

## Prospective cross-sectional study on visual health assessment in the pediatric population

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### Abstract

**Background Aim:** This study investigates the prevalence and severity of myopia among 841 pediatric individuals aged 3.5 to 16 years in Bangalore. The global rise in myopia, particularly among children, underscores the urgency for preventive measures. To assess the occurrence and severity of myopia in the pediatric population, providing insights into the growing public health concern and advocating for holistic interventions.

**Methods:** Conducted as a prospective cross-sectional study, the research utilized visual acuity assessments with the Snellen chart. A total of 840 participants were included, and data analysis employed descriptive statistics through Microsoft Excel.

**Results:** Out of the participants, 26.79% experienced visual impairment, with 22.50% having mild myopia, 2.62% moderate myopia, and 0.71% severe myopia. Astigmatism and squint eyes were observed in 0.36% and 0.60% of cases, respectively.

**Conclusion:** The study contributes valuable insights into pediatric myopia, emphasizing the need for a holistic approach through education and awareness. With 26.79% of participants affected, evidence-based interventions are crucial to safeguard the eye health of the younger population globally.

**Keywords:** Myopia; Visual health; Nearsightedness; Prevalence of myopia; Descriptive statistics.

## 1. Introduction

### 1.1. Definition

A refractive anomaly characterized by the convergence of incident parallel light rays in front of the retinal plane when the eye is in a state of relaxed accommodation. This condition arises from excessive corneal curvature or an elongated axial length of the eyeball. It is alternatively referred to as myopia.[1] Myopia primarily entails the elongation of the ocular axis, and its etiology can be attributed to both hereditary and ecological influences.[2]

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## **1.2. Myopia and Its Significance as a Growing Global Health Concern, Especially Among Children.**

Myopia, recognized as a prevalent condition of near-sightedness, has emerged as an escalating worldwide health issue, notably affecting the younger demographic.[3] Myopia is linked to an elevated susceptibility to developing vision-endangering ailments, such as myopic macular degeneration.[4] The frequency of myopia rises with advancing years, and youngsters of Asian descent face the greatest likelihood of developing myopia.[5] Immediate action is necessitated from governmental bodies, non-governmental organizations, and scholars to forestall or decelerate the advancement of myopia.[4]

## **1.3. Statistics or Data Showing the Increasing Prevalence of Myopia, Both Globally and In India**

Based on the available data, myopia is emerging as a pressing global health issue, with its occurrence on the rise across the globe, particularly among youngsters. In 2010, the worldwide incidence of myopia was approximated to affect 27% of the global populace, impacting a staggering 1.45 billion individuals.[4] By the year 2050, it is forecasted that approximately half of the Earth's inhabitants will be afflicted by myopia.[6] Nonetheless, a recent research investigation anticipated that the incidence of myopia among urban Indian children aged 5 to 15 years surged from 4.44% in 1999 to a significant 21.15% in 2019.[7]

## **1.4. Importance of Studying Myopia Prevalence and Risk Factors in Children**

Examining the incidence and determinants of myopia in the pediatric population holds significance due to the escalating worldwide health issue posed by myopia, particularly in children. Myopia is linked with an elevated susceptibility to the emergence of vision-compromising ailments such as myopic macular degeneration, retinal detachment, and glaucomatous disorders.[8] Factors contributing to the development of myopia in children encompass genetic predisposition, familial myopic history, and environmental elements, including extended close-range activities and restricted engagement in outdoor pursuits.[9] Discerning alterable determinants linked to the onset of myopia holds significance in formulating economically efficient intervention approaches.[10] Lately, numerous cross-sectional investigations have documented disparities in the occurrence of myopia within school-aged youths hailing from diverse geographical locales and ethnic origins [5]. As an illustration, the prevalence of myopia in 12-year-old and 17-year-old pupils of Asian descent residing in Australia was recorded at 42.7% and 59.1%, correspondingly, while the incidence of myopia in 12-year-old and 17-year-old youngsters of European Caucasian heritage within the same age brackets stood at 8.3% and 17.7%, respectively.[11] Myopia, colloquially referred to as near-sightedness, has undeniably evolved into a prominent healthcare concern within East Asia in recent decades, owing to its burgeoning ubiquity, particularly among the demographic of school-age youths and emerging adults. The data furnished, indicating that a staggering 80-90% of individuals completing their educational pursuits are afflicted by myopia, serves to underscore the gravity of this issue in the region.[12]

