

## A Hospital Based Descriptive Cross-Sectional Assessment of Refractive Error

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Received: 13-01-2023 / Revised: 17-02-2023 / Accepted: 07-03-2023

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Conflict of interest: Nil

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### Abstract

**Aim:** The aim of the present study was to determine refractive error study in western region of Bihar region.

**Methods:** This cross-sectional study was conducted at department of Ophthalmology, Bhagwan Mahavir Institute of Medical Sciences for 12 months. Total 540 children of age group 6-16 years of the selected school were screened for visual acuity testing using Snellen's Chart for distance and Jaeger's chart for near with the help of experienced optometrist in the respective class. Among 540 children screened at school, 100 were found to have refractive errors.

**Results:** Out of 100 children diagnosed to have refractive errors, myopia was seen in 62 cases (62%), hypermetropia in 15 cases (15%) and astigmatism in 23 cases (23%). Among the cases of refractive errors, 18 cases (18%) were in the age group of 6 to  $\leq 9$  years, 30 cases (30%) in the age group of  $>9$  to  $\leq 12$  years and 52 cases (52%) in the age group of  $>12$  to  $\leq 16$  years. Maximum numbers of cases were seen in the age group of  $>12$  to  $\leq 16$  years. By applying Chi-square test we found a significant association between age and refractive errors. Among the total study participants diagnosed to have refractive errors, according to the proposed revision of categories for visual impairment 90% of the cases had mild visual impairment and 10% cases had moderate visual impairment. No cases in the category of severe visual impairment and blindness were observed.

**Conclusion:** Majority of children had visual impairment in the form of simple myopia and low degree astigmatism. Early screening and timely correction of refractive errors plays key role in preventing its consequences.

**Keywords:** Myopia; Hyperopia; Astigmatism; Prevalence; Cross-Sectional Study.

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### Introduction

Refractive error is an anomaly of the dioptric system of the eye in which it fails to bring rays of light into a focus on retina. Myopia, hypermetropia and astigmatism

are different types of refractive errors. Axial length of the eye, corneal curvature, position and refractive index of crystalline lens determine the refractive state of the

eye. There is compelling evidence for both genetic and environmental influence on refractive development. [1-3] The specific genetic polymorphisms or environmental risk factors responsible remain largely unknown. Though earlier studies showed near work particularly reading, to be a significant environmental factor that may lead to myopia. [4-6] A susceptibility locus of myopia in the normal population is linked to the PAX6 region on chromosome 11. [7] Uncorrected refractive errors are a common cause of visual impairment and blindness worldwide. It is estimated that 2.3 billion people are living with this disorder. [8] Although most errors can be corrected by optical or surgical methods; these treatments have some drawbacks and pose a large economic burden.

In developing countries, children in the school going age group represent 25% of the population. [9] Among this population refractive error can be easily diagnosed, measured and corrected to attain normal vision. WHO prioritised the prevention of blindness due to uncorrected refractive errors in children as an important agenda. [10] Realizing the enormous need for correction of refractive errors worldwide, the World Health Organization has adopted the correction of refractive errors in developed and developing countries as one of the main priorities in its "Vision 2020: the right to sight" initiative. [11] The pattern of refractive errors varies according to population characteristics such as age, gender and ethnic group.

A review of the literature and medical databases reveals that many studies have been conducted on the epidemiology of refractive errors across the world since 1990. [12,13] Although numerous studies report the prevalence of refractive errors every year, many new articles are published on the epidemiology of these errors annually due to their importance and prevalence. Although recent studies [14,15] suggest an increase in the

prevalence of myopia due to lifestyles changes, differences in ethnic groups, measurement methods, definitions of refractive errors, and age groups of the participants hinder a definite conclusion regarding the pattern of the distribution of refractive errors worldwide. The distribution of refractive errors is not equal in different countries. A high prevalence of myopia in East Asian countries is a common finding in most previous studies. [14]

The aim of the present study was to determine refractive error study in western region of Bihar region.

