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Vision Screening in Nigerian School Children

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SUMMARY:

The study was conducted to establish the ability of simple screening tests conducted by readily available non-ophthalmic personnel (such as teachers rather than ophthalmologists, the gold standard) to detect cases of reduced visual acuity in school children. Trained schoolteachers assessed the ability of pupils to read the E-chart at the 6/12 line. A total of 1618 students comprising of 525 pupils from one government owned public primary school (mixed boys and girls) and 1093 from another private secondary school (boys only) school located in the metropolis were screened by the teachers. The trained schoolteachers were able to attain a sensitivity of 78.3% and specificity of 92.1% for the visual acuity testing. The trained schoolteachers were able to achieve reasonably high levels of specificity and modest levels of sensitivity in carrying out screening using visual acuity testing. Schoolteachers can reduce the workload of ophthalmic personnel who at the moment are few and are overworked. They can also play a vital role in vision testing exercises in school children especially in developing countries where there is little or no provision for school health services in schools attended by those from a poor background.

KEY WORDS: ***Vision screening, School children***

INTRODUCTION

Screening[1] is the presumptive identification of individuals in a population at risk likely to be affected by an asymptomatic/subclinical condition who can benefit with further investigation. It is a public health intervention measure[2] which has to fulfil ideally certain criteria but which may not always be possible in practice. Screening aims to reduce the magnitude of disease burden and by inference the associated negative social, economic, education and other impact in a community.

The relative ease and low cost with which a school screening programme can be implemented[3] by the government in developing countries cannot be compared with the immense benefit that will be derived from correcting defective vision and thus enabling a child to achieve its full potential which is a fundamental right of the child. The role of community ophthalmology in proposing and designing such a package to governments will be crucial. It is heartening to note that the VISION 2020 manifesto[4] accords refractive errors the importance it deserves.

There are few ophthalmologists (one per 760,000 population) and related ophthalmic personnel and services[5] in Nigeria. Also there are only few ophthalmic nurses (1 per 390,000 population) with even fewer optometrists (1 per 1.2 million population). There are no ophthalmic assistants or refractionists in Nigeria. In other developing countries with shortage of ophthalmic personnel, ophthalmic assistants usually trained in tertiary centres by ophthalmic nurses, assist ophthalmologists and perform other activities which the ophthalmic nurses should normally do. In Nigeria, there is uneven distribution of ophthalmologists, with the majority in some urban centres especially in private practice. Studies[6,7] indicate that ametropia or refractive error constitute the largest percentage of cases attending eye clinics in Nigeria. This substantially increases the workload of the few available ophthalmic personnel.

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It is envisioned that a school vision-screening programme, which utilises readily available non-ophthalmic personnel (e.g. teachers) will substantially decrease the workload of ophthalmic personnel allowing them to concentrate on dealing with other blinding conditions. In addition the programme will lead to increased eye health awareness and education in the society in the spirit of community participation and intersectoral collaboration. This fact has been successfully proven in other developing countries notably India[3] whereby teachers have been trained to conduct school screening which lead to a 20 fold decrease in the workload of ophthalmic assistants. This study aims to find out how utilisable school teachers may be especially for vision screening of their pupils. This will go a long way to reduce the workload of already overburdened ophthalmologists. Teachers have often been made use in goverment activities, for example, national census with proven benefits.

MATERIALS AND METHODS

The study was conducted in 2 schools: one government owned primary school and one private secondary school located within the urban centre of Kaduna. After establishing rapport with the Principal/ Headmaster, the study was explained to them and their approval obtained. Permission and authorization to do the study was sought and obtained from the Kaduna State Primary Schools Management Board and Kaduna State Model (Secondary) Schools Management Board respectively. The two schools selected were namely:

(a) L.E.A Primary School Maiduguri Road, Kaduna. This is a junior school and there are boys and girls enrolled in this school.

(b) Rimi Junior College, Kaduna. This is a private secondary school and admits only boys.

Five teachers were nominated by the principal of the secondary school based on their interest in science subjects, interest in the vision testing exercise and motivation in working with students.

