

EFFECTIVENESS OF TEACHERS IN THE DETECTION OF EYE DISORDERS AMONG PRIMARY SCHOOL CHILDREN IN ABAKALIKI METROPOLIS, EBONYI STATE NIGERIA

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ABSTRACT

Background: Schoolteachers who have knowledge on eye diseases can detect early children with eye disorders and refer them promptly to an eye specialist. The aim of this study is to assess the effectiveness of teachers in a vision screening program for primary school children in Abakaliki.

Methods: This descriptive cross-sectional study was conducted among 20 randomly selected primary schoolteachers in Abakaliki to screen for vision abnormalities and detect eye problems among 350 children from 5 schools. Teachers participated in a 2-day training using a modified training algorithm on vision screening using a Snellen's chart and in the identification of common ocular abnormalities. Data was analysed using IBM SPSS version 26 statistical program and a p-value of <0.05 at 95% confidence level was statistically significant.

Results: A total of 379 children were enrolled into the study however, 350 (92.3%) children participated in the study. School teachers correctly identified 283 (92.8%) children who had normal vision and 33(73.3%) who had impaired vision. Overall 60 (17.1%) children with perceived eye defects were referred to the ophthalmologist for re-examination. Refractive error and allergic conjunctivitis were the most common eye problems identified and children with refractive error and other ocular morbidity were referred to the base hospital.

Conclusion: Teachers are a valuable resource in the detection of eye disorders among school children. Their effectiveness can be further enhanced by regular training, and collaboration with eye care professionals. Addressing these limitations through policy implementation can lead to better eye health outcomes for school children in Nigeria.

Keywords: Visual acuity, Eye disorders, Refractive error, School vision screening, Teachers

INTRODUCTION:

Globally, there are at least 2.2 billion individuals who experience either near or distant vision impairment and approximately 1 billion of these vision impairment could have been avoided or have not yet been adequately addressed. The primary causes of vision impairment and blindness worldwide are refractive errors and cataracts¹. The estimate of 1 billion likely underestimates the actual number of children with vision impairment, mainly due to limited data on prevalence and causes in child populations.¹ Available data shows that globally, an estimated 19 million children have vision impairment and 12 million of these children have visual impairment caused by refractive error, while 1.4 million have irreversible blindness, requiring access to vision rehabilitation services to optimise function and reduce disability.²

Population-based studies in Nigeria show that 6.1% - 26% of school aged children aged 6-16 years have visual impairment, with uncorrected refractive error being a significant cause.³⁻⁷ There is an existing policy by the Nigerian Ministry of Health on school eye health program that recommends periodic eye screening of school children; however, implementation has not been very effective⁸. This may be a result of insufficient trained human resources, poor distribution of resources for eye care and limited access to quality eye care services in low- and middle-income countries like Nigeria.^{9,10} Due to lack of adequate rehabilitative services, children who have severe visual impairment and blindness may not be able to attend school which may lead to high drop-out rates¹¹. The impact of visual impairment and blindness in this population is well

documented and can be challenging in the child's development's physical, social, economic, and psychological well-being.¹²⁻¹⁴ It is, therefore, critical to develop strategies to improve the eye health of school children, and prevent causes of visual impairment and blindness.

School teachers can play major roles in school eye health programs. Their role in implementing these programs is vital as school children spend most of their awake hours with the teachers to get educated.^{15,16} Community-based innovative strategies such as training teachers in vision screening of school children should be promoted for early detection and prompt referral of school children with ocular morbidity. There is a need to develop this approach to utilise the existing workforce to achieve more comprehensive coverage of eye health services, especially in this age group. The aim of this study is to assess the effectiveness of training schoolteachers to screen for vision problems in primary school children in Abakaliki, Ebonyi State, Nigeria.

MATERIALS AND METHODS

This study was a cross-sectional pilot study carried out over 4 weeks from mid-February to mid-March 2019 in Abakaliki metropolis of Ebonyi State, Nigeria.

The minimum sample size was calculated using Fisher's formula and then the corrected formula for population <10,000

$$n_f = \frac{n}{1 + \frac{n}{N}}$$

Where n_f = minimum sample size for population less than 10,000

n = the desired sample size

N = estimated population size

A multi-staged random sampling method was employed in selecting the children that were going to be examined. Schools in the metropolis were enumerated and using a set of computer-generated numbers, 3 public and 2 private schools were included. Number of children from those schools were also obtained and using simple proportion, the sample size required for the study was calculated.

Three hundred and fifty children aged 6-16 years studying in 5 different primary schools were randomly selected and enrolled in the study to be screened for vision problems by selected teachers.