### Materials and Methods

This cross-sectional study was conducted at department of Ophthalmology, Bhagwan Mahavir Institute of Medical Sciences for 12 months. Total 540 children of age group 6-16 years of the selected school were screened for visual acuity testing using Snellen's Chart for distance and Jaeger's chart for near with the help of experienced optometrist in the respective class. This was followed by detail examination of these children by Ophthalmologists to rule out causes of visual impairment other than refractive errors. Among 540 children screened at school, 100 were found to have refractive errors. (Table 1)

Children with ocular pathologies other than refractive errors affecting visual functions were excluded from the study. Those children who had difficulty in reading 6/6 and N/6 or less were listed and these children were further examined with the parent's consent. Refractive errors were confirmed after cycloplegic refraction using homatropine 2% eye drops.

### Statistical Analysis

Prevalence and 95% confidence intervals (CIs) of refractive errors were calculated. A simple logistic regression model was used to examine correlations between

myopia, hyperopia, astigmatism, and anisometropia on one hand, and age, sex and region of residence on the other hand. Age, sex and residence were then separately included into multivariate logistic regression models for myopia,

hyperopia, astigmatism and anisometropia to test their role in these conditions and to eliminate the effects of confounding variables.

## Results

**Table 1: Prevalence of Refractive errors**

Refractive errors	No. of cases	Percentage
Not present (Emmetropia)	440	81.48%
Present (Ametropia)	100	18.52%

Among 540 children screened at school, 100 were found to have refractive errors.

**Table 2: Pattern of Refractive errors**

Pattern of Refractive errors	No. of cases	Percentage
Myopia	62	62%
Hypermetropia	15	15%
Astigmatism	23	23%
Total	100	100

Out of 100 children diagnosed to have refractive errors, myopia was seen in 62 cases (62%), hypermetropia in 15 cases (15%) and astigmatism in 23 cases (23%).

**Table 3: Age and Refractive errors**

Pattern of Refractive errors	Age in years			
	6 to ≤9 years	>9 to ≤12 years	>12 to ≤16 years	Total
	No. of cases	No. of cases	No. of cases	No. of cases (%)
Astigmatism	5	8	10	23 (23%)
Myopia	4	18	40	62 (62%)
Hypermetropia	9	4	2	15 (15%)
Total	18 (18%)	30 (30%)	52 (52%)	100 (100%)

Among the cases of refractive errors, 18 cases (18%) were in the age group of 6 to ≤9 years, 30 cases (30%) in the age group of >9 to ≤12 years and 52 cases (52%) in the age group of >12 to ≤16 years.

Maximum numbers of cases were seen in the age group of >12 to ≤16 years. By applying Chi-square test we found a significant association between age and refractive errors. ( $\chi^2=24.480$ ,  $p=0.001$ )

**Table 4: Distribution of case according to the degree of Refractive errors**

Degree of Refractive errors	Low (<2D)	Moderate (≥2 to ≤6D)	Severe (>6D)	Total
Myopia	56	6	0	62 (62%)
Astigmatism	23	0	0	23 (23%)
Hypermetropia	11	4	0	15 (15%)
Total	90	10	0	100 (100%)

Among the total 62 cases of myopia, low degree myopia was seen in 56 cases and moderate degree was seen in 6 cases. 23 cases of low degree astigmatism were seen. Among the total 15 cases of hypermetropia, low degree hypermetropia was seen in 11 cases and moderate degree was seen in 4 cases.

**Table 5: Distribution of cases of refractive errors according to Visual impairment**

Visual impairment	No. of cases(%)
Mild Visual Impairment (6/6-6/18)	90 (90%)
Moderate Visual Impairment (<6/18-6/60)	10 (10%)
Severe Visual Impairment (<6/60-3/60)	0
Blindness (<3/60)	0
Total	100 (100%)

Among the total study participants diagnosed to have refractive errors, according to the proposed revision of categories for visual impairment 90% of the cases had mild visual impairment and 10% cases had moderate visual impairment. No cases in the category of severe visual impairment and blindness were observed.

