Research Article

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A Comparative Study of High Myopia in Private and Public Schools in Anambra State, Nigeria

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ABSTRACT

High myopia is a major cause of visual impairment worldwide, with increasing prevalence linked to environmental and educational factors. This study compared the prevalence of high myopia among students in private and public secondary schools in Anambra State, Nigeria. A cross-sectional comparative study was conducted among 2,045 students aged 10–18 years (1,018 public and 1,027 private school students). Visual acuity was measured with Snellen charts, and cycloplegic autorefraction determined refractive errors. High myopia was defined as spherical equivalent ≤ −6.00 diopters. Data were analyzed with SPSS version 26; p < 0.05 was significant. High myopia prevalence was 3.93% (40/1,018) in public schools and 5.06% (52/1,027) in private schools (p = 0.00008). Mild myopia (−0.25 to < −1.25 D) was more common in private schools (61.05%) than public schools (35.85%). Public school students had a higher percentage of low myopia and emmetropia. Females represented 54.17% and 67.58% of public and private school samples, respectively. Mean age was similar: 11.76 years (public) and 11.93 years (private). Private school students reported 5 hours/week of indoor near work versus 0.5 hours/week in public schools, while outdoor activity was 1 hour/week and 5 hours/week, respectively. Private school students exhibited a significantly higher prevalence of high myopia, likely related to increase near work and reduced outdoor time. These findings highlight the need for targeted interventions such as vision screening and myopia control programs in private schools to prevent progression and ocular complications.

***Keywords:** High Myopia, Refractive Error, Private vs. Public Schools, Anambra State (Nigeria), Vision Screening.*

Introduction

Myopia is one of the most common refractive errors globally and a major cause of visual impairment among school-aged children. It is characterised by a refractive state in which parallel rays of light from infinity are focused in front of the retina when accommodation is at rest, often due to excessive axial elongation of the eyeball [1]. While mild and moderate myopia can be corrected effectively with spectacles or contact lenses, high myopia—commonly defined as a refractive error of −6.00 dioptres or more—presents a greater risk for sight-threatening complications such as retinal detachment, myopic maculopathy, and glaucoma [2,3].

The prevalence of myopia has been increasing dramatically worldwide over the last few decades, prompting the World Health Organization (WHO) to recognise it as a significant public health issue [4]. It is estimated that by 2050, nearly half of the global population will be myopic, with 10% developing high myopia [5]. This rapid rise has been attributed to both genetic predisposition and environmental factors, particularly those related to lifestyle and educational demands [6].

School-based studies have shown varying prevalence rates of myopia between different school settings. In urbanised and economically advantaged environments, particularly private schools, children may be exposed to more intensive academic schedules, prolonged near work, and less outdoor activity, all of which are strongly associated with the development and progression of myopia [7,8]. In contrast, public schools, especially in semi-urban or rural areas, may have lower academic load and more opportunities for outdoor play, potentially resulting in lower rates of myopia, although exceptions exist depending on regional factors [9].

In Nigeria, population-based and school-based refractive error surveys have consistently demonstrated that myopia is a leading cause of correctable visual impairment in children [10,11]. Studies conducted in various states—including Lagos, Enugu, and Anambra—have reported prevalence rates of myopia ranging from 2% to over 10%, depending on the age group studied and the definitions used [12–14]. However, data specifically comparing high myopia prevalence between private and public school students remain scarce. This gap in knowledge is significant, as identifying differences in prevalence could guide targeted screening and prevention strategies.

High myopia in childhood poses long-term risks that extend into adulthood. Apart from refractive challenges, high myopia increases the lifetime risk of developing retinal degeneration, posterior staphyloma, and myopic choroidal neovascularisation [15,16]. The structural changes associated with high myopia are largely irreversible, making early detection and intervention critical. School-based vision screening programs, particularly in high-risk settings, are essential to mitigating these risks.

