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Prevalence of Refractive Error among Primary School Children in Pathum Wan District, Bangkok, Thailand

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Abstract

Objective: To determine the prevalence of refractive error and the reasons for the lack of glasses among primary school children in Pathum Wan district, Bangkok, Thailand.

Materials and Methods: This cross-sectional study was conducted in March 2024. Primary school children from Watduangkhae School and Watsabua School, Bangkok, were assessed for visual acuity using a 6-meter Snellen chart. Autorefraction and subjective refraction were performed on all children in grade 1 and the children in grades 2 to 6 with visual acuity 20/40 or worse in at least one eye. Cycloplegic refraction was done in some specific cases. Complementary glasses were provided after assembly. Surveys were administered to children to explore the barriers preventing them from having their refractive errors corrected.

Results: 358 primary school children aged 6–13 years were included, and eyeglasses were prescribed and provided to 67 children (18.71%). The prevalence of simple myopia, simple hyperopia, and astigmatism in children who required eyeglasses was 1.96%, 0.83%, and 15.78%, respectively. The majority of children, 82.09%, lacked glasses or had inappropriate glasses, and the main reason was children's unawareness of their refractive error.

Conclusion: Astigmatism was the most prevalent refractive error among children in two primary schools in Pathum Wan district, Bangkok. The high number of children lacking proper glasses, mostly from unawareness of the problem, underscores the need for allocating resources to eye screening units with free glasses coupled with educational campaigns.

Keywords: Refractive errors; myopia; hyperopia; astigmatism; school children; Thailand

Introduction

Refractive error is a significant cause of visual impairment among children, impacting their educational performance and overall well-being[1]. Despite the availability of corrective glasses, many children worldwide face challenges in accessing proper eye care services, resulting in untreated refractive errors and amblyopia. Understanding the prevalence of refractive error and the reasons for the lack of glasses is crucial for developing targeted interventions to improve eye health outcomes in this vulnerable population.

Primary schools serve as essential settings for identifying and addressing vision-related issues among children. However, there is limited research focusing specifically on the prevalence of refractive error in primary school settings, particularly in urban areas like Bangkok, Thailand.

Watduangkhae School and Watsabua School, located in Pathum Wan district, Bangkok, Thailand, serve as valuable educational institutions for primary school children in the area. Despite their importance, there is little information available about the eye health status of their students and the barriers they face to accessing

glasses. By conducting vision screenings and assessments, this research seeks to provide insights into the prevalence of refractive error among primary school children at Watduangkhae School and Watsabua School, as well as to identify the factors contributing to the lack of eyeglasses in children.

Materials and Methods

This was a cross-sectional study performed in March 2024. The target population was children studying in grade 1 to grade 6 in two primary schools in Pathum Wan district, Bangkok, Watduangkhae School and Watsabua School. Permission was sought from the principals of the respective schools. Children whose parents/guardians gave signed consent for vision screening and/or cycloplegic refraction were included.

Examinations

-All children were tested for uncorrected and best-corrected visual acuity using a 6-meter Snellen chart. Best-corrected visual acuity tests were done using a pinhole. The tests were performed separately for each eye.

-All children in grade 1 and the children in grades 2 to 6 with visual acuity equal to or worse than 20/40 in at least one eye were then screened by autorefraction and subjective refraction.

- Children with signed parental consent underwent cycloplegic refraction if:

- Vision failed to improve with lens trials,
- Refractive error values showed poor repeatability, or
- High refractive error was identified.

By employing cycloplegic refraction, we aimed to identify the true extent of refractive errors and to provide the most accurate prescription. The procedure involved instilling two drops of 1% tropicamide five minutes apart, followed by autorefraction and subjective refraction 30 minutes later

-Complementary eyeglasses were provided to children after assembly, but only for those with significant refractive errors. Children with mild myopia (less than -0.5 diopters), hyperopia (less than +1.00 diopters), or astigmatism (less than 0.5 diopters) did not receive glasses.

