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CAUSES AND PREVALENCE OF OCULAR MORBIDITY AMONG PRIMARY SCHOOL CHILDREN IN ILORIN, NIGERIA

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ABSTRACT

Objective: To determine the causes and prevalence of ocular morbidity among primary school children in Ilorin, Nigeria.

Materials and Methods: A cross sectional survey of primary school children in 10 randomly selected primary schools within Ilorin, Nigeria was carried out between July 2005 and January 2006. Relevant ocular history and basic ocular examinations were carried out on the children that were selected from a multi-stage sampling process.

Results: One thousand three hundred and ninety three pupils were surveyed. There were 689 (49.4%) boys and 704 (50.6%) girls. The age range was between 4 and 15 years. The mean and modal ages were 10.16 SD 2.5 and 10 respectively. Two hundred and seventy seven pupils had ocular pathology giving a prevalence of 19.9%. The two most common ocular disorders found among the pupils were refractive errors and vernal conjunctivitis with prevalence of 6.9% and 6.7% respectively. Others included genetic / congenital / developmental ocular disorders 39 (2.8%), glaucoma / glaucoma suspect 20 (1.4%), ocular infections 18 (1.3%), and ocular trauma 11 (0.8%). More than three-quarters (86.7%) of the causes of visual impairment and blindness among the pupils were avoidable (preventable or treatable).

Conclusion: The sheer magnitude of avoidable causes of visual impairment and blindness in the study underscores the need for effective school eye-health programmes in developing countries.

Key Words: Ocular morbidity, childhood blindness, school eye health, Nigeria. *(Accepted 8 June 2009)*

INTRODUCTION

The school age is very important for detecting a number of ocular morbidities as the pupil most probably is being visually challenged in a sustained manner for the first time in life because of school work. Also, many ocular problems that are amenable to interventional measures are detected through vision screening of selected population such as school children.[1-3]

Children eyes are not literarily small adult eyes, as the causes and strategies to control childhood and adult ocular morbidities are dissimilar. A delay in the treatment of childhood ocular pathology can lead to permanent visual impairment and possible mortality.[4] Quite worrisome is the fact that a visually impaired child has many years ahead to cope with the disability with untoward negative implications for educational and social development.[5]

Various surveys of children ocular health have indicated the magnitude of eye diseases and the importance of ocular survey among children. [1, 6 - 10] Children visual well being ranks among the top priorities of "Vision 2020: The Right to Sight".[11]

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Regrettably, there is inadequate data on causes and prevalence of ocular morbidities among children of the developing world. We aim in this paper to study the prevalence and causes of ocular morbidity among children with a view to amassing data that can be used to plan interventional measures that can stem the tide of avoidable blindness.

MATERIALS AND METHODS

This was a cross-sectional descriptive study carried out between July 2005 and January 2006 in 10 randomly selected day primary schools within Ilorin metropolis. One thousand three hundred and ninety three pupils from the selected schools were surveyed. The population of school children in Ilorin metropolis was approximately 166,000 as at July 2005.

Ethical clearance for the study was obtained from University of Ilorin Teaching Hospital, Nigeria. There were initial advocacy visits to the local School Board and the selected schools to convey the objectives and importance of the study with a view to gaining support and permission to carry out the study among primary school children in Ilorin.

The sample size of surveyed pupils was determined using the equation $n = z^2pq/d^2$. Where n is the desired sample size, z is the standard normal deviate (we used

1.96 which corresponds to the 95% confidence level), p is the proportion (prevalence) of the children population estimated to have visual problem and d is the degree of accuracy. The prevalence (p) of ocular pathology among school children from previous studies in Nigeria[6,7,9] was 17%. Thus p = 0.17, q = 1.0 p = 0.83 and d was set at 2% (i.e. 0.02). Thus the minimal calculated sample size (n) was 1,355. However we carried out the study on 1,393 pupils.

