



RESEARCH ARTICLE

VISUAL IMPAIRMENT AND ITS RELATIONSHIP TO ACADEMIC PERFORMANCE AMONG PRIMARY SCHOOL CHILDREN IN SOKOTO METROPOLIS, NORTH-WESTERN NIGERIA

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ABSTRACT

Introduction: Vision plays a very important role in child learning and development, thus, any problem with child's vision could adversely affect his/her academic performance. This study therefore aims at determining the relationship between visual impairment and academic performance among primary school children within Sokoto metropolis.

Materials and Method: A descriptive cross sectional survey of primary school children in four randomly selected primary schools within Sokoto metropolis was carried out between July 2016 and August 2016. Relevant history and basic ocular examinations were carried out on the primary school children that were selected using a multi-stage sampling technique. Data were analysed using the Statistical Package for Social Sciences (IBM SPSS) version 20.

Results: A total of 184 pupils were surveyed; 84 (45.7%) were males and 100 (54.3%) were females. The age range was between 5 and 15 years and the mean age was 10.84 years \pm 2.19. The prevalence of visual impairment was found to be 12.0% and uncorrected refractive error was the commonest cause of visual impairment seen in this study with a prevalence of 10.3% followed by posterior segment affection which with a prevalence of 1.6%. The average academic performance was found to be significantly higher in the normal sighted pupil compared to those with visual impairment ($p=0.04$).

Conclusion: The negative implications of visual impairment on education and its effects on subsequent socio-economic life, calls for the need to increase effort on visual screening and other related interventional measures.

INTRODUCTION

Visual disorders are the fourth most common disabilities of children and a leading cause of handicapping condition in childhood (Ciner *et al.*, 1998). Visual impairment is the visual acuity of less than 6/6 in the better eye (Fahd *et al.*, 2013) or when the presenting visual acuity is less than 6/6 in the better eye (WHO, 2015). In the United States of America, about 2.4% of school children are said to be visually impaired and that only 13.7% of visually impaired individuals would be able to complete a Bachelors degree or higher degrees (Erickson *et al.*, 2015). The control of visual impairment and blindness in children is a priority of the World Health Organization's VISION 2020: The Right to Sight program (Gilbert and Foster, 2001). The World Health Organization (WHO) estimates that 80% of visual impairment is either preventable or curable with appropriate treatment (WHO, 2014) and thus, screening for visual problems in children may improve future vision and educational achievement (Mathers *et al.*, 2010).

The Nigerian constitution ensures equality, freedom, justice and dignity of all individuals including persons with visual impairment. Visually impaired children differ in educational need and characteristics from children with normal vision. It has been reported that majority of persons with visual impairment can lead a better quality of life if they have equitable educational opportunities and effective access to rehabilitation measures (Suresh *et al.*, 2014). Regrettably, there is inadequate data on visual impairment and its relationship to academic performance among primary school children in Northern Nigeria. This study aim to screen for visual impairment among primary school children within sokoto metropolis and relate it to their academic performance

MATERIALS AND METHODS

The study was conducted in Sokoto metropolis, Sokoto Metropolis is the capital of Sokoto State and it comprises of Sokoto North, Sokoto South, part of Wamakko and part of Dange-Shuni Local Government Areas (LGAs). Sokoto Metropolis has a projected population of 687,767 people out of the projected population of 4,968,458 million people in the

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state (NPC, 2016). There are 230 primary Schools (161 Public schools and 69 private schools) within the metropolis as at March 2016 with a total of 118,830 pupils (SUBEB, 2016).

The study population comprised of primary schools pupils in Sokoto metropolis

Primary Schools pupils aged 5-15 years in the selected schools of the metropolis were included while Primary school pupil less than 5 years and/ or greater 15 years of age, mentally retarded pupils, those with no light perception visual acuity or with less than 75% school attendance were excluded.

The study design was a descriptive cross sectional study. The sample size was determined using the formula

$$n = z^2 p q / d^2,$$

Where

n = desired sample size (where the population is greater than 10,000).

z = the standard normal deviate, usually set at 1.96, which corresponds to the 95% confidence level.

p = is the proportion (prevalence) of the primary school children population estimated to have visual problem from previous studies which was 11.6% (Umar *et al.*, 2007).

q = is the proportion of the primary school children without visual impairment i.e.

$$q = 1 - p = 0.884$$

d = is the degree of accuracy (was set at 0.05).

