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School-Based Screening of Reduced Visual Acuity among Early Grade Children: Implications for Inclusive Education

Salma Mlilima, Huruma Olofea, Baraka Kondo*

The University of Dodoma, Tanzania

Correspondence: E-mail: mlilimasalma@gmail.com

ABSTRACT

Reduced visual acuity is a learning-related health concern that may limit children's participation in classroom activities, especially during the early grades when reading, writing, and visual engagement are developing. This study examined the prevalence of reduced visual acuity among Standard Three pupils in a public primary school in Dodoma, Tanzania. A quantitative school-based screening design was used. A total of 200 pupils were screened using the LEA Symbols Chart under standardized testing conditions. Visual acuity worse than 6/12 was classified as reduced visual acuity. The findings showed that 35 pupils had reduced visual acuity, indicating that a considerable proportion of early grade learners may experience vision-related barriers to learning. Most affected pupils had bilateral impairment, and most cases were mild or moderate. The study highlights the need for routine school-based vision screening, referral systems, teacher awareness, and access to corrective interventions to support inclusive and effective early grade education.

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1. INTRODUCTION

Reduced visual acuity among school-age children is commonly associated with uncorrected refractive errors and other visual problems. Globally, childhood visual impairment remains a significant concern because many cases are preventable or correctable when detected early. Visual impairment affects millions of children worldwide, and uncorrected refractive errors remain one of the major causes of reduced vision. If visual problems are not identified during the early years of schooling, children may continue learning under unfavorable conditions, which may contribute to poor reading development and reduced classroom performance. The connection between visual acuity and learning is particularly important in early primary education. Early-grade pupils are still developing foundational literacy skills, and visual limitations may interfere with their ability to recognize letters, words, numbers, and classroom materials. Visual acuity can influence early literacy development and children's learning performance (Bruce et al., 2016). For this reason, school-based vision screening is an important strategy for identifying children who may need further eye examination, referral, or corrective support.

Evidence from high-income countries shows that systematic school-based vision screening can reduce the burden of undetected visual problems among children. In Norway, school vision screening helped identify children with visual difficulties and supported referral for further assessment (Falkenberg et al., 2019). In Singapore, school-based interventions were used to address childhood myopia and reduce visual problems among school children (Karupiah et al., 2021). Similarly, recent reviews have emphasized that school vision screening can contribute to early detection, timely intervention, and improved educational participation when supported by effective referral systems and access to eye care services (Little et al., 2025).

In many low- and middle-income countries, however, visual health problems among children may remain undetected because routine school screening is limited. Studies from Asian and African contexts have reported varying levels of visual impairment among school children. In China, visual impairment among school-aged children increased over time, showing the growing importance of monitoring children's vision in educational settings (Jan et al., 2019). In Malaysia, reduced uncorrected distance visual acuity was reported among school children, indicating that visual problems remain a concern even where school populations are relatively accessible (Ismail and Sukumaran, 2022). School-based screening is important for identifying hidden visual barriers to learning.

In sub-Saharan Africa, studies also show that reduced visual acuity and refractive errors affect a considerable proportion of school-age children. Research in Ethiopia reported visual acuity impairment among primary school children, with refractive errors identified as an important cause (Darge et al., 2017). In Nigeria, visual impairment among school-aged children was also linked to uncorrected refractive errors and other preventable causes (Ekpenyong et al., 2020). In Ghana and other African contexts, refractive errors among school children have been documented as a continuing public health and educational concern (Ovenseri-Ogbomo et al., 2022). However, many African studies focus on broad school-age populations, while fewer studies specifically examine early-grade pupils whose literacy development depends heavily on visual functioning.

In East Africa, available evidence confirms the need for stronger school eye health programs. In Kenya, smartphone-based screening identified visual impairment among school

children and demonstrated the usefulness of school-based approaches in detecting vision problems (Rono et al., 2018). In Uganda, visual impairment among children attending an eye clinic was associated with different causes, including refractive errors (Kinengyere et al., 2017). Although these studies provide valuable evidence, more localized data are still needed, especially for younger pupils in early primary grades.

