OPEN ACCESS

Saudi Journal of Medicine
Abbreviated Key Title: Saudi J Med
ISSN 2518-3389 (Print) | ISSN 2518-3397 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Teacher-Led School Vision Screening: A Feasibility Study Among Primary School Pupils

Mustapha Bature[1]*, Aminatu Ali Abdul Rahman[2]

[1]Department of Ophthalmology, Usmanu Danfodiyo University, Sokoto
[2]Department of Paediatrics, National Eye Centre, Kaduna

DOI: https://doi.org/10.36348/sjm.2026.v11i06.003 | **Received:** 12.04.2026 | **Accepted:** 04.06.2026 | **Published:** 05.06.2026

***Corresponding Author:** Mustapha Bature
Department of Ophthalmology, Usmanu Danfodiyo University, Sokoto

Abstract

Background: School vision screening is an effective strategy for early detection of visual impairment among children. However, shortage of eye care personnel in low- and middle-income countries necessitates the involvement of non-eye health workers such as school teachers. This study assessed the usability of trained school teachers for vision screening and identification of common eye conditions among primary school pupils in Kaduna North Local Government Area, Nigeria. ***Methods:*** A cross-sectional analytic study was conducted among 352 primary school pupils aged 5–15 years selected from 11 public and private schools in Kaduna North Local Government Area. Twenty-two teachers (two per school) underwent structured training on visual acuity assessment using Peek Acuity and Tumbling E-chart as well as identification of common external eye abnormalities. Teachers screened pupils for vision impairment and ocular abnormalities and referred suspected cases for evaluation by an ophthalmology research team. Data were analysed using Stata MP version 14. ***Results:*** The teachers successfully screened all 352 pupils comprising 704 eyes. Eighteen pupils (2.6%) were identified as having visual acuity worse than 6/12 using Peek Acuity while 14 pupils (2.0%) were identified using the Tumbling E-chart. Teachers identified ocular abnormalities in 96 pupils (27.3%), including itching (16.8%), eye discharge (5.4%), red eye (4.6%), and abnormal whitish reflex (0.6%). Overall, 110 pupils (31.3%) were referred for further ophthalmic assessment. Subsequent evaluation by the ophthalmology team confirmed ocular conditions among referred pupils, including conjunctivitis, refractive errors, cataract, ptosis, and corneal scars. The prevalence of refractive error was 2.3%, while vision impairment was detected in 2.27% of pupils. Agreement between teacher-administered visual acuity assessments using Peek Acuity and Tumbling E-chart was high (Cronbach's alpha = 0.804). ***Conclusion:*** School teachers can effectively participate in vision screening following structured training. Their ability to identify visual impairment and common ocular abnormalities demonstrates the feasibility of integrating teacher-led screening into school eye health programmes. This approach may improve early detection and referral of eye conditions in resource-limited settings.

Keywords: School vision screening; Teachers; Visual impairment; School eye health; Refractive error; Children; Nigeria.

INTRODUCTION

Childhood visual impairment remains an important public health problem, particularly in low- and middle-income countries where access to eye care services is limited.[1,2] Visual impairment in children negatively affects educational attainment, psychosocial development, quality of life, and future productivity. [3–5] Early detection through school-based screening programmes provides an opportunity for prompt intervention and prevention of avoidable visual disability. [6]

The shortage and unequal distribution of eye care professionals in many developing countries have prompted the adoption of task-sharing strategies. [7] School teachers are uniquely positioned to participate in school eye health programmes because of their regular interaction with children and their ability to observe behavioural changes associated with visual difficulties. Previous studies have demonstrated that appropriately trained teachers can perform vision screening with acceptable levels of sensitivity and specificity. [8,9]

Nigeria's school health programme provides an opportunity for integration of eye health activities. However, evidence regarding the usability of teachers for school vision screening remains limited. This study therefore evaluated the performance of trained teachers in screening primary school pupils for visual impairment

and common ocular abnormalities in Kaduna North Local Government Area.

