

## Full Length Research

# Refractive error pattern of children in South-South Nigeria: A tertiary hospital study

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**This study aimed to determine the pattern of refractive errors among children in Bayelsa State, South-South Nigeria. A retrospective review of all the children (4 - 15 years) who were refracted at the eye clinic of the Niger Delta University Teaching Hospital between January 2009 and December 2012 was carried out. Data on age, sex and refractive error diagnosis of the children, were collected and analysed using the statistical package for social sciences (SPSS version 16) and scientific calculator. One hundred and fourteen children (114) consisting of 72 (63.2%) females and 42 (36.8%) males had refractive error. A total of 506 children were seen at the eye clinic within the study period, giving a refractive error prevalence of 22.5%. Myopia with 61.4% of cases was the most common type of refractive error. The prevalence of myopia, astigmatism and hyperopia were 13.8%, 6.1% and 2.6% respectively. The highest degree of myopia recorded was - 11.0 DS. Compound myopic astigmatism was the most common type of astigmatic error. The various types of refractive errors were more common in females. Refractive error was common in the study population with myopia as the most common type. Refractive error was also, more prevalent in females and this was statistically significant ( $p = 0.00$ ).**

**Key words:** Refractive error, children, pattern, Bayelsa State.

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## INTRODUCTION

A refractive error is an optical defect of the eye that prevents light from being brought to a sharp focus by the cornea and lens onto the retina (Schwab, 1999). Refractive error is a major contributor to visual impairment which is a significant cause of morbidity in children worldwide (Ager, 1998; Gilbert and Foster, 2001). Refractive error is among the priority diseases listed in the vision 2020; "the right to sight" initiative of the World Health Organisation (WHO) for the elimination of avoidable blindness in childhood. The WHO estimates that worldwide, 1.2 million children aged between 5 to 15 years are visually impaired because of uncorrected refractive errors: conditions that could be easily diagnosed and corrected with glasses and contact lenses (Dandona et al., 1999a). Global estimates by the WHO on visual impairment and its causes in 2010, reported uncorrected refractive error (43%) as the major cause of visual impairment (Pascolini and Mariotti, 2012).

The visual experience of a child plays a significant role

In his/her psychological, physical and intellectual development (AAP and AAO, 2003). Uncorrected refractive error is a common cause of abnormal visual experience that leads to amblyopia (Weakley, 2001). Children with uncorrected refractive error need to be treated early as delay in treatment can lead to amblyopia.

Without appropriate optical correction, millions of children are losing educational opportunities (WHO, 2006). Early detection of a vision problem can have educational, behavioural and certainly, quality of life benefits (AAP and AAO, 2003).

To the author's knowledge, no detailed study on refractive error pattern in children has been carried out in Bayelsa State, South-South Nigeria. This study aims to provide relevant data on refractive error patterns in Children for the planning of health care services in Bayelsa State.

## METHODS

The records of children (4 - 15 years) who were refracted at the optometric unit of the Ophthalmology department

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**Table 1.** Age and sex distribution of study population.

Age	Gender		Total
	Female	Male	
4	0 (0%)	1 (2.4%)	1(0.9%)
5	3 (4.2%)	2 (4.8%)	5(4.4%)
6	2 (2.8%)	2 (4.8%)	4(3.5%)
7	0 (0%)	1 (2.4%)	1(0.9%)
8	2 (2.8%)	4 (9.5%)	6(5.3%)
9	5 (6.9%)	2 (4.8%)	7(6.1%)
10	5 (6.9%)	6 (14.3%)	11(9.6%)
11	7 (9.7%)	4 (9.5%)	11(9.6%)
12	10 (13.9%)	4 (9.5%)	14(12.3%)
13	9 (12.5%)	10 (23.8%)	19(16.7%)
14	14 (19.4%)	3 (7.1%)	17(14.9%)
15	15 (20.8%)	3 (7.1%)	18(15.8%)
Total	72(100.%)	42(100.%)	114(100.0%)

of Niger Delta University Teaching Hospital between January 2009 to December 2012 were retrospectively reviewed. Children who had no refractive errors were excluded from the study. Also, children with spherical refractive errors less than  $\pm 0.5$  dioptre sphere (DS) or cylindrical refractive error less than  $\pm 0.5$  dioptre cylinder (DC) were excluded from the study.