Therefore $n = 157.57$

Twenty percent (20%) non response was anticipated, which was adjusted as follows $n_s = n/R = 157.57/0.8 = 196.96$ pupils. Approximately 197 pupils were recruited for the study.

A multistage sampling technique was used as follows

Stage I: four primary schools (proportionate sampling of 3 public and 1 private) were selected; one from each local government comprising the metropolis by using simple random sampling technique (balloting). There was proportionate allocation of pupils to each selected school.

Stage II: from each selected school, stratified sampling technique was used for class 1-6 as follows

- From each class arm, a sub-class (e.g. A, B or C) was selected using a simple random sampling technique (balloting technique).

- Proportionate allocation of samples was done to each sub-class.

Stage III: from each of the selected sub-class, systematic sampling technique was used to select pupils as follows;

- Sampling interval was calculated using the formula N/n where N is the total number of pupil within the sub-class and n is the proportionate allocation of the sub-class.

- Starting number for each sub-class was selected using simple random sampling technique (balloting).

The method of data collection was interviewer-administered semi-structured questionnaires which were completed for the selected pupils, parents and class teachers by the research assistants. The examinations were carried out in the classrooms in broad day light with the

class teacher present. Data were collected through the months of July and August 2016

Visual acuity was measured using the Illiterate E chart which was hung on a wall at a distance of 6metres in well lit room and at a height of two metres. Visual Acuity was measured (one eye at a time) with each pupil standing and facing the chart, and then reading out the letters on the charts starting from the biggest letter to the smallest readable letter. The eye not being measured was covered with a hand-held occluder held in place by the researcher (Okoro and Odeyemi, 2013). For those with impaired visual acuity, i.e. VA below 6/6, the Pin Hole Visual Acuity was then measured. This was done at the same distance of six meters. With the occluder still in place, the eye being measured was made to peep at the chart through the pin hole and the Pin Hole visual acuity was then recorded (Okoro and Odeyemi, 2013). Fundoscopy and the intra ocular pressure measurement were not carried out/measured because the school environment was not ideal for such procedure. Average academic score was calculated by adding the aggregate score of first, second and third term continuous assessment and examination scores, and calculating the average. Collected data was entered and analyzed using statistical package for social science (SPSS) version 20 (SPSS Inc. Chicago, IL, U.S.A.) and MS Excel 2013. Frequency distribution tables were constructed; cross tabulations were done to examine relationship between categorical variables, Chi-square test was used to compare differences between proportions, Student 't' test was used to compare means. All statistical analysis was set at 5% level of significance ($p < 0.05$). Refractive error was diagnosed based on visual acuity of 6/9 or worse that improved with pin-hole test (Ayanniyi *et al.*, 2010). Posterior segment eye pathology was diagnosed based on visual acuity of 6/9 or worse that remain the same with pin-hole test (Rajesh *et al.*, 2007). Approval for the study was obtained from the ethics committee of Usmanu Danfodiyo University Teaching Hospital (UDUTH) Sokoto. Approval was also obtained from Sokoto Universal Basic Education Board (SUBEB) and principals of selected schools. Written informed consent was obtained from the parents of participating pupil and assent was obtained for each participating pupil. Limitations of the study include Inability to carry out full ophthalmologic examination.

RESULTS

A total of 197 questionnaires were administered, out of which 184 questionnaires were completed fully, thus giving a response rate of 93.40%. Four pupils were excluded because they were not fully cooperative with visual acuity measurement. The prevalence of visual impairment was found to be 12.0%. [Table 1] Uncorrected refractive error was the commonest cause of visual impairment seen with a prevalence of 10.3%, this was followed by Posterior segment affection which was found in 3 of the respondents (1.6%). There was slight predominance of female 100 pupils (54.3%) to male 84 pupils (45.7%) with male to female ratio M: F 1:1.2, although the difference was not statistically significant ($P = 0.848$) and about 50% of the sampled pupils were between 10 – 12 years. [Table 2]. Majority of the respondents were Muslims (97.8%) while 2.2% were Christian. No statistically significant difference was found between parent of normal sighted children and those visual impaired children in terms of socioeconomic and educational status ($p > 0.05$).