METHODS

This was a cross-sectional analytic study conducted between September 2020 and February 2021 among primary school pupils in Kaduna North Local Government Area, Kaduna State, Nigeria. The study involved 352 pupils aged 5–15 years selected through multistage stratified sampling from eleven primary schools (two public and nine private schools).

Sample Size Calculation

Using the sample size formula for a sensitivity (or specificity) of more than one diagnostic test, the comparison in this design involved two alternative diagnostic tests (P_1 and P_2). [10] To calculate the sensitivity of two alternative diagnostic tasks H0: $P_1 = P_2$ versus H1: $P_1 \neq P_2$. The sample size needed to have 95% confidence and 80% power to detect a difference of 10% from a sensitivity of 70% (i.e. $P_1 = 0.70$, $P_2 = 80\%$ and $P^* = 0.75$) can be calculated by:

$$N = \frac{[Z_\alpha \sqrt{2xP^*(1-P^*)} + Z_\beta \sqrt{P_1(1-P_1)+P_2(1-P_2)}]^2}{(p_1 - p_2)^2}$$

Where:

N= minimum sample size

Z_α= probability of falsely rejecting a true null hypothesis (α) = 0.05, $Z_\alpha = 1.96$

Z_β= probability of failing to reject a false null hypothesis (β) = 0.80, $Z_\beta = 0.84$

P_1= expected proportion of test 1= sensitivity/specificity of 70% = 0.70

P_2= expected proportion of test 2= 80% power = 0.80

P*= average proportion of the two diagnostic tests= 0.75

$$N = \frac{[1.96 \times \sqrt{2} \times 0.75 \times 0.25 + 0.84 \times \sqrt{0.70x\,(1-0.70) + 0.80\,x(1-0.80)}]^2}{(0.70-0.80)^2}$$

N= 293 pupils

With 20% attrition rate, 20/100 x 293 = 58.6

Therefore, a total sample size of 352 was used for the study.

Teacher Selection and Training

Twenty-two teachers were selected by simple random sampling from the participating schools. The twenty-two (22) teachers recruited from the primary schools for the study had a one-week training on the use of Tumbling E-chart and Peek Acuity app by the principal investigator at LEA Badarawa 1. They were provided with the Peek Acuity app on Android devices and Tumbling E-charts for the study. A leaflet describing the study objectives and a consent form was given to each of the teachers. They had training on how to:

a) correctly measure distance visual acuity, apply the 227cclude, conduct visual acuity assessment with both Tumbling E-chart and Peek acuity, and record the visual acuity on the questionnaire.

b) Identify common external/visible eye abnormalities using images from a computer. Subsequently, the clinical signs such as redness, abnormal eye deviation, abnormal whitish reflex and discharge were demonstrated with primary school pupils at Badarawa LEA using a pen torch.

c) How to fill the referral forms. The teachers were trained to achieve substantial level of inter-rater reliability. A set of 5 school pupils at the training centre were used to establish the competence of the teachers in the training and the kappa score.[11] Following the completion of the training, the school teachers were assessed for the Peek acuity and Tumbling E-chart measurement while pairing them with the principal investigator (standard) in order to calculate the kappa score. The teachers identified pupils with vision impairment and or external eye abnormality out of the 5 pupils as depicted by the principal investigator. A Kappa coefficient was used to verify the presence of the themes that were presented.

The results were tabulated and interpreted as follows: values ≤ 0 as indicating no agreement, 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41– 0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement. A kappa score of >0.7 was considered significant for the level of competence in screening for vision impairment and/or external eye abnormality. Those teachers with a score <70% had to retake the test on the next training day.

Screening Procedure

The recommended guidelines of the World Health Organization were adhered to, minimising risk of transmission for COVID-19 using personal protective equipment such as the face shield, face mask and gloves.[12]

The study was conducted on the school premises and data recorded. Children with vision impairment and/or external eye abnormality were evaluated, treated and also refraction was done on-site, while those with ocular abnormalities that required specialist care were referred to National Eye Centre Kaduna for review and management.

