Abstract

Background: Vision problems have been shown to adversely affect a significant percentage of the population. The aim of this study was to determine the prevalence of refractive error and visual impairment in primary school children in Onitsha, Anambra State, Nigeria.

Setting: The study was conducted in a primary school in Onitsha, Anambra State, Nigeria.

Methods: A stratified random cluster sampling method was used to select primary schools in Onitsha North and South. A total of 1020 children were included in the study, which included visual acuity measurements, ocular motilities, retinoscopy, and fundus examination.

Results: The prevalence of uncorrected, presenting and best corrected visual acuity was 2.8%, 5.2%, and 9.5%, respectively. Refractive error accounted for 86.6% of all causes of visual impairment, with astigmatism (36.1%) and hyperopia (17.5%) being the most common. Refractive error was highest among children aged between 5 and 7 years.

Conclusion: The prevalence of refractive error and visual impairment in primary school children in Onitsha, Anambra State, Nigeria is high. It is recommended that services and strategies for the prevention and treatment of these conditions be prioritized in the region.

Introduction

Refractive error (RE) is an optical defect of the eye that prevents the accurate focusing of light on the retina. It is a major cause of visual impairment (VI) and blindness worldwide. In 2006, 153 million people had uncorrected refractive error (URE) worldwide. The resulting VI can lead to health, socio-economic, and educational consequences, with the consequent economic burden falling predominantly on developing countries such as Nigeria. Refractive error surgery, with spectacles being the most common and cost-effective treatment strategies.

Studies on the prevalence of RE and VI have been conducted in various regions of Nigeria, with most being conducted on older children and VI peculiar to children in each community, as this varies from community to community.

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References


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geographical and socio-economical differences, which may have a VI in Onitsha, Anambra State, Nigeria. Data on RE and VI will be in this group. In addition, the information can be used as baseline

**Methods**

Onitsha is an urban area located on the eastern bank of the Niger children from all the private and public schools in Onitsha North area projected to be 15,324 by the year 2017. A multi the baseline sample size was determined using the equation

\[ N = \frac{(Z^2)(1.0 - P)(P)}{([B][P])^2} \]

where \( P \) is the anticipated prevalence of RE, \( B \) is the desired error previous studies conducted in Nigeria ranged between 7.3% and 2 estimates from previous studies, was used. The minimum sample adjust for anticipated absenteeism and non-participation rate, whe

Children aged between 5 and 15 years whose parents or legal gua were children who gave verbal assent and/or signed assent, childr Children younger than 5 years and older than 15 years, those who provide informed consent were excluded from the study. Ethical aj Biomedical Research and Ethics Committee (BE620/16) and Onitsl Declaration of Helsinki for research involving human subjects. The with the children in their schools. Each school provided a room in the children would be called out of class to have their eyes tested

**Clinical examination**

Clinical examinations were conducted by five optometrists in the 1 Anambra State, Nigeria. Examination procedures followed the orig distance visual acuity (VA) was measured with a retro-illuminated Ocular deviations were evaluated with a cover test at both distanc degree of tropia measured using corneal light reflex and neutralisi

Examination of the anterior segment was performed with a pen to used: two drops of 1% cyclopentolate eye drops administered 15 administered. The light reflex and pupil dilation were checked afte or greater and a light reflex was absent. Cycloplegic refraction wa: a semi-dark room at a distance of 67 cm and a +1.50 D lens in th according to the manufacturer’s instructions. The auto-refractor w rankings were obtained for each eye. Using the objective refractio refraction was determined using the trial frame. Refractive error w refractive correction with or without pinhole.

Examination of the crystalline lens, vitreous and fundus was perfo who had an unaided VA of 20/40 or worse in either eye to ascerta

**Pilot study**

Prior to the main study, a pilot study was conducted among 50 pri procedures, methods and logistics. All queries that arose from the main study was performed.

**Definition of terms**

Uncorrected VA of 20/40 or less was regarded as mainly because 20/40 or less, less than 20/63 and 20/200 or less were used in de or more and astigmatism as −0.50 D or more using subjective ref

**Data management and analysis**

Class enumeration and clinical examination data forms were revi Assistance of a statistician was sought for the data analysis, whic
Social Sciences (SPSS) version 24. Ranges, means, standard deviations, and correlation tests were used to investigate relationships between age and visual acuity.

**Ethical consideration**
The study was approved by the Biomedical Research and Ethics Committee of the University of Nigeria, Onitsha, Nigeria, and the study was conducted according to the tenets of the Declaration of Helsinki.

**Results**
Of the 1020 primary school children aged between 5 and 15 years (97.8%) who participated in the study, the mean age was 9.01 ± 2.5 years and 389 (39%) were aged between 8 and 10 years.

