



Visual Acuity in Primary School Pupils in Lagos, Nigeria

Okoro V.A¹ , Odeyemi K.A²

¹Lagos State University Teaching Hospital, Lagos, Nigeria

²Department of Community Health, University of Lagos, Nigeria

KEYWORDS

VISUAL ACUITY,
SCREENING,
SCHOOL
CHILDREN,
SCHOOL HEALTH

ABSTRACT

Background: Visual impairment is usually due to conditions that could be diagnosed and corrected if discovered early. However many cases go undiagnosed. Restoration of sight is among the most cost-effective interventions in health care.

Methodology: This is a descriptive cross-sectional study, carried out to determine the prevalence of refractive error, squint, and colour vision defect among primary school students. One hundred and eighty three pupils, aged 5-11 years were selected. Visual Acuity was measured using the Snellen chart. Colour vision and squint were assessed using the Ishikara colour vision test plates and corneal reflex test respectively. The tests were conducted by two optometrists with the assistance of a teacher and a class assistant.

Results: Most (78%) of the study population were found to have good visual acuity, 18.6 percent had fair vision, while 3.3 percent had poor vision. Prevalence (%) of refractive error, colour vision and squint among the study population were 21, 0.04 and 1.6, respectively. Majority of the students had good visual acuity and refractive error was the major cause (95%) of all reduction in visual acuity.

Conclusion: Eye defects occur among school children with potential negative effects. Pre-school entry eye examinations and regular screening is advocated and glasses should be made available for children with refractive error.

Correspondence to

Dr Kofoworola A Odeyemi

Department of Community Health, University of Lagos . Lagos, Nigeria.

Email kofodeyemi@yahoo.com

INTRODUCTION

The eye is the organ of sight and a window to the body and soul. We perceive the world around us and everything in it with the eyes and learn by observing with the eyes. Visual Acuity (VA) is defined as acuteness or clearness of vision which is dependent on the sharpness of the retinal focus within the eye, the sensitivity of the nervous elements and the interpretative faculty of the brain¹. It is a quantitative measure of the ability to identify black symbols on a white background at a standardized distance as the size of the symbols is varied. Visual Acuity is the most common clinical measurement of visual function.

Blindness, especially preventable or avoidable blindness is a public health problem, more especially when it affects children. Blindness has profound human and socio economic consequences. The cost of lost productivity, rehabilitation and education of the blind constitute a significant economic burden to

a nation².

The World Health Organisation (WHO) reports that 39 million people are blind and 285 million people are visually impaired worldwide.³ 90 percent of the visually impaired live in developing countries. Uncorrected refractive errors are the main cause of visual impairment. 80 percent of all visual impairments can be avoided or cured.

Out of the estimated 19 million children that are visually impaired globally, 12 million were due to refractive error, a condition that could be easily diagnosed and corrected.⁴ Restoration of sight and methods targeting blindness prevention are among the most cost-effective interventions in health care. In recognition of the importance of good vision for all people, and the negative economic impact of visual impairment, the WHO in 1999 partnered with International Agency for the prevention of Blindness (IAPB) and launched a global initiative VISION 2020: The Right to sight.²

A visually impaired child is most times incorrectly labelled as unintelligent because of poor academic performance. Meanwhile his poor academic performance may have been as a result of the fact that he finds it difficult to read books, does not copy his notes correctly or because he does not see the board clearly. If this goes undetected, the child might lose interest in education. It can also create some developmental gap in the child during the critical formative years (5-12yrs) ⁵. Provision of appropriate spectacles is one of the simplest, most effective strategies to improve vision, yet uncorrected refractive error is the primary cause of moderate vision impairment throughout the world.

Colour vision deficiency affects about 1 in 25 children.^{6,7} An affected child sees colour differently from most of his classmates or family members and may have learning difficulties when his perception clashes with normal colour perception.⁶

In developing countries like Nigeria, routine eye examinations are rarely conducted especially for children. Therefore, programmes like school vision screening are important because they might be the only means of early detection of visual anomalies and treatment to prevent avoidable visual impairment with its potential negative effects on a child's education and development.

This study is designed to screen school age children aged 5-12years attending primary school with a view to determine their visual acuity distribution and pattern. The study also aims at determining the prevalence of common ocular morbidity such as refractive error, conjunctivitis, squint, colour vision disorder and also offering necessary advice to children so affected (through their teachers) to seek proper intervention.

METHODOLOGY

This is a descriptive cross-sectional study carried out in a private primary school in Akoka, Lagos in which there were (480) four hundred and eighty pupils.

