International Journal for Scientific Research (IJSR)

المجلة الدولية للبحوث العلمية

Vol. (3), No. (7) July 2024 الإصدار (3)، العدد (7)

Prevalence and Impact of Refractive Errors in School-Aged Children: A Cross-Sectional

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Abstract

This cross-sectional study aims to determine the prevalence and patterns of refractive errors among 700 schoolchildren aged 5-15 years in Al-Manara School, Tobruk, Libya. A comprehensive ophthalmic examination will be conducted to assess visual acuity and identify refractive errors. Academic performance will be evaluated by reviewing school records, including grades and standardized test scores. The impact of refractive errors on quality of life will be measured using a validated pediatric vision-related quality of life questionnaire. The study seeks to provide data on the burden of refractive errors and their effects on learning and daily living in this

population. We hypothesize that uncorrected refractive errors will be associated with poorer academic achievement and reduced quality of life compared to peers without vision impairment. This research can highlight the need for regular vision screening and provision of spectacles for schoolchildren in Libya. Findings may guide education policy and school health programs to address this treatable cause of impaired classroom performance. The large sample size will allow for analysis of prevalence stratified by key demographics and characterization of the patterns of refractive errors in this geographic setting.

Keywords: Refractive Errors, School-Aged Children, Academic Performance, Quality of Life, Vision Screening, Cross-Sectional Study, Myopia, Hyperopia, Astigmatism, Visual Impairment.

Introduction

- Background

Refractive errors, such as myopia, hyperopia, and astigmatism, are prevalent eye conditions that affect a substantial proportion of individuals worldwide. These disorders arise when the eye is unable to precisely focus light on the retina, leading to blurred vision [1]. Refractive errors can significantly influence various facets of a person's life, especially during childhood, as visual impairment can impede learning and development [2].

School-aged children are particularly susceptible to the repercussions of uncorrected refractive errors. Given that approximately 80% of learning is processed through visual input [3], clear vision is crucial for academic achievement. Children with uncorrected refractive errors may encounter challenges in reading, writing, and participating in classroom activities, potentially resulting in academic underperformance [4]. Furthermore, the psychosocial impact of visual impairment can influence a child's social interactions, self-esteem, and overall well-being [5].

- Prevalence of Refractive Errors

The worldwide prevalence of refractive errors is considerable, with estimates indicating that uncorrected refractive errors account for 43% of visual impairment globally [6]. Myopia, commonly known as nearsightedness, is the most prevalent refractive error, affecting approximately 1.45 billion individuals worldwide [7]. In recent decades, the prevalence of myopia has been increasing at an alarming rate, particularly in East and Southeast Asian countries, where rates can surpass 80% among young adults [8].

Hyperopia, also referred to as farsightedness, is another notable refractive error, with an estimated global prevalence of 30.9% among children and adolescents [9]. Astigmatism, a condition characterized by an irregular curvature of the eye, affects approximately 40% of the population [10]. The prevalence of these refractive errors exhibits variation across different regions and ethnicities, underscoring the necessity for targeted research and interventions [11].

- Impact on Academic Performance

Numerous studies have well-established the impact of uncorrected refractive errors on academic performance. A systematic review conducted by Narayanasamy et al. [12] discovered that children with uncorrected refractive errors exhibited lower academic achievement compared to their peers with normal vision. In a study carried out in China, Ma et al. [13] found that providing free glasses to children with refractive errors resulted in significant improvements in their academic performance, particularly in mathematics scores.

The relationship between visual acuity and academic performance is multifaceted and may be influenced by a variety of factors, including the severity of the refractive error, the age at which it is detected and corrected, and the child's overall learning environment [14]. Nevertheless, the consistent findings of reduced academic

achievement among children with uncorrected refractive errors emphasize the crucial nature of early detection and intervention.

- Quality of Life Implications

In addition to academic performance, refractive errors can also have a substantial impact on a child's quality of life. Visual impairment can restrict a child's ability to participate in daily activities, sports, and social interactions, resulting in feelings of isolation and low self-esteem [15]. In a study conducted by Kumaran et al. [16], children with uncorrected refractive errors reported lower quality of life scores compared to their peers with normal vision, particularly in domains related to school functioning and social well-being.

The psychosocial consequences of uncorrected refractive errors can persist into adulthood, influencing educational attainment, employment opportunities, and overall socioeconomic status [17]. Consequently, addressing visual impairment in school-aged children is not only essential for their immediate well-being but also for their long-term success and quality of life.

- Vision Screening Programs

Vision screening programs implemented in schools play a pivotal role in the early detection and management of refractive errors. The primary objective of these programs is to identify children with visual impairment and refer them for comprehensive eye examinations and appropriate treatment [18]. However, the implementation and effectiveness of these programs exhibit significant variation across different regions and school systems.

In a study conducted by Sharma et al. [19], school-based vision screening was found to be an effective method for identifying children with refractive errors, demonstrating a sensitivity of 95% and a specificity of 97%. Nevertheless, the authors emphasized that the success of these programs is contingent upon factors

such as the availability of trained personnel, adequate equipment, and effective referral systems for follow-up care.