Biodata

The pupil's identification number, date of examination, age, sex and class were recorded.

Visual Acuity Measurement

The teachers were randomly assigned into either Peek Acuity or Tumbling E-chart groups in each school via balloting. The teachers assessed the pupils independently during the break time. In Tumbling E-chart, the assessments were done outside the classroom on the corridor where ambient illumination was the best while the Peek Acuity test was done in the classroom with 100% maximum screen illumination and to reduce glare. The chart was taken close to the child and an explanation of optotypes was done before commencement of the test. Each child was given a unique identification (ID) number and had visual acuity test using Peek Acuity and Tumbling E-chart consecutively or the reverse. First half of the study pupils in each school had the Tumbling E-chart before Peek Acuity and the remaining half had Peek Acuity before Tumbling E-chart. However, the only study child at Taurari Trendsetters had Peek before the Tumbling E-chart by balloting. The unaided visual acuity of the pupils were recorded against their unique ID number in both groups by the school teachers.

Tumbling E-chart testing

Each child was asked to stand at 6 meters measured using a tape measure as a guide, then wear the trial frame adjusted to the child's inter-pupillary distance (IPD). One eye was measured at a time. The child was shown how to identify the direction of the optotypes at close range. An occluder was then placed into the trial frame to occlude the non-tested eye. The teacher stood beside the Tumbling E-chart; pointed to the 6/12 optotype and asked the child to identify the direction it was facing. Looking at the letter on a chart, the child points in the direction the letter was facing: up, down, left, or right. The child who could identify four of the five optotypes of the 6/12 was asked to proceed to the next line of 6/9 and 6/6. However, any child who failed to read the 6/12 line (could not identify four out of five optotypes), was asked to identify the 6/60 E optotype. If they failed to identify the 6/60 E optotype, the visual acuity was recorded as <6/60. Children who could not see 6/12 were referred to the PI for review and refraction. All children with an ocular abnormality were also referred for evaluation despite their level of visual acuity. The paper referral form was completed in triplicate: one copy given to the child, one copy to the head teacher, and one copy to the PI. The data was coded and recorded on Excel sheet and Stata MP for evaluation.

Peek Acuity testing

Each child was asked to stand at 2 metres using a tape measure as a guide; then wear the trial frame adjusted to the child's inter-pupillary distance (IPD). The teacher used the Peek Acuity vision screening app on a smartphone at 2m and each eye was tested separately, with the fellow eye covered with an occluder. A series of up to five Tumbling-E optotypes were presented randomly in one of four orientations. The child identified the direction he/she perceived the arms of the letter E to be pointing, and the teacher used the phone's touch screen to swipe in the same direction to enter the child's response without looking at the phone's screen. One optotype was presented at a time. The test was automatically concluded when the threshold number of passes (four of five) or fails (two of five) at the 6/12 optotype size was reached. If the child fails the 6/12 level, the app will automatically present a 6/60 sized optotype and the test will be repeated to determine whether or not 6/60 could be seen. The final visual acuity was displayed on the screen of the smartphone. Children who had a visual acuity worse than 6/12 in either eye or inter-ocular difference of more than two lines of visual acuity were referred to the PI. The paper referral form was completed in triplicate: one copy given to the child, one copy to the head teacher, and one copy to the PI. The data were coded and recorded on Excel sheet and Stata MP for evaluation.

Eye Examination and Refraction

After the visual acuity measurement, the teachers asked the child if he/she has itching and then used a pen torch to inspect the child's eye for redness, abnormal eye deviation, abnormal whitish reflex and discharge. All children with visual acuity worse than 6/12 or external ocular abnormality were referred to the principal investigator and research team.