Study Population comprised of pupils who were

within the ages of 5 and 12 years. The inclusion criteria included the ability to identify and read the letters of the English alphabets, identify and read numbers 0 - 100. Approval to conduct the study was sought and obtained from the head teacher. Also consent and approval of the parents of the pupils was sought and obtained.

Sample Selection

The minimum required sample size was calculated using the formulae $n = z^2 pq/d^2$ and was = 106. Where; n = desired sample size, z = standard normal deviate (1.96), p = proportion of population with Attribute (Refractive error). From previous study⁸, p = 7.44% (0.07), q= 1-p, d = degree of accuracy desired (0.05)

The sample size used for this study was 183.

The classes were stratified into primary 1 to primary 6. Each class has several arms with a total of 20 classes in the school. Simple random sampling technique using the ballot method was used to select eight classes. All pupils in each selected arm were recruited into the study. A total of 183 (one hundred and eighty three) pupils were recruited for the study.

Data Collection

The tool for data collection was a structured questionnaire in two sections A and B. The section A was completed by the pupils themselves and section B was completed by the researcher. Information sought and recorded by each consenting pupil included name, age, sex, class, history of spectacle use by child or parents and previous eye tests. Data collected in section B included the result of Visual Acuity Test, Pinhole Visual Acuity Test, Colour Vision Test and Squint Test. The teacher led the pupils of his/her class when it was their turn into the school library where the test procedure was explained to them and subsequently carried out by 2 optometrists.

Procedures

Visual Acuity Measurement

The Snellen chart was hung on a wall at a distance of 6 metres in well lit room (the school library) and a height of 2 metres. Visual Acuity was measured one eye at a time (monocularly) with each pupil standing and facing the chart, and then reading out the letters on the charts starting from the biggest one to the smallest readable.

The eye not being measured was covered with a hand-held occluder held in place by the researcher.

For the purpose of this study, the definitions of the various visual acuities are

Good - visual acuity of $\frac{6}{5}$ and $\frac{6}{6}$

Fair - $\frac{6}{9}$ and $\frac{6}{12}$

Poor - worse than $\frac{6}{12}$

Pin Hole Visual Acuity Measurement

If the visual acuity measurement, through the Snellens chart result was reduced, i.e. below $\frac{6}{6}$, the Pin Hole Visual Acuity was then measured. This was done at the same distance. With the occluder still in place, the eye being measured was made to peep through the pin hole at the chart and the Pin Hole Visual Acuity is recorded.

Colour Vision Test

Using the Ishihara colour vision plate, each plate was shown to the child binocularly at the distance of about 75cm for a few seconds. Ability to identify all the numbers mean good colour vision and were recorded as such.

Test for Squint (Corneal Reflex Test)

A manifest squint (large angle of deviation of 20 degrees or more) is so obvious to an observer that no special testing procedure is required for its detection. For smaller angles of deviation, a testing procedure

(corneal Reflex test) was done.

Data Analysis

The data obtained was collated and analysed using the Epi-info version 6.0 statistical package for medical research.

Limitation of study

The findings of this study cannot be generalized since the study was conducted in one selected private school and characteristics of the school will determine the pupils attending.

RESULTS

A total of one hundred and eighty-three (183) pupils participated in this study. 87 (47.5%) of them were males whilst 96 (52.5%) were females. The mean age for males was 7.3 ± 1.4 years while for females it was 7.4 ± 1.3 years.

Only 32 (17.5%) of the respondents had had an eye test prior to the study period while 10 (5.5%) of them currently wear glasses for correction of refractive error. 4 (4.6%) of the 10 pupils weaning glasses are males whilst 6 (6.3%) of them are females. The study revealed that 41 percent and 45.4 percent of the respondents' mothers and fathers, respectively wear glasses.

Majority of the participants had good visual acuity 77.6% (right eye) and 78.1% (left eye). 19.7 percent and 18.6 percent had a fair visual acuity in right and left eyes, respectively while 2.7 percent and 3.3 percent had poor visual acuity in right and left eyes respectively. There was no statistically significant difference between visual acuity of the right and left eyes ($p > 0.05$).

Most (95%) participants with reduced (fair or poor) visual acuity had it improved when they looked through a pin hole. In other words, refractive error was responsible for reduction in visual acuity of 95 percent of those having reduced visual acuity. This

amounts to about 21 percent prevalence rate of refractive error in the study population. Only one pupil (male) was found to have colour vision defect, while 3 pupils (1 male and 2 females) had squint.