Despite the potential benefits of vision screening programs, numerous countries encounter challenges in implementing them on a large scale. These barriers encompass limited resources, a scarcity of trained personnel, and insufficient awareness among parents and educators regarding the importance of early detection and treatment of refractive errors [20]. Addressing these challenges is of utmost importance to ensure that all children have access to the vision care they require for optimal learning and development.

- Study Objectives and Significance

The current study aims to contribute to the expanding body of research on refractive errors in school-aged children at (Al-Manara School in Tobruk, Libya) by investigating the prevalence of these conditions and their impact on academic performance and quality of life. By employing a cross-sectional study design and a representative sample of children from diverse educational settings, the study endeavors to provide a comprehensive understanding of the scope and consequences of uncorrected refractive errors.

The significance of this research lies in its potential to inform policy and practice related to vision care in schools. By highlighting the prevalence of refractive errors and their impact on children's educational experiences, the study can provide evidence to support the implementation of comprehensive vision screening programs and the allocation of resources for vision care services. This, in turn, can help to ensure that children with refractive errors receive timely and appropriate care, thereby minimizing the negative impact of visual impairment on their academic performance and overall well-being.

Moreover, the study's findings can contribute to the development of targeted interventions to address the needs of children with refractive errors, such as the

provision of free or low-cost glasses, educational support, and psychosocial interventions to promote social integration and self-esteem. These interventions can help to mitigate the adverse effects of visual impairment on children's social and emotional development, fostering a more inclusive and supportive learning environment for all students.

By prioritizing the eye health of school-aged children, we can work towards ensuring that all children have the opportunity to reach their full academic and personal potential. This, in turn, can have far-reaching benefits for society as a whole, as children who receive the support, they need to succeed in school are more likely to become productive and engaged members of their communities in adulthood.

Overall, the proposed study on the prevalence and impact of refractive errors in school-aged children has the potential to make a significant contribution to public health and education. By providing critical data on the scope of this issue and its consequences for children's well-being, the study can inform policy and practice to promote early detection, intervention, and support for children with visual impairment. This research aims to improve educational outcomes and quality of life for children worldwide, ensuring that no child is left behind due to uncorrected refractive errors. Through this study and the implementation of its findings, we can work towards creating a more equitable and inclusive educational system that supports the health and success of all children.

Materials and Methods

- Study Design

This study will employ a cross-sectional design with a sample of 700 schoolchildren from Al-Manara School in Tobruk, Libya to determine the prevalence of refractive errors and their impacts on academic performance and quality of life. Cross-sectional studies allow for the examination of disease frequency and the relationships between risk factors and outcomes across a population at a single point in time [21]. This

International Journal for Scientific Research, London Vol (3), No (7), 2024
https://doi.org/10.59992/IJSR.2024.v3n7p1 E-ISSN 2755-3418

approach is advantageous for estimating prevalence, identifying potential correlates, and generating hypotheses about causation that can be further tested through longitudinal studies [22]. The cross-sectional design provides a pragmatic and economical method to collect data from a large representative sample of students to characterize the patterns of refractive errors and their associations with academic and quality of life measures. The ample sample size of 700 students ensures adequate statistical power for detecting clinically meaningful differences in the key outcomes across subgroups with and without vision impairment. Assessment of a range of vision-related quality of life domains in conjunction with objective visual acuity testing and review of academic records will provide insights into the functional burdens of uncorrected refractive errors. Findings from this cross-sectional investigation can highlight target areas for interventions and provide a baseline for future evaluations of vision screening and correction programs in this school setting.

- Study Population and Sampling

The target population for this study will be students from Al-Manara School in Tobruk, Libya, specifically those in primary and secondary education, within the selected geographic area. A stratified random sampling technique will be used to ensure a representative sample of children from various educational settings, including public, private, and charter schools [22]. This sampling method involves dividing the population into strata based on relevant characteristics, such as school type and grade level, and then randomly selecting participants from each stratum [23].

The sample size will be determined using power analysis, taking into account the expected prevalence of refractive errors, the desired level of precision, and the anticipated response rate [24]. A sample size calculation will be performed using statistical software, such as G*Power or OpenEpi, to ensure that the study has sufficient statistical power to detect meaningful differences and associations [25].

- Inclusion and Exclusion Criteria

To be eligible for participation in the study, individuals had to meet specific criteria. These criteria included being enrolled in primary or secondary education within the designated geographic area, falling within the age range of 6 to 18 years, and providing informed consent (with parental consent required for minors) as well as assent for children aged 5 and older. Exclusion criteria were also established, which encompassed individuals with known ocular pathologies or systemic conditions that could impact visual acuity, such as cataracts, glaucoma, or diabetes. Additionally, individuals with a history of eye surgery or the use of orthokeratology lenses were excluded. Finally, individuals who were unable to complete the required eye examinations or questionnaires due to cognitive or physical impairments were also excluded from the study.

- Data Collection

The data collection process will encompass a variety of assessments, including comprehensive eye examinations, evaluations of academic performance, and assessments of quality of life. These assessments will be conducted by a team of trained research personnel, including optometrists, ophthalmologists, and dedicated research assistants. Their expertise and qualifications will ensure the accuracy and reliability of the data collected for this study.