The eye clinic of the Niger Delta University Teaching Hospital serves as the major referral centre in Bayelsa State and the surrounding neighbouring communities in Rivers State and Delta State in South-South Nigeria.

The children's age, sex and clinical diagnosis was retrieved from the medical records department. The diagnosis of patients was grouped into myopia, hyperopia, myopic astigmatism, compound myopic astigmatism and mixed astigmatism.

The data obtained were stored and analysed using the statistical package of the Social sciences software (SPSS) version 16 and scientific calculator. Chi-Square test was used to compare variables and a p-value of less than 0.05 was considered clinically significant.

### Study definitions

For the purpose of this study, the following operational definitions were used for the various types of refractive error:

Low Myopia was spherical error  $\geq -0.5$  DS to  $-2.75$  DS, moderate Myopia was  $-3.0$  DS to  $-5.0$  DS and high myopia was error  $> -5.0$  DS. Low hyperopia was spherical error  $\geq +0.5$  DS to  $+2.75$  DS, moderate Hyperopia was  $+3.0$  DS to  $+5.0$  DS and high Hyperopia was error  $> +5.0$  DS.

Astigmatism was considered in the minus cylinder format and was included as such when cylindrical error was  $\geq 0.5$  DC in any axis. Simple myopic astigmatism was cylindrical error of Plano/  $\geq -0.50$  DC, compound myopic astigmatism was  $\geq -0.5$  DS /  $\geq -0.5$  DC and mixed astigmatism was  $\geq +0.5$  DS /  $\geq -0.5$  DC.

Low astigmatism was cylindrical error  $\geq -0.50$  DC to  $-2.0$  DC, moderate astigmatism was error of  $-2.25$  DC to  $-4.0$  DC and high astigmatism was error  $> -4.0$  DC.

### RESULTS

A total of 114 children who were refracted at the optometry unit of the ophthalmology department of the NDUTH during the period of this study had refractive error. There were 72 (63.2%) females and 42 (36.8%) males (Table 1).

The mean, median and modal ages were 11.6, 12 and 13 years respectively with standard deviation of 2.86. The male to female ratio in children aged 4 – 10 years was 1:1 while the sex ratio in the 11 - 15 years age range was 1:1.4.

A total of 506 children were seen in the eye department of NDUTH within the study period giving a refractive error prevalence of 22.5%. Refractive error which was more common in females was statistically significant ( $p = 0.00$ ).

Myopia with 70 (61.4%) cases was the most common refractive error diagnosis followed by Astigmatism with 31 cases (27.2%). Hyperopia with 13 (11.4%) cases was the least common (table 2). Compound myopic astigmatism was the most common type of astigmatic error (45.2%) followed by simple myopic (38.5%) and mixed astigmatism (16.1%).

**Table 2.** Refractive error distribution in the study population.

Refractive error	Frequency	Percent
Myopia	70	61.4%
Hyperopia	13	11.4%
Simple Myopic astigmatism	12	10.5%
Comp'd myopic astigmatism	14	12.3%
Mixed astigmatism	5	4.4%
Total	114	100.0%

**Table 3.** Age group Distribution of Refractive errors.

Age group	Refractive error Diagnosis			Total
	Myopia	Hyperopia	Astigmatism	
4-6	5 (7.1%)	3 (23.1%)	2 (6.5%)	10 (8.8%)
7-9	8 (11.4%)	2 (15.4%)	4 (12.9%)	14 (12.3%)
10-12	24 (34.3%)	0 (0.0%)	12 (38.7%)	36 (31.6%)
13-15	33 (47.1%)	8 (61.5%)	13 (41.9%)	54 (47.4%)
Total	70 (100%)	13 (100%)	31 (100%)	114 (100%)