**Visual acuity**
Of the 998 children examined, uncorrected VA of 20/32 or better in both eyes was found in 946 (95%) children, while 20/40 or worse in the better eye and 20 (2%) wore spectacles. Eighty-three (8.3%) had best corrected VA of 20/40 or worse in the better eye, indicating a prevalence of uncorrected VA of 20/40 or worse in the better eye.

**Refractive error**
Ninety-seven (9.7%) children who had VA of 20/40 or worse in either eye (87.6%) had right eyes and 79 (81.4%) had left eyes. However, pupil dilation was needed for cycloplegia dilation in both eyes, while the absence of light reflex without full pupil dilation was a criterion for cycloplegia dilation in both eyes. Children satisfied one or both criteria for cycloplegia dilation in both eyes.

Hyperopia ranged from +1 D to 5 D with retinoscopy and from +1 D to −11.50 D with auto-refraction. Myopia increased with increasing age and was highest among children aged between 14 and 15 years. Astigmatism of −0.50 D to −1.75 D was found in 24 (5.4%) right eyes and 26 (5.6%) left eyes with auto-refraction. Astigmatism of ≥ 2 D was found in 7 (4.1%) right eyes and 6 (6.2%) left eyes with auto-refraction. The prevalence of hyperopia ranged between 17.5% and 23% in retinoscopy, the prevalence of myopia ranged from 6.2% in 5- to 6-year-olds to 49.5% in adolescents, while auto-refraction, fixation and claustrophobia.

**TABLE 1:**

<table>
<thead>
<tr>
<th>Refractive Error</th>
<th>Number of Children</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperopia</td>
<td>97</td>
<td>9.7%</td>
</tr>
<tr>
<td>Myopia</td>
<td>912</td>
<td>91.2%</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>51</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

Of the 97 children who had RE, 45 (46.4%) had myopia, 35 (36.1%) had hyperopia, and 17 (17.4%) had astigmatism. Two (4.1%) children who had RE were males, while RE was higher among females (53.1%) than males (46.9%). Refractions of 20/40 or worse were not significantly associated with age and gender (Pearson’s \( \chi^2 = 4.17, p = 0.04 \)). Myopia was significantly associated with RE (Pearson’s \( \chi^2 = 4.17, p = 0.04 \)).
Out of 70 eyes of 35 children with astigmatism, 41 (58.6%) eyes

TABLE 3: (https://avehjournal.org/index.php/aveh/article/view)

Ocular anomalies
Exotropia accounted for the highest proportion of deviations and t 10 (1%) with distant fixation. Twenty-one (72.4%) of the tropias at near. The exterior and anterior segment abnormalities were observed eyes of 10 (1%) children. Conjunctival abnormalities were present in two eyes of two (0.2%) children, and an abnormal lens was observed retinal degenerations, were present in 8 eyes of 12 (1.2%) children.

Causes of visual impairment
Of the 97 children with uncorrected VA of 20/40 or worse in the better refraction, while 13 (13.4%) could not be improved to ≥ 20/32 in eye) was therefore 13 (1.3%) (Table 4 (#T0004_455)).

TABLE 4: (https://avehjournal.org/index.php/aveh/article/view)

Nine (69.2%) children who had VI were females and 4 (30.8%) were aged between 8 and 10 years and no VI was found in children older (Pearson’s $\chi^2 = 19.36, p = 0.00$) but not with gender (Pearson’s $\chi^2$).

Discussion
Except for a relatively large number of 8- to 10-year-olds and a reasonably uniform. The high response rate in this study could be because of the fact that Onitsha, so the children felt it was an opportunity to get their eyes examined. Health teachers and Parent-Teacher Association (PTA) also contributed to the prevalence rate.

The prevalence of RE among primary school children aged between various ages in a range of African countries.

TABLE 5: (https://avehjournal.org/index.php/aveh/article/view)

The prevalence of 9.7% for URE is higher than the 2.2% reported in Nigeria, specifically the 7.3% and 8.7% in Lagos. However, the prevalence is lower than 22.5% and 58.0% reported in other studies.

However, the prevalence is lower than 22.5% and 58.0% reported prevalence recorded in Bayelsa study could be because of the fact...
and normal VA could have been missed. In addition, the current study among 4- to 15-year-olds, which could have accounted for this difference in the general population,\(^9\) the differences for the between them. For example, the current study of RE, while a sample size of 4225 and VA of 20/32 or worse were

Comparison of the current study with studies in Africa shows that the differences observed in the prevalence co\(^5\) authors and differences in demographic variables. Moreover, lifest\(^3\) variations in the prevalence of RE.\(^31\) Recently, incre\(^5\) dwellers, have been suggested to be factors influencing the prevalence increased near work and indoor activities common among urban d\(^33\) Although racial and ethnic differences have also shown that genetically determined factors (such as eye light exposure) to impact RE development in black people.\(^2\)

Various studies have shown that gender differences at the age of 6 parameters of males and females being reported, which suggests found to be significantly higher in females (56.7%) than males (4\(^9\)) South-South Nigeria,\(^9\) Kebbi State N

