinical studies from Asia and Africa; however, direct comparison with population-based studies should be interpreted cautiously due to differences in study design and access to early screening services [11, 15, 19]. Amblyogenic factors, including uncorrected hyperopia and anisometropia, were observed in this cohort, highlighting the clinical importance of timely detection and appropriate management [7, 9, 20]. Consistent with previous reports, children with uncorrected refractive errors were more frequently reported to experience difficulties with academic activities and sustained near tasks [6, 16]. Together, these findings underscore the broader clinical and functional implications associated with pediatric refractive errors and strabismus.

This study highlights the connection between visual disability and the physical and mental health of children across all age groups. Children with strabismus were also more likely to feel less confident in group activities and tend to shy away from socializing—reminiscent of findings from other psychosocial studies [17, 25]. Uncorrected refractive errors induced headaches, visual fatigue, and avoidance of visually demanding activities, which subsequently restricted participation in sports and outdoor activities [5, 21].

A connection between vision problems and mental health implications cannot be underestimated. High levels of anxiety, depression, and low self-esteem have been reported in children with strabismus and amblyopia, as compared to their peers, by previous studies [26, 29]. Our study provides additional evidence by demonstrating that untreated childhood vision problems are linked to decreased overall functioning and well-being, emphasizing the interconnectedness of sensory, motor, and emotional development. The findings support the importance of interventions that extend beyond correcting eyesight or performing surgery and which focus on a broader range of child development outcomes.

Results of this study work to justify pediatric vision screening within school health programs as a feasible and cost-effective measure. The screening program in a school has been reported to increase the detection ratio of refractive errors and strabismus, which leads to early intervention [22, 24]. Early intervention not only avoids amblyopia but also enhances children's ability to learn and participate in recreation [14, 15].

Also crucial is the involvement of the parents. Many parents still do not know the warning symptoms associated with visual defects, such as rubbing of the eye, squinting, and avoidance of near work [23]. Community education programs, along with the distribution of simple screening tools, can facilitate parents seeking early ophthalmic help. Strategies that involve teachers in the frontline detection of vision problems could reinforce early detection efforts.

From a policy perspective, incorporating pediatric vision within existing child health and development efforts provides an opportunity to address disability comprehensively. Eye health can also be combined with nutrition, immunization, and mental health services, making care from health systems more holistic. This comprehensive approach avoids treating pediatric vision in isolation but considers it as an essential determinant of general health, educational, and social development [27, 28].

Although the association between refractive errors and pediatric strabismus has been widely reported, the present study

contributes region-specific clinical data from a tertiary hospital in Bangladesh, where such information remains limited. This single-center, retrospective, descriptive analysis does not introduce new methodology or mechanistic insights; however, it provides valuable local epidemiological evidence that may inform clinical practice and service planning in similar low- and middle-income settings.

Strengths and Limitations:

One of the strengths of the study is its hospital-based clinical dataset obtained from a tertiary referral center. However, some limitations need to be recognized. Because this was a hospital-based study conducted at a tertiary referral center, the findings may not be generalizable to the general pediatric population. Additionally, the lack of longitudinal follow-up limits our capacity to evaluate long-term outcomes or the progression of vision abnormalities.

5. Conclusions

This study emphasizes the notable burdens of pediatric vision disorders and their multifaceted effect on child health. By showing that refractive errors and strabismus are not simply a seeing difficulty but actually prevent people from the necessary active participation and well-being, our results highlight the importance of early detection and management. School vision screening, parental enlightenment, and policy integration of vision care in comprehensive child health programs appear as indispensable solutions to this situation. Considering these interventions may not only enhance visual outcomes but also optimize learning, social engagement, and psychological coping of children.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Bangabandhu Sheikh Mujib Medical University (BSMMU) (protocol code BSMMU/2021/8879, registration no. 4400, and date of approval 15 June 2021).

Informed Consent Statement

Informed consent was obtained from the guardians of all child participants involved in the study, with written consent forms provided in both Bangla and English.

Abbreviations

RE	Refractive Error
BSMMU	Bangabandhu Sheikh Mujib Medical University
VA	Visual Acuity
OR	Odds Ratio
CI	Confidence Interval
SD	Standard Deviation
NS	Not Significant
LMICs	Low- and Middle-Income Countries
ET	Esotropia
XT	Exotropia
N	Sample Size / Number of Participants

Acknowledgments

The authors would like to express their sincere gratitude to all the patients and their guardians who participated in this study. The authors also thank the Department of Ophthalmology and Community Ophthalmology of Bangabandhu Sheikh Mujib Medical University (BSMMU), including all staff and members, for their invaluable support and involvement in this research. During the preparation of this manuscript, the authors used ChatGPT (GPT-5, OpenAI) for assistance in drafting and REFINING TEXT and *Grammarly for* grammatical correction. The authors have reviewed and edited the output from these tools and take full responsibility for the content of this publication.