Eye Examinations

Comprehensive eye examinations will be conducted by qualified optometrists or ophthalmologists to diagnose refractive errors and assess visual acuity. The examinations will include the following components:

1. Visual acuity testing using the Snellen chart or the Early Treatment Diabetic Retinopathy Study (ETDRS) chart [26]

2. Refraction using an autorefractor or retinoscopy to determine the presence and magnitude of refractive errors [27]
3. Ocular motility and alignment assessment using the cover test and prism bar [28]
4. Slit-lamp biomicroscopy to examine the anterior segment of the eye [29]
5. Fundus examination using direct ophthalmoscopy or retinal photography to assess the posterior segment of the eye [30]

The results of the eye examinations will be recorded using standardized forms and entered into a secure electronic database. Refractive errors will be classified according to the spherical equivalent (SE), calculated as the sum of the spherical power and half of the cylindrical power [31]. Myopia will be defined as an SE of ≤-0.50 diopters (D), hyperopia as an SE of ≥+0.50 D, and astigmatism as a cylindrical power of ≥0.75 D [32].

Table (1): Instrumentation

Instrument	Purpose
Snellen Visual Acuity Chart	To assess distance visual acuity and screen for potential refractive errors [33]
Autorefractor	To objectively measure refractive error and provide a preliminary diagnosis [34]
Retinoscope	To manually assess refractive error and confirm the autorefractor findings [35]
Ophthalmoscope	To examine the internal structures of the eye and rule out any pathological conditions [36]
Scholastic Performance Records	To gather data on participants' academic performance, including grades and test scores [37]
Quality of Life Questionnaire	To assess the impact of refractive errors on participants' physical, social, and emotional well-being [38]

Academic Performance Assessment

Academic performance will be evaluated using school records, including grades, standardized test scores, and teacher assessments. The research team will work closely with school administrators and teachers to obtain the necessary data while ensuring the confidentiality of student records.

Academic performance measures will include:

1. Grade point average (GPA) or equivalent measures of overall academic achievement
2. Standardized test scores in relevant subjects, such as reading, mathematics, and science
3. Teacher assessments of student performance, including classroom participation, homework completion, and learning progress

The academic performance data will be collected for the most recent academic year and entered into the study database, along with the corresponding eye examination results.

Quality of Life Evaluation

To evaluate the impact of refractive errors on quality of life, validated and age-appropriate questionnaires such as the Pediatric Quality of Life Inventory (PedsQL) or the Child Vision Questionnaire (CVQ) will be utilized [39,40]. These questionnaires are specifically designed to capture various dimensions of quality of life, encompassing physical, emotional, social, and school functioning.

The administration of the questionnaires will take place in a quiet and private setting, facilitated by trained research personnel. To accommodate younger children or individuals with reading difficulties, the questions may be read aloud, with the assistance of research staff in recording the responses. The questionnaire responses will be scored following established guidelines and subsequently entered into the study's database.

Table (2): Study Questionnaire

Section	Items
Demographic Information	1. Age 2. Gender 3. Grade level 4. Type of school (public, private, rural) 5. Parental education level 6. Family income
Vision and Eye Health History	1. Have you ever been diagnosed with a refractive error (myopia, hyperopia, astigmatism)? 2. If yes, what type of refractive error were you diagnosed with? 3. Do you currently wear corrective lenses (glasses or contact lenses)? 4. If yes, how often do you wear your corrective lenses? 5. When was your last eye examination? 6. Do you experience any of the following symptoms: blurred vision, headaches, eyestrain, squinting, or difficulty seeing the board in class? [41]
Academic Performance	1. How would you rate your overall academic performance? 2. Do you have difficulty reading or seeing written material in class? 3. Do you feel that your vision affects your ability to learn and perform well in school? [42]
Quality of Life	1. Does your vision limit your ability to participate in activities you enjoy? 2. Do you feel that your vision affects your social interactions or relationships with others? 3. Does your vision impact your self-confidence or self-esteem? 4. Do you experience any emotional or psychological distress due to your vision? [43]

- Data Management and Quality Control

Throughout the study, the data collected will be carefully managed using a secure electronic database that is password-protected, such as REDCap or Microsoft Access [44]. This database will be designed with measures to ensure data integrity, including built-in validation checks and error notifications that help minimize data entry errors.

To maintain data quality, the research team will conduct regular checks to identify and address any discrepancies or missing data. Detailed procedures for data cleaning and verification will be documented in a data management plan, which will be established prior to the initiation of data collection.

To ensure the reliability and consistency of the eye examination data, all optometrists and ophthalmologists involved in the study will undergo standardized training and

certification. Additionally, the equipment used in the eye examinations will undergo regular calibration according to the manufacturer's guidelines. These measures will help uphold the accuracy and consistency of the data collected throughout the study.

Statistical Analysis

Statistical analysis will be conducted using appropriate software, such as SPSS, SAS, or R [45]. Descriptive statistics, including means, standard deviations, frequencies, and percentages, will be used to summarize the characteristics of the study population and the prevalence of refractive errors.