The principal investigator and the research assistant examined the children on-site. External inspection, corneal light reflex test and pupil testing were done with a pen torch. Motility testing and undilated fundoscopy with a direct ophthalmoscope (Heine, Germany) was done for children with decrease in vision as prescribed in the WHO guidelines due to COVID-19 pandemic. Those with refractive error had an on-site cycloplegic refraction and dilated fundoscopic examination in their respective schools. Dilated fundoscopy was done with a direct ophthalmoscope (Heine, Germany) while cycloplegic refraction was done with 1% cyclopentolate drops instilled at 15-minute intervals over 1 hour. A streak retinoscope (Heine, Germany) was used for objective refraction and subsequently a subjective refraction was done with a trial lenses. Spectacles were issued within a week of screening.

At the end of VA testing by both methods, the children were asked which of the two tests they preferred, based on the ease of use and ease of the VA assessment.

As a service for the survey, other children in the school with ocular problems and not involved in the study were evaluated at a separate desk. Those with eye conditions were treated with medications such as topical

anti allergics, antibiotic drops etc and other conditions such as corneal scar, ptosis, cataract etc were appropriately referred.

Referral

Children with conditions such as cataract, ptosis, squint etc that warranted further evaluation were referred to the National Eye Centre Kaduna by the PI.

Data Analysis

Data were analysed using Stata MP version 14. Descriptive statistics were used to summarise screening outcomes. Agreement between visual acuity assessment methods was assessed using intraclass correlation and Cronbach's alpha.

RESULTS

A total of 352 pupils participated, with a mean age of 10.3 ± 2.2 years. Females constituted 54.6% of participants.

Table 1: Socio-demographic factors of primary schools' pupils

Socio-demographic characteristic	Frequency (%)
Age group in years	
1-5	2 (0.6)
6-10	180 (51.1)
11-15	170 (48.3)
Total	**352 (100.0)**
Sex	
Female	192 (54.6)
Male	160 (45.4)
Total	**352 (100.0)**
Class	
1	58 (16.5)
2	49 (13.9)
3	68 (19.3)
4	63 (17.9)
5	56 (15.9)
6	58 (16.5)
Total	**352 (100.0)**
Mean age 10.3 ± 2.2years Minimum =5 and maximum =15	

Visual Acuity Assessment by School Teachers

Seven hundred and four eyes of 352 pupils were examined sequentially with both Peek Acuity and Tumbling E-chart by the trained school teachers. Majority of the pupils had visual acuity of 6/6 (LogMAR, 0.0) or better using both methods. Eighteen pupils in the Peek Acuity group (2.6%) and fourteen pupils in the Tumbling E-chart group (2.0%) had vision worse than 6/12 (LogMAR 0.3) from the teachers' vision assessment (Table 2).

Table 2: Distribution of visual acuity done by primary school teachers

Visual Acuity	Peek Acuity Number of Eyes (%)	Tumbling E-chart Number of Eyes (%)
6/6 or better	617 (87.6)	628 (89.2)
6/7.5	44 (6.3)	0 (0.0)
6/9	12 (1.7)	40 (5.7)
6/12	13 (1.8)	22 (3.1)
6/15	3 (0.4)	0 (0.0)
6/18	4 (0.6)	6 (0.9)
6/24	2 (0.3)	3 (0.4)
6/36	1 (0.1)	1 (0.1)
6/48	2 (0.3)	0 (0.0)
<6/60	6 (0.9)	4 (0.6)
Total	**704 (100.0)**	**704 (100.0)**

About one-third of the students had other eye abnormalities (27.3%) while the majority were normal. Itching was more common in females (n=33) than males (n=26), while males had more cases of red eye. However, the difference in eye conditions between males and females was not statistically significant (Table 3).

