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# Pattern of Refractive Errors Amongst Children Attending a New Teaching Hospital in Kaduna, Nigeria: A 2-Year Review

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## Abstract:

**AIM:** The aim of this study was to assess the prevalence and pattern of presentation of refractive errors (REs) amongst children 5–16 years who attended the eye clinic of a tertiary hospital over a 2-year period.

**SETTING:** The outpatient unit of the Department of Ophthalmology, Barau Dikko Teaching Hospital, Kaduna, Nigeria.

**SUBJECTS AND METHODS:** A descriptive retrospective study of children aged 5–16 years, who presented to our facility between January 2017 and December 2018 with various ocular complaints. Those with presenting visual acuity <6/9 were included in the study. Demographic data were retrieved from patient records. The visual acuity, ocular complaints, RE, general ocular examination and prior history of spectacles use were also extracted from the records. Statistical analysis was done with SPSS version 18.

**RESULTS:** A total number of 14,004 patients of all ages were seen in outpatients Department of Ophthalmology Clinic. Five thousand six hundred and nine were children aged 5–16 years. Seven per cent of the patients (392) had REs, while 93% (5217) had no RE. The mean age was 10.7 years and with a male-to-female ratio of 1.2:1. Two hundred and thirty patients were in the 11–16 years (58.6%), while 162 (41.4%) belonged to the 5–10 years age group. Myopia accounted for 212 (54%), while mixed astigmatism only 9 (2%). Hyperopia 100 (27%), simple myopic astigmatism 40 (10%), compound myopic astigmatism 18 (4%) and compound hyperopic astigmatism 13 (3%) made up the other REs. Asthenopic symptoms accounted for 78% of all presenting ocular symptoms and were common amongst those with myopia and astigmatism, while 22% had no symptoms. Most of the REs were of mild-to-moderate grade based on their spherical equivalent.

**CONCLUSION:** RE was identified as a problem amongst children 5–16 years with myopia more common. Most cases of RE in this study were myopia and associated with ocular complaints which were mostly asthenopic symptoms. The majority of the REs were mild to moderate.

## Keywords:

Asthenopic symptoms, children, Kaduna, refractive error, uncorrected refractive error, visual acuity

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## Introduction

Refractive error (RE), a common childhood problem, is a major cause of visual impairment (VI) and also the second major cause of treatable blindness worldwide.<sup>[1]</sup>

Globally, it is estimated that about 19 million children are visually impaired, with about 12 million being blind from uncorrected refractive error (URE). The majority of these children are in the 5–15 years age group.<sup>[2,3]</sup> URE has been recognised as a public health challenge in many countries including Nigeria.<sup>[4-8]</sup> URE negatively impacts on

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developmental milestones, education, job opportunities and eventually, the quality of life.<sup>[9,10]</sup> Therefore, there is a need for early detection and treatment of REs in children.<sup>[8]</sup>

Blindness from URE in a country suggests poor access to eye care services as the provision of spectacles is an easy, affordable and effective eye care service.<sup>[11]</sup> Various patterns of RE have been identified across different parts of the world.<sup>[8,12,13]</sup> Children with RE may present with various ocular-related complaints depending on the type and extent.

This study aims to assess the prevalence and pattern of RE amongst children aged 5–16 years who attended our facility during the study period. We also intend to identify the presenting complaints, distribution and the degree of REs amongst the study population. Information obtained from this study will be useful for planning public health services and advocacy to address the burden of URE amongst children in Kaduna state and serve as a basis for state policy on school eye health programmes.

## Subjects and Methods

This is a hospital-based descriptive retrospective study of children aged 5–16 years who were seen at the outpatient unit of the Ophthalmology Department, Barau Dikko Teaching Hospital, Kaduna, Nigeria, between January 2017 and December 2018. Patients with visual acuity (VA) <6/9 and requiring  $\pm 0.5$  dioptre sphere (Ds) or cylinder (Dcyl) of correction to see at least 2 or more lines better than presenting visual acuity (PVA) were included in the study, while those with other ocular pathologies along with incomplete information in their records were excluded from the study. Patient's demographic information such as age, sex, ethnic group and educational level was also retrieved and recorded. Other information recorded included presenting complaints, PVA aided and unaided and refraction results along with the prior history of use of spectacles.