For the study, twenty schools were randomly selected from private and government-funded primary schools within the metropolis representing 1/3 of the registered primary schools in the metropolis. A list of teachers

was obtained from the Ebonyi State Universal Basic Education Board (UBEB) and 20 teachers were randomly selected from the pre-selected schools and trained to test visual acuity and recognise common symptoms and signs of vision problems among school children. These teachers were trained by two ophthalmologists; 10 trainees per trainer to ensure that they were adequately taught in the different aspects of primary eye care within the scope of the modified training manual developed.

The students who participated in the study provided informed consent duly signed by their parents.

Pre-study activity: Training of the teachers

To be able to carry out screening, selected teachers participated in a 2-day training on primary eye care. The aim of the training was to improve their knowledge, attitude, and practice of eye health. Inclusion criteria for teachers was based on their years of teaching (5 years and more), level of education (Post secondary school) and who gave consent to participate.

A pre-test was administered to assess the knowledge of the teachers on primary eye care and vision screening before training commenced. Each training session lasted about 5 hours daily with a cumulative 1 hour break between sessions. Training manual was adapted from the Afro-Primary Eye Care Manual¹⁷ and was in the form of slideshows, audio-visuals, and demonstrations. A post test was also administered also to assess the level of knowledge on eye care among the teachers.

Contents of training included:

1. Training on testing and correct recording of visual acuity of the school children using a Snellen's chart placed at 6m.
2. Interpretation and categorisation of the Visual Acuity (VA) measured, into normal or abnormal/impaired for the purposes of referral using <6/9 as cut-off.
3. Recognising common signs and symptoms of eye disease among school children such as red eye, eye discharge and refractive error.
4. Health education on harmful eye practices such as using traditional eye medications, sharing handkerchief and dirty fingers and complications that may arise from these practices.
5. Ways of preventing the spread of infectious eye diseases among children such as appropriate face and hand washing techniques.

To evaluate inter-observer variability, 10 participants were recruited and full ocular examination was carried out by the principal researcher and the 2 resident doctors on the team. Ocular findings were recorded separately and Kappa statistics was calculated. $K=0.68$ (95% CI 0.66-0.78).

Study procedure

The teachers were divided into four teams of five teachers each and an ophthalmologist was assigned to each team for quality control. Before the start of the examination process in the school, the study procedure was explained to the trained teachers by the principal researcher. The research assistants enumerated and assigned 18 pupils whose parents gave consent to participate randomly to each teacher to examine and to document their findings. Every child maintained the number assigned to them by the team leader throughout the process of examination to ensure uniformity. The proforma had information on sociodemographic characteristics, visual acuity measurement, eye symptoms (e.g. difficulty seeing the blackboard, eye pain, trauma, itching, tearing), and signs such as redness, discharge, and eye deviation, whitish opacity of the eye and lid swelling. After examination, every teacher cross-checked that each form was filled in appropriately before handing it over to the team lead. The various team leaders re-examined all the children recruited, and their findings were documented to compare with the teacher. Any child with visual acuity of less than 6/9 or with any ocular complaint or abnormal ocular finding was noted and referred as instructed by the research team.

Children found to have common eye conditions such as allergic conjunctivitis and bacterial conjunctivitis were given anti-allergic and antibiotic eyedrops respectively while the those who required refraction and further ocular examinations outside the scope of primary care were referred to the base hospital.

Statistical analysis

Daily data cleaning and entering on an excel sheet was done by the principal researcher while coding and analysis were performed using Statistical Package for Social Sciences (SPSS) statistical software for Windows version 26 (SPSS Inc, Chicago, Illinois, USA).

Socio-demographic characteristics of the study participants were analyzed using descriptive statistics. Continuous variables were summarized using mean and standard deviation, while categorical variables were described using percentages and proportions. A p-value of 0.05 was statistically significant.

Ethical approval: The study was carried out in line with the Declaration of Helsinki for biomedical research. Ethical approval was from the Alex Ekwueme Federal University Teaching Hospital Abakaliki (FETHA/REC/VOL1/2018/615, Ebonyi State and permission was sought from the Ebonyi State Ministry of Education, Ebonyi State Universal Basic Education Board (UBEB), and the management of Private schools to examine the pupils.

RESULTS

A total of twenty teachers recruited into the pilot participated. There were 12 females and eight males trained to examine 379 children enrolled on the study. Three hundred and fifty children were examined, giving an overall response rate of 92.3%. Children who were not examined were either not cooperative or absent from school. The mean age among the study population was 9.8 ± 2.1 years (range 6- 16 years), modal age of nine years. There were more female participants (62.3%) with a male-female ratio of 1:1.7. Majority (98.9%) were Christians, and about 1/5 (17.1%) had at least one eye complaint. Table 1 below shows the sociodemographic characteristics of the school children examined.