In Tanzania, reduced visual acuity among school children has been reported in different regions. Previous studies found reduced visual acuity or refractive error among primary school children in areas (Kingo and Ndawi, 2018; Mafwiri et al., 2017; Mashayo et al., 2015). Vision problems among Tanzanian school children are not isolated cases. However, evidence remains limited for early-grade learners in Dodoma, particularly those in Standard Three, a stage when children are expected to strengthen reading, writing, and visual learning skills. Without reliable local data, schools and education authorities may find it difficult to plan screening, referral, classroom support, and corrective interventions.

Reduced visual acuity is also relevant to inclusive education. Inclusive education requires that learners with different needs be identified and supported. Thus, they can participate meaningfully in learning activities. Children with uncorrected visual problems may not always be formally recognized as learners requiring support, yet they may face barriers similar to other children with learning-related difficulties. If these barriers are not addressed, affected pupils may struggle silently in the classroom. Integrating vision screening into school health and inclusive education programs can help identify pupils who need support and reduce avoidable learning disadvantages.

This study examined the prevalence of reduced visual acuity among Standard Three pupils in a public primary school in Dodoma, Tanzania. Specifically, it assessed the overall prevalence of reduced visual acuity, described its distribution by sex and age, examined laterality and severity among affected pupils, and discussed the implications for inclusive early-grade education. The study aimed to provide school-based evidence that can support routine vision screening, referral systems, teacher awareness, and access to corrective interventions for young learners.

2. METHODS

This study used a quantitative school-based screening design to assess the prevalence of reduced visual acuity among early-grade pupils in Dodoma, Tanzania. A quantitative approach was appropriate because the study aimed to measure the proportion of pupils with reduced visual acuity using standardized numerical indicators. A cross-sectional descriptive design was applied because visual acuity was assessed at one point in time among pupils in a defined school population. This design is commonly used in prevalence studies because it allows researchers to describe the magnitude of a health-related condition within a specific group (Setia, 2016).

The study was conducted in a public primary school in Dodoma, Tanzania. Dodoma was selected because it is an important educational and administrative center, and previous studies in Tanzania have reported reduced visual acuity and refractive errors among school children in different regions (Kingo and Ndawi, 2018; Mafwiri et al., 2017; Mashayo et al., 2015). The target population consisted of Standard Three pupils because this level represents an important stage in early-grade learning, where children increasingly depend on reading, writing, copying from the board, and interpreting visual materials. Visual functioning is

therefore important for academic participation and foundational literacy development (Bruce et al., 2016; Snow and Matthews, 2016).

A multistage sampling procedure was used to select the study site. From public primary schools in Dodoma, schools with appropriate classroom lighting conditions were first identified. Schools with larger Standard Three enrolment were then considered to support reliable prevalence estimation. One school was selected using simple random sampling. All 200 Standard Three pupils who were present during the screening period were included in the study. Including all eligible pupils helped reduce sampling error and ensured that every child in the selected class level had an opportunity to participate in the screening.

Data were collected through structured visual acuity screening. The LEA Symbols Chart was used because it is a standardized and child-friendly tool for assessing visual acuity among young learners, including children who may not yet be fully confident with letters or numbers (Hamm et al., 2020). Each pupil was screened individually under controlled lighting conditions. Visual acuity was assessed using standardized testing procedures, and pupils were asked to identify symbols on the chart. Visual acuity worse than 6/12 was classified as reduced visual acuity, following the screening threshold used in the study.

The data collected included visual acuity status, sex, age, laterality of impairment, and severity category. Pupils were classified as having normal visual acuity or reduced visual acuity. Among pupils with reduced visual acuity, cases were further described as unilateral or bilateral and categorized according to severity level. These classifications allowed the study to describe not only the overall prevalence but also the distribution of visual acuity problems across demographic and clinical characteristics.

Data were analyzed using descriptive statistics. Frequencies and percentages were computed to determine the overall prevalence of reduced visual acuity among the pupils. Cross-tabulations were used to describe the distribution of reduced visual acuity by sex, age, laterality, and severity. The results were presented in tables to provide a clear summary of the screening findings.