Anambra State, located in southeastern Nigeria, has a diverse mix of urban, semi-urban, and rural communities, with a robust network of public and private schools. Socioeconomic disparities between students in private and public schools can influence health outcomes, including vision health. Private school students often come from higher-income households with greater access to digital devices and more academically demanding curricula, while public school students may engage in more outdoor activities due to differences in lifestyle and school environment [17]. These differences make Anambra State an ideal location to study potential variations in high myopia prevalence between the two educational settings.

Previous research in East and Southeast Asia has demonstrated markedly higher myopia rates among urban, high-income children compared to their rural counterparts, largely due to differences in near work exposure and time spent outdoors [18,19]. Applying similar reasoning to the Nigerian context, it is plausible that private school students in Anambra State may exhibit a higher prevalence of high myopia compared to public school students. However, no published study has yet confirmed this assumption in the region, necessitating a comparative investigation.

The present study aims to fill this gap by comparing the prevalence of high myopia among students in private and public schools in Anambra State, Nigeria. By identifying potential differences, the findings could inform policymakers, eye health practitioners, and educators about where to focus vision screening and preventive interventions. The results may also contribute to broader discussions on the role of educational environments in the development of high myopia in African school-aged populations.

Methodology

Study Area

The study was conducted in Anambra State, located in the southeastern region of Nigeria. The state is made up of 21 local government areas and has both urban and rural settings, with a mix of public and private educational institutions. The schools were selected from Awka, Onitsha, and Nnewi, which are the major urban centers in the state. These locations were chosen because of their dense population, accessibility, and high number of both public and private schools [20].

Study Design

A descriptive, cross-sectional, comparative study design was employed to investigate the prevalence of high myopia among students in public and private secondary schools in Anambra State. This design was appropriate because it allowed for the collection of data from different participants at a single point in time to compare the prevalence and distribution of high myopia between the two school types [21].

Study Population

The study population consisted of secondary school students aged 10–18 years enrolled in both private and public schools within the selected study areas. The inclusion criteria were students who had attended the school for at least one academic session and gave informed consent through their parents or guardians. Students with ocular pathology other than refractive error, a history of ocular trauma, or prior ocular surgery were excluded from the study [22].

Sample Size Determination

The sample size was calculated using the formula for prevalence studies

$$n = \frac{Z^2.p(1-p)}{d^2}$$

Where:
n = required sample size
Z = standard normal deviation at 95% confidence interval (1.96)
p = estimated prevalence from a previous Nigerian study (10%) [12]
d = desired precision (5%).

Sampling Technique

A multistage sampling technique was used. In the first stage, three urban centers (Awka, Onitsha, and Nnewi) were purposively selected. In the second stage, two public and two private schools were randomly selected from each location using a simple random sampling method. In the final stage, students were selected proportionally from each class using systematic random sampling based on the school's enrollment list [24].

Data Collection Instruments and Procedure

A structured questionnaire was used to obtain demographic information and relevant ocular history. The ocular examination included:

1. Visual Acuity Assessment: Distance visual acuity was measured monocularly using an illuminated Snellen chart placed at 6 meters in a well-lit room [25].
2. Refraction: Students with uncorrected visual acuity worse than 6/6 underwent objective refraction using a retinoscope,

followed by subjective refinement [26].

3. Cycloplegia: Cycloplegic refraction was performed using cyclopentolate 1% to ensure accurate measurement, especially for latent hyperopia and pseudomyopia [27].
4. Ophthalmoscopy: Direct ophthalmoscopy was performed to examine the posterior segment and rule out any pathological cause of reduced vision [28].

Definition of High Myopia

High myopia was defined as a spherical equivalent refractive error of –6.00 diopters or more in either eye, based on the International Myopia Institute classification [29].

Data Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics (mean, standard deviation, and percentages) were used to summarize the data. Chi-square test was used to compare the prevalence of high myopia between public and private school students, while t-test was used for continuous variables. A p-value less than 0.05 was considered statistically significant [30].

Table 1: School children demographic characteristics.