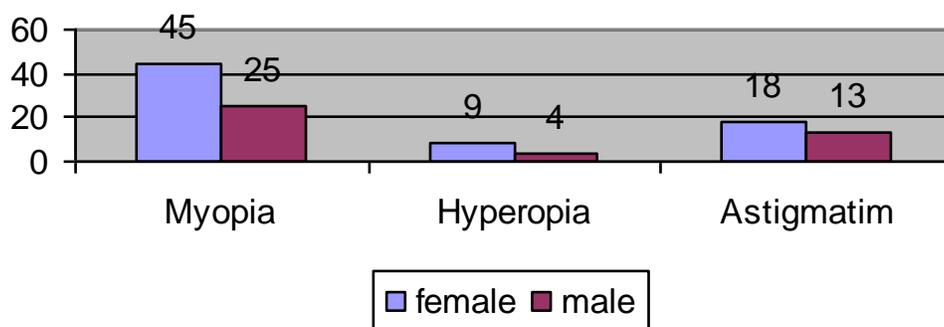
**Figure 1.** Sex distribution of refractive errors.

Table 2 show the prevalence of myopia, astigmatism and hyperopia were 13.8%, 6.1% and 2.6% respectively.

Fifty four (54) cases (47.4%) of refractive error occurred in the 13 – 15 year age group (Table 3). Myopia was more common in all the age groups (Table 3). The occurrence of myopia and astigmatism increased with age while hyperopia was more common at the extremes (Table 3).

The various types of refractive errors were more common in females as shown in Figure 1.

## Discussion

Since children do not usually complain of visual difficulties, early detection and prompt treatment of eye disease is important to prevent vision problems and eye morbidities which could affect their learning ability,

personality and adjustment in school (Nwosu, 1999; Adegbehingbe et al., 2003).

In a study (Nkanga, 1997) on refractive error in primary school children in Enugu, South-East Nigeria, a prevalence of 7.4% was reported. A similar study (Faderin, 2001) on refractive error in primary school children in Lagos, South-West Nigeria, found a prevalence of 7.3%.

Kawuma and Mayeku (2002) in Uganda found the prevalence of refractive errors in primary school children to be 11.6%. The higher prevalence observed in the study by Kawuma and Mayeku may be partly due to the relatively small study population of 623 pupils.

In a study in China, Zhao et al. (2000) found the prevalence of uncorrected refracted error in children with visual acuity of 6/12 or less, in at least one eye to be 12.8% and this decreased to 1.8% after correcting for refractive error. It has been observed that refractive error

has assumed epidemic proportions in Asia (McCarthy, 2006). Ethnic, racial and environmental factors may play a role in the observed differences in prevalence of reduced vision in the various regions.

This study is hospital based and is therefore not insulated from some of the bias associated with hospital based studies. The study will be compared with some hospital based and community based studies. In the course of this study however, most of the literatures encountered were community based studies and so there are some differences in study definitions which will be so highlighted.

The refractive error prevalence reported in this study was 22.5%. Comparatively, the 7.3% prevalence of refractive error in school children reported by Faderin (2001) in Lagos South West Nigeria and 7.4% by Nkanga (1997), in Enugu South East Nigeria, were much lower. The lower prevalence observed in these studies may be related to differences in case definitions and methodologies. Also, the lower prevalence recorded in the study by Nkanga, may not be unrelated to the observation that it was a vision screening program and so, some pupils with low levels of refractive error and who have normal visual acuity, may have been screened out. The high prevalence in the current study may be related to the bias inherent in hospital based studies, which may not reflect a wide representation of the study population.

The refractive error prevalence in this study was close to that (19.2%) observed by Tong et al. (2002) in Singapore and the 20% prevalence reported by Kleinstein et al. (2003) in America. Though the case definition and some measurement techniques in the study by Kleinstein et al. (2013) was different from that in the current study, the age group studied (5 - 17 years) was close.