Studies have shown that the human eye grows by 5 mm from birth\(^6\) The prevalence of RE has been reported to increase population,\(^7\) indicating the possibility of a relationship highest (48.9%) among children 11 to 13 years old. Similar finding\(^9\) in South-South Nigeria. However, a study in Enugu between RE and age. The large age range of 12–21 years used in

Myopia was the most prevalent (46.4%) URE found in this study.\(^1\) urban environment engage more in indoor and near work activitie\(^8\) Studies in Abia State,\(^8\) and Bayelsa condition among primary school children aged between 7 and 17 \^ environments, variations in the prevalence rates could be attributed the current study used a sample size of 998 and an age range of \(^5\) 4225 and an age range of 7–17 years. In addition, the present stud

Studies in Tanzania and South Africa by Wedner et al.\(^14\) prevalent refractive condition among children aged between 5 and China,\(^36\) Vietnam,\(^37\) and Egypt\(^38\) studies was attributed to the high prevalence of myopia in Asians early detection and management being highly indicated for educat

In this study, myopia was found to increase with age, starting forr 6 which is the grade for preparing and writing entrance examinati\(^6\) onset of myopia. A possible reason could be the onset of juvenile because of axial elongation that is usually caused by intensive near progression starting from 12 to 17 years in Abia State, Nigeria, wi\(^15\) \(^7\) and South Africa,\(^15\) with the upward

Myopia was found to be significantly associated with males (\(p = 0\) activities, such as computer video games, chatting on phones, rea\(^17\) also found myopia to be sign Mayeku\(^18\) reported contrary results in Tanzanian an\(^18\) did not find any significant association between gender of the diverse age groups in the study samples. The prevalence of be among the reasons for the differences observed in the prevaler astigmatism are important, as most asthenopic symptoms that co of astigmatism of \(-0.50\) D or worse found in this study was high.
with increased near work. The prevalence is lower than 38.8% reported comparable to 6.1% and 7.8% recorded in South-South Nigeria. Discrepancies could be the inclusion of diverse age and ethnic groups.

With-the-rule astigmatism was the most common type found in this study. Similar findings were reported by Atif et al.\(^{16}\) among children. Naidoo et al.\(^{15}\) found astigmatism to increase with age, the variability in the prevalence of astigmatism in this study, the various studies. For example, Ahuama and Atowa\(^{8}\) and higher (Table 5). The study by Ahuama and Atowa\(^{8}\) could have increased the prevalence of hyperopia, as it is well reported (Table 5).\(^{19}\) Hyperopia was found to decrease because of the fact that this younger age group is prone to being involved in near work and less outdoor activities, thus reducing the prevalence reported in other Nigerian studies but higher (Table 5). This wide variation could in part be because of the various studies. For example, Ahuama and Atowa\(^{8}\) and higher (Table 5). Hyperopia was found to decrease because of the fact that this younger age group is prone to being involved in near work and less outdoor activities, thus reducing the prevalence reported in other Nigerian studies but higher (Table 5).

The prevalence of VI (Table 5) was 1.3%, indicating that VI is relatively uncommon in this study. This is higher than those reported in other Nigerian studies but lower (Table 5). It is, however, not possible to make a general comparison of VI backgrounds and methodologies used. Most (84%) uncorrected VI were found in children.

Several limitations of our study must be acknowledged. First, some 6-year-olds was difficult because of poor attention span, lack of cooperation, and near work compared with the older age groups. Similar findings are well supported by studies in China, Ghana, and Chile. The study by Ahuama and Atowa\(^{8}\) also recorded a result similar to that reported by Opobiri et al.\(^{18}\) but contrary to findings obtained by Kawuma and Mayeku\(^{18}\). The wide variation in the prevalence of hyperopia in some of these studies could also have influenced the findings.

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In conclusion, this is the first RESC study undertaken in Onitsha, Nigeria. The prevalence of VI in primary school children were 9.7% and 1.3%, respectively. These need to conduct local studies to establish regional baseline data to ensure early detection of VI.

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Competing interests
The authors declare that they have no financial or personal relationship.

Authors’ contributions
N.E.E. and K.P.M. made equal contributions to the writing of this article.

References
44. Chuka-Okosa CM. Refractive error among students of a post pri
https://doi.org/10.4314/wajm.v24i1.28166

45. Abebe B. Unilateral blindness and low vision due to strabismic an

46. Yoseph W, Samson B. Screening for ocular abnormalities and sub

47. Taha AO, Ibrahim SM. Prevalence of manifest horizontal strabism
57. https://doi.org/10.4103/1858-540X.169437

48. Akpe BA, Abadom EG, Omoti EA. Prevalence of amblyopia in prin
https://doi.org/10.4103/2384-5589.170174

49. Kassa T, Daegu GA. Prevalence of refractive errors in pre-school