Validity was supported by the use of a standardized visual acuity screening tool and consistent screening procedures. Reliability was strengthened by applying the same testing distance, lighting conditions, and screening instructions for all pupils. A pre-test was conducted in a similar school setting, and repeated measurements were performed for a selected subsample to check consistency.

Ethical procedures were observed throughout the study. Ethical clearance was obtained from the University of Dodoma Research Ethics Committee. Permission was also obtained from the relevant local education authorities and the selected school. Pupils and their guardians were informed about the purpose and procedures of the screening, and participation was voluntary. Confidentiality was maintained by anonymizing pupils' information and using the data only for academic and research purposes.

3. RESULTS AND DISCUSSION

The overall prevalence of reduced visual acuity among the screened pupils is presented in **Table 1**. A total of 200 Standard Three pupils participated in the screening. Pupils with visual acuity worse than 6/12 were classified as having reduced visual acuity. 35 out of 200 pupils had reduced visual acuity, giving an overall prevalence of 17.5%. Nearly one in six Standard Three pupils in the screened group experienced visual acuity below the expected threshold

for normal classroom functioning. This finding is important because early-grade learning depends heavily on visual tasks such as reading, writing, copying from the board, identifying symbols, and following visual instructions.

Table 1. Prevalence of reduced visual acuity among Standard Three pupils.

VISUAL ACUITY CATEGORY	FREQUENCY (N)	OVERALL (%)	BOYS N (%)	GIRLS N (%)
Normal visual acuity ($\geq 6/12$)	165	82.5	73 (79.3)	92 (85.2)
Reduced visual acuity ($< 6/12$)	35	17.5	19 (20.7)	16 (14.8)
Total	200	100.0	92 (100.0)	108 (100.0)

The prevalence found in this study suggests that reduced visual acuity may be a hidden learning barrier among early-grade pupils. Children with uncorrected visual problems may struggle to access classroom materials, but their difficulties may be misinterpreted as poor attention, low motivation, or weak academic ability. Visual acuity can influence early literacy and classroom learning, especially when children are developing foundational reading skills (Bruce et al., 2016). Therefore, the finding highlights the need to treat vision screening as part of inclusive education and school health support.

The sex distribution of normal and reduced visual acuity is presented in **Table 2**. This table shows how visual acuity status differed between boys and girls. 19 boys and 16 girls had reduced visual acuity. Boys accounted for a slightly higher proportion of affected pupils than girls. Although the difference was not large, it suggests the need to observe possible sex-related patterns in visual health among early-grade learners. Some previous studies have reported sex differences in childhood refractive errors, but findings across contexts are not always consistent because visual acuity may be influenced by biological, behavioral, environmental, and educational factors (Mahzabeen et al., 2023; Morgan et al., 2018).

Table 2. Distribution of normal and reduced visual acuity by sex.

SEX	NORMAL VA	PERCENT	REDUCED VA	PERCENT	TOTAL	PERCENT
Boys	73	36.5	19	9.5	92	46.0
Girls	92	46.0	16	8.0	108	54.0
Total	165	82.5	35	17.5	200	100.0

The characteristics of pupils with reduced visual acuity are presented in **Table 3**. This table focuses only on the 35 pupils identified with reduced visual acuity and describes their distribution by sex and age. Males represented 54.3% of the pupils with reduced visual acuity, while females represented 45.7%. In terms of age, eight-year-old pupils formed the largest proportion of affected pupils, accounting for 42.9% of the reduced visual acuity subgroup. Pupils aged nine and ten years accounted for 31.4 and 25.7%, respectively.

Table 3. Characteristics of the subgroup with reduced visual acuity.

CHARACTERISTIC	CATEGORY	FREQUENCY (N)	PERCENT (%)
Sex	Male	19	54.3
	Female	16	45.7
Age (years)	8	15	42.9
	9	11	31.4
	10	9	25.7
Total		35	100.0

The higher proportion among eight-year-olds is educationally important because this age group is usually in a critical stage of early literacy development. At this level, pupils are expected to move from basic recognition of letters and words toward more independent reading and classroom participation. Undetected visual problems may therefore affect reading fluency, writing accuracy, attention, and participation in visual learning tasks. Previous studies have emphasized that early-grade reading and language development depend strongly on children’s ability to access visual learning materials effectively (Snow and Matthews, 2016).