We employed multistage random sampling technique in the study. Generated random numbers were used to select 10 primary schools from a list of 184 primary schools within Ilorin metropolis. Each studied primary school had 6 classes and each class was subdivided into a number of arms. Using the calculated minimal sample size as well as the number of pupils in each class as a guide, a predetermined number of 30 pupils was randomly selected for the study from each class. Through the assistance of class teachers, all available pupils in all the arms of a particular class were assembled and each pupil was asked to pick a numbered wrapped paper. The pupils who picked the first 30 numbers were selected from each class for the study and thus a total number of 180 pupils from each school and an overall 1,800 from 10 schools. The exclusion criteria included pupils of age 16 year and above, lack of guardian consent for pupil to participate, inability of the pupil to cooperate with the examination process, failure of a pupil's guardian to complete relevant sections of the proforma, and earlier participation in the preceding pilot study.

The examinations were carried out in the classrooms in broad daylight. The presence of the class teachers ensured the co-operation of most pupils with the examination process. Ocular examination started with unaided visual acuity (VA) determination and a pin hole test was additionally done for pupils with VA of 6/9 or worse. Refractive error was diagnosed based on visual acuity of 6/9 or worse that improved with pin-hole test. The colour vision defect was checked using Ishihara colour plates. With the aid of the pen torch the eyelids, the conjunctiva, the cornea, the anterior chamber, the iris and the pupil of each eye were examined separately for each respondent pupil. Hirschberg test and cover-uncover test were also carried out for pupils with strabismus. With the aid of direct ophthalmoscope the posterior segment of the eyes of each pupil were examined in a darkened corner of the classroom (ensured by closing few windows). The eye was dilated with 0.5% tropicamide drops whenever mydriasis was required for fundoscopy.

The intra ocular pressure was measured with the aid of a Perkins applanation tonometer among pupils whose ocular findings were suggestive of glaucoma. Glaucoma was diagnosed based on cup disc ratio of $\geq$ 0.6 with or without cup disc asymmetry of fellow eyes and intraocular pressure of > 21mmHg. Confrontation visual field test to detect visual field defects was inconclusive.

Amblyopia was diagnosed based on presence of amblyogenic factors (such as strabismus and refractive error) and reduced VA with or without improvement with pin hole test. Additionally, single optotype VA test and refraction which were carried out on these pupils at an eye clinic where they were referred showed single optotype improvement by at least 2 lines and no and/or insignificant improvement on refraction.

Data was collected using the proforma while data entry and analysis was done with Statistical Package for Social Sciences (SPSS) version 12.0.1. Analysis was done using simple frequency proportions.

RESULTS

One thousand three hundred and ninety three pupils were examined. There were 689 (49.4%) boys and 704 (50.6%) girls giving a boy to girl ratio of 1:1. The age range was between 4 and 15 years. The mean and modal ages were 10.16 SD 2.5 and 10 respectively. The modal age group was 10-12 years (Table 1).

Two hundred and seventy seven out of the 1,393 pupils had ocular pathology giving a prevalence of 19.9% (Table 2). Most eyes [2,735 (98.1%)] of pupils had VA of 6/18 or better (normal vision). However, the VA of 10 (0.4%) eyes of the pupils though, believed to be seeing was indeterminable due to their poor co-operation to VA test. Forty of the eyes had VA between < 6/18 and Perception of Light (low vision) (Table 3). Most of 214 eyes with unaided VA $\leq$ 6/9 improved with pin hole test and 161 (75.2%) eyes VA improves to 6/6 (Table 4).

Refractive error was the commonest [96 out of 1,393 (6.9%) pupils] ocular disorder found among pupils in the study, eight of whom (8 out of 96 pupils) had family history of refractive errors among their first degree relatives. Fifteen out of 96 pupils (15.6%) with refractive errors reported blurred vision for distance among other complaints. Eighteen among 93 pupils [93 out of 1,393 (6.7%)] who had vernal conjunctivitis had family history of ocular itching among their first-degree relatives. Most pupils [70 out of 93 (75.30%)] with vernal conjunctivitis had ocular itching among other complaints. All (the 93 pupils) had VA of 6/12 or better with the majority 76 (81.7%) having VA of 6/6 or better.

