

Refractive errors in primary school children in Nigeria.

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SUMMARY:

The study was carried out to determine the prevalence of refractive errors in primary school children in the Nigerian Army children school, Bonny Camp Lagos, Nigeria. A total of 919 pupils from two primary schools (one private school and one public school) were screened. The schools and classes were selected using stratified random sampling method. Refractive error was defined for this study as visual acuity of less than 6/9, or any visual acuity correctable with minimum of plus or minus 1.0 dioptre sphere, with or without minimum of plus or minus 0.5 dioptre cylinder to normal (6/5) vision. The prevalence of refractive error was 7.3% (95% CI = 5.5% - 9.1%). Hypermetropia predominated with 52.2% of all errors and was common between 6 and 15 years of age. Myopia was found in only 9% of children and was common in children less than 8 years of age. However, astigmatism was seen in 38.8% of children who were not above 13 years of age. More girls (56%) presented with refractive errors than boys (44%). It is advisable that pupils be tested whilst at primary school so that they can maximally utilize their visual endowment during learning processes at this rather formative stage of life.

KEY WORDS: *Refractive errors, primary school children.*

INTRODUCTION

Many studies¹⁻⁵ on blindness and visual impairment in Nigerian children have shown that some of its causes were due to uncorrected refractive errors. In these studies, the prevalence has consistently been around 8.9% whilst in the United States, the prevalence is estimated to be 8.2%.

In vision screening of school children at ages 7, 11 and 16, Tibbenham *et al*⁷ found that children who when screened at age 7 had normal visual acuity. However, on subsequent screening at age 16, children were found to have reduced visual acuity by two lines. Yawn⁸ in his study documented ocular morbidity of 1.2% in 5 year olds rising to 9.1% in 13 year olds. Youngson⁹ therefore argued that functional maturity of the visual system is completed by age 7-8 and any screening after this age is unnecessary.

It has also been documented¹⁰ that the precise visual task on a child is usually at school (primary) age and it is essential to have an idea of the child's vision in order to meet his educational needs. Amongst children attending primary schools, usually

aged between 5 and 11 years old, if such errors persisted uncorrected, amblyopia may have occurred and it may be too late to treat and this may affect the child's performance at school.

It is therefore desirable to assess the prevalence of refractive errors in primary school children, using the Nigerian Army children school. It is hoped that the results of this study may serve as a basis for a national policy on school vision screening.

METHODS AND MATERIALS

This was a cross-sectional study of the prevalence of refractive errors among primary school children attending two Army children schools at Bonny Camp, Lagos between March and June 2000.

Two schools, out of 5 Command and 28 Army Children Schools in Lagos State, were selected using a stratified random sampling. The selected schools were the C.C.S (school A) and A.C.S (school B). The two schools are situated within the Bonny Camp Military Cantonment, Victoria Island, Lagos and are within 500 meters of each other. The Army Eye Centre

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is also within the same cantonment. This was where the personnel involved with the study work were employed.

The sample size was calculated using an estimated prevalence of 8%^{5,6}, desired precision of 2% and a desired design effect of 1. These figures were used in the calculation of sample size because most studies on refractive errors in Nigerian children estimates its prevalence at around 8%. A design effect of 1 is acceptable in studies where cluster sampling has not been done and precision of 2% yielded same size which was affordable within the limits of resources available for conduct of the study.

Sample size for school A was 550 and for school B was 450. In school A, each of the 32 arms (primary one to six) had approximately 70 pupils in each class. Seventeen numbers were selected randomly from random numbers generated from 1 to 70 using Epi-Info. The same method was employed for school B with 24 arms of approximately 46 pupils in each class in selecting 16 numbers for each class. A new set of random numbers was generated for each class. The pupils whose serial number in the class register correspond to these numbers were included in the study. Informed consent was secured from the parents of all children selected for the study through letters sent to their parents, before they were finally included in the study. Ethical approval for the study was obtained from the ethical committee of the Lagos State Health Management Board.

There were two teams (a team for each school), each made up of one enumerator, one ophthalmic nurse and one optometrist. The instruments utilized were the Snellen E-chart, retinoscope, ophthalmoscope, pen torch and a tape measure. The team underwent five days training. A pilot study was carried out in the medical Centre on all primary school children that attended our eye clinic prior to the study proper. This was done to standardise our study procedures and to refine our survey instruments in order to minimise foreseeable errors.

Definition of refractive error

Refractive error was defined for this study as visual acuity of less than 6/9, or any visual acuity correctable with minimum of plus or minus 1.0 dioptre sphere, with or without minimum of plus or minus 0.5 dioptre cylinder to normal (6/5) vision.