The following definitions similar to that of another study<sup>[9]</sup> were used:

Normal vision = PVA  $\geq 6/9$

Mild visual impairment = PVA < 6/9 to  $\geq 6/18$

Moderate visual impairment = PVA < 6/18 to  $\geq 6/60$

Severe visual impairment = PVA < 6/60 to  $\geq 3/60$

Blindness = PVA < 3/60

Low myopia = < -0.5 to -1.00 Ds

Moderate myopia =  $\geq -1.25$  to < -5.00 Ds.

High myopia =  $\geq -5.00$  to -10.0 Ds.

Extreme myopia = >10.00 Ds.

Low hypermetropia = +0.5 to < +1.00 Ds.

Moderate hypermetropia = +1.25Ds to + 5.00Ds.

High hypermetropia = >+5.00 to + 10.00Ds.

Extreme hypermetropia = >+10.00Ds.

Low astigmatism = >-0.25 to - 0.75Dcyl

Moderate astigmatism = -1.00 to - 2.75Dcyl

High astigmatism = -3.00Dcyl and above

Ethical clearance was given by the Barau Dikko Teaching Hospital Ethical Committee on Research and Helsinki Declaration was duly followed. Data analysis was done using the Statistical Package for the Social Sciences 18 (SPSS Inc Chicago IL, USA). Chi-square test and *t*-test were used to calculate differences between percentages and means, respectively, *P* < 0.05 was considered to be statistically significant.

Barau Dikko Teaching Hospital, Kaduna, Nigeria, is a 240-bed capacity hospital recently upgraded from the status of a specialist to a teaching hospital. It is the apex of health care delivery by Kaduna state government and attends to patients from within Kaduna and the neighbouring states of Niger, Katsina, Kano and Nasarawa. The hospital offers services in various specialities including ophthalmology. The Ophthalmology Department offers various clinical, surgical and refraction services including dispensing of spectacles.

## Results

### Prevalence of refractive error

A total of 14,004 people were seen at the ophthalmology outpatient unit of Barau Dikko Teaching Hospital, Kaduna, Nigeria, between January 2017 and December 2018 for various ocular problems. Of this number, 5209 (40%) were children aged 5–16 years from which 392 (7%) had RE [Figure 1]. Males were 210 (53.6%), while females were 182 (46.4%) with a male-to-female ratio of 1.2:1 and a mean age of  $10.7 \pm 2.2$  years.

### Age distribution of refractive error

More people in the age group of 11–16 years had RE representing 58.7% (230), while the age group of 5–10 years had 41.3% (162) participants [Figure 2]. Males in the age group 14–16 years (36%) had more RE in contrast to females with RE who were more in the 11–13 years age group (30.1%).

### Sex distribution of refractive error

A total of 206 (52.6%) of the study population were males, while 47.4% (186) were females [Table 1].

### Presenting complaints

About 79.3% of complaints were those associated with asthenopia, 13.8% complaints were of difficulty reading prints while 6.9% had no symptoms [Table 2].

### Spectacle use

Spectacle use does not seem to be popular amongst our students as only 11 (2.8%) of the students were recorded to be using glasses during the study period.

### Distribution of types of refractive errors

In this study [Tables 3 and 4], myopia accounted for 212 (54%) of RE, while mixed astigmatism was the least with 9 (2.3%).

Majority (63.3%) of those with RE based on spherical equivalent had mild RE with only 6.6% having high RE [Figure 3].

## Discussion

### Prevalence of refractive errors

The prevalence of RE in this study was 7%. Most hospital-based studies in Nigeria reported a higher frequency of RE amongst the paediatric age groups.<sup>[14-16]</sup> The reason for the disparity in results within Nigeria is not clear, but this may not be unconnected with the difference in methodology, case definition and bias associated with hospital-based studies. RE may also be associated with difference in its geographical distributions. It is apparent that RE is a common presentation amongst children in most eye clinics across Nigeria. A study in Ghana found the prevalence of RE similar to that of our study.<sup>[17]</sup> Studies in China and amongst Chinese residents in the United States of America revealed prevalence as high as 27.0% and 37.2%, respectively,<sup>[18,19]</sup> while a study in Nepal found a prevalence as low as 2.9%.<sup>[20]</sup> Racial background has been found to play an important role in determining the prevalence of RE.<sup>[19]</sup>

### Age of distribution

About half of the patients, 230 (58.7%) were aged 11–16 years, this finding is similar to other findings in Nigeria and other parts of the world.<sup>[14-16,20,21]</sup> It has been attributed to the refractive changes of the eye that occurs between the age of 11–16 years which is as a result of increased axial length of the globe. At this age, children are able to identify and explain visual symptoms better,<sup>[5]</sup> and the visual demands at school during this period also exaggerate visual needs. Since most of the patients presented at an older age, it only highlights the inadequacy of early screening