Table 1: Sociodemographic characteristics of participants

	Number (350)	Frequency(%)
Gender		
Male	132	37.7
Female	218	62.3
Age		
≤10	173	49.4
>10	177	50.6
Type of the school attended		
Private	169	48.3
Public	181	51.7
Religion		
Christian	346	98.9
Islam	4	1.1
Pupils with at least one eye complaint	60	17.1

As observed by the teachers, 60(17.4%) school children had at least one eye complaint which were one or a combination of the following; itching, difficulty seeing the blackboard, eye pain, tearing and redness. There were more complaints among males than females and in children older than 10 years of age. Below is a graph showing the distribution of eye complaints among school children by gender and age (figure 1).

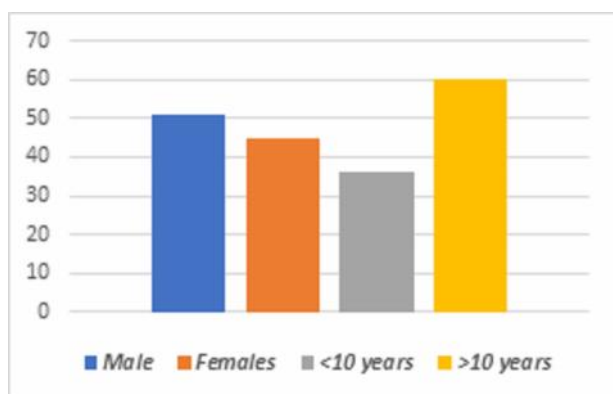


Figure 1: Distribution of eye complaints among school children as observed by the teachers

The research team re-examined the children enrolled in the study, and 47 (13.4%) had various forms of eye problems. Refractive error observed in 51.1% and allergic conjunctivitis in 27.7% were the most common eye disorders noted in this study. Approximately 55.3%

of females and 59.6% of children older than ten had eye problems. There was no statistical significance of ocular morbidity by gender or age. (χ^2 P-value >0.05). Table 2.

Following visual acuity measurement by the teachers, 295 (84.3%) school children had normal vision, while 55(15.7%) were categorised as having impaired vision. After re-examination by the research team, an additional 10 children were observed to have normal vision, while 45(12.9%) of the total number had visual impairment ranging from mild to severe impairment. Figure 2.

The teachers correctly identified 283(92.8%) school children with normal vision and accurately categorised 33(73.3%) people with impaired vision. Below is a table (Table 2) describing the sensitivity and specificity of using this method in screening for vision problems among school children in Ebonyi State. The teachers correctly identified 73.3% of children who had eye problems and 92.8% of those who didn't have any ocular abnormalities. While the probability that the school children who were screened by the teachers actually had eye problems (positive predictive value) was 60%.

Sensitivity $TP/TP+FN = 33 \times 100/45 = 73.3\%$ (CI 66.7% - 79.9%)

Specificity $TN/TN+FP = 283 \times 100/305 = 92.8\%$ (CI 91.3% - 94.3%)

Table 2: Distribution of eye disorders by age and sex.

Eye disorders	SEX		AGE	
	Male N=21(44.7)	Female N=26(55.3)	≤10 Years N=19(40.4)	>10 Years N=28(59.6)
Refractive error	11 (23.4)	13 (27.7)	7(14.9)	17(36.2)
Allergic conjunctivitis	6 (12.8)	7 (14.9)	9(19.1)	4 (8.5)
Glaucoma suspect	2 (4.3)	1 (2.1)	0(0.0)	3(6.4)
Bacterial conjunctivitis	2 (4.3)	4 (8.5)	3(6.4)	3(6.4)
Amblyopia	0 (0.0)	1 (2.1)	0(0.0)	1 (2.1)
p-value	(0.287)		(0.142)	

TABLE 3: Sensitivity, specificity, positive and negative predictive values of teachers' visual acuity testing

		TEACHERS' VISUAL ACUITY ¹		
		NORMAL	IMPAIRED	
RESEARCHERS' VISUAL ACUITY (Gold Standard)	NORMAL	283 (TN)	22 (FP)	305
	IMPAIRED	12 (FN)	33 (TP)	45
		295	55	350