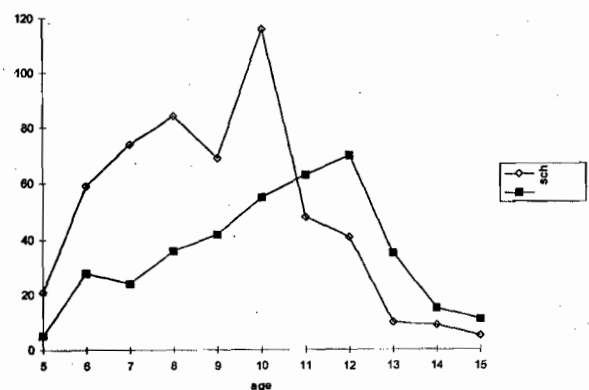
Examination

The enumerator registered all the children

involved in the study. The ophthalmic nurses tested distant and vision using the Snellen E-chart. All the pupils with visual acuity of 6/9 or less were given an appointment to see the optometrist for refraction. Those pupils with no improvement after refraction were referred to the ophthalmologist. The optometrist recorded the results of the refraction in a special data sheet specifically designed for the study. The authors cross-checked and corrected or confirmed all results obtained by the optometrist. All the data were entered into the computer and analysed using the Epi-Info version 6 statistical packages.

RESULTS

A total of 919 pupils from School A (535 pupils) and School B (384 pupils) were screened for refractive errors. The age distribution in the study population is shown in Figure 1. The pupils included in the study from school A (Group A) were younger than the pupils from school B (Group B). In school A the mean age of the pupils was 8.5 years, (s.d. = 2.09). At school B, the mean age was 10.5 years (s.d. = 2.96). There were 501 boys and 418 girls in the study population with an overall male to female ratio was 1.2:1. The male to female ratio in Groups A and B was 1.2:1.



Out of a total of 919 pupils that were screened for refractive errors, only 160 pupils, improved with refraction. 105 from school A and 55 from school B. The 105 pupils from school A comprised of 45 (43%) boys and 60 (57%) girls while the 55 pupils comprised of 25 (45%) boys and 30 (55%) girls. More

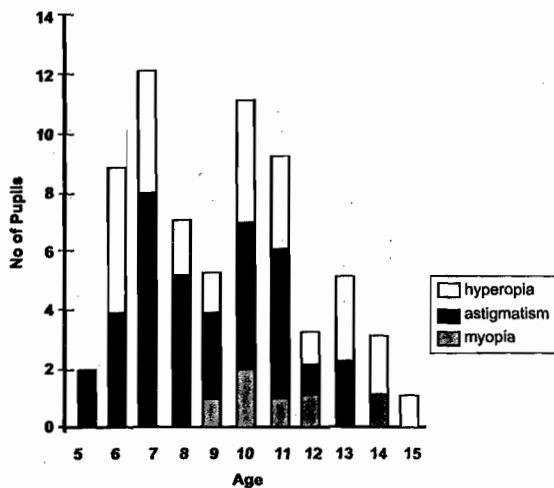
girls presented with refractive errors than boys.

Of these 160, 37 pupils (23.1%) and 86 (53.8%) had uncorrected visual acuity of 6/6 and 6/9 respectively. However, 30 of these pupils with 6/6 and 6/9 vision fulfilled the inclusion criteria of having refractive errors that is at least + or - 1.0D sphere, or + or - 0.50D cylinder or both. Only 37 pupils (23.1%) had visual acuity of less than 6/9, e.g 6/12 and below. Therefore overall, 67 pupils who had refractive errors, 48 pupils were from school A and 19 pupils were from school B.

The overall prevalence of refractive errors in the study was 7.3% (95% CI of 5.5%–9.1%). In school A, prevalence of refractive errors was 8.9% (95% CI of 6.5%–11.5%) and for school B was 4.95% (95% CI of 2.7%–7.1%). p value = 0.0206. Of the 67 pupils with refractive errors, six (9.0%) pupils had myopia, hypersmetropia was seen in 35 (52.2%) pupils and 26 (38.8%) pupils has astigmatism. Of these 19 (16.4%) had simple astigmatism while 7 (22.4%) were mixed astigmatism. The frequency of the different types of refractive errors is shown in Table 1. Boys presented less frequently with refractive errors than girls.

Table 1: Types and frequency of refractive errors.

Type of Error	Number	Frequency %
Myopia	6	9.0
Hypermetropia	35	52.9
Astigmatism (simple)	26	38.8
Total	67	100



Hypermetropia was detected amongst children between the ages of 6 and 15 years. Myopia was not detected in any pupil less than 8 years whilst astigmatism (including the 15 with mixed astigmatism) was not seen in children above 13 years of age. The age distribution of children with different types of refractive errors is shown in Figure 2.