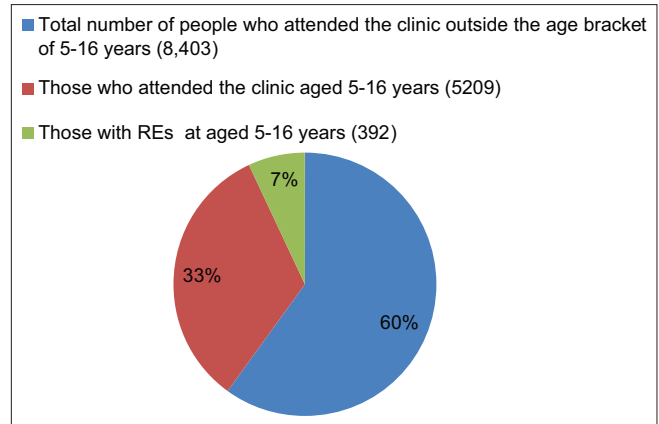


Figure 1: Clinic attendance

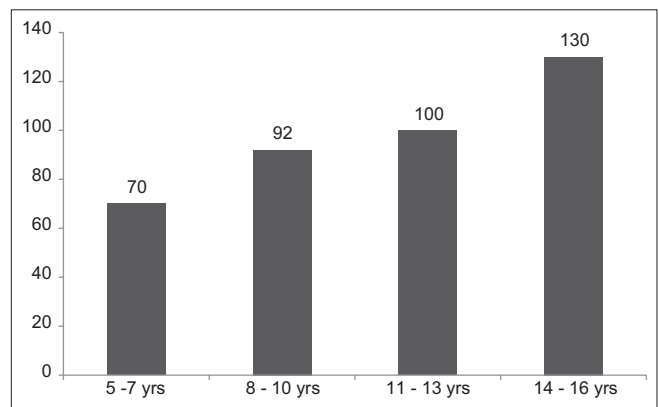


Figure 2: Age distribution of refractive errors

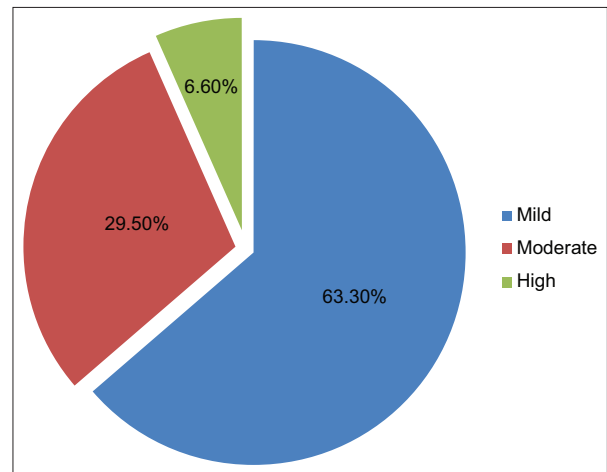


Figure 3: Degree of refractive errors based on spherical equivalent

and oversight of parents to the visual challenges of their children. Late presentation of RE for treatment may not be successful because of the risk of the development of amblyopia, especially in cases of high RE or coexisting ocular abnormalities. All children need to be screened for RE on entry to school and yearly afterwards till completion of primary school. VA of 6/6 does not guarantee visual health, besides,

**Table 1: Sex distribution of refractive errors**

Sex	5-7	8-10	11-13	14-16
Female	30	45	56	55
Male	40	55	36	75
Total	70	100	92	130

**Table 2: Presenting complaints**

Type of complaint	Number of people, n (%)
Blurred vision	75 (19.1)
Eye ache	87 (22.2)
Headache	82 (20.9)
Tearing	62 (15.8)
Difficulty reading prints	54 (13.8)
Deviation of eye	5 (1.3)
No symptom	27 (6.9)

**Table 3: Distribution of types of refractive errors**

Type of error	Frequency (%)
Myopia	212 (54.0)
Hyperopia	100 (27)
Simple myopic astigmatism	40 (10)
Compound myopic astigmatism	18 (4)
Compound hyperopic astigmatism	13 (3)
Mixed astigmatism	9 (2)
Total	392 (100)

**Table 4: Refractive error based on spherical equivalent**

Degree of RE	Dioptric power (D)	Hypermetropia (+D)	Myopia (-D)
Mild	≤ 1.25	40	65
Moderate	>1.25-5.0	14	35
High	≥ 5	3	8