There was a statistically significant Association between age and wearing of glasses ($\chi^2 = 15.73$, $df =$

1, $P = 0.00$) among the pupils studied. 3 (2.0%) of the 10 pupils wearing glasses were in the age range of 5-8 years, whilst 7 (20.6%) were in the age range of 9-12 years. There was however, no statistically significant association between sex and wearing of glasses ($\chi^2 = 0.03$, $df = 1$, $P = 0.87$).

Table 1: Age and sex distribution of respondents

Variable	Sex		
	Male	Female	Total
	Frequency Percent (%)	Frequency Percent (%)	Frequency Percent (%)
Age			
5 – 7	51 (58.6)	65 (67.7)	116 (63.3)
8 – 11	36 (41.4)	31 (32.3)	67 (36.7)
Total	87 (100)	96 (100)	183 (100)

Mean age=7.1 \pm 1.4years.

Table 2: Result of visual acuity using Snellens chart

Result of Visual Acuity	Right eye		Left eye	
	Frequency	Percent	Frequency	Percent
Good	142	77.6	143	78.1
Fair	36	19.7	34	18.6
Poor	5	2.7	6	3.3
Total	183	100	183	100

$X^2 = 0.15$, p -value = 0.92

Table 3: Result of pin hole test for participants with fair or bad visual acuity

Result of Pin Hole Test	Right eye		Left eye	
	Frequency	Percent	Frequency	Percent
Improved	39	95.1	38	95.0
Not improved	2	4.9	2	5.0
Total	41	100	40	100

$X^2 = 0.24$, p -value = 0.63

Table 4: Distribution of participants by presence of colour vision or squint

Variable	Frequency	Percent (n=183)
Colour vision	1	0.6
Squint	3	1.6

DISCUSSION

The importance of School based vision screening in primary eye care cannot be over-emphasized. It remains a simple, cheap, cost efficient and effective means of detecting visual anomalies which otherwise would have gone undetected and therefore untreated. This is illustrated in this study where 82.5 percent of the study populations have never had an eye test. This is similar to a study in Benin City⁹ where 82 percent of female secondary school students screened had never had eye test before. This figure is high and a reflection that Nigeria has not mandated and institutionalized routine medical checks and screening at school entry as part of school health services.

To ensure a high sensitivity (97.9%), a cut off criteria of visual acuity less than $\frac{6}{6}$ in any eye was adopted in this study. Even though the positive predictive value is low (31.8%), an over referral is justifiable when weighed against the consequences of undetected visual anomaly. For the right eye, majority of the respondents (77.6%) had good visual acuity while 19.7 and 2.7 percent had fair and poor visual acuity, respectively. These were comparable with the left eye figures of 78.1 percent, 18.6 percent, and 3.3 percent in good, fair and poor visual acuities, respectively. For the right eye, 22.4 percent of those studied were found to have a visual acuity of less than $\frac{6}{6}$. Similar pattern existed in the left eye.

An improvement of visual acuity with the pin hole is usually interpreted to mean the presence of refractive error as the underlying cause of reduced visual acuity¹⁰. The type and classification of the error is however beyond the scope of this study. 95.1 percent of those with reduced visual acuity had refractive error since they had an improvement with the pin hole. This translates to a 21.3 percent

prevalence of refractive error in the study population. This is higher than reported in other studies. A previous study by Ozemele et al in 1997 reported a prevalence of 5.3 percent¹⁰. Refractive error prevalence of 7.4 percent⁸ and 3.1 percent¹² have been reported in Nigerian students. This seemingly high prevalence of reduced visual acuity in this study, may have been as a result of the high sensitivity (97.9%) of the screening test criteria used. (Visual acuity of less than $\frac{6}{6}$ in any eye).

One pupil (0.6%) was found to have colour Vision defect. This pupil was a male and unable to identify most of the numbers of the Ishihara colour vision test plates. In another study on childhood Eye diseases in Nigeria, a 0.4 percent prevalence of colour vision defect was reported¹². Colour vision defect is documented to affect 8% of boys and 0.5% girls i.e. more males than females^{6,7}.

Three (1.6%) pupils had squint in this study. This figure is similar to a 1.1 percent prevalence reported in a hospital based study in Enugu¹³. Other population based studies have reported lower values 0.05%¹¹, 0.5%¹⁰ and 0.4%¹².