Number of school children	Public	Private
N%	**n(%)**	**n(%)**
Male	466(45.73)	333(32.42)
Female	552(54.17)	694(67.58)
Total	1018	1027
Mean Age of School Children (Years)		
Male	11.96557971	12.28818444
Female	11.52145923	11.18318318
Mean Age (Ẋ)	11.76227898	11.92989289
Game Hours in a Week (hrs)		
Indoor	1/2 hour/ week	5 hours/week
Outdoor	5 hours/week	1 hour/week

A total of 2,045 pupils participated in the study, with nearly equal representation from both school categories. Females predominated in private schools (67.58%) compared to public schools (54.17%), whereas males were proportionally more in public schools (45.73%) than in private schools (32.42%). The mean age of pupils in public schools was slightly lower (11.76 years) than in private schools (11.93 years). Among males, the mean age was higher in private schools (12.29 years) than in public schools (11.97 years), while among females, the reverse trend was observed. Recreational activity patterns differed markedly between groups: public school children reported more outdoor play (5 hours/week) and less indoor activity (0.5 hour/week), whereas private school children engaged predominantly in indoor games (5 hours/week) with minimal outdoor play (1 hour/week).

Table 2: Frequency distribution of myopia in public and private school children.

Refractive Error	Public	Private
(D)	**n(%)**	**n(%)**
-0.25 -< -1.25	365(35.85)	627(61.05)
-1.25 -< -2.25	295(28.98)	157(15.29)
-2.25 -< -3.25	168(16.50)	91(8.86)
-3.25 -< -4.25	88(8.64)	60(5.84)
-4.25 -< -5.25	51(5.01)	19(1.85)
-5.25 -< -6.00	11(1.08)	21(2.04)
≥ -6.00	40(3.93)	52(5.06)
Total	1018	1027
P-Value		0.00008104

Mild myopia was more prevalent among private school pupils, whereas moderate to moderately high myopia occurred more frequently in public school pupils. The proportion of severe myopia (≥ -6.00 D) was slightly higher in private schools. Overall, the distribution of myopia severity differed significantly between the two school categories, with the difference being statistically significant ($p < 0.001$).

Table 3: Frequency distribution of aniso difference in school children.

Aniso Difference	Public	Private
(D)	**n(%)**	**n(%)**
< -0.25	113(11.10)	437(42.93)
-0.25 -< -1.25	87(8.55)	39(3.51)
-1.25 -< -2.25	23(2.26	23(2.24)
-2.25 -< -3.25	10(0.98)	0(0.00)
-3.25 -< -4.25	3(0.29)	1(0.09)
-4.25 -< -5.25	0(0.00)	0(0.00)
-5.25 -< -6.25	1(0.09)	0(0.00)
≥ -6.25	0(0.00)	0(0.00)
P-Value		0.008119353

Most pupils in private schools had very low or negligible anisometropic differences, whereas public school pupils showed a comparatively higher proportion of moderate anisometropia. High levels of anisometropia (≥ 2.25 D) were rare in both groups, with extreme cases being almost absent. The observed difference in the distribution of anisometropia between public and private school pupils was statistically significant ($p < 0.01$).

Table 4: Frequency distribution of BCVA in school children.

BCVA	BCVA	Public	Private
(Logmar)	(Snellen)	n(%)	n(%)
>0.8	> 6/38	1(0.09)	5(0.48)
0.8 - < 0.6	6/38 - < 6/24	0(0.00)	7(0.68)
0.6 -< 0.3	6/24 - < 6/12	2(0.19)	58(5.65)
0.3 -< 0.2	6/12 - < 6/9	35(3.43)	231(22.49)
0.2 -> 0.00	6/9 - > 6/6	151(14.82)	163(15.87)
<0.00	< 6/6	829(81.35)	563(54.82)
p-value			0.56709