Table 1. Prevalence of visual impairment (Visual acuity < 6/6) among respondents

Variable	Visual acuity \geq 6/6	Visual acuity < 6/6
Sex		
Male	74(40.2)	10(6.4)
Female	88(47.8)	12(6.5)
Total	162	22

Table 2. Prevalence of visual impairment among primary school children by age group and sex

Variables	Normal sighted N=162 Frequency (%)	Visually impairment N=22 Frequency (%)	P-value
Sex			0.984
Male	74 (40.2)	10 (5.4)	
Female	88 (47.8)	12 (6.5)	
Age			0.001
<7 years	0 (0.0)	2 (1.1)	
7 – 9 years	44 (23.9)	5 (2.7)	
10 – 12 years	81 (44.0)	11 (6.0)	
13 – 15 years	37 (20.7)	4 (1.6)	

Table 3. Socio-demographic characteristics of respondents

Variable	Normal vision N= 162 Frequency (%)	Visually impaired N= 22 Frequency (%)	p- values
Religion			0.456
Islam	158 (85.9)	22 (12.0)	
Christianity	4 (2.2)	0 (0.0)	
Parent smoking status			0.467
YES	9 (4.9)	2 (1.1)	
NO	153 (83.1)	20 (10.9)	
Education of father			0.637
Primary	7 (3.8)	1 (0.5)	
Secondary	35 (19.0)	4 (2.2)	
Tertiary	105 (57.1)	13 (7.1)	
None	15 (8.2)	4 (2.2)	
Education of mother			0.651
Primary	10 (5.4)	3 (1.6)	
Secondary	46 (25.0)	5 (2.7)	
Tertiary	46 (25.0)	6 (3.3)	
None	60 (32.6)	8 (4.3)	
Occupation of father			0.492
Civil servant	104 (56.5)	12 (6.5)	
Business	55 (29.9)	10 (5.4)	
Farming	3 (1.6)	0 (0.0)	
Unemployed	0 (0.0)	0 (0.0)	
Occupation of mother			0.805
Civil servant	36 (19.6)	4 (2.2)	
Business	13 (7.1)	3 (1.6)	
Farming	1 (0.5)	0 (0.0)	
Unemployed	112 (60.9)	15 (8.2)	
Birth order			0.305
\leq 5	106 (57.6)	12 (6.5)	
>5	56 (30.4)	10 (5.4)	
Family size			0.058
\leq 10	127 (69.0)	14 (7.6)	
>10	35 (19.0)	8 (4.3)	

Table 4. Relationship between academic performance and visual impairment among respondents

Variable	Normal vision N= 162 Frequency (%)	Visually impaired N= 22 Frequency (%)
Academic score (%)		
0 – 39	4 (2.2)	2 (1.1)
40 – 49	17 (9.2)	6 (3.3)
50 – 59	39 (21.2)	5 (2.7)
60 – 69	32 (17.4)	1 (0.5)
70 – 100	70 (38.0)	8 (4.3)

FEX² = 9.198, P = 0.04 (fisher's exact)

Birth order and family size were not statistically associated with VA of the pupil ($p=0.305$ for birth order and $p=0.058$ for family size). [Table 3]. About 45% of respondents with impaired vision had previous eye examination whereas only 8% of the normal sighted children had previous eye examination.

The difference was found to be statistically significant ($p=0.000$). Among all the 184 pupils that completed the study, only 23 (12.5%) of them have had previous eye examination. The parents of up to 64 (34.8%) of the sampled pupils were found to be using glasses, however no statistical association was found between this variable (parents using glasses) and

vision of the pupils ($p=0.52$). Relatives of visually impaired children tends to wore glasses or have associated eye problems more than the relatives of normal sighted children ($p=0.01$). The average academic performance was found to be higher among those with normal vision ($65.94\% \pm 13.41$) as compared to those with impaired vision ($61.27\% \pm 19.17$) and the difference was statistically significant ($p=0.04$) [Table 4].