## **1.5. Risk factor**

### *1.5.1. Near-focused tasks*

In addition to the substantial engagement in near-focused tasks, the act of closely scrutinizing textual content has been posited as a potential contributing factor to the development of myopia. However, it is worth noting that there exists a paucity of comprehensive data on this subject. Notably, in the case of myopic children, there is evidence to suggest that they tend to maintain a closer proximity to text in comparison to their emmetropic counterparts. Furthermore, it has been observed that the progression of myopia is notably more pronounced among children who habitually maintain shorter viewing distances from textual materials.[13]

The preservative impact in question may potentially be attributed to several factors of elevated sophistication. These encompass the heightened luminance encountered in outdoor environments, the chromatic properties inherent to natural daylight, or the augmentation of vitamin D levels associated with increased outdoor exposure.[14]

- **Ethnicity:** The incidence of myopia demonstrates notable disparities among distinct regional and ethnic populations. In population-based studies involving children, a greater prevalence of myopia has been documented within the Chinese ethnic demographic.[15]
- **Urbanization:** The incidence of myopia exhibits an elevated prevalence in metropolitan regions.[16]
- **Education Level:** Elevated levels of formal education have been empirically linked to an augmented susceptibility to myopia.[17]
- **Near Work:** Prolonged engagement in tasks that require close visual focus has been ascertained to heighten the likelihood of developing myopia. [17]

- Outdoor Time: A reduced allocation of time spent outdoors has been correlated with an escalated proclivity for myopia development. [17]
- Family History: The presence of a familial history of myopia has been established as a significant factor in elevating the risk of myopia.[15]

### 1.6. Research Gap

Based on the findings from the literature, there exist various deficiencies and constraints in our existing comprehension of pediatric myopia, particularly in pinpointing precise determinants. While certain risk factors for childhood myopia, such as genetic predisposition, parental myopic history, and environmental influences, are recognized, the precise mechanisms through which these factors contribute to the initiation and advancement of myopia remain to be comprehensively elucidated.[18]

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## 2. Materials and methods

### 2.1. Study design

This research endeavor was conducted as a Prospective, cross-sectional, singular-center study, overseen by RE LIVE Health care solutions, which expertly coordinated a health camp in Bangalore during the period spanning from February to April 2023. Prior to commencing the study, formal informed consent was diligently obtained from the leadership of RE LIVE health care solutions, and explicit authorization for the utilization of data collected during the health camp was duly granted.

### 2.2. Subjects

#### 2.2.1. Inclusion Criteria

A total of 841 pediatric individuals, with an age range spanning from 3.5 to 16, who were enrolled as students at the school from Nursery to Grade 10, were enrolled in this research program. The eligibility criteria encompassed the following conditions: the subjects were required to fall within the age bracket of 3.5 to 16 years, possess a consistent refractive error with no more than a -4 to -0.75 diopter alteration in spherical and -1.75 to -0.5 cylindrical refraction within the preceding year, and exhibit a straightforward or composite myopic refractive condition, either with or without astigmatism.

#### 2.2.2. Exclusion Criteria

Suffering from any ocular ailment such as glaucoma, cataracts, or progressive corneal conditions like keratoconus or pellucid marginal degeneration. Additionally, having corneal dystrophy or degeneration, lens-related issues like cataracts or lens sclerosis, a current or history of uveitis, dry eye syndrome, persistent epithelial defects, central corneal leucoma, being prescribed antiglaucoma or hypotonic therapy, displaying indications of retinal vascular pathology, and experiencing conditions affecting ocular alignment such as strabismus or nystagmus, or any other disorder that impacts the ability to focus the eyes.

### 2.3. Procedure

The tool utilized to evaluate visual acuity is known as the Snellen chart. This chart is composed of letters or symbols in varying sizes, arranged in rows. To measure one's visual acuity, the patient stands at a distance of 20 feet from the chart and reads the smallest line they can discern. This is then recorded as a fraction, with the numerator denoting the distance from the chart and the denominator indicating the distance at which a person with normal vision would be able to read the same line. This well-known tool is frequently employed in both ophthalmology clinics and eye examinations for the purpose of assessing visual acuity.[19]

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## 3. Results

### 3.1. Data Analysis

In the process of analyzing the dataset, Descriptive Statistics played a pivotal role, employing Microsoft Excel as the primary tool for data exploration. The fundamental statistical measures of central tendency and variability, such as the mean and standard deviation, were computed to gain insights into the distribution and characteristics of the data. The mean, or average, served as a representative measure of central tendency, providing a summary of the dataset's typical

value. Meanwhile, the standard deviation illuminated the degree of variability or dispersion around the mean, and confidence interval was also calculated which offered a valuable understanding of the data's overall spread. The prevalence of myopia was determined by MD app.