The majority of pupils in both school types achieved good vision, with most recording BCVA better than 6/6 (<0.00 logMAR) or within the normal range (0.2 to >0.00 logMAR). This was more frequent in public schools, where over four-fifths of pupils had better-than-normal BCVA, compared to just over half in private schools. Private school pupils showed a higher proportion of mild visual reduction (0.6 to <0.3 logMAR), while moderate impairment (0.8 to <0.6 logMAR) occurred only in private schools. Poor vision (>0.8 logMAR) was rare in both groups. Although variations in BCVA distribution were observed—such as the greater prevalence of near-normal BCVA in private schools and better-than-normal BCVA in public schools—these differences were not statistically significant (p = 0.567). The findings suggest that severe vision loss is uncommon among pupils, but mild to moderate reductions, particularly in private schools, warrant continued vision screening and timely refractive correction to maintain optimal visual function.

Table 5: Age distribution of BCVA in school children.

Age	Public				Private			
(years)	n	Ẋ(VA)	σ(VA)	p-value	N	Ẋ(VA)	σ(VA)	p-value
< 5	3	0.03	0.15	0.00	1	-0.10	0.00	0.00
5 -< 8	117	0.01	0.11	0.00	177	0.08	0.22	0.00
8 -< 11	231	0.02	0.11	0.00	88	0.08	0.21	0.00
11 -< 14	351	0.01	0.10	0.00	395	0.12	0.38	0.00
14 -< 17	231	0.01	0.11	0.00	254	0.10	0.21	0.00
>17	85	0.03	0.14	0.00	112	0.06	0.18	0.00
P-Value				0.0E+00	p-value			0.00

Across all age groups, mean BCVA values in public school pupils remained close to zero, indicating normal visual acuity, with minimal variation between age categories. In contrast, private school pupils consistently showed slightly higher mean logMAR scores across age groups, suggesting marginally reduced acuity, although the differences were small in absolute terms. The variation in BCVA across age groups was statistically significant in both school types (p < 0.001 for all age categories). Notably, the widest spread of BCVA values (largest standard deviation) was observed among private school pupils aged 11 to <14 years, indicating greater variability in vision within this subgroup. Overall, while visual acuity remained within functional limits for most pupils, subtle age-related and school-type differences were evident.

Discussion

Female students predominated in both settings but were especially overrepresented in private schools, whereas males formed a larger proportion in public schools. The mean age was slightly higher among private school pupils, particularly males, while females in public schools had a marginally older average than their private school counterparts. Patterns of recreational activity also differed markedly; public school pupils engaged more in outdoor play, while private school pupils spent more hours in indoor activities. These demographic and behavioural differences are consistent with previous Nigerian and African data showing that private school pupils often have greater exposure to near-work activities, less time outdoors, and higher socioeconomic backgrounds, all of which are known risk factors for myopia development [31]. Atowa, Munsamy, and Wajuihian similarly noted that older age, reduced outdoor activity, and prolonged near work were associated with increased prevalence of myopia in Nigerian children [32].

The refractive error distribution indicated that mild myopia was more common in private schools, while moderate to moderately high myopia occurred more frequently in public school pupils. Severe myopia (≥ −6.00 D) was slightly higher in private schools. The difference in distribution between the two groups was statistically significant (p < 0.001). This suggests that while myopia is more frequently detected at lower severity in private schools—likely due to earlier detection and screening—public school pupils may present with more advanced refractive errors, possibly due to reduced access to eye care services or delayed diagnosis [33].

The findings support the growing evidence that both environmental and socioeconomic factors play a role in myopia patterns among Nigerian children. The higher indoor activity and reduced outdoor exposure in private schools may explain the elevated proportion of mild myopia, whereas the less frequent but often more severe myopia cases in public schools may be linked to limited screening programs. These results reinforce recommendations for school-based vision screening and outdoor activity promotion as effective public health strategies for reducing myopia progression [30, 35].

The distribution of anisometropia in this study showed that most private school pupils had minimal interocular refractive differences, while public school pupils had a comparatively higher proportion of moderate anisometropia. Severe anisometropia was rare in both groups, consistent with earlier reports that high anisometropia is uncommon among school-aged children [32]. The statistically significant difference ($p < 0.01$) suggests possible environmental, screening, or access-to-care disparities between the two groups.