### Discussion

Refractive errors are the most prevalent visual disorder among children with more than 20% of children having refractive errors. Although refractive errors are easily correctable, they are the main cause of visual impairment in children. [16,17] Refractive errors are the most common ocular problem affecting all age groups. They are considered a public health challenge. Recent studies and WHO reports indicate that refractive errors are the first cause of visual impairment and the second cause of visual loss worldwide as 43% of visual impairments are attributed to refractive errors. [18] In a review study, Naidoo et al. [19] showed that uncorrected refractive errors were responsible for visual impairment in 101.2 million people and blindness in 6.8 million people in 2010.

The prevalence of refractive errors in the present study was 18.52% and it was comparable to studies done in Haryana by Seema et al where the prevalence was 13.65% [20] and by Ghosh et al in Kolkata where the prevalence was 14.7%. [21] Out

of 100 children diagnosed to have refractive errors, myopia was seen in 62 cases (62%), hypermetropia in 15 cases (15%) and astigmatism in 23 cases (23%). Similar observations were found in the study done by Rahman M et al. [22] In a study conducted by Dulani et al, myopia was seen in 63.4% cases, astigmatism in 25.8% cases followed by hypermetropia in 11.35% cases. [23]

Among the cases of refractive errors, 18 cases (18%) were in the age group of 6 to  $\leq 9$  years, 30 cases (30%) in the age group of  $>9$  to  $\leq 12$  years and 52 cases (52%) in the age group of  $>12$  to  $\leq 16$  years. Maximum numbers of cases were seen in the age group of  $>12$  to  $\leq 16$  years. By applying Chi-square test we found a significant association between age and refractive errors. ( $\chi^2=24.480$ ,  $p=0.001$ ). In a study by Manjunath Patil et al, refractive errors were most commonly found in the age group of 10- 12 years. [24] Variations seen between different studies may be due to the difference of minimum and the maximum age of children included in different studies. Among the total 62 cases of myopia, low degree myopia was seen in 56 cases (90.32) and moderate degree was seen in 6 cases (9.68). 23 cases of low degree astigmatism were seen. Among the total 15 cases of hypermetropia, low degree hypermetropia was seen in 11 cases and moderate degree was seen in 4 cases. Similar results were seen in the study by Sarma et al, wherein low myopia was seen

in 89.61% cases, and moderate degree in 10.39% cases. [25]

Among the total study participants diagnosed to have refractive errors, according to the proposed revision of categories for visual impairment 90% of the cases had mild visual impairment and 10% cases had moderate visual impairment. [26] No cases in the category of severe visual impairment and blindness were observed. In a study conducted by Manjunath Patil et al also, 94% children had mild visual impairment which is comparable to our study. [24]

### Conclusion

Timely detection and correction of refractive errors in school going children of a rural area is still the need of time. Although majority of children had mild visual impairment in the form of simple myopia and low degree astigmatism the prevalence of 18.52% is still alarming.