### 3.2. Patient data analysis

Subjects were selected within an age range spanning from 3.5 to 16 years (with an average age of  $9.57 \pm 1.62$  years). Therefore, with 95% confidence, the average age is estimated to be between 7.95 and 11.19 years. A total of 840 individual subjects were selected for the study.

Our study revealed the frequency of different visual conditions, it was discovered that myopia, also known as near-sightedness, has a significant impact on a large portion of the population. The data revealed a concerning trend, with 189 (22.50%) of cases falling under the category of mild myopia, indicating a widespread prevalence of this common refractive error. Moreover, moderate myopia was identified in 22 (2.62%) of cases, demonstrating a noticeable but not as prevalent occurrence of this visual impairment. An even smaller proportion, representing just 6 (0.71%) of cases, displayed severe myopia, underscoring the rare incidence of more severe near-sightedness.

The study delved into additional visual disorders, including astigmatism and squint eyes. Results showed that 3 (0.36%) of cases had astigmatism, while 5 (0.60%) of individuals displayed squint eyes as shown in. While less common, the incorporation of these conditions underscores the thorough scope of the research, encompassing a diverse range of visual impairments. On the other hand, the study unveiled that most of the participants 615 (73.21%), possessed normal eyesight, providing a sense of reassurance. This finding highlights the significant number of people who have preserved eyesight, giving valuable information to both healthcare experts and ophthalmology researchers. Overall, the distribution of these results reveals the varied visual health landscape present within the surveyed population.

Through extensive research on visual conditions, this study found that the overall prevalence rate was found to be 26.79%. All the severity of myopia cases are summarized in Table 1, and participants experienced some form of visual impairment. This highlights a significant proportion of the surveyed population being affected by conditions such as mild, moderate, and severe myopia, astigmatism, squint eyes, and normal eyesight. This prevalence rate serves as a crucial measure, encompassing the overall occurrence of these visual conditions.

**Table 1** Severity of the myopia and total number of cases

Myopia severity	Number of cases	Percentage
Mild myopia	189	22.50%
Moderate myopia	22	2.62%
Severe myopia	6	0.71%
Astigmatism	3	0.36%
Squint eyes	5	0.60%
Normal eyesight	615	73.21%
Total	840	100%

### 3.3. Descriptive statistical analysis

An in-depth evaluation of the degree of myopia was conducted, revealing valuable insights into left and right spherical measurements for various levels of myopia. Among those with mild myopia, the average left spherical measurement was  $-0.85 \pm 0.39$ , and the average right spherical measurement was  $-0.88 \pm 0.41$ . With a precise confidence interval (CI) spanning from -0.87 to -0.82, a clear estimation of myopia severity within this category was obtained. In cases of moderate myopia, the average left spherical measurement was found to be  $-2.72 \pm 0.32$ , with the right measurement slightly lower at  $-2.55 \pm 0.63$ . The corresponding 95% CI for moderate myopia, ranging from -2.74 to -2.69, highlights a significantly higher degree of myopia compared to the mild category. In addition, it was noted that those with severe myopia had even more extreme levels of near-sightedness, as evident in their average left and right spherical measurements of  $-3.58 \pm 0.18$  and  $-3.45 \pm 0.22$ , respectively. The 95% confidence interval for this subgroup fell between -3.59 and -3.56, indicating a noticeable escalation of myopia within this group.

Our analysis also included the examination of cylindrical values for those with astigmatism. The average cylindrical measurement for the left eye was  $-0.58 \pm 0.92$ , and for the right eye was  $-0.64$ , with a 95% confidence interval between  $-0.51$  and  $-0.64$ . This comprehensive data sheds light on the extent of myopia and astigmatism among the subjects, offering important considerations for clinical evaluations and customized treatments to address the diverse spectrum of visual impairments present in this population. All the descriptive data is shown in Table 2.

**Table 2** Descriptive analysis of sample

Severity of myopia	Variables			
	Mean $\pm$ SD		Confidence interval (95% CI)	
	Left spherical	Right spherical	Lower	Higher
Mild myopia	$-0.85 \pm 0.39$	$-0.88 \pm 0.41$	-0.87	-0.82
Moderate myopia	$-2.72 \pm 0.32$	$-2.55 \pm 0.63$	-2.74	-2.69
Severe myopia	$-3.58 \pm 0.18$	$-3.45 \pm 0.22$	-3.59	-3.56
	Left cylindrical	Right cylindrical		
Astigmatism	$-0.58 \pm 0.92$		-0.64	-0.51