Author Contributions

Syed Mohammad Didarul Alam: Conceptualization, Data curation, Methodology, Validation, Resources, Writing – original draft, Writing – review & editing

Mohammad Mizanur Rahman: Funding acquisition, Resources, Writing – original draft, Writing – review & editing

Aysha Siddika Mukta: Software, Validation, Resources

Shams Mohammed Noman: Funding Acquisition, Investigation, Resources, Supervision, Visualisation

Md Zahangir Alam: Project administration

Mohd Zaki Awg Isa: Writing – review & editing

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to institutional and ethical restrictions imposed by the Bangabandhu Sheikh Mujib Medical University (BSMMU) policy to protect patient confidentiality.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] Abady, N. H.; Al-Jumaili, A. A.; Fayyadh, R. A. Association between Strabismus and Refractive Errors among Preschool Children in Fallujah, Iraq. Indian J. Public Health Res. Dev. 2019, 10, 508-513. https://doi.org/10.5958/0976-5506.2019.01055.6

[2] Al-Tamimi, E. R.; Shakeel, A.; Yassin, S. A.; Ali, S. I.; Khan, U. A. A clinic-based study of refractive errors, strabismus, and amblyopia in pediatric age group. J. Fam. Community Med. 2015, 22, 158. https://doi.org/10.4103/2230-8229.163031

[3] American Academy of Ophthalmology. Pediatric Ophthalmology and Strabismus, 2021-2022, Basic and Clinical Science Course, Section 6; AAO: San Francisco, CA, USA, 2021; pp. 15-16.

[4] Agaje, B. G.; Delelegne, D.; Abera, E.; Desta, K.; Girum, M.; Mossie, M.; Eshetu, D.; Hirigo, A. T. Strabismus prevalence and associated factors among pediatric patients in southern Ethiopia: A cross-sectional study. J. Int. Med. Res. 2020, 48, 0300060520964339. https://doi.org/10.1177/0300060520964339

[5] Bruce, A.; Santorelli, G. Prevalence and risk factors of strabismus in a UK multi-ethnic birth cohort. Strabismus 2016, 24, 153-160. https://doi.org/10.1080/09273972.2016.1242639

[6] Chia, A.; Roy, L.; Seenyen, L. Comitant horizontal strabismus: An Asian perspective. Br. J. Ophthalmol. 2007, 91, 1337-1340. https://doi.org/10.1136/bjo.2006.112854

[7] Czepita, D.; Mojsa, A.; Ustianowska, M.; Czepita, M.; Lachowicz, E. Prevalence of refractive errors in schoolchildren ranging from 6 to 18 years of age. Ann. Acad. Med. Stetin. 2007, 53, 53-56.

[8] Dandona, R.; Dandona, L. Refractive error blindness. Bull. World Health Organ. 2001, 79, 237-243. https://doi.org/10.1590/S0042-96862001000300013

[9] Dirani, M.; Chan, Y. H.; Gazzard, G.; Hornbeak, D. M.; Leo, S. W.; Selvaraj, P.; Zhou, B.; Young, T. L.; Mitchell, P.; Vanna, R.; Wong, T. Y. Prevalence of refractive error in Singaporean Chinese children: The STARS study. Investig. Ophthalmol. Vis. Sci. 2010, 51, 1348-1355. https://doi.org/10.1167/iovs.09-3587

[10] Elkington, A. R.; Frank, H. J.; Greaney, M. J. Clinical Optics, 3rd ed.; Blackwell Science Ltd.: Oxford, UK, 1999; pp. 113-115.

[11] Ferdausi, N.; Hussain, A. H. M.; Mostafa, G.; Ahmed, J. Prevalence of refractive error among primary school children in Bangladesh: Demographic pattern analysis. J. Ophthalmol. Bangladesh 2017, 44, 4-9.

[12] Gao, Z.; Meng, N.; Muecke, J.; Chan, W. O.; Piseth, H.; Kong, A.; Nguyen, T. P.; Dehghan, Y.; Selva, D.; Casson, R.; Ang, K. Refractive error in school children in an urban and rural setting in Cambodia. Ophthalmic Epidemiol. 2012, 19, 16-22. https://doi.org/10.3109/09286586.2011.642400

[13] Gunton, K. B.; Wasserman, B. N.; DeBenedictis, C. Strabismus. Prim. Care Clin. Office Pract. 2015, 42, 393-407.

[14] Gupta, M.; Gupta, B. P.; Chauhan, A.; Bhardwaj, A. Ocular morbidity prevalence among school children in Shimla, Himachal, North India. Indian J. Ophthalmol. 2009, 57, 133. https://doi.org/10.4103/0301-4738.45503

[15] Harvey, E. M.; Dobson, V.; Miller, J. M.; Sherrill, D. L. Treatment of astigmatism-related amblyopia in 3- to 5-year-old children. Vision Res. 2004, 44, 1623-1634. https://doi.org/10.1016/j.visres.2004.01.034

[16] Hashemi, H.; Fotouhi, A.; Yekta, A.; Pakzad, R.; Ostadimoghaddam, H.; Khabazkhoob, M. Global and regional estimates of prevalence of refractive errors: Systematic review and meta-analysis. J. Curr. Ophthalmol. 2018, 30, 3-22. https://doi.org/10.1016/j.joco.2017.08.009