A two session one day training workshop was held in the school 3 days prior to the commencement of the vision screening exercise. The teachers were given an intensive task oriented training on visual acuity measurements using illiterate E-chart, including the underlying basic principles and how to record their findings. Demonstration on measuring visual acuity was conducted by the researchers and all participants held a series of practice sessions. Visual acuity cut-off of <6/12 was chosen because it was felt this might be a more appropriate level for the visual needs of school age children who should be able to read from blackboards and video display sets, etc. The ability to read at least 3 out of 5 optotypes on the 6/12 line was taken as Pass, and less as Fail. Each of the teachers was given a kitbag containing a string 6 metres long, an E-chart with only the 6/12 line containing 5 optotypes, some chalk, a pentorch with spare bulbs and batteries, some plain sheets of paper, a pen and a training manual. All participants were encouraged to read and practise what was taught to them at home and to ask questions when they needed more clarifications. A quick revision/pilot was done for the teachers on the same day before commencing the exercise. The screening lasted five days.

The sample size for the study was computed using the EPISTAT programme. All the selected students were screened by the teachers. Starting from the second day of the screening exercise, the authors reviewed only the 38 students assessed by the teachers and judged to have failed the visual acuity test. The authors only screened 275 students out of those judged by the teachers to have passed the VA test, which comprised of 100 pupils (20% sub-sample) from the primary school and 175 students (16% sub-sample) selected by systematic random sampling. A starting point was the selection of a random number from a numbered list of students in each class and then additional students were selected at regular intervals of two or three until the required number was obtained. These students were examined by the authors using identical criteria and instruments as the teachers. The results obtained by ophthalmologist was regarded as the gold standard and was compared with that of the teachers.

Visual acuity assessment was repeated with pin-hole on all selected pupils in the[2] schools and those pupils who improved had refraction done in a semi-darkened room within the school premises by the optometrist from the Guinness Eye Centre, Kaduna. Refraction was done in a semi-darkened room in the respective schools allocated for that purpose. Both subjective and/or objective refraction was carried out on students suspected to have refractive errors. Students who did not improve with pin-hole were referred to see the ophthalmologist in Guinness Eye Centre, Kaduna for management. These pupils were given their prescriptions and a letter to their parents explaining the problem with an offer for glasses at a subsidised cost.

The whole sequence of events described above was similarly carried out in the second school, the following week. The screening exercise lasted 5 days in each of the two schools with a total of 1618 students screened in 10 days. A total of 1618 pupils were screened by the teachers and comprised of 525 pupils from LEA primary school and 1093 from Rimi secondary school. The authors examined all the 38 students that failed and the 275 students (sub-sample) that passed the VA test.

The educational background of all the teachers involved with the screening was secondary school certificate for all the teachers but in addition, all the secondary school teachers possessed the teacher training certificate. There is no internationally accepted method of recording refraction results[8]. In this study, refraction results were recorded as the corresponding value in dioptre sphere or the equivalent in cylinder with the meridian noted where appropriate.

RESULTS

A total of 1618 pupils were screened by the teachers and comprised of 525 pupils from LEA primary school and 1093 from Rimi secondary school. A coverage of 77.6% was achieved in the secondary school while that in the primary school was 49.4%.

The 525 pupils from LEA comprised of 263 boys and 262 girls with a male to female ratio of 1:1. The age and sex distribution of 525 pupils screened in LEA primary school is shown in Figure 1. The 1093

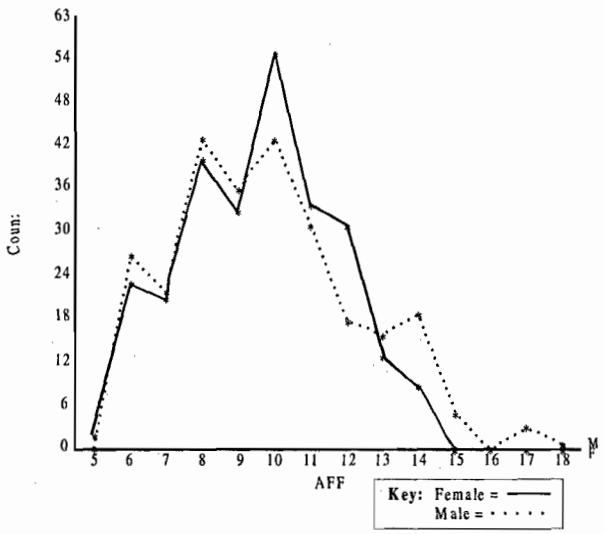

Figure 1: ***Line graph shoing Age and Sex distribution of screened pupils in LEA Primary School, Maiduguri Road, Kaduna.***