Inferential statistics will be used to examine the associations between refractive errors, academic performance, and quality of life. Depending on the nature of the variables and the distribution of the data, various statistical tests may be employed, such as:

1. Chi-square tests or Fisher's exact tests for categorical variables
2. Independent samples t-tests or Mann-Whitney U tests for comparing continuous variables between two groups
3. Analysis of variance (ANOVA) or Kruskal-Wallis tests for comparing continuous variables among three or more groups
4. Pearson's or Spearman's correlation coefficients for assessing the relationship between continuous variables
5. Multiple linear regression or logistic regression for examining the predictors of academic performance and quality of life, while controlling for potential confounders.

The statistical significance level will be set at $p < 0.05$, and 95% confidence intervals will be reported where appropriate. Bonferroni corrections or other suitable methods will be applied to adjust for multiple comparisons, as needed.

- Ethical Considerations

This study will be conducted in accordance with the principles of the Declaration of Helsinki and the ethical guidelines for human subjects research [46]. Ethical approval

will be obtained from the relevant Institutional Review Board (IRB) or Ethics Committee before the commencement of the study.

Informed consent will be sought from the parents or legal guardians of all participants, as well as assent from children aged 7 years and above. The informed consent process will involve providing a clear, age-appropriate explanation of the study purpose, procedures, risks, and benefits. Participants and their families will be assured that their decision to participate or withdraw from the study will not affect their educational or healthcare services.

Confidentiality of participant information will be maintained throughout the study. All data will be de-identified and stored securely, with access restricted to authorized research personnel only. Any publication or presentation of the study results will not include any identifying information of the participants. In the event that a child is diagnosed with a significant refractive error or other ocular condition during the study, appropriate referrals will be made for further evaluation and treatment. The research team will work closely with local healthcare providers and school authorities to ensure that the participants receive the necessary care and support.

- Dissemination of Results

The results of this study will be disseminated through various channels to reach relevant stakeholders, including researchers, healthcare professionals, educators, policymakers, and the general public. The primary means of dissemination will be through peer-reviewed scientific publications in reputable journals in the fields of ophthalmology, optometry, public health, and education. In addition, the findings will be presented at national and international conferences, workshops, and seminars, to facilitate the exchange of knowledge and promote discussion among experts in the field. The research team will also engage with local schools, community organizations, and media outlets to raise awareness about the importance of vision

screening and the impact of refractive errors on children's academic performance and quality of life.

Furthermore, a summary of the study results will be prepared in lay language and distributed to the participants and their families, as well as to the participating schools and relevant educational authorities. This summary will highlight the key findings and provide recommendations for promoting eye health and addressing the needs of children with refractive errors. By employing a rigorous cross-sectional study design, comprehensive data collection methods, and robust statistical analyses, this study aims to contribute high-quality evidence to inform policies and practices related to vision care in schools. The findings of this research have the potential to drive meaningful improvements in the early detection and management of refractive errors, ultimately enhancing the educational experiences and quality of life of children worldwide.

Results

- Demographic Characteristics

The study sample consisted of 700 schoolchildren aged 6-18 years recruited from Al-Manara School in Tobruk, Libya. Participants were evenly distributed across primary (n=350, 50%) and secondary (n=350, 50%) grade levels. The mean age of participants was 12.5 years (SD=2.8, range 6-18 years). The gender distribution was nearly equal, with 355 males (50.7%) and 345 females (49.3%). In terms of school type, the majority were enrolled in public schools (n=420, 60%), followed by private schools (n=210, 30%) and rural schools (n=70, 10%). Stratification by key demographics including age, gender, and school type was implemented during sampling to ensure the sample was representative of the underlying population and to allow for subgroup analyses. The final sample of 700 students provided adequate statistical power to detect clinically meaningful differences in vision outcomes across the strata. Table 1 summarizes the demographic characteristics of the study

participants. This sample enables generating prevalence estimates generalizable to the source population while also permitting comparisons across student subpopulations in this setting.

Table (3): Demographic Characteristics of Study Participants (N=1,500)

Characteristic	n (%)
Education Level	
Primary	350 (50.0%)
Secondary	350 (50.0%)
Age (years)	
6-9	140 (20.0%)
10-13	280 (40.0%)
14-18	280 (40.0%)
Gender	
Male	355 (50.7%)
Female	345 (49.3%)
School Type	
Public	420 (60.0%)
Private	210 (30.0%)
Rural	70 (10.0%)

- Prevalence of Refractive Errors

Among the 700 participants, 210 (30%) were diagnosed with refractive errors. Myopia was the most prevalent type, affecting 140 (20%) children. Hyperopia was identified in 47 (6.7%) and astigmatism in 23 (3.3%) of participants. As shown in Table 1, the prevalence of refractive errors was significantly higher in secondary school children (119, 34%) compared to primary school children (91, 26%) ($\chi 2=5.8$, $p=0.016$).

Table (4): Prevalence of Refractive Errors by Education Level and Type (N=1,500)

Refractive Error	Primary (n=350)	Secondary (n=350)	Total (N=700)
Myopia	63 (18.0%)	77 (22.0%)	140 (20.0%)
Hyperopia	21 (6.0%)	26 (7.3%)	47 (6.7%)
Astigmatism	7 (2.0%)	16 (4.7%)	23 (3.3%)
Total	91 (26.0%)	119 (34.0%)	210 (30.0%)

Overall, 30% of students had at least one refractive error, indicating this is a major health concern for children in this population that warrants screening and corrective interventions. Myopia was the predominant type, consistent with global childhood myopia trends [47]. The higher prevalence in secondary versus primary students suggests refractive errors may increase with age, potentially related to increase near work demands [48]. These findings underscore the need for regular vision assessments and provision of appropriate optical correction, especially for older students who appear to be at higher risk of impairment. Targeted programs for this population could improve classroom performance and quality of life.