[17] Hatt, S. R.; Leske, D. A.; Castaneda, Y. S.; Wernimont, S. M.; Liebermann, L.; Cheng-Patel, C. S.; Birch, E. E.; Holmes, J. M. Association of strabismus with functional vision and eye-related quality of life in children. JAMA Ophthalmol. 2020, 138, 528-535. https://doi.org/10.1001/jamaophthalmol.2020.0209

[18] He, H.; Fu, J.; Meng, Z.; Chen, W.; Li, L.; Zhao, X. Prevalence and associated risk factors for childhood strabismus in Lhasa, Tibet, China: A cross-sectional, school-based study. BMC Ophthalmol. 2020, 20, 315. https://doi.org/10.1186/s12886-020-01732-2

[19] Kader, M. A.; Tarafder, S. R.; Anwar, A. A.; Sajj, A. B.; Karmokar, P. K.; Das, C. K. Study of refractive errors on school-going children in North West Zone of Bangladesh. TAJ J. Teach. Assoc. 2016, 29, 1-6. https://doi.org/10.3329/taj.v29i1.39084

[20] Kazi, U.; Saleem, A.; Ali, M. H. G.; Abro, A. S.; Khan, H. Frequency of refractive error in children with strabismus at tertiary care hospital Gadap Town, Karachi. Professional Med. J. 2021, 28, 686-690. https://doi.org/10.29309/TPMJ/2021.28.05.5794

[21] Lee, J. E.; Kim, C. Z.; Nam, K. Y.; Lee, S. U.; Lee, S. J. An epidemiologic survey of strabismus and nystagmus in South Korea: KNHANES V. J. Korean Ophthalmol. Soc. 2017, 58, 998-1006. https://doi.org/10.3341/jkos.2017.58.11.1260

[22] Malik, N.; Masud, H.; Basit, I.; Noor, P. Frequency of refractive error and amblyopia in strabismus in pediatric age group. Pak. Armed Forces Med. J. 2021, 71, 405-408. https://doi.org/10.51253/pafmj.v71i2.3109

[23] Michaeline, I.; Sheriff, A.; Bimbo, A. Pediatric refractive errors in an eye clinic in Osogbo, Nigeria. Ethiop. J. Health Sci. 2016, 26, 147-154. https://doi.org/10.4314/ejhs.v26i2.8

[24] Naidoo, K. S.; Leasher, J.; Bourne, R. R.; Flaxman, S. R.; Jonas, J. B.; Keeffe, J.; Limburg, H.; Pesudovs, K.; Price, H.; White, R. A.; Wong, T. Y. Global vision impairment and blindness due to uncorrected refractive error, 1990-2010. Optom. Vis. Sci. 2016, 93, 227-234. https://doi.org/10.1097/OPX.0000000000000796

[25] Norouzirad, R.; Hashemi, H.; Yekta, A.; Nirouzad, F.; Ostadimoghaddam, H.; Yazdani, N.; Dadbin, N.; Javaherforoushzadeh, A.; Khabazkhoob, M. The prevalence of refractive errors in 6- to 15-year-old school children in Dezful, Iran. J. Curr. Ophthalmol. 2015, 27, 51-55. https://doi.org/10.1016/j.joco.2014.11.006

[26] H Nwachukwu, AA Onua, and AO Adio, Risk Factors of Strabismus in Children in a Southern Nigerian Tertiary Hospital. World Journal of Ophthalmology & Vision ResearchVolume 2 - Issue 3, 2019, https://doi.org10.33552/WJOVR.2019.02.000541

[27] Paduca, A.; Arnăut, O.; Cardaniuc, C.; Spinei, L.; Bendelic, E.; Bruenech, J. R.; Lundmark, P. O. Epidemiology of childhood manifest strabismus in the Republic of Moldova. Strabismus 2020, 28, 128-135. https://doi.org/10.1080/09273972.2020.1786789

[28] Pokharel, A.; Pokharel, P. K.; Das, H.; Adhikari, S. The patterns of refractive errors among the school children of rural and urban settings in Nepal. Nepal J. Ophthalmol. 2010, 2, 114-120. https://doi.org/10.3126/nepjoph.v2i2.3712

[29] Qanat A S; Alsuheili A; Alzahrani A M; Faydhi A A; Albadri A H; Alhibshi N. Assessment of Different Types of Strabismus Among Pediatric Patients in a Tertiary Hospital in Jeddah. Cureus. 2020 Dec 8; 12(12): e11978.

[30] Zimmermann, A.; de Carvalho, K. M. M.; Atihe, C.; Alam SMD, Quddus AHG, Husain R, Gupta JD. Ocular Status, Health Seeking Behaviours and Barriers to Uptake Eye Care Services among Children of Slum Community in Chittagong, Bangladesh. J Ophthalmol Clinical Res. 2017; 1(2): 1-7. 29. https://doi.org/10.33140/jocr/01/02/00007