The laterality of reduced visual acuity among affected pupils is presented in **Table 4**. This table shows whether visual impairment affected one eye or both eyes. Most affected pupils had bilateral reduced visual acuity. A total of 28 pupils, or 80.0% of the reduced visual acuity subgroup, had reduced visual acuity in both eyes. Only 7 pupils, or 20.0%, had unilateral reduced visual acuity. This finding is important because bilateral impairment is more likely to affect classroom functioning than impairment in one eye only. Pupils with bilateral reduced visual acuity may have greater difficulty reading text, seeing the board, identifying visual details, and participating in visually guided learning activities.

Table 4. Laterality of reduced visual acuity among affected pupils.

LATERALITY	TOTAL N (%)	BOYS N (%)	GIRLS N (%)
Bilateral (both eyes)	28 (80.0)	16 (84.2)	12 (75.0)
Unilateral (one eye)	7 (20.0)	3 (15.8)	4 (25.0)
Total	35 (100.0)	19 (100.0)	16 (100.0)

The high proportion of bilateral cases supports the need for systematic screening rather than relying only on teacher observation. Children with bilateral visual problems may adapt to blurred vision and may not complain, especially if they assume that their vision is normal. School-based screening can therefore identify pupils who may otherwise remain unnoticed. Evidence from school vision screening studies shows that structured screening can support early detection and referral, particularly where access to eye care services is limited (Falkenberg et al., 2019; Little et al., 2025; Rono et al., 2018).

The severity of reduced visual acuity among affected pupils is presented in **Table 5**. This table classifies the 35 affected pupils into mild, moderate, severe visual impairment, and blindness categories. Most affected pupils had mild or moderate reduced visual acuity. Mild visual impairment was the most common category, affecting 21 pupils, while 12 pupils had moderate visual impairment. Only two pupils had severe visual impairment, and no cases of blindness were identified. Most cases detected in this study may be manageable if pupils receive timely referral, further eye examination, and corrective intervention where needed.

Table 5. Severity of reduced visual acuity among affected pupils.

SEVERITY CATEGORY	VISUAL ACUITY (BETTER EYE)	FREQUENCY (N)	PERCENT (%)	CUMULATIVE PERCENT
Mild visual impairment	<6/12 to 6/18	21	60.0	60.0
Moderate visual impairment	<6/18 to 6/60	12	34.3	94.3
Severe visual impairment	<6/60 to 3/60	2	5.7	100.0
Blindness	<3/60	0	0.0	
Total		35	100.0	

The predominance of mild and moderate impairment has important implications for school health and inclusive education. Mild and moderate visual problems may not always be obvious to teachers or parents, yet they can still interfere with learning. These pupils may be able to move around normally but still experience difficulty seeing print, board work, or visual learning materials. Because many cases are likely to be correctable, school-based screening and referral systems can play an important role in preventing avoidable learning disadvantages.

The distribution of study participants and visual acuity by age and sex is presented in **Table 6**. This table provides a detailed breakdown of normal and reduced visual acuity across age and sex groups. Eight-year-old pupils formed the largest age group in the sample and also contributed the highest number of reduced visual acuity cases. However, reduced visual acuity was present across all age groups. Ten-year-old boys contributed a noticeable number of cases, while both boys and girls aged nine years contributed equal numbers of reduced visual acuity cases. This indicates that vision screening should not be limited to one age subgroup but should be routinely implemented across early primary grades.

Table 6. Distribution of study participants and visual acuity by age and sex.