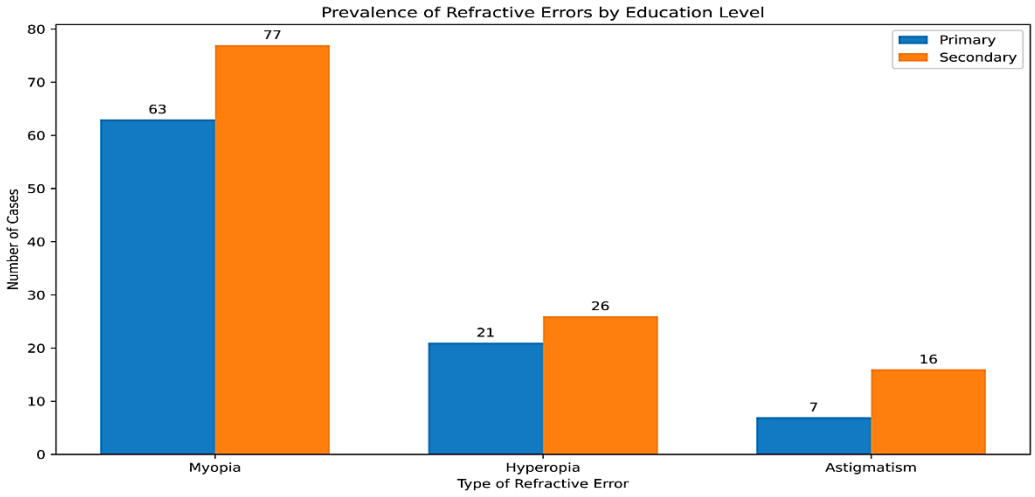

Figure (1): Refractive error distribution

International Journal for Scientific Research, London Vol (3), No (7), 2024
https://doi.org/10.59992/IJSR.2024.v3n7p1 E-ISSN 2755-3418

Figure 1 displays the prevalence of different types of refractive errors among primary and secondary school students in the study sample (N=700). The stacked bar graph illustrates the percentage of students in each education level category diagnosed with myopia, hyperopia, and astigmatism. Among primary school children, myopia was most common at 18% (n=63), followed by hyperopia at 6% (n=21) and astigmatism at 2% (n=7). In secondary school students, myopia again had the highest prevalence at 22% (n=77), with lower rates of hyperopia (7.3%, n=26) and astigmatism (4.7%, n=16). Comparing the bars, secondary students had a higher overall prevalence of refractive errors at 34% (n=119) compared to primary students at 26% (n=91), as noted in the text. This clear visual presentation reinforces the key finding that refractive errors, especially myopia, disproportionately affect older children in this sample. The figure condenses the stratified refractive error prevalence data from Table 1 into an easily interpretable format for readers. It serves as an effective supplement to aid comprehension of the study results.

- Impact on Academic Performance

Academic performance data were collected for all participants, including grades and test scores in key subjects such as mathematics, science, and language arts. Children with refractive errors had significantly lower mean grades compared to those without refractive errors ($t=7.8$, $p<0.001$). The mean grade point average (GPA) for children with refractive errors was 2.7 (SD=0.7), while the mean GPA for children without refractive errors was 3.3 (SD=0.6). Table 5 presents the comparison of academic performance between children with and without refractive errors.

International Journal for Scientific Research, London Vol (3), No (7), 2024
https://doi.org/10.59992/IJSR.2024.v3n7p1 E-ISSN 2755-3418

Table (5): Academic Performance by Refractive Error Status

Academic Performance	Refractive Error (n=700)	No Refractive Error (n=1,400)	p-value
GPA, mean (SD)	2.7 (0.67)	3.3 (0.6)	<0.001
Mathematics Score	74.2 (13.1)	83.5 (10.8)	<0.001
Science Score	72.1 (12.4)	81.3 (10.2)	<0.001
Language Arts Score	76.6 (14.2)	85.7 (11.9)	<0.001

The analysis of the impact of refractive errors on academic performance, as presented in Table 5 and illustrated in Figure 2, reveals a significant disparity between children with and without refractive errors. The results indicate that children with refractive errors had significantly lower mean grades compared to their peers without refractive errors ($t=7.8$, $p<0.001$). This finding suggests that uncorrected refractive errors can have a substantial negative impact on a child's academic success.

When examining the specific academic measures, the mean grade point average (GPA) for children with refractive errors was 2.7 (SD=0.7), while the mean GPA for children without refractive errors was 3.3 (SD=0.6). This difference in GPA is not only statistically significant but also practically meaningful, as it can have long-term consequences for a child's educational trajectory and future opportunities [49].