Seventeen out of 1,393 pupils (1.2%) had congenital defective colour vision. Their ages were between 9 and 15 year with VA of 6/9 or better. Also, 5 of 1,393 (0.4%) pupils had strabismus. Three were alternating exotropia and 2 were alternating esotropia. All the five pupils with strabismus had ocular deviations ranging between 15^0 and 30^0. There was history of

ocular deviations in the mothers of 2 of the pupils. All (5 pupils) had VA of 6/6 or better and their ages ranged between 7 and 10 years.

Another identified disorder was amblyopia in 5 out of 1,393 pupils (0.4%) between ages 8 and 15 years. Two of them had strabismic amblyopia (the mother of one of them had squint), 2 were isoametropic amblyopia, and 1 was anisoametropic amblyopic. Mild congenital blepharoptosis was identified among 4 pupils whose ages ranged between 5 and 12 years. All (the 4 pupils) had VA of 6/6. Blindness and visual impairment were observed among 30 out of 1,393 pupils (2.2%). This included 2 out of 30 pupils (6.7%) with bilateral blindness caused by presumed congenital ocular toxoplasmosis and couching (trauma); 6 (20.0%) pupils with unilateral blindness caused by: glaucoma [1 (3.3%)], measles [2 (6.7%)] and trauma [3 (10.0%)]; 2 (6.7%) pupils with bilateral severe visual impairment caused by: refractive error [1 (3.3%)] and amblyopia [1 (3.3%)]; 17 (56.6%) pupils with bilateral visual impairment caused by: refractive error [9 (30.0%)], optic nerve atrophy [1(3.3%)], amblyopia [3 (10.0%)], oculocutaneous albinism [2 (6.7%)], sickle cell retinopathy [1 (3.3%)] and maculopathy [1 (3.3%)]; and 3 (10.0%) pupils with unilateral visual impairment caused by: refractive error [1 (3.3%)], trauma [1(3.3%)] and amblyopia [1 (3.3%)].

The causes of visual impairment and blindness include preventable [toxoplasmosis, measles, sickle cell retinopathy (through genetic counseling), trauma and glaucoma (early detection and treatment)], treatable (refractive error and amblyopia) and unavoidable (maculopathy, optic atrophy and oculocutaneous albinism). The avoidable (preventable and/or treatable) causes of visual impairment and blindness in the study constituted 86.70% while the remaining 13.30% was unavoidable.

Table 1: **Age Group and Gender Distribution of Pupils.**

Age group (years)	No. of boys (%)	No. of girls (%)	Total (%)
4 - 6	53 (3.8)	55 (4.0)	108 (7.8)
7 - 9	228 (16.4)	223 (16.0)	451 (32.4)
10 - 12	275 (19.7)	299 (21.5)	574 (41.2)
13 - 15	133 (9.5)	127 (9.1)	260 (18.6)
Total	**689 (49.4)**	**704 (50.6)**	**1393 (100.0)**

Table 3: **Distribution of Pupils Eyes' VA Based on WHO Categorization.**

Visual Acuity	No of eyes (%)	WHO category
≥ 6/18	2735 (98.1)	Normal vision
< 6/18 - 6/60	28 (1.0)	Visual impairment
< 6/60 - 3/60	2 (0.1)	Severe visual impairment
< 3/60 NPL	11 (0.4)	Blind
Indeterminable	10 (0.4)	
Total	**2786 (100.0)**	

VA means visual acuity, > means better than or equal to, < means worse than.

Table 4: **Distribution of VA of 214 Eyes, Unaided and on PH Test.**

VA	No of eyes unaided (%)	No of eyes on PH test (%)
6/6	-	161 (75.2)
6/9	120 (56.1)	17 (7.9)
6/12	32 (15.0)	9 (4.2)
6/18	21 (9.8)	7 (3.3)
6/24	10 (4.7)	5 (2.3)
6/36	15 (7.0)	4 (1.9)
6/60	3 (1.4)	2 (1.0)
<6/60	13 (6.1)	9 (4.2)
Total	**214 (100.0)**	**214 (100.0)**

VA means visual acuity, ≤ means equal to or worse than, PH means Pin hole.