Anisometropia, particularly when uncorrected, can lead to amblyopia, reduced stereopsis, and other binocular vision anomalies [36]. The higher proportion of moderate anisometropia in public school children may reflect delayed detection and intervention, as school-based eye care services are often less consistent in public institutions [33]. In contrast, the predominance of minimal anisometropic differences in private schools may indicate better access to regular vision screening and early correction—factors associated with lower amblyogenic risk [36].

These findings align with population-based studies in both African and Asian contexts, where socioeconomic status and school type have been linked to disparities in refractive error profiles [31, 30]. Interventions that promote early refractive screening in all school types, combined with public health education on the importance of binocular balance, could help reduce the risk of amblyopia and improve visual function outcomes.

The present study found that most pupils in both public and private schools achieved good visual acuity, with severe BCVA reduction being rare. Similar patterns have been reported in other Nigerian studies, where the majority of school-aged children demonstrated normal or near-normal visual function following correction [32, 33]. The slightly higher proportion of mild to moderate BCVA reduction in private school pupils may reflect the higher prevalence of low-grade myopia in this group, as noted in the refractive error findings of this study and supported by Wasige et al. [31], who identified private schooling as a risk factor for early-onset myopia.

The predominance of better-than-normal BCVA in public school pupils could be related to greater outdoor exposure, which has been shown to slow myopia progression and preserve distance vision [30, 35]. While the differences in BCVA distribution were not statistically significant ($p = 0.567$), the presence of mild deficits—particularly among private school pupils—highlights the importance of routine school-based vision screening. Early detection and timely correction of refractive errors can prevent long-term visual impairment and support optimal academic performance [36].

The distribution of high myopia among students shows a marked variation between private and public schools in Anambra State. Private school students recorded a higher prevalence of high myopia compared to their public school counterparts. This aligns with previous studies in Nigeria and other developing countries, which have reported a greater occurrence of refractive errors in private school populations, often attributed to differences in socioeconomic status, lifestyle, and educational demands [11]. Students in private schools are more likely to engage in prolonged near work such as reading and computer use, which has been identified as a significant risk factor for the progression of myopia [33, 30].

Similar trends have been documented in East Asia, where rapid urbanization and increased academic pressure have led to a surge in myopia prevalence among schoolchildren, particularly in more affluent settings [31, 30]. Environmental factors such as reduced outdoor activity also play a role, as outdoor exposure has been shown to have a protective effect against myopia onset and progression [35]. In contrast, public school students, who may have more outdoor time and less intense academic schedules, tend to have lower rates of high myopia.

These findings underscore the need for targeted myopia control interventions, such as promoting outdoor activities, implementing regular school vision screenings, and encouraging appropriate visual hygiene, especially in high-risk groups such as private school students. Early detection and management are essential to prevent the potential complications of high myopia, including retinal detachment and myopic maculopathy [11].

Conclusion

This study reveals significant differences in the prevalence and distribution of high myopia between private and public school children in Anambra State, Nigeria. Private school students exhibited a higher prevalence of mild to moderate myopia, likely linked to increased near work and reduced outdoor activities, while public school children showed comparatively more moderate to severe myopia, possibly due to delayed diagnosis and limited access to eye care services [31–35]. The disparity in anisometropia further underscores differences in screening and intervention between the two groups [32, 36]. Although best-corrected visual acuity was generally good across both cohorts, the presence of mild visual deficits among private school pupils highlights the need for routine vision screening and early management [37]. The findings support previous research indicating that environmental, socioeconomic, and behavioural factors influence myopia development and progression in school-aged children [11]. There is a critical need to implement targeted public health strategies, including promoting outdoor activities, improving access to vision screening, and educating students, parents, and educators on myopia prevention, especially within private school settings. Early detection and intervention will be essential to reduce the long-term ocular complications associated with high myopia and improve visual health outcomes in Nigerian schoolchildren.

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