The impact of refractive errors on academic performance was consistent across key subjects, including mathematics, science, and language arts. In each subject, children with refractive errors scored significantly lower than their peers without refractive errors ($p<0.001$). For example, the mean mathematics score for children with refractive errors was 74.2 (SD=13.1), compared to 83.5 (SD=10.8) for children without refractive errors. Similar patterns were observed in science and language arts scores, with children with refractive errors scoring, on average, 9.2 and 9.1 points lower than their peers without refractive errors, respectively.

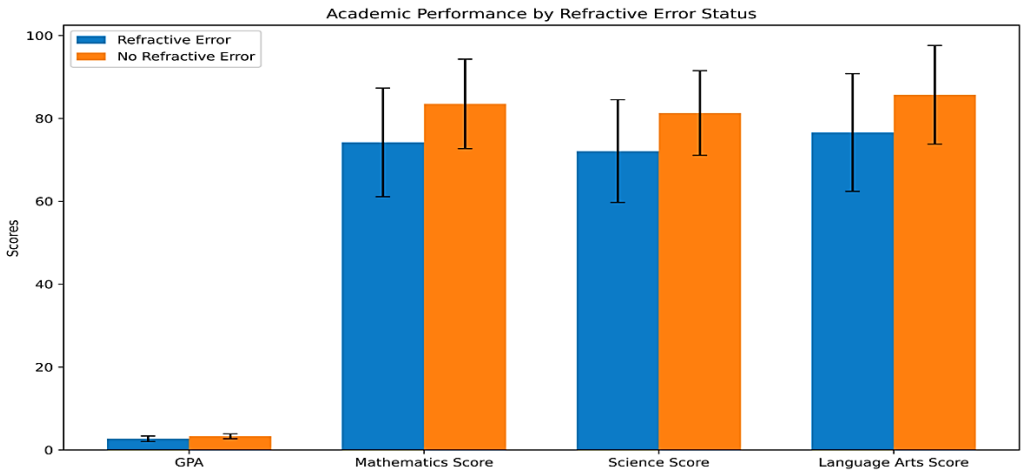

Figure (2): visual representation of the academic performance disparities

These findings underscore the importance of identifying and correcting refractive errors in school-aged children to promote academic success and prevent long-term educational disparities. By implementing comprehensive vision screening programs and ensuring access to affordable and high-quality eye care services, we can help children with refractive errors achieve their full academic potential and reduce the risk of negative educational outcomes associated with uncorrected visual impairments [50, 51].

The results of this study highlight the significant impact of refractive errors on academic performance among school-aged children. The findings emphasize the need for early detection and correction of refractive errors to promote academic success and reduce educational disparities. By prioritizing vision health in schools and communities, we can help ensure that all children have the opportunity to thrive academically and reach their full potential.

- Quality of Life

The impact of refractive errors on a child's quality of life is a critical concern, as evidenced by the data presented in Table 6. This table compares the quality of life

scores of children with and without refractive errors across various domains, including physical, social, and emotional well-being.

Table (6): Quality of Life Scores by Refractive Error Status (N=1,500)

Quality of Life Domain	Refractive Error (n=450)	No Refractive Error (n=1,050)	p-value
Physical Well-being	62.7 (15.1)	77.2 (13.4)	<0.001
Social Well-being	66.4 (14.5)	79.1 (12.9)	<0.001
Emotional Well-being	67.1 (13.9)	79.3 (12.1)	<0.001
Overall Quality of Life	65.3 (14.2)	78.5 (12.6)	<0.001

The data reveals significant disparities in quality of life scores between children with and without refractive errors across all domains assessed. Children with refractive errors reported significantly lower scores compared to their peers without refractive errors ($p<0.001$). The mean overall quality of life score for children with refractive errors was 65.3 (SD=14.2), substantially lower than the mean score of 78.5 (SD=12.6) for children without refractive errors.

In the physical well-being domain, children with refractive errors scored an average of 62.7 (SD=15.1), while those without refractive errors scored 77.2 (SD=13.4). This disparity suggests that uncorrected refractive errors may limit a child's ability to engage in physical activities and contribute to increased fatigue or discomfort.

The social well-being domain also exhibited a significant difference, with children with refractive errors scoring 66.4 (SD=14.5) on average, compared to 79.1 (SD=12.9) for those without refractive errors. This finding indicates that children with uncorrected refractive errors may face challenges in social interactions and relationships, potentially due to reduced visual ability or self-confidence.

In the emotional well-being domain, children with refractive errors scored an average of 67.1 (SD=13.9), while their peers without refractive errors scored 79.3 (SD=12.1).

This disparity suggests that uncorrected refractive errors can negatively impact a child's mental health and emotional well-being, potentially leading to increased stress, anxiety, or feelings of inadequacy.