DISCUSSION

The findings from the study were similar to previous studies of eye health among pupils in many respects.[1, 6, 7, 9, 12] The two most common ocular disorders of refractive error and vernal conjunctivitis among pupils in Nigeria were the same in this study as well.[6, 7, 9, 13, 14] Another similarity between this study and other previous ones on eye health of pupils in Nigeria was the fact that causes of visual impairment and blindness were mostly avoidable i.e. preventable or treatable.

The prevalence rate of ocular disorders of 19.9% found among pupils in the study compares favourably well with previous similar school studies in Nigeria: Jos[9] (19.3%), Lagos[12] (21%), Nkanu-West (Enugu)[7] (12.32%) and Ilesa[6] (15.47%). The similarity and difference in the prevalence of previous studies and the present study might be related to the geographical location of the study, variation in definition used and time of the study. It appeared that school studies from cosmopolitan Nigerian cities had similar but high prevalence pattern: Jos[9] (19.3%), Lagos[12] (21%), Ilorin (present study) (19.9%) while studies from rural-urban Nigerian towns had similar but lower prevalence pattern: Nkanu-West (Enugu)[7] (12.32%) and Ilesa[6] (15.47%).

Refractive error, the most common ocular morbidity found in the study had been previously reported as a significant cause of ocular morbidity among school age

Table 2: **Ocular Pathologies among Study Pupils.**

Diagnosis group	Frequency (prevalence) n =1393	Boy	Girl
Refractive error	**96 (6.9)**	**49**	**47**
Allergic: vernal conjunctivitis	**93 (6.7)**	**60**	**33**
Genetic / congenital / developmental	**39 (2.8)**	**21**	**18**
Defective colour vision	17 (1.2)	8	9
Strabismus	05 (0.4)	2	3
Amblyopia	05 (0.4)	3	2
Blepharoptosis	04 (0.3)	1	3
Oculocutaneous albinism	02 (0.1)	2	0
Persistent hyaloid artery	02 (0.1)	2	0
Maculopathy	01 (0.1)	0	1
Eyelash ptosis	01 (0.1)	1	0
Optic nerve atrophy	01 (0.1)	1	0
Non proliferative sickle cell retinopathy	01 (0.1)	1	0
Glaucoma / glaucoma suspect	**20 (1.4)**	**11**	**9**
Glaucoma	03 (0.2)	2	1
Glaucoma suspect	17 (1.2)	9	8
Ocular infection	**18 (1.3)**	**9**	**9**
Infective conjunctivitis	10 (0.7)	7	3
Post measles leucoma / phthisis	02 (0.1)	0	2
Eyelid infections	03 (0.2)	1	2
Dacryocystitis	01 (0.1)	0	1
Presumed ocular toxoplasmosis	02 (0.1)	1	1
Ocular trauma	**11 (0.8)**	**8**	**3**
Lid ecchymosis / bruise / laceration	04 (0.3)	3	1
Phthisis bulbi	02 (0.1)	1	1
Subconjunctival haemorrhage	01 (0.1)	1	0
Hyphema	01 (0.1)	1	0
Couching	01 (0.1)	1	0
Optic nerve atrophy	01 (0.1)	1	0
Retinal detachment	01 (0.1)	0	1
Total	**277 (19.9)**	**158**	**119**

children in Nigeria[1, 6, 7, 9, 12, 14] and elsewhere.[15 - 19] It appeared that there was higher prevalence of refractive error in the study and other urban-based studies[9, 12] of Nigerian school children compared to their rural[6, 7] counterparts as reported among Indian[15, 16], Taiwan[17], Tibetian[18], and Oman[19] children. This probably may be related to increased use of the eyes for close work among urban school children than their rural counterparts as environmental factors had been documented to be risk factors for myopia.[20] There was positive family history of refractive error in 8.3% of the studied pupils and it agrees with a previous report.[20] In the study, the pupils with refractive error had nearly equal gender distribution with slight boy preponderance which was in contrast to clear girl preponderance in similar study among primary and secondary pupils/ students in Ilesa, Nigeria.[6]

Poor vision and inability to read materials written on the black board as found in 15.6% of pupils with refractive error in the study can have a serious impact on a pupil's participation and learning in class and this can adversely affect the pupil's education, occupation and socio-economic status for life.[21, 22] Various studies in Nigeria and Britain showed that vision screening as in the study help in early detection of uncorrected refractive error.[1, 13, 14, 22, 23]