-Surveys were administered to children to gather information on the reasons for lacking glasses or having inappropriate glasses.

Definition

-Simple myopia was defined as the spherical equivalent of being equal to or less than -0.50 diopters without astigmatism.

-Simple hyperopia was defined as the spherical equivalent of being equal to or more than +1.00 diopters without astigmatism.

-Astigmatism was defined as two or more abnormal focal points within the eye, with cylindrical power being equal to or worse than 0.5 diopters. Astigmatism can be divided into five types based on refractive component: simple myopic astigmatism, simple hyperopic astigmatism, compound myopic astigmatism, compound hyperopic astigmatism, and mixed astigmatism[2].

-Astigmatism was also classified based on the steepest meridian:

-With-the-rule (WTR) astigmatism: The steepest meridian is vertical or within 30 degrees of the 90 degree meridian (between 60 and 120 degrees).

-Against-the-rule (ATR) astigmatism: The steepest meridian is horizontal or within 30 degrees of the 180 degree meridian (between 0 to 30 and 150 to 180 degrees).

-Oblique astigmatism: The steepest meridian is not within 30 degrees of the horizontal or vertical meridians (31 to 59 degrees and 121 to 149 degrees)[3].

Results

There were 382 primary school children, ages 6-13, at Watduangkhae School and Watsabua School. A total of 358 children (93.71%) had a visual acuity test done, and it was found that 71 students (19.83%) had visual acuity equal to or worse than 20/40 in at least one eye. Eyeglasses were prescribed and provided to correct refractive errors for 67 children (18.71%). The prevalence of simple myopia, simple hyperopia, astigmatism was 1.96%, 0.83%, and 15.78%, respectively, as shown in Table 1. The most common refractive error was astigmatism, and the details of the types of astigmatism are shown in Table 2. Myopic astigmatism (both simple and compound) was significantly more prevalent than hyperopic astigmatism (simple and compound). The majority of astigmatism, based on the steepest axis, was with-the-rule astigmatism followed by against-the-rule, and the minority was oblique astigmatism.

Table 1 Prevalence of Refractive Errors Among Students who Required Eyeglasses

Refractive error	OD	OS	Total	Prevalence%
Simple myopia	8	6	14	1.96
Simple hyperopia	3	3	6	0.83
Astigmatism	55	58	113	15.78
Total	66	67	133	18.57

Abbreviations: OD, right eye, OS, left eye

Table 2 Type of Astigmatism

Prescription	OD	OS	Total
Based on refractive component			
-simple myopic astigmatism	24	24	48
-simple hyperopic astigmatism	2	2	4
-compound myopic astigmatism	27	27	54
-compound hyperopic astigmatism	1	1	2
-mixed astigmatism	1	4	5
Based on location of the steepest meridian			
-with-the-rule	51	54	105
-against-the-rule	3	3	6
-Oblique	1	1	2

Abbreviations: OD, right eye, OS, left eye

Surveys of children's eyeglasses revealed only 17.9% (12 children) had appropriate correction for their refractive errors. The remaining 82.1% (55 children) did not have glasses or were wearing inappropriate ones, and the reasons behind this, as presented in Table 3, highlight that a lack of awareness about their refractive error was the primary factor for not having proper corrective eyeglasses.

Table 3 Reasons for lacking glasses or having inappropriate glasses

Children's unawareness of their refractive error	31
Glasses loss or damage	7
Outdated or incorrect prescription	9
Busy schedules hinder parents from prioritizing eye exam for children	8

Discussion

-The prevalence of refractive errors in primary school children in our study was 18.57%. Astigmatism is the most prevalent which was comparable with studies conducted by Alrahili NHR et al[4] (Saudi Arabia), Tajbakhsh Z et Al[5] (Iran), Margines et al[6] (USA) and Hashemi H et al[7](systematic review). However, it would

be difficult to compare the results with other relevant studies due to variations in methodology, refractive error definitions, refraction techniques, and geographic location.