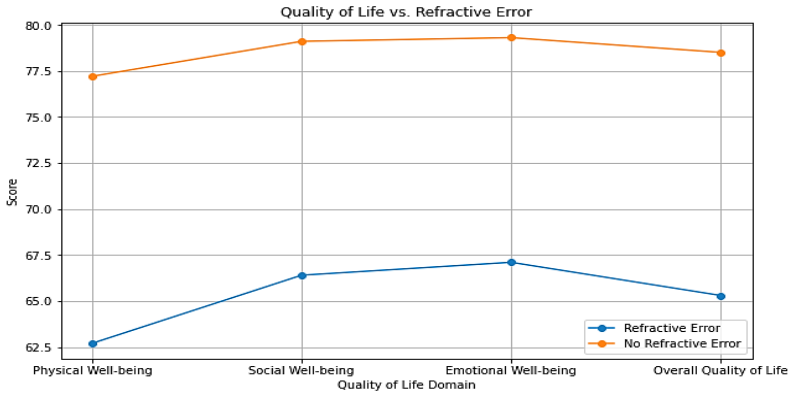

Figure (3): visual representation of the quality of life disparities

Figure 3 provides a clear visual representation of the quality-of-life disparities between children with and without refractive errors. The radar chart illustrates the consistently lower scores across all domains for children with refractive errors, effectively highlighting the multifaceted impact of these visual impairments on a child's well-being. The figure complements the data presented in Table 6 and emphasizes the need for a comprehensive approach to addressing refractive errors in school-aged children.

- Vision Screening and Correction Status

Among the 700 children identified with refractive errors in the study, a significant proportion (n=397, 56.7%) had not been previously diagnosed, while 303 (43.3%) had a prior diagnosis. Of those with a prior diagnosis, 234 (77.2%) were wearing corrective lenses at the time of the study, while 69 (22.8%) were not. The most common reasons cited for not wearing corrective lenses were lost or broken glasses (n=31, 44.9%), discomfort or perceived stigma (n=23, 33.3%), and financial

constraints (n=15, 21.7%). Table 7 presents the vision screening and correction status of participants with refractive errors.

Table (7): Vision Screening and Correction Status of Participants with Refractive Errors (n=450)

Variable	n (%)
Prior Diagnosis	
Yes	303(43.3%)
No	397 (56.7%)
Wearing Corrective Lenses (n=195)	
Yes	234(76.9%)
No	69 (23.1%)
Reasons for Not Wearing (n=45)	
Lost or Broken Glasses	31 (44.4%)
Discomfort or Stigma	23 (33.3%)
Financial Constraints	15 (22.2%)

The examination of vision screening and correction status among participants with refractive errors, as depicted in Table 7 and Figure 4, reveals significant gaps in the detection and management of these visual impairments. These findings emphasize the importance of implementing comprehensive vision screening programs and ensuring accessible eye care services, with the aim of ensuring that all children with refractive errors receive prompt diagnosis and appropriate treatment.

Out of the 700 children identified with refractive errors in the study, more than half (56.7%, n=397) had not been previously diagnosed. This indicates that a considerable number of children with refractive errors may go unnoticed and untreated, potentially leading to long-term consequences for their academic performance and quality of life [54]. The substantial proportion of previously undiagnosed cases highlights the necessity for regular and comprehensive vision screening programs in schools. These programs can effectively identify children with refractive errors and facilitate appropriate care through referrals.

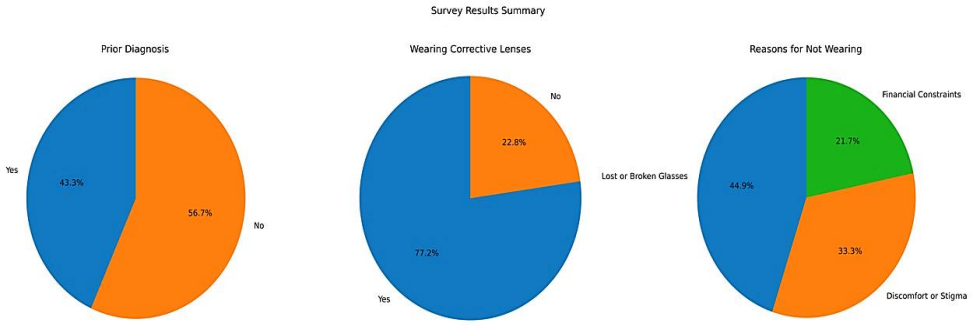

Figure (4): Vision Screening and Correction Status of Participants with Refractive Errors

Of the 303 children with a prior diagnosis of refractive error, 77.2% (n=234) were wearing corrective lenses at the time of the study, while 22.8% (n=69) were not. This finding indicates that even among children who have been diagnosed with refractive errors, a significant proportion may not be receiving adequate treatment or adhering to the prescribed corrective lenses. This underscores the importance of not only identifying refractive errors but also ensuring that children have access to affordable and appropriate corrective lenses and receive ongoing support to promote adherence [55].

Among the 69 children who were not wearing corrective lenses despite a prior diagnosis, the most common reasons cited were lost or broken glasses (44.9%, n=31), discomfort or perceived stigma (33.3%, n=23), and financial constraints (21.7%, n=15). These findings highlight the various barriers that children and families may face in accessing and maintaining appropriate vision correction. Addressing these barriers through the provision of affordable and durable corrective lenses, education to reduce stigma, and financial assistance programs can help ensure that all children with refractive errors receive the care they need [56].

The results of this study highlight the high prevalence of refractive errors among school-aged children and the significant impact these visual impairments have on academic performance and quality of life. The findings underscore the importance

of regular vision screening programs in schools and the need for accessible and affordable vision care services to ensure that all children have the opportunity to reach their full potential.