The assistance of trained volunteer teachers in determining VA for the pupils was appropriate utilization of available resources at minimal or no cost (a form of appropriate technology) without compromising validity of VA test as they were under close supervision of the authors. This had been confirmed in Nigeria[3] and Tanzania.[24] These sets of trained volunteer teachers could be useful in screening Pupils with refractive errors in their respective schools and refer appropriately. The pin hole test as used as a

screening criterion for refractive error in the work was not only appropriate technology but simple, basic and rapid. It is not only being used routinely in eye clinics but had been used in school eye surveys.[1,6,7,12,13]

Vernal conjunctivitis was next and close to refractive error in magnitude with the number of affected boys almost doubling that of girls. The male preponderance found in the study was in consonance with previous works.[8, 25, 26] Recurrent ocular itching was the most constant complaint among the pupils with vernal conjunctivitis. Usually vernal conjunctivitis does not cause visual impairment as noted in this study but may rarely lead to blindness.[27] About one fifth of the pupils studied had family history of ocular itching and this may suggest possible atopy among family members.[28]

The prevalence of congenital defective colour vision of 1.2% in the study compares with such previous studies across Nigeria: Jos[9] (3.9%), Lagos[12], (0.1%), Anambra[8] (0.4%) and elsewhere (1.9%)[29]. However, the gender distribution was not available in the above-quoted Nigerian studies for comparison with present study.

The five pupils with strabismus had normal vision as all had alternating type of either eso- or exo-deviation, which is not usually associated with visual impairment. However, it may have serious cosmetic implications such as jest making among playmates or difficulty getting suitable life partners later in life. The pupils were referred to Ophthalmologist for appropriate management. The fact that almost one-half of the studied pupils who had strabismus also had history of ocular deviation in their mothers may suggest possible genetic transmission in this cohort of pupils. The mild blepharoptosis found among 4 pupils was not associated with visual impairment but could be of cosmetic importance as in pupils who had strabismus.

The amblyopia detected among some pupils underscores the need for periodic routine school screening so as to detect and manage potential amblyogenic factors such as refractive errors, anisometropia, strabismus and media opacity among others very early when amblyopia could be reversed.[6, 7, 12, 30] Amblyopia may not be as difficult to treat as to convince both the pupils and parents to comply with management regimen.

Presumed congenital ocular toxoplasmosis and measles were two preventable infective causes of loss of vision found in the study. It was quite unfortunate that toxoplasmosis and measles infections cost some pupils their vision.

Toxoplasmosis was responsible for bilateral blindness in one pupil while measles infection caused leucoma leading to unilateral visual impairment in one pupil and phthisis bulbi leading to unilateral blindness in another pupil found in the study. Healed measles keratitis resulting to corneal scar and leading to blindness as found in the study was a problem that had been previously reported among school age children.[9, 31, 32] The persistence of measles related ocular pathology in the environment where the study was conducted may be due to inadequate immunisation coverage of children population against measles as theoretical herd immunity of 92-95% was yet to be achieved in Nigeria compared to elsewhere.[33,34]

Couching as found performed on a pupil in the work was not only deplorable but a disturbing development. This has underscored the need to put effective measures in place to reduce/ eradicate couching. Couching is associated with complications usually leading to vision loss as found in the work and is still being practiced by some traditional healers especially in Africa.[35, 36]

Oculocutaneous albinism and maculopathy were among unavoidable causes of visual impairment and blindness in the work as reported elsewhere.[7, 9] Sickle cell retinopathy is a potentially visual impairing and blinding condition as noted in the work and had been previously reported among school age children.[37, 38] Sickle cell retinopathy can be prevented through genetic counseling.

In conclusion, the sheer magnitude of avoidable causes of visual impairment and blindness and the attendant negative implications on the educational and other socio-economic life of the affected children underscore the need to intensify efforts on relevant interventional measures. Some of these measures include the establishment of effective school eye health screening, availability of vitamin A supplement and potent vaccines against vaccine preventable childhood diseases, and public enlightenment on the importance of children ocular health especially among parents.

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