RE: Refractive error

testing VA alone in screening programmes is not conclusive as VA is not only visual sharpness but also the quality of vision as there may be aberrations or low contrast sensitivity.<sup>[22]</sup>

### Sex distribution of refractive error

The gender distribution of RE in this study shows that 207 (52.6%) participants were male and 186 (47.4%) of the participants were female, this is in contrast to other hospital-based studies across Nigeria<sup>[5,14-16]</sup> and Asia<sup>[20,21]</sup> where more females presented with RE because they tend to report more readily than boys because it has been suggested that girls tend to read more than boys,<sup>[5]</sup> while others have suggested early pubertal changes in girls to be the reason.<sup>[23]</sup> The reason for the higher prevalence of males in this study may not be unconnected with the bias associated with hospital-based studies, besides most females in the northern part of Nigeria are under strict religious laws to avoid going to public places unaccompanied by relatives.

### Presenting complaints

Some patients with RE may not complain of any ocular symptoms but many of those presenting to the hospital with RE come because of one complain or the other. In this study, asthenopic symptoms were the predominant complaints amongst 233 (58.9%) of the participants. This is similar to the findings in Brazil by Schellini *et al.*<sup>[24]</sup> who identified asthenopic symptoms and poor distant vision to be the major symptoms. Kuswanto *et al.*<sup>[25]</sup> in a study in Indonesia amongst primary school-age pupils found asthenopia to be highly associated with REs, especially myopia and astigmatism. Our study also revealed that 27 (6.9%) of people had no visual complaints. It is believed that symptoms are more frequent with females because they are more likely to report symptoms.

### Spectacle use

Spectacles have been identified to be cost-effective in correcting RE across the world,<sup>[26]</sup> however, only 11 (2.8%) of children who needed spectacles in our study had a history of prior use despite presenting at an average age of 10.7 years. This is similar to the findings by Olusanya *et al.*<sup>[15]</sup> in southwest Nigeria and other studies in Asia and America.<sup>[20,27,28]</sup> Reasons ascribed to this include societal myths, paucity of RE services and lack of awareness of guardians and parents. The cost of spectacles may also be an important factor in developing countries.

### Distribution of the types of refractive errors

Myopia accounted for 212 (54%) of the study population, while mixed astigmatism was the least with only 9 (2%) of the children with RE. Olusanya *et al.*<sup>[15]</sup> in the southwest and Opubiri *et al.*<sup>[16]</sup> in south-south Nigeria also found myopia to be the most common RE in their studies, however, some other studies across Nigeria found astigmatism to be more common,<sup>[4,14,29]</sup> and another within Nigeria<sup>[8]</sup> found hyperopia to be the most common. Various studies across the world have documented various RE patterns.<sup>[17,20,30]</sup> The difference in the RE types in studies within Nigeria and across the world may be explained by the difference in the case definition and methodology of the studies. Pan *et al.*<sup>[19]</sup> confirmed differences across the racial distribution of RE in a population in the United States.

### Conclusion

REs are a major reason for the presentation of children aged 5–16 years to the eye clinic. This study found RE to be responsible for 7% of presentations at the outpatient unit of our department in this age group with male affectation being the more predominant. Myopia was the major RE accounting for 54% of all REs, while asthenopia was the most common symptom, especially in myope and astigmatic, and was mostly of the mild-to-moderate grade.

### Limitation of the study

This study used VA of 6/9 as a basis for testing RE which limited the accuracy of the results. It has been reported that as many as 10% of hyperopia and 6.6% of those with astigmatism may be missed even if screening is based on the use of VA of 6/6. Therefore, it is believed that many students in this study with RE might have been missed because of the use of VA <6/9 as a basis for screening for RE, thereby reducing the actual prevalence of RE. VA <6/9 was used for convenience only.

### Recommendation

We recommend early visual screening of children (pre-school) for REs because of the effects of amblyopia in later life. All children irrespective of their presenting VA should be screened for RE. Parents, guardians and teachers should be involved in close monitoring of these children to identify these REs early as many will not complain of symptoms. Sensitisation at public places on the need for early ocular screening for RE should be encouraged while screening for RE should be made mandatory on entering primary school and subsequently yearly till completion of primary school. It is also hoped that the result will serve as a template for policymakers in health care and related agencies in tackling childhood REs.

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### Conflicts of interest

There are no conflicts of interest.

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