¹ where **TN**= TRUE NEGATIVE , **FP**= FALSE POSITIVE, **FN**= FALSE NEGATIVE, **TP**= TRUE POSITIVE

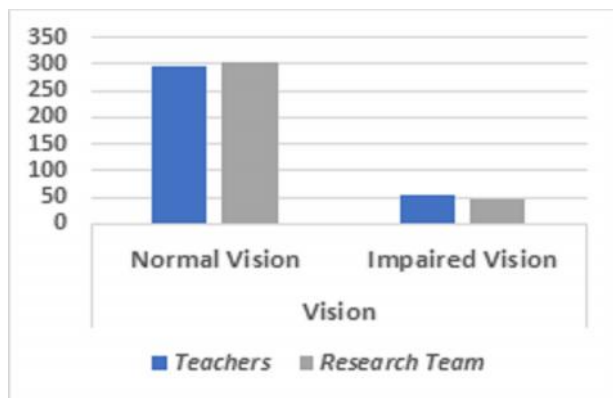


Figure 2: Comparison of visual acuity assessments

Positive predictive value – $33 \times 100/55 = 60\%$ (CI 47.1% - 72.9%)

Negative predictive value- $283 \times 100/295 = 95.9\%$ (CI 85.0% -100%)

DISCUSSION

Vision screening of school children is an effective strategy in the early detection and management of eye conditions; however, in resource-poor settings in low and middle-income areas, where there are few eye care professionals per million population to cater for cataract backlog and emerging diseases like diabetic retinopathy, screening in schools has not been given the required attention¹⁸.

To achieve health system-strengthening approach to eye care delivery, training of human resources for eye health at the primary level is vital to generate demand and reduce the workload at the secondary and tertiary levels.¹⁹ Furthermore, eye conditions are identified early and referred to appropriate levels, and minor eye conditions such as allergic conjunctivitis can receive some attention at the primary level. Uncorrected refractive error, a leading cause of visual impairment among school children, can be sorted out early to avoid amblyopia.^{18,20}

This study explored the possibility of using teachers as vision screeners in schools to support the human resource for eye health at the community level and found out that this is an achievable and cost-effective strategy that government, non-governmental organisations and relevant community stakeholders should implement. Even though the framework used for the training was developed using a guide²¹, the World Health Organisation - Afro Primary Eye Health (WHO AFRO-PEC) package is an excellent resource for training eye care workers at the primary level to identify, provide appropriate first aid and refer to the appropriate level of care.¹⁷

Although this study was conducted as a pilot in a semi-urban area, evidence has shown that training on primary eye care among teachers in urban and rural areas can increase their knowledge of eye health. They are more likely to serve as vision ambassadors at the community level^{15,22,23}. Therefore, the training conducted among the teachers improved their knowledge of eye health and they were able to correctly identify the majority of the schoolchildren who had normal vision and missed a few who had some eye abnormalities. Considering that conditions on the field may be different from those in a clinic setting, report on the final result of visual acuity by the teachers may vary which was noted in a similar study.²⁴

The overall prevalence of ocular morbidity in this study was lower when compared to studies conducted in some parts Mangalore²⁵, Ilorin²⁶, Zaria²⁷ Sokoto²⁸ and China.²⁹ On the other hand, the study by Okoye *et al.*⁷ recorded a lower prevalence of ocular morbidity (6.1%). This may be as a result of the sample size which is smaller when compared with these other studies and the location where study was carried out which is in an urban area. Frequency of ocular morbidity was more common among the females when compared to studies in Mangalore²⁵ Ilorin²⁶ and Zaria²⁷ that found out that ocular morbidity was more in males, however, the pattern of ocular morbidity in children of the age group studied were similar. Refractive error and allergic conjunctivitis were the most common causes of eye disorder.

The sensitivity and specificity of vision screening of primary school children by their teachers were 73.3% and 92.8%, respectively, which is similar to the findings in studies carried out in Ogun State and Western India.^{24,30} Therefore, teachers trained in primary eye health using an appropriate framework can identify and refer children with eye disorders such as refractive errors to the appropriate level of care. In turn, this improves access to eye health for school children.

Limitations to this study is that it was carried out in Abakaliki metropolis which is an urban setting and therefore this results may differ if carried out in a rural setting. This is a pilot study, and for this study to be more robust, there is need for collaboration with relevant state ministries to improve on training and screening modalities.

CONCLUSION

The impact of training the teachers using a validated tool like the WHO AFRO PEC manual as a guide, to conduct vision screening and identify eye problems was demonstrated by the sensitivity, specificity of their testing results as well as the probability of correctly

identifying children with vision abnormalities. This is one of the strategies to achieving integration of primary eye care services to eliminate causes of avoidable blindness. Government, non-governmental organisations and relevant stakeholders should invest in eye care as a component of school health and support the development of these teachers as a resource for primary eye health care delivery.

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