In this study, myopia was the most prevalent type of refractive error (13.8%) and this was followed by astigmatism (6.1%) and hyperopia (2.6%). Similarly, Adegbehingbe (2003) in her hospital based study on Refractive error in Ile-Ife, South western Nigeria also observed that myopia was the most common error in children and in the entire population studied, with a comparatively higher prevalence of 22.7%. The high prevalence in the Adegbehingbe study may be related to differences in case definitions and the reason that it was hospital based and involved all age groups. As was observed in this current study, Megbelayin et al. (2013) and Alam et al. (2011) also noted in their studies that myopic spherical error is often the commonest form of refractive errors in school age children.

The findings in the current study was however, different from the Andhra Pradesh Eye disease study in Hyderabad, India, which observed that hyperopia was more common in children 15 years or less while myopia was more common in adults (Dandona et al., 1999b). In another study by John Kempel et al. (2004) it was

observed that myopia was more common in persons over 40 years in USA, Western Europe and Australia. The differences in the types of refractive error dominant in the different age groups, across the various regions, may be related to ethnic, racial and environmental factors.

The 6.1% prevalence of astigmatism observed in the current study was higher than that of Megbalayin et al. (2013) who reported a prevalence of 3% astigmatism in secondary school students in Calabar, Nigeria. Though the case definition for astigmatism was similar in both studies (cylindrical error of  $\geq -0.5$  DC), the higher prevalence in the current study may be related to the smaller sample size. The prevalence of astigmatism in the current study was higher than that (2.2%) reported by Pokharel et al. (2000) in Nepal but was much lower than the 15% prevalence reported by Zhao et al. (2000) in rural China and Kleinstein. The small sample size and the differences in case definitions may be responsible for the high prevalence observed in the study by Zhao.

Compound myopic astigmatism was the most common type (45.2%) of astigmatic errors observed in this study. The study by Megbelayin et al (2013) also reported compound myopic astigmatism (65.7%) as the most common astigmatic error. Adegbehingbe et al. (2005) also observed in their study on refractive errors in children, that myopic astigmatism was the most common type of astigmatism.

This study generally observed that the prevalence of refractive error increased with age. The study by Chuka-Okosa (2005) involving school aged children did not observe an increase in prevalence of refractive error with age. In the current study the occurrence of myopia and astigmatism increased with age while hyperopia was more common at the extremes. Sahelian (2005) in his study on astigmatism also observed an increase in prevalence with age. However, Lian-hong (2010) in his study on astigmatism among school children aged 6-15 years in China, noted that age did not significantly affect the prevalence of astigmatism.

In the current study, refractive error was more common in females (63.2%) and this was statistically significant ( $p = 0.00$ ). Onakpoya and Adeoye (2009) in their study of childhood eye diseases in South Western Nigeria, observed that 73.2% of the children with refractive errors were female. The higher prevalence observed in females may in part, not be unrelated to the observation by Niiranem (1981), in his study on ocular injuries in children, which suggested that young females tend to report visual problems more than males. Similarly Lian-Hong reported a slightly higher prevalence of refractive error in girls but this observation was not statistically significant. However, He et al. (2004) in a large population based study on refractive error in urban southern China reported a significant gender difference with retinoscopy but not with autorefraction. Though a strong association was noted between refractive error and gender in this current study, this observation may not

be conclusive due to the small study population and therefore, a large population study may be needed to test these findings.

In this study the lower degrees of refractive error (low myopia, low hyperopia and low astigmatism) were more common. Similar findings were observed by Ezepeue and Nworah (1992) in Eastern Nigeria and Li et al. (2001) in China. Megbelayin et al. (2013) in his study on astigmatism in children however, observed that moderate astigmatism ( $> -1$  to  $-3$  DC) was more common. The findings observed may be related to differences in case definitions, as in our study, low astigmatism was  $-0.5$  DC to  $-2.0$  DC while moderate astigmatism was cylindrical error of  $-2.25$  DC to  $-4.0$  DC. There was no case of high astigmatism ( $> -4.0$  DC) in this study.

## Conclusion

The prevalence of refractive Error in children in this Hospital based study in South-South Nigeria was 22.5%. In view of the observation that refractive error was common in this study, there is the need for health education to increase awareness on refractive error in children and also, provision of easily accessible and affordable eye care services (including optical) in the local communities.

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## Conflict of interest

No conflict of interest associated with this work.

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