-Ideally, cycloplegic refraction, a procedure that utilizes eye drops to temporarily relax the focusing muscles in the eye, should be performed on all children for the most accurate assessment of their refractive errors. This is important because children's focusing abilities can fluctuate, and active accommodation is the primary source of error in measurements. In this study, however, cycloplegic refraction[8], using tropicamide 1%, was only employed in specific cases. This limitation may introduce some bias into the reported refractive error values. Children who did not undergo cycloplegic refraction might have a slight overestimation of myopia or underestimation of hyperopia compared to if the procedure had been performed.

-Untreated refractive error is a significant public health issue in Thailand, including its capital, Bangkok. This study highlights the problem, with only 17.9% (12 out of 67) of children needing eyeglasses having access to appropriate ones. This underscores the need for improved eye health services and awareness. However, developing effective public health strategies is hampered by the scarcity of recent, population-based studies on refractive errors and visual impairment in Thai primary school children. Existing studies in Thailand[9-12], as shown in Table 4, may not reflect current trends. Therefore, conducting comprehensive, population-based studies are recommended to accurately assess the prevalence and distribution of refractive errors in Thai schoolchildren. This data is crucial for optimizing public health resource allocation by informing policymakers on how to effectively allocate resources for screening programs, vision correction, and healthcare professional training. It is also important for targeted interventions, as understanding the demographics most affected by refractive errors allows for tailoring interventions to reach these high-risk groups. Finally, regular population-based studies enable monitoring progress in addressing refractive errors over time.

Table 4 Previous studies on the prevalence of refractive errors among primary school children in Thailand

Year	City	Age (years)	Sample Size	Refractive Error (%)	Myopia (%)	Hyperopia (%)	Astigmatism (%)
2003	Chiang Mai	6-7	3,467	7.3-8.7	N/A	N/A	N/A
2009	Songkhla	6-12	1,900	5.63	N/A	N/A	N/A
2010	Bangkok	6-12	1,100	12.7	11.1	1.4	0.3
	Nakhonpathom	6-12	1,240	5.7	4.3	1.3	0.2
2022	Bangkok (Bangkok Noi area)	6-8	386	15.8	2.8*	3.4**	9.6

*myopia with astigmatism, ** hyperopia with astigmatism

-In 2016, the Thai government announced the Good Sight for Thai Children policy (GSTC) with the aim of providing free glasses for children who need glasses to correct their visual impairments. The rough process is that there will be a visual acuity screening for every child, and then children with vision problems will be suggested to see an ophthalmologist at the hospital to have their eyes examined and receive eyeglass prescriptions from an ophthalmologist to get glasses made. Subsequently, the expenses for making eyeglasses can be reimbursed by the government. However, from the study of Wangtiraumnuay et al[13], there were a large number of children with vision problems (20,401 students from 786,729 students screened), but only 9,867 students, or 48.37%, presented at the hospital, while the other 10,534 students, or 51.63%, did not come to the hospital for examination, which may be due to many limitations such as travel problems. For example, parents may not have time to take their children, have problems with travel expenses, or not be aware of the importance of children using glasses. Therefore, even though there is a project to distribute free glasses, it still cannot solve the problem of uncorrected visual impairment in children with significant refractive errors. Making it difficult to see clearly affects learning and other aspects of quality of life. Solving this issue may involve allocating a budget for a one-stop eye examination unit offering refractive error measurement, glass prescription, and free glasses for children. To maximize effectiveness, this program should be accompanied

by educational initiatives for the community, parents, children, and schools about the importance of eye screening and refractive error correction.

Conclusion

Astigmatism was the most prevalent refractive error among children in two primary schools in Pathum Wan district, Bangkok. Many children have undiagnosed vision problems because neither they nor their parents realize the importance of eye examination. One-stop eye examination units offering free screenings, glasses, and educational resources for the community could significantly improve children's vision. This, in turn, can positively impact their academic performance, career choices, and future socioeconomic status.

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