students screened in Rimi secondary school were all boys. The age distribution of 1093 boys screened in

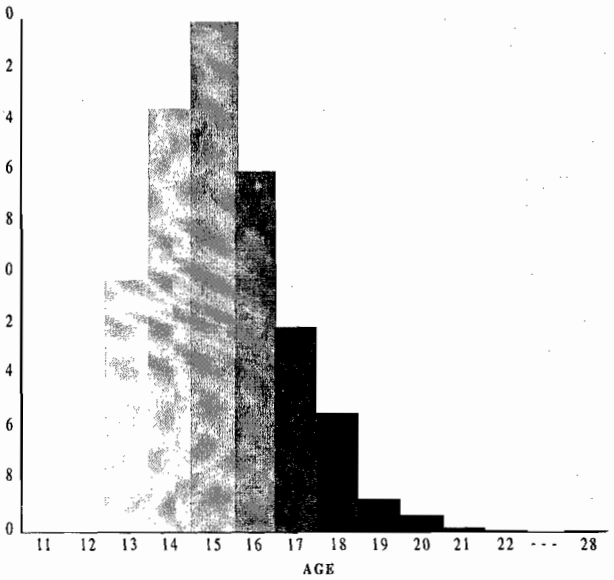

Figure 2: ***Histogram showing Age distribution of students in Rimi College Junior, Kaduna State***

Rimi secondary school is shown in Figure 2.

Comparing the findings of the teachers to those of ophthalmologists using the findings of the ophthalmologists in the 275 students examined in the subsample of the selected children already examined by the teachers, the ophthalmologists findings were used as the gold standard.

18 students who failed (by ophthalmologists) were identified by teachers as failed

232 students who passed (by ophthalmologists) were identified by teachers as passed

5 students who failed (by ophthalmologists) were wrongly identify as passed

20 students who passed (by ophthalmologists) were wrongly identify as failed.

Agreement between teachers and ophthalmologists = 91.6% for good vision and 78.3% for poor vision

Sensitivity and specificity in LEA primary school were 75% and 89.1 % respectively

Sensitivity and specificity in Rimi secondary school were 80% and 93.8% respectively

Combined sensitivity and specificity in both schools were 78.3% and 92.1% respectively

The positive and negative predictive values in LEA were 37.5% and 97.6% respectively

The positive and negative predictive values in Rimi were 54.5% and 98.0% respectively

The combined positive and negative predictive values were 47.4% and 97.9%

The sensitivity, specificity, combined sensitivity and specificity, positive, negative and combined

predictive values for the Teachers Visual Acuity test is shown in Table 1 .

Table 1: ***Sensitivity, Specificity, Positive and Negative predictive values of Teachers visual Acuity in school children.***

Statistical values (C.1%)	LEA school	Rimi College	Both LEA + Rimi
Sensitivity	75% (35.6, 95.5)	80% (51.4, 94.7)	98.3% (55.8, 91.7)
Specificity	89.1% (80.5, 94.4)	93.8% (88.5, 96.8)	92.1 *87.8, 95.0)
+predictive value	37.5% (16.3, 64.1)	54.5% (32.7, 74.9)	47.4% (31.3, 64)
- predictive value	97.6 (90.9, 99.6)	98.0% (93.9, 99.5)	97.9% (94.9, 99.2)

DISCUSSION

The reliability and validity of visual acuity testing using the E-chart has been well established[8]. Its sensitivity and specificity as screening tools for low vision have been calculated to be 85% and 96% respectively in other studies relative to other methods of visual acuity screening. An added advantage of using this test is that it is simple to explain and language barriers can be easily overcome. In addition only one person is required to administer the test[9].

