

Original Research Article

## Assessing the Quality of Vision Screening By Teachers among School Children in the Bibiani-Ahwianso-Bekwai District, Ghana

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### ABSTRACT

**Background:** An effective and efficient school vision screening program will lead to early detection and management of childhood vision impairment. Non health professionals specifically teachers can be utilized for vision screening because of their unique relationship with pupils.

**Aim:** To assess the quality of vision screening of school children by teachers.

**Methods:** In this cross-sectional study, school teachers were trained to screen pupils in four basic schools in the Bibiani-Ahwianso-Bekwai district of Ghana. Pupils were re-screened by the research team to assess the quality of vision screening by teachers.

**Results:** Nine hundred and seventy eight (978) school children were screened by 32 teachers. The sensitivity and specificity of the vision screening by teachers was 76% (95% CI: 59% - 88%) and 96% (95% CI: 95% - 98%) respectively. The positive predictive value was 47% (95% CI: 34% - 60%) and negative positive value was 99% (95% CI: 98% - 99.5%).

**Conclusion:** With the requisite training, teachers can perform vision screening for school children with a high degree of accuracy.

**Keywords:** Vision screening, school children, vision impairment, teachers.

### INTRODUCTION

All persons regardless of age can be affected by vision disabling conditions. However, childhood vision impairment has a more devastating impact on quality of life. This is attributable to the number of years they will have to live with such condition. Children's academic development, future employability and social inclusion are also negatively affected. <sup>[1]</sup> The late detection of vision problems is a major obstacle in preventing vision disability. <sup>[2]</sup> School vision screening in this regard can help identify or detect children with impaired vision or ocular diseases which could lead to profound vision loss. The early detection of visual conditions will prevent vision disability and impact positively on

children's quality of life. <sup>[3]</sup> A simple but effective school vision screening program involves the testing of visual acuity and the provision of visual aids to all children with considerable ametropia. <sup>[4]</sup>

School vision screening programs have inherent defects and limitation and as such cannot substitute a comprehensive eye examination. However, it can augment the provision of primary eye care services to the pediatric population. This is because screening has been found to be cost effective, relatively easy to perform and has the ability to identify ocular conditions that is prevalent in more than 1% of the student population for possible refractive correction or further ocular management. <sup>[5,6]</sup> It is thus imperative that eye care professionals

advocate and collaborate with government to implement effective national school screening programs as exists in India. [7]

School screening for vision is basically conducted by eye care professionals or school nurses in some instances. In recent times, there have been growing numbers of research conducted to determine the possibility of utilizing non eye health professionals to screen school children. Teachers have been the focus of this study because they have a special responsibility to support the academic as well as the social development of pupils. Moreover, they are well placed to identify pupils with vision impairment because of their constant interactions with them. [8] In one such study conducted in Nigeria, teachers were able to correctly identify 78% of pupils with vision problems and 92% of pupils with normal vision. [9] Training of teachers for vision screening has been found to improve the detection of early vision problems in children. [10]

In countries where there is a deficit of eye care professionals, teachers could be trained to become first line screeners. This is the case in Ghana where there are few ophthalmic professionals serving a population of about 25 million. [11] Involving teachers in vision screening will therefore reduce the amount of work needed to be done by the few eyecare professionals. It will also increase coverage, services and timeliness in terms of eyecare to the student population. To date there has been no study done in Ghana to investigate teachers' involvement in vision screening programs. This study sought to assess the quality of teachers' vision screening tests among school children.

## **METHODS**

This was a cross-sectional study conducted in Bibiani, the capital of the Bibiani Ahwianso Bekwai district of Ghana. By simple random sampling four basic schools were selected for the study. The participating schools included 2 private and 2 public educational institutions.

Permission to carry out the study was obtained from the District Education Directorate and heads of participating schools. Informed consent was obtained from the guardians of the pupils. Head teachers of the selected schools were requested to nominate teachers handling pupils of the upper primary (4<sup>th</sup> to 6<sup>th</sup> grade) and Junior high school (7<sup>th</sup> to 9<sup>th</sup> grade) class for training.

A day's training workshop was organized for the teachers in each school by the research team. The teachers were taken through the techniques of visual acuity measurement and the recording format. A tumbling "E" distance vision card with a single row of 6/9 was utilized for the training.

The teachers were taught to carry out vision screening in the following way: The vision card was to be displayed at 3 metres to the child and performed under good natural lighting conditions. The vision card was white and contained a row of "E" in different rotations. For each eye the child was to indicate the direction of the limbs of the "E" with the palm placed on the other eye. Teachers were to measure vision in the right eye first followed by the left eye. The teachers had to explain the procedure to the pupils in the local akan language which is widely spoken in the area. If a pupil was able to identify 5 out of the 5 optotypes, the visual acuity is recorded as Pass. However, if the pupil was unable to identify at least one optotype, the vision acuity was recorded as Fail.

The teachers were taken through a practical demonstration of the vision screening procedure. To assess their comprehension about the procedure, teachers had to perform the test among themselves. The teachers were tasked to conduct the vision screening of all students in the upper primary and Junior high school of their respective institution within a period of three days after the training workshop. Each teacher was given a vision screening card and a recording form. The teachers conducted the vision screening within the

stipulated period and they recorded the name, age, sex, class and the vision status of each student screened. The research team consisting of two optometrists, ophthalmic nurse, enrolled nurse and optician subsequently visited the participating schools. The team re-screened all students examined by the teachers.