AGE GROUP	SEX	NORMAL VA N (% OF TOTAL)	REDUCED VA N (% OF TOTAL)	TOTAL N (% OF TOTAL)
8 years	Boys	28 (14.0)	7 (3.5)	35 (17.5)
	Girls	40 (20.0)	8 (4.0)	48 (24.0)
	Subtotal	68 (34.0)	15 (7.5)	83 (41.5)
9 years	Boys	25 (12.5)	4 (2.0)	29 (14.5)
	Girls	32 (16.0)	4 (2.0)	36 (18.0)
	Subtotal	57 (28.5)	8 (4.0)	65 (32.5)
10 years	Boys	20 (10.0)	8 (4.0)	28 (14.0)
	Girls	20 (10.0)	4 (2.0)	24 (12.0)
	Subtotal	40 (20.0)	12 (6.0)	52 (26.0)
Total		165 (82.5)	35 (17.5)	200 (100.0)

The prevalence of 17.5% found in this study is higher than some earlier findings from Tanzania. Studies in Kibaha and Kahama reported lower levels of reduced visual acuity or refractive error among school children, while research in Mbarali also documented visual impairment among children in Tanzania (Kingo and Ndawi, 2018; Mafwiri et al., 2017; Mashayo et al., 2015). The higher prevalence in the present study may be related to differences in screening tools, age group, school environment, classroom conditions, or local access to eye care services. It may also reflect the value of using a standardized and child-friendly screening tool such as the LEA Symbols Chart. When compared with findings from other African contexts, the prevalence in this study also appears relatively high. Studies in Ethiopia and Nigeria reported lower prevalence rates of visual acuity impairment among school-aged children, while a systematic review and meta-analysis documented refractive errors among African school children more broadly (Darge et al., 2017; Ekpenyong et al., 2020; Ovenseri-Ogbomo et al., 2022). However, direct comparison should be made cautiously because studies differ in age range, screening method, definition of reduced visual acuity, school setting, and access to follow-up eye care. The findings also differ from evidence in high-income settings where school vision screening and referral systems are more established. Studies from Norway, Singapore, and the United Kingdom have shown that systematic

screening, early referral, and access to corrective services can reduce the burden of unaddressed visual problems among school children (Falkenberg et al., 2019; Karuppiah et al., 2021; Little et al., 2025). This comparison suggests that the higher prevalence observed in the present study may reflect gaps in routine screening and corrective support in school settings. From an inclusive education perspective, reduced visual acuity should be treated as a barrier that can limit participation if it is not identified and addressed. Pupils with reduced visual acuity may have difficulty seeing text, copying notes, reading classroom materials, and engaging with visual instruction. These difficulties can affect academic confidence, participation, and learning outcomes. Since many affected pupils in this study had mild or moderate impairment, timely screening and referral could help reduce avoidable educational disadvantages.

The findings support the need to integrate vision screening into school health and inclusive education programs. Teachers should be trained to recognize possible signs of visual difficulty, such as squinting, sitting very close to the board, copying errors, frequent eye rubbing, or avoidance of reading tasks. Schools should also establish referral pathways to eye care professionals and support parents in accessing corrective interventions such as spectacles where needed. Such measures can help ensure that children with vision-related learning barriers are identified early and supported appropriately.

Reduced visual acuity among Standard Three pupils in Dodoma City is both a health issue and an educational equity concern. The prevalence, laterality, and severity patterns indicate that routine school-based vision screening is necessary for early detection. Integrating vision care into early-grade education can strengthen inclusive learning, improve classroom participation, and support equitable educational outcomes for pupils with visual difficulties.

4. CONCLUSION

Reduced visual acuity is a significant learning-related health concern among Standard Three pupils in Dodoma, Tanzania. 17.5% of the pupils had reduced visual acuity, indicating that nearly one in six early-grade learners may experience vision-related barriers that affect classroom participation, reading, writing, and access to instructional materials. Most affected pupils had bilateral reduced visual acuity, and most cases were classified as mild or moderate. Many visual problems among early-grade pupils may remain unnoticed unless routine school-based screening is conducted. Since mild and moderate impairments can still affect learning, early detection, referral, and corrective support are important for strengthening inclusive education. The study highlights the need to integrate vision screening into school health and early-grade education programs. Schools should strengthen referral systems, improve teacher awareness of visual learning difficulties, and support access to corrective interventions such as spectacles. Future studies may include more schools, compare rural and urban settings, and examine how corrected vision affects literacy development and classroom participation.

5. AUTHORS' NOTE

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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