### References

1. Stambolian D, Ciner EB, Reider LC, Moy C, Dana D, Owens R, Schlifka M, Holmes T, Ibay G, Bailey-Wilson JE. Genome-wide scan for myopia in the Old Order Amish. *American journal of ophthalmology*. 2005 Sep 1;140(3):469-76.
2. Wojciechowski R, Moy C, Ciner E, Ibay G, Reider L, Bailey-Wilson JE, Stambolian D. Genomewide scan in Ashkenazi Jewish families demonstrates evidence of linkage of ocular refraction to a QTL on chromosome 1p36. *Human genetics*. 2006 May; 119:389-99.
3. Hammond CJ, Snieder H, Gilbert CE, Spector TD. Genes and environment in refractive error: the twin eye study. *Investigative ophthalmology & visual science*. 2001 May 1;42(6):1232-6.
4. Angle J, Wissmann DA. The epidemiology of Myopia. *Am J Epidemiol* 1980; 111:220-228.
5. Saw SM, Katz J, Schein OD, Chew SJ, Chan TK. Epidemiology of Myopia. *Epidemiol Rev*. 1996; 18:175-87.
6. GOLDSCHMIDT E. The importance of heredity and environment in the etiology of low myopia. *Acta Ophthalmologica*. 1981 Oct;59(5):759-62.
7. Hammond CJ, Andrew T, Mak YT, Spector TD. A susceptibility locus for myopia in the normal population is linked to the PAX6 gene region on chromosome 11: a genomewide scan of dizygotic twins. *The American Journal of Human Genetics*. 2004 Aug 1;75(2):294-304.
8. Holden BA, Sulaiman S, Knox K. The challenge of providing spectacles in the developing world. *Community Eye Health*. 2000;13(33):9.
9. World Health Organization. Preventing blindness in children. Report of a WHO/IAPB scientific meeting. Geneva, 2000.
10. World Health Organization. Prevention of blindness & deafness. Consultation on development of standards for characterization of visual loss and visual function. Geneva: World Health Organization; 4–5 september 2003.
11. Dandona R, Dandona L. Refractive error blindness. *Bulletin of the World Health Organization*. 2001; 79:237-43.
12. Pan CW, Dirani M, Cheng CY, Wong TY, Saw SM. The age-specific prevalence of myopia in Asia: a meta-analysis. *Optom Vis Sci*. 2015; 92(3): 258e266.
13. Rudnicka AR, Kapetanakis VV, Wathern AK, et al. Global variations and time trends in the prevalence of childhood myopia, a systematic review and quantitative meta-analysis: implications for aetiology and early prevention. *Br J Ophthalmol*. 2016;100(7):882e890.
14. Dolgin E. The myopia boom. *Nature*. 2015;519(7543):276e278.
15. Foster PJ, Jiang Y. Epidemiology of myopia. *Eye*. 2014;28(2):202e208.

16. Hashemi H, Fotouhi A, Mohammad K. The age-and gender-specific prevalences of refractive errors in Tehran: the Tehran Eye Study. *Ophthalmic epidemiology*. 2004 Jan 1;11(3):213-25.
17. Wong TY, Foster PJ, Hee J, Ng TP, Tielsch JM, Chew SJ, Johnson GJ, Seah SK. Prevalence and risk factors for refractive errors in adult Chinese in Singapore. *Investigative ophthalmology & visual science*. 2000 Aug 1;41(9):2486-94.
18. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol*. 2012;96(5):614e618.
19. Naidoo KS, Leasher J, Bourne RR, et al. Global vision impairment and blindness due to uncorrected refractive error, 1990e2010. *Optom Vis Sci*. 2016;93(3):227e234.
20. Seema S, Vashisht B, Meenakshi K, Manish G. Magnitude of refractive errors among school children in a rural block of Haryana. *The Internet J. Epidemiol*. 2009;2(6):21-4
21. Ghosh S, Mukhopadhyay U, Maji D, Bhaduri G. Visual impairment in urban school children of low-income families in Kolkata, India. *Indian journal of public health*. 2012 Apr 1;56(2):163.
22. Rahman M, Devi B, Kuli JJ, Gogoi G. A study on the refractive status of school going children aged between 10 to 15 years in Dibrugarh Town, Assam, India. *IOSR J Dent Med Sci*. 2015;14(2):27-33.
23. Dulani N, Dulani H. Prevalence of refractive errors among school children in Jaipur, Rajasthan. *Int J Sci Study*. 2014 Aug;2(5):52-.
24. Patil M, Mehta R, Dhamdhare I. Study of prevalence and socio-demographic features of refractive error in children attending secondary school. *Indian Journal of Clinical and Experimental Ophthalmology*. 2016 Jan;2(1):68-71.
25. Sarma KD, Krishnatreya M. A Study on Refractive Errors Among the School Children of Guwahati City. *International Journal of Contemporary Medical Research*. 2016 Aug;3(8): 2258-60.
26. Kenfuni M. M., Gallouo M., alafifi, Mahmoud, Tsikambu A. C. D., Alafifi R., Moataz A., Dakir M., Debbagh A., & Aboutaieb, R. Pyonephrose: Risk factors, clinical, para-clinical and anatomopathological profile about 19 cases. *Journal of Medical Research and Health Sciences*, 2022; 5(2): 1770–1773.