### STATISTICAL ANALYSIS

Data was entered and summarized using SPSS Version 17 software. The research team and teachers used the same instrument for screening. However, the results of the research team were used as the gold standard. The sensitivity, specificity, positive predictive value and negative predictive value of teachers data was calculated after determining true positives, false positives, true negatives and false negatives.

### RESULTS

In this study, a total of 978 pupils were screened by 32 school teachers from the four selected basic schools. This comprised of 328 from the private schools and 650 from the public educational institutions. Slightly more female (50.3%) than male (49.7%) pupils were screened. The median age was 12.8 and within a range of 8 and 19. The class and sex distribution of the pupils screened is shown below in Table 1.

**Table 1: Distribution of the class and sex of pupils**

Class	Male	Female
4	65	85
5	87	72
6	90	70
JHS 1	63	108
JHS 2	125	88
JHS 3	56	69
Total	486	492

**Table 2: Comparison of research team's visual acuity results and teachers' results**

		GOLD STANDARD (VISUAL ACUITY)	
		FAIL	PASS
TEACHERS SCREENING (VISUAL ACUITY)	FAIL	29 (TP)	33 (FP)
	PASS	9 (FN)	907 (TN)
		SENSITIVITY = 76% (95%CI: 59% - 88%)	SPECIFICITY = 96% (95%CI: 95% - 98%)
		PPV = 47% (95% CI: 34% - 60%)	NPV = 99% (95% CI: 98% - 99.5%)

### Teachers' vision screening results versus research team's results

The visual acuity results of the pupils as measured by the teachers were evaluated against the results of the research team. Nine hundred and seventy eight (978) pupils screened by the teachers were also assessed by the research team. The visual acuity results of the research team were used as the gold standard.

Sixty two (62) pupils failed the visual acuity screening according to the test conducted by the teachers. Twenty nine (29) students who failed according to the teachers screening were identified to have failed by the research team. Nine (9) pupils who failed according to the research team's screening were judged to have passed by the teachers.

Thus, the teachers correctly identified 29 pupils who failed (True positives – TP), incorrectly identified 33 pupils who passed (False positives – FP), correctly identified 907 pupils who passed (True negatives – TN) and incorrectly identified 9 pupils who failed (False negatives – FN). The Cohen's Kappa score ( $k = 0.55$ ) for both eyes in this study shows a moderate agreement between the research team and teachers vision screening. Sensitivity and specificity of 76% and 96% respectively was achieved by the teachers in visual acuity screening. Table 2 shows the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of the teachers visual acuity screening using the research teams result as the optimum standard.

### DISCUSSION

Most pupils in Ghana are not screened for vision impairment prior to

enrolling or while in school. In cases where vision screening is done, it is usually conducted by eye care professionals. This

study assessed the quality of a school vision screening performed by teachers.

A tumbling E chart with a single line was used to measure the visual acuity of the pupils. This type of Snellen chart is considered to be less costly and perplexing, fast, reliable and valid. It can therefore be used with ease by non-healthcare professionals including teachers.<sup>[7]</sup> Further, a distance of 3 metres rather than the conventional 6 metres was used for the measurement of vision. A short working distance is ideal for vision screening in children because it enhances the reliability and replication of the test.<sup>[12]</sup> The screener is in close proximity to the pupil when a shorter distance is used. Thus co-operation and concentration is greatly enhanced.<sup>[13]</sup>

The teachers performed the vision screening remarkably as demonstrated by the high sensitivity and specificity recorded. They were able to detect close to 80 percent of pupils with vision problems ( $VA < 6/9$ ) and identify almost all pupils with normal vision. Similar studies using various visual acuity cut off criteria has shown close agreement between teachers and eyecare professionals' vision screening results.<sup>[9,14-16]</sup> Few related studies however noted an average and low sensitivity.<sup>[17,18]</sup>

In this study the positive predictive value of the teachers' vision screening was 47%. This indicates that less than half of the pupils who failed the vision screening according to the teachers truly had a vision problem. This finding is consistent with a similar study conducted by Limburg et al in which a high sensitivity and low predictive value of 45% was recorded.<sup>[15]</sup> The low positive predictive value may be due to the rigorous visual acuity cut off of 6/9 used in both studies. Increasing the visual acuity threshold to 6/12 would significantly improve the positive predictive value according to a study by Langeslag-Smith et al.<sup>[19]</sup>

Other reasons for the high false positives and low positive predictive value are that pupils may not have comprehended the test when it was explicated the first time.

Moreover teachers may have been overly cautious not to miss students with vision problem and thus were likely to fail students when they were uncertain about test result. To curb this, it is suggested that pupils who fail vision screening tests must be rescreened at least two times possibly on another day.<sup>[15]</sup> The negative predictive value of 99% in this study was high. It is worth noting that the high specificity and negative predictive value indicates that teachers were most unlikely to miss students with vision impairment. This is a demonstration of the high quality of vision screening performed by teachers.

## CONCLUSION

The quality of a vision screening test is dependent on screeners ability to correctly discriminate between those who have or do not have vision disorders. The findings of this study indicate that non health professionals like teachers can perform high quality vision screening. Thus, teachers' involvement in vision screening will reduce vision disability by early detection, when correction is more effective. They can be used as first line vision screeners to augment the provision of eyecare services to school going children.

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