The reasons for this disparity in coverage was due to the advice of the principal (head teacher) of the secondary school, who suggested that the vision-testing program be scheduled to coincide with examinations which from his experience are well attended even by truant students, as they need to show their end of term exam results to their parents as evidence that they had been attending school. This idea proved very useful in attaining this level of coverage especially in the public secondary school. This was not the case in the in the primary school because there were no exams for the pupils scheduled within the period left to conduct the exercise. So the coverage here was less though more likely to be consistent with the "normal" school attendance. Also, school attendance was probably worsened by incidental communal riots, which may have resulted in parents withdrawing their children temporarily from school.

Using the authors as the gold standard and a visual acuity level of 6/12, the sensitivity and specificity of 75% and 89% respectively of the teacher's findings in the VA test were quite high. In the secondary school it was much higher with 80% and 93.8% for sensitivity and specificity respectively probably because of the higher educational background of the teachers. The combined results of both primary and secondary schools for sensitivity and specificity were quite commendable with 78.3% and 92.1% respectively. Individual and combined positive predictive value of 47.4% and negative predictive values of 97.9% were quite encouraging.

The above results of the sensitivity, specificity, positive and negative predictive values for the teacher's findings in the VA test (Table 1) compares quite favourably with that obtained in a similar study in India by Limburg[10] et al. Although, they used a visual acuity level of 6/9, they obtained a sensitivity and specificity of 71% and 94% respectively with a predictive value for the positive test of 45%.

In this study, the sensitivity and positive predictive values of the screening procedure for the visual acuity test were relatively lower for primary school teachers than for their counterparts in the secondary school relative to but it is well known that these values are influenced by a host of factors e.g. prevalence of the conditions being screened, how subjective or objective the screening tests are themselves, the quality and duration of the training for the teachers, etc.

On the other hand, the accuracy with which the teachers confirm the absence of refractive error was quite good; as evidenced by the high specificity and negative predictive values. In fact it is comparable to that achieved by trained staff such as paramedical ophthalmic assistants[11]. The concept and findings of this study should be put in the proper context and perspective i.e. a non ophthalmic personnel (e.g. schoolteacher) who is readily available, willing and accessible to students (subject of interest) is given a one day training after which s/he screens a large number of students for eye conditions and is able to say with a high degree of certainty that the majority of the students "passed" the test (have normal or near normal visual acuity) and with a modest degree of certainty that a minority "failed" the test (have visual impairment and/or other eye problems). This is a notable achievement on the part of the teachers. In addition, there is a concurrent increase in eye health awareness, uptake of eye health services and health education. The fact that all this is happening where there was nothing being done previously is a worthwhile achievement. The service rendered by the teachers has the potential to greatly reduce the workload of scarce ophthalmic personnel freeing their time to deal with other sight threatening conditions.

Available results indicate that hypermetropia is much more common than myopia; amongst school children in both the two schools studied. Even though this might not be conclusive, it is in consonance with

the observations made in an on going prospective study of children presenting with refractive errors at the Guinness Eye Centre, Kaduna[12].

The last stage of a vision screening programme, which consists of provision of appropriate spectacles to students with refractive errors, was disrupted by a resurgence of civil unrest and had to be suspended. Resumption of this phase was not possible due to certain constraints. A preliminary encounter with some of the parents of the children with refractive errors was encouraging. The overall response was good.

Discussions with an optometrist and an optician had identified a source of cheap lenses (cheaper than that available from hospitals) imported from India and readily available even in the market. This option, if further explored and if subsidised, will make the spectacles more affordable to the parents of the children who need them but might not be able to afford them. Interestingly, no one was found to be using spectacles amongst all the students screened during the exercise. However, more studies need to be conducted to solve a host of questions e.g. cost effectiveness, poor follow up and use of spectacles etc.

CONCLUSION

This study has shown that it is possible to successfully utilise the services of non-ophthalmic personnel (e.g. schoolteachers) to conduct school vision testing programs.

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