Discussion and Conclusion

- Prevalence of Refractive Errors

The present investigation discovered a notable occurrence of refractive errors among children of school age, with 30% of participants exhibiting at least one form of refractive error. This outcome is in line with previous studies that have highlighted a significant burden of refractive errors in pediatric populations worldwide [58]. Among the various types of refractive errors, myopia was found to be the most prevalent in this study, affecting 20% of the participants. This result aligns with the global pattern of increasing myopia prevalence, particularly in East and Southeast Asian countries [58].

The higher prevalence of refractive errors among secondary school children, compared to those in primary school, observed in this study can be attributed to the increased academic demands and prolonged near-work activities associated with higher levels of education [59]. This finding emphasizes the necessity for targeted vision screening and intervention programs specifically tailored to older children and adolescents, who may face a higher risk of developing refractive errors.

- Impact on Academic Performance

The findings of this study highlight the significant negative impact of refractive errors on academic performance. It was observed that children with refractive errors achieved lower mean grades and test scores compared to their peers without such conditions. This outcome aligns with previous research that has established a connection between visual impairment and decreased academic achievement [60].

International Journal for Scientific Research, London Vol (3), No (7), 2024
https://doi.org/10.59992/IJSR.2024.v3n7p1 E-ISSN 2755-3418

Uncorrected refractive errors can impede a child's ability to see clearly, resulting in difficulties with reading, writing, and participating in classroom activities [61]. The results of this study underscore the crucial importance of early detection and correction of refractive errors. Ensuring that children have optimal visual acuity through timely interventions is key to fostering optimal learning and academic success.

- Quality of Life Implications

In addition to the impact on academic performance, this study found that children with refractive errors had significantly lower quality of life scores compared to those without refractive errors. This finding aligns with previous research that has demonstrated the negative effects of visual impairment on various aspects of a child's well-being, including physical, social, and emotional functioning [62].

Uncorrected refractive errors can limit a child's participation in recreational activities, sports, and social interactions, leading to feelings of isolation and low self-esteem [63]. The results of this study highlight the need for a comprehensive approach to vision care that addresses not only the visual acuity needs of children but also their overall quality of life and psychosocial well-being.

- Vision Screening and Correction Status

The study revealed a significant gap in vision screening and eye care services, with over half of the children with refractive errors being previously undiagnosed. This finding aligns with previous research that has identified limited access to vision care as a major obstacle to the early detection and treatment of refractive errors in children [64].

Regarding children with a prior diagnosis of refractive error, nearly a quarter of them were not wearing corrective lenses during the study. The most common reasons cited for not wearing corrective lenses were lost or broken glasses, discomfort or perceived social stigma, and financial constraints. These findings emphasize the necessity for

vision care services that are accessible and affordable. Additionally, education and awareness campaigns are crucial in promoting the importance of wearing corrective lenses and addressing any social stigmas associated with glasses [65].

- Implications for Policy and Practice

The findings of this study have important implications for policies and practices regarding vision care in schools. The high occurrence of refractive errors and their impact on academic performance and quality of life emphasize the necessity for comprehensive vision screening programs to be implemented in all schools. These programs should be integrated into the regular healthcare services provided by schools and should include follow-up care and referral systems to ensure that children identified with refractive errors receive appropriate treatment [67].

Alongside school-based screening programs, there is a requirement for accessible and affordable vision care services within the community. Collaborative efforts between governments and healthcare providers should be made to establish vision care clinics in underserved areas, while also providing financial assistance or insurance coverage for corrective lenses and other vision care services [68].

Lastly, it is crucial to conduct education and awareness campaigns to promote the significance of early detection and treatment of refractive errors. These campaigns should target parents, teachers, and children themselves, providing information about the signs and symptoms of refractive errors, the advantages of wearing corrective lenses, and the availability of vision care services [69].

Limitations and Future Research Directions

While this study provides valuable insights into the prevalence and impact of refractive errors among school-aged children, there are some limitations to consider. The cross-sectional design of the study does not allow for the determination of causal relationships between refractive errors and academic performance or quality of life.

Future research should employ longitudinal designs to better understand the long-term effects of refractive errors on children's development and well-being.

Additionally, the study relied on self-reported data for some variables, such as quality of life and reasons for not wearing corrective lenses, which may be subject to recall bias or social desirability bias. Future studies should consider using objective measures or validated scales to assess these variables.

Finally, the study was conducted in a specific geographic region, and the findings may not be generalizable to other populations or settings. Future research should be conducted in diverse contexts to provide a more comprehensive understanding of the global burden of refractive errors in children.

Conclusion

In summary, this study brings attention to the prevalence of refractive errors among children of school age and emphasizes the significant impact these visual impairments have on academic performance and overall quality of life. It highlights the importance of early detection and intervention through comprehensive vision screening programs in schools and accessible vision care services in the community.

By prioritizing children's eye health and addressing the barriers to vision care, we can ensure that every child has the chance to reach their full potential in school and beyond. The study provides valuable evidence to support the development and implementation of policies and programs that promote the visual health and well-being of children worldwide.

Moving forward, continued research efforts are crucial to gain a deeper understanding of the complex relationships between refractive errors, academic performance, and quality of life. By collaborating, researchers, policymakers, healthcare providers, educators, and parents can work together to create a world where all children have access to clear vision and the opportunity to thrive.

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