Ten (5.5%) of the pupils were found to be wearing glasses as at the time of this study. This number represents only 25 percent of those in this study population who needed to wear glasses on account of their refractive error. This is undesirable as eye glasses alone have been shown to greatly reduce the prevalence of Visual impairment¹². It was also reported in another study that 93.9% of those with Visual impairment will benefit from the use of eye glasses⁸. In this study, sadly, one child aged 8 years who was labelled dull and have consequently repeated primary one twice was discovered to have poor Visual Acuity. A simple pair of glasses may have made a world of difference in the life of this

child who was described as “not having interest in academic work”. This finding highlights the social consequence of reduced Visual Acuity caused by correctable refractive error.

A comparison of the visual acuities in both eyes shows that 78.1 percent of the participants had the same Visual Acuity in both eyes. Other researchers have also had to use visual acuity either Eye in their studies having noted no reported differences between Visual Acuities in both Eyes⁸.

More pupils in the younger age-group 5-8 years (79.9%) appeared to have better Visual Acuity than their counter parts in the older age groups 9-12years 67.6 percent of whom were reported to have good Visual Acuity. This difference is however not statistically significant ($P > 0.05$). Therefore no relationship was established between age and Visual Acuity.

Similarly there is no statistically significant difference between Visual Acuity and sex ($P > 0.05$). A statistically significant association was established between age and wearing of glasses ($P < 0.05$). The ages of seven (70%) out of the 10 pupils wearing glasses ranges between 9-12 years whilst 3 (30%) of them were in the lower age range. This may be explained by the fact that the children on their part may be too young to know and complain of any visual defects thereby reducing their chances of getting tested and obtaining glasses. Also, the older children may have more academically and therefore more visually challenging tasks and activities than the younger ones, thereby making any visual defects more obvious to them.

CONCLUSION AND RECOMMENDATION

This study has demonstrated a high prevalence of reduced visual acuity (22.4%) with refractive error accounting for 95% of these reductions in visual acuity. A 21.3 percent prevalence for refractive error was found. A prevalence of 0.6% for colour vision defect and 1.6% in squint was found among the study population.

Undetected poor vision can be a stumbling block to a child's academic pursuit. As part of school health

programme, a compulsory visual acuity Assessment is recommended before entering into primary school and subsequently annually whilst the child is in school. Pupils found to have reduced visual acuity should be referred to the eye care specialist and appropriate treatment obtained before school entry. Teachers should be equipped with basic knowledge on how to measure and interpret visual acuity of pupils, informing parents of pupils found to have any reduction in vision for appropriate action.

REFERENCES

1. Cline D. Hofstetter HW; Griffin JR. Dictionary of Visual Science 4th ed. Butterworth-Heinemann, Boston 1997.
2. WHO. Global Initiative for the Elimination of Avoidable Blindness WHO/PBL/97.61 Rev. 2.2000.
3. WHO. Visual impairment and blindness fact sheet N 282 Oct 2011
4. WHO. Fifty sixth world health assembly. Agenda 14.7. Elimination of avoidable blindness. 28 April 2003
5. Jan. J. E, Groenvled M. Visual behaviours and adaptations associated with cortical and ocular impairment in children. Journal of Visual Impairment and Blindness, American Foundation for the Blind April, 1993; 60
6. Windsor RL, Windsor LK. Vision Enhancement Journal. Low vision centre of Indiana. www.eyessociates.com.
7. Wagner BT, Kline D. Basis of Colour Vision Deficiency. University of Calgary Tutorial Topics. 2005.
8. Dennis G. N., Paul D. School Vision Screening Programme in Enugu, Nigeria: Assessment of Referral Criteria for Error of Refraction. Nig. Journ of Ophthalmol, 1997, 34-40.
9. Ideh VCU, Osahon AI, Oseji, M, Akpan P.

- Vision Screening in Secondary School Children in Benin City. 25th International Congress of International Medical Women's Association 2001.
10. Clifford R. The Eye in General Medicine. Chapman and Hall Ltd .1983 ;3.
 11. Ozemela C.P, Bolarin I.B School Eye Health Services in Kaduna State, Nigeria Journal of Ophthalmol, 1997 60-63.
 12. Nwosu N. N. Childhood Eye Diseases in Amanbra State Nigeria. Nig. Journal of Ophthalmol 1999, Vol. 7, 1, 24-38.
 13. Onwasigwe EN, Umeh RE, Onwasigwe CN, Aniebue P.N. Referral Pattern of Children to the Eye Department of the University of Nigeria Teaching Hospital Enugu. Nigeria Journ of Opthal, 1996, 5-6.