#### 4. Discussion

Myopia, a commonly occurring refractive error, is known to develop and advance most rapidly during childhood. Numerous studies have been undertaken to better understand the frequency and progression of this condition in children. One study discovered that the occurrence of myopia significantly escalated among Chinese schoolchildren as they progressed from grade 1 to grade 6, with noteworthy annual changes in their vision.[20] According to a recent study, the COVID-19 pandemic and subsequent home confinement resulted in a significant increase in myopia among children ages 6 to 8. [21] A recent study conducted on young adults revealed that a staggering 25.8% of the cohort had myopia by the time they reached 20 years old. Interestingly, the study also found a significant link between the amount of time spent outdoors and the prevalence of myopia.[22] Spending excessive amounts of time on screen devices has been strongly associated with a higher prevalence of myopia, particularly when using such devices for more than three hours each day. The rate of myopia progression among students who utilized projectors and televisions for online learning was observed to be slower compared to those who used mobile phones and tablets. This suggests that the choice of technology may have a considerable impact on their learning experience.[23] Myopia, also known as near-sightedness, is a common vision problem that causes distant objects to appear blurry. This condition has become a pressing concern in the realm of public health, particularly among younger populations. Alarming statistics show a steep rise in myopia cases across the globe, with notable increases in countries like India and China. [24] India has crafted a comprehensive national guidelines document to effectively address progressive myopia in children. This milestone document seeks to establish a unified expert consensus on managing childhood myopia in the Indian context.[25]

#### 5. Conclusion

This insightful cross-sectional study carried out in Bangalore provides valuable information on the frequency and features of myopia among children and teenagers aged 3.5 to 16 years. A total of 841 participants from Nursery to Grade 10 were analyzed, revealing significant findings on the prevalence of visual impairments in this age group. Furthermore, the study delved into the severity of myopia, uncovering varying levels of near-sightedness among different categories. This included detailed measurements of mild, moderate, and severe myopia in both the left and right eye, painting a comprehensive picture of the extent of myopia within this sample. Thorough investigation of pediatric myopia, this study offers a valuable contribution to our understanding of this condition. Its findings not only lay the groundwork for further research but also serve as a guide for healthcare professionals in developing successful interventions. With myopia becoming increasingly prevalent, particularly among children, it is vital that we take a holistic approach and prioritize education, awareness, and evidence-based measures to protect the eye health of younger generations.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

The authors declare no conflict of interest.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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### Author's short biography

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#### Author Name: Dharani V

I have earned a Master of Pharmacy (M. Pharm) degree with a specialization in Pharmacy Practice. With a robust background spanning seven years in pharmacovigilance, I bring a wealth of expertise to the healthcare landscape. Over 3.5 years of dedicated service in academics and teaching reflect my commitment to nurturing the next generation of professionals. My research endeavours have not only contributed to the clinical field but have also led to active participation in international conferences. Guiding diverse projects underscores my passion for hands-on clinical work. Engaging in patient counselling, teaching, and active involvement in ward rounds and pharmacovigilance programs showcase my multifaceted commitment to advancing healthcare practices.



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#### Author Name: Pavithra S

I'm dedicated Pharm D intern with a passion for advancing healthcare through my clinical expertise and research contributions. With a strong foundation in clinical and pharmaceutical sciences, I have successfully published my research work in various journals, showcasing my commitment to the dissemination of valuable knowledge. My multifaceted skill set combines hands-on clinical experience with a profound understanding of research methodologies, making me a promising professional in the field.



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#### Author Name: Zaid Khan

I'm pursuing my Pharm D degree and serves as a dedicated research intern. My academic journey is marked by a profound commitment to advancing pharmaceutical and clinical knowledge. I have demonstrated scholarly excellence by publishing numerous review and research articles in various reputable journals. I have mainly contributed to clinical and pharmaceutical multidisciplinary research areas, and I have also fortified in advanced healthcare technologies. As a research enthusiast, I have accumulated four years of extensive research experience in the pharmaceutical and clinical field. This valuable experience has provided me with a comprehensive understanding of drug development, healthcare practices, clinical pharmacy practice and their impact on patient outcomes. My research interests



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encompass a broad spectrum within the pharmaceutical and clinical domain, reflecting my passion for contributing to innovative solutions in healthcare. My active involvement in national and international conferences attests to my commitment to staying informed about the latest advancements in the field.

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**Author Name: Basava Prasad**

Dedicated Pharm D student known for my exceptional clinical skills and passion for research. With a strong foundation in clinical pharmacy practice and research, I have demonstrated a keen understanding of clinical practices and research. my commitment to advancing medical knowledge and enthusiasm for research make me a promising professional in the field. my relentless pursuit of excellence positions me as a future leader in pharmacy, poised to contribute significantly to the healthcare industry.

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