DISCUSSION

Visual impairment can have both immediate and long-term consequences in both children and adults (Resnikoff *et al.*, 2004). In this study, the prevalence of visual impairment was found to be 12.0%; this is similar to what was obtained by Umar *et al.*, (2007) in the same study area, Figueiredo *et al.*, (1993) in South American State of Brazil. Some studies however, reported lower prevalence; 7.7% in Western China by Lian-Hong *et al.*, (2012) and 3.5% in Iran by Fotouhi *et al.*, (2007). However higher prevalence were reported elsewhere; 19.7% in Qatar, (Al-Nuaimi *et al.*, 2010) and 25.1% in India (Padhye *et al.*, 2011). This variation may be related to the type of sampling method used, size of population screened and the variation of geographical location or perhaps, difference in socio-economic status of the parents. Uncorrected refractive error was the commonest cause of visual impairment seen in this study with a prevalence of 10.3%. This was similar to the findings reported by Ayanniyi *et al.*, (2010) in Ilorin, Kwara State, North-Central, Nigeria and Deshpande and Malathi (2011) in rural area of Maharashtra in India. This was followed by Posterior segment affectionation which was found in three of the respondents (1.6%); this is similar to what was reported in a study by Rajesh *et al.*, (2007). There was slight predominance of female respondents (54.3%) as compared to males (45.7%), although the difference was not statistically significant ($P = 0.984$).

Visual impairment was found to be significantly associated with the ages of the pupils being more frequent in older age group (>10years) ($X^2=16.30$, $p=0.001$). Similar findings were made by Fahd *et al.*, (2013) who showed that uncorrected refractive errors were more common in age group 12-14 years among primary school children in Saudi Arabia and Rajesh *et al.*, (2007) who showed that ocular morbidity are more common among 13-14 year age group. Alicja *et al.*, (2008) state that the prevalence of reduced vision ranged from 4.4% to 6.5% at 10 to 11 years and from 9.4% to 11.4% at 16 years. Okoro and Odeyemi (2012) found that children aged 5 to 8 years have better visual acuity than those aged 9 to 12years. There were no statistically significant association between the sex of the pupils ($p=0.984$), family size ($p=0.058$), literacy status of the pupils parents ($p=0.637$ for fathers and 0.651 for mothers), occupation of pupils parents ($p=0.492$ for fathers and 0.805 for mothers) and visual impairment Rajesh *et al.*, (2007) reported similar findings.

About 45% of respondents with impaired vision had previous eye examination while only 8% of the normal sighted children had previous eye examination. The difference was found to be statistically significant ($p=0.000$) and this difference might be due to poor school eye health and poor routine eye health check up. Up to 87.5% of the pupils have never had previous eye examination; this is close to the 82.5% obtained by Okoro and Odeyemi (2012) in Lagos and the 82% reported by Ideh *et al.*, (2001) in Benin City. These high figures are reflections that there is poor implementation of routine medical check-up and screening at school entry as part of school health services

in Nigeria. Relatives of visually impaired children tends to wear glasses or have associated eye problems more than the relatives of normal sighted children ($p=0.01$) and up to 64 (34.8%) of the parents were using glasses, however no statistical difference was observed ($p=0.52$). This finding was similar to what was obtained by Syaratul-Emma *et al.*, (2008) Similarly Aniza *et al.*, (2012) found no relationship between visual impairment and using of glasses by parent. About 8.7% of the pupils have their first degree relatives wearing glasses or have eye problems; this is similar to what was obtained by Ayanniyi *et al.*, (2010) of 8.3%. The academic performance of the visually impaired children was significantly lower than that of the normal sighted children ($P=0.04$). Similar findings were reported by Umar *et al.*, (2007) in the same study area, Kotingo *et al.*, (2014) in south-south Nigeria, Toledo *et al.*, (2010) in Brazil, Simionato *et al.*, (2007) in north-eastern Rio Grande do Sol, Brazil and Chen *et al.*, (2011) in Malaysia. These findings are may be due to the fact that eighty percent of what children learn in school comes through the use of the eyes (Unitedhealthcare, 2012).

Conclusion

The prevalence of visual impairment was found to be 12.0% and uncorrected refractive error was the commonest cause of visual impairment seen in this study with a prevalence of 10.3% followed by posterior segment affectionation which with a prevalence of 1.6%. Up to 87.5% of the pupils have never had previous eye examination. The academic performance of the visually impaired pupils were significantly lower than that of the normal sighted vision ($p=0.04$). In view of the above findings, the following recommendations were made. Establishment and integration of an effective school eye health into school health programme where a compulsory visual acuity assessment is performed before entering into primary schools 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 identify pupils with visual problem and inform the parents of pupils found to have any reduction in vision for appropriate action. Public enlightenment on the importance of children's ocular health especially among parents should be given.

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