DISCUSSION

In virtually many studies on visual disturbance, refractive errors have been the major cause of visual morbidity^{4,11,12}. Numerous authors have quoted prevalence of refractive errors in their work to be between 8.2% and 15.7%^{13,37-38}. Maul *et al*¹³ found that prevalence of refractive errors in children in Chile was 9.8%, whilst Pokharel *et al*¹⁴ recorded 1.58% in Nepal and Zhao *et al*¹⁵ found it to be 11.3% in China. Results from the few studies on prevalence of refractive errors that had been carried out in Nigeria, revealed Yoloye's¹ 8.9%, Balogun³ 8.7% and Nkanga⁴, 7.4%. In this study, the prevalence of refractive errors was found to be 7.3% which compares favourably with the results of other workers in Nigeria as shown in Table 2. The difference in the prevalence figures obtained from these studies might have been due to the different working definition adopted for each study. Desai *et al*¹⁶ regarded uncorrected visual acuity of 6/9 or worse as subnormal after age 6, whereas Yasuna¹⁷ regarded a visual acuity of 6/12 or worse in younger children, 6–8 year old, as abnormal and in children over 8 years, visual acuity of 6/9 or worse was considered for referral if there is a difference of two lines or more between the two eyes. Visual acuity of 6/9 in younger children has been suggested by some authors to represent functional immaturity rather than structural defects^{18,17,19}. Others however recommend that visual acuity of 6/9 should be taken as a warning sign or an early indicator of refractive errors such as myopia or astigmatism or more progressive ophthalmologic or cerebral disorders.

In the studies by Balogun³ and Nkanga⁴, similar trend was noticed that pupils in the private/urban schools tend to have slightly higher prevalence of refractive errors than their counterparts in the public/rural schools. Unfortunately no suggestion was given for this difference that was noticed. In this study however the difference in the prevalence of refractive errors was not due to the unequal number in the sample sizes of the two schools. It is most probably due to the difference in the ages of the children in

the two schools. This difference may be due to the fact that the children in school A are younger and had been exposed earlier to near work and reading. It is also widely agreed that a refractive error of -0.5D and above rarely occurs before age of six^{15,20}, and manifests after age eight. It is an important cause of visual impairment, varying with age, sex and race^{21,22}.

Comparing the distribution of the different types of refractive errors, hypermetropia was the commonest refractive error identified. This is most commonly found in children between the ages of six to eight, which corresponds to the period of increased academic demand. The consequent effect on a child's education is therefore of considerable concern as hypermetropia has been identified with loss of interest in academic work due to associated blurring of vision and asthenopic symptoms²³. Hypermetropia is associated with reading difficulties and tends to decrease during school age, being most pronounced at age 6–7¹² and almost non-existent by age 15^{13,15}. Choi *et al*²⁴ in their study reported an incidence of 6.2% in primary school children. Other studies have found the incidence of hypermetropia in primary school children varying from 2.3% and 7.1% in males^{1,3,12,13,25} and 8.9% in females¹⁴. Significant hypermetropia which is not identified early and corrected tends to result in amblyopia and manifest as squint^{23,25}.

Myopia was not found in any child below the age of nine years old. This seemed to be slightly lower than the results obtained in other studies, but is comparable if for myopia, -0.5 dioptre was used²⁶ in this study. Early diagnosis and treatment is advisable because a child may become introverted. Incidence of myopia increases with age and peaks at puberty, at about age 10 years old¹⁴. Females tends to have a slightly higher prevalence¹⁴ in both myopia and hypermetropia than their male counterparts and whether the males eventually catch up with them is unknown. Maul *et al*¹³ found 3.4% of five year old to be myopic (-0.5D or less), increasing to 19.4% in males and 14.7% in females by age 15. Zhao *et al*¹⁵ found myopia to be absent in the five year old, but it then increased to 36.7% in males and 55% in females by age 15. In the study by Pokhabel *et al*¹⁴, myopia was observed in less than 3% of the children studied. Mantyarvi²⁷ in his study of Finnish school children found that about 23% of them were myopic by age 15. The incidence of myopia in African children seems to be lower, 2% among Liberian children

(Monrovia)²⁸, 1.4% in Tanzanian children (Dar Es Salaam)²⁸ and about 2.9% in Nigeria³. Girls were observed to have a higher incidence of myopia than the boys²⁸. Myopia progresses during school age^{13,25} and it is with this in mind that the frequency with which screening tests should be carried out during a child's school life needs to be determined.

The highest incidence of astigmatism was been found to be during the first few years of life (Figure 3) with value of + or - 1.00D cylinder²³, reducing to a minimum by age 4. Some children however retain their astigmatic error. Taracli *et al*²¹ reported that 47% of all refractive errors were due to astigmatism with a peak at ages 8–9. In a Los Angeles study²¹, an incidence rate of 7.6% was reported. In Nigeria the values obtained were 1.5%¹ and 1.8%³. However, this variation may be due to the fact that refractive errors results are not always presented in the same format in the literature and hence the difficulty in comparing results. Also astigmatism is not always expressed as a separate group, most times being reported as spherical equivalents of cylindrical lenses. Astigmatism is also an important cause of visual morbidity and leads to amblyopia²³. Da-Silva *et al*²⁹ emphasized the importance of early detection and correction of astigmatic errors and that most asthenopic complaints of school children were usually due to astigmatism, which relates to poor performance in school. The number of times a child should be screened during his school career differs in different countries. In the UK for instance this varies according to the district. Stewart-Brown *et al*³⁰ advised between 2 and 13 times, whilst some districts advocate screening the children every year³¹.

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