Table 3: Spectrum of Eye conditions seen among the pupils by the teachers

Eye conditions noted by teachers	Sex		Total (%)	χ^2	p-value
	Female (%)	Male (%)			
None	143 (74.5)	113 (70.6)	256 (72.7)	5.79	0.22
Itching	33 (17.1)	26 (16.3)	59 (16.8)		
Red eye	5 (2.6)	11 (6.9)	16 (4.6)		
Abnormal whitish reflex	2 (1.0)	0 (0.0)	2 (0.6)		
Discharge	9 (4.9)	10 (6.3)	19 (5.4)		
Total	**192 (100.0)**	**160 (100.0)**	**352 (100.0)**		

Referrals

Among the 352 pupils screened by the school teachers for vision impairment and ocular conditions, 31.3% were referred for further review by the principal investigator (Table 4). The ratio of pupils referred to those not referred was 1:2.2, with an equal number of male and female (chi-square statistic with Yates correction=1.08, p= 0.30)

Table 4: Referral to the principal investigator by school teachers

	Sex				
Referral	**Female (%)**	**Male (%)**	**Total**	χ^2	**p-value**
Yes	55 (28.7)	55 (34.4)	110 (31.3)	1.33	0.25
No	137 (71.4)	105 (65.6)	242 (68.8)		
Total	**192 (100.0)**	**160 (100.0)**	**352 (100.0)**		

DISCUSSION

This study demonstrates that school teachers can be effectively trained to perform vision screening and identify common eye conditions among school children. Following a structured training programme, teachers successfully screened more than three hundred pupils and appropriately referred children requiring ophthalmic evaluation. This is similar to the findings of Aniemaka *et al.,* at Ebonyi Southeastern Nigeria where they demonstrated the effectiveness of school teachers in detecting ocular disorders among primary school pupils.[8]

The referral rate of 31.3% reflects the teachers' ability to identify both visual impairment and external ocular abnormalities. Importantly, subsequent ophthalmic examination confirmed several clinically significant conditions among referred pupils, supporting the validity of teacher-based screening.

The high level of agreement between visual acuity assessment methods suggests that teachers can reliably administer standardized vision screening tools as demonstrated by Rono *et al.,*[13,14] The findings are consistent with previous studies from Peru and Nigeria which reported acceptable screening performance by trained teachers.[15,16]

Teacher-led screening offers several advantages. It is cost-effective, sustainable, and can substantially expand screening coverage, particularly in areas with limited eye care personnel.[9,17] Teachers interact daily with children and can facilitate timely referral and follow-up.[9]

The study supports integration of teacher-led vision screening into routine school health programmes. Periodic retraining, supportive supervision, and linkage with eye care services are essential for sustaining programme effectiveness.

CONCLUSION

School teachers demonstrated good usability as vision screeners following structured training. They were able to assess visual acuity, identify common ocular abnormalities, and appropriately refer children for further evaluation. Teacher-led vision screening represents a practical and sustainable strategy for strengthening school eye health programmes and improving early detection of childhood visual impairment in resource-constrained settings.

REFERENCES

1. Eze UA, Obasuyi OC, Salihu DV, Bature M, Yeye-Agba OO, Kanmodi KK. Prevalence and Causes of Blindness and Visual Impairment Among Nigerian Children: A Systematic Review. OPTH. 2024 Feb; Volume 18:289–301. doi:10.2147/OPTH.S440744
2. Loulidi S, Loukid M, Boussaa S. Visual impairment and blindness among children: A literature review. Clinical Epidemiology and Global Health. 2025 Jul; 34:102094. doi: 10.1016/j.cegh.2025.102094
3. Loh L, Prem-Senthil M, Constable PA. A systematic review of the impact of childhood vision impairment on reading and literacy in education. Journal of Optometry. 2024 Apr;17(2):100495. doi: 10.1016/j.optom.2023.100495
4. Šemrov A, Tadić V, Cortina-Borja M, Rahi JS, on behalf of The Resilience and Childhood Visual Impairment Study Group. Individual, family, and environmental determinants of vision-related quality of life of children and young people with visual impairment. Little JA, editor. PLoS ONE.

2023 Nov 16;18(11): e0294532. doi: 10.1371/journal.pone.0294532

5. Cheng Y, Wang S, Pavlopoulou G, Hayton J, Sideropoulos V. Mental Health and Quality of Life in Children and Young People with Vision Impairment: A Systematic Review. Neurodiversity. 2025 May; 3:27546330251346835. doi:10.1177/27546330251346835
6. Anokye GO, Price-Sanchez C, Yong AC, Ali M, Tate C, Graham R, *et al.,* School-based eye health interventions for improving eye care and spectacles compliance in children in low- and middle-income countries: A scoping review. AJO International. 2025 Jul;2(2):100126. doi: 10.1016/j.ajoint.2025.100126
7. Graham R. Facing the crisis in human resources for eye health in sub-Saharan Africa. Community Eye Health. 2017;30(100):85–7. PubMed PMID: 29483753; PubMed Central PMCID: PMC5820633.
8. Aniemeka DI, Ezeanosike E, Ogbonnaya CE, Chuka-Okosa CM, Adeke AS, Onyebuchi AN, *et al.,* Effectiveness of Teachers in The Detection of Eye Disorders Among Primary School Children in Abakaliki Metropolis, Ebonyi State Nigeria. Ann Ib Postgrad Med. 2023 Dec;21(3):20–6. PubMed PMID: 38706626; PubMed Central PMCID: PMC11065192.
9. Little JA, Chan VF, Saw SM, Tham YC, Chew L, Foo LL, *et al.,* Current status of school vision screening—rationale, models, impact and challenges: a review. Br J Ophthalmol. 2025 Nov;109(11):1207–14. doi:10.1136/bjo-2024-326726
10. Bolarinwa O. Sample size estimation for health and social science researchers: The principles and considerations for different study designs. Niger Postgrad Med J. 2020;27(2):67. doi: 10.4103/npmj.npmj_19_20
11. Anthony J. Viera, Joanne M. Garrett. Understanding Interobserver Agreement: The Kappa Statistic. Family Medicine. 2005;37(5):360–3.
12. Dunn K, Hamilton Hurwitz H, Toledo JP, Schwaber MJ, Chu M, Chou R, *et al.,* Summary of WHO infection prevention and control guideline for covid-19: striving for evidence-based practice in infection prevention and control. BMJ. 2024 May 23; q645. doi:10.1136/bmj. q645
13. Rono HK, Bastawrous A, Macleod D, Wanjala E, Di Tanna GL, Weiss HA, *et al.,* Smartphone-based screening for visual impairment in Kenyan school children: a cluster randomised controlled trial. The Lancet Global Health. 2018 Aug;6(8): e924–32. doi:10.1016/S2214-109X(18)30244-4
14. Bhaskaran A, Babu M, Abhilash B, Sudhakar NA, Dixitha V. Comparison of smartphone application-based visual acuity with traditional visual acuity chart for use in tele-ophthalmology. Taiwan Journal of Ophthalmology. 2022 Apr;12(2):155–63. doi: 10.4103/tjo.tjo_7_22
15. Adhisesha Reddy P, Bassett K. Visual acuity screening in schools: A systematic review of alternate screening methods. Schumacher U, editor. Cogent Medicine. 2017 Jan;4(1):1371103. doi:10.1080/2331205X.2017.1371103
16. Aritonang C, Putri SA, Utomo B. The effectiveness of using peek acuity in vision screening for the admission of elementary school students. Bali Med J. 2022 Jul 31;11(2):671–5. doi:10.15562/bmj. v11i2.3445
17. Govender-Poonsamy P, Mashige KP, Bhawanibik A, Maphanga NA, Mngadi N, Neno S, *et al.,* Validating teachers for Visual Acuity Screening in rural South African schools. African Vision and Eye Health. 2025 Mar 18;84(1): a906. doi:10.4102/aveh. v84i1.906