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THE ESCALATING BURDEN OF CHILDHOOD MYOPIA (4-16 YEARS) IN PUNJAB, PAKISTAN: A REVIEW OF PREVALENCE, RISK FACTORS, AND PREVENTIVE STRATEGIES

Original Research

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ABSTRACT

Background: Childhood myopia has emerged as a rapidly growing public health concern worldwide, with marked increases reported across both developed and developing countries. In Punjab, Pakistan, the rising burden among children aged 4–16 years is particularly alarming due to its association with long-term visual impairment, reduced quality of life, and increased risk of sight-threatening conditions in adulthood. The accelerated pace of urbanization, changing educational demands, reduced outdoor activity, and higher digital device use have collectively contributed to this growing epidemiological challenge in the region.

Objective: To examine the prevalence, associated risk factors, and preventive strategies for childhood myopia among children aged 4–16 years in Punjab, Pakistan.

Methods: A systematic search of PubMed, Google Scholar, ResearchGate, and institutional repositories was conducted for studies published between 2015 and 2025. Eligible studies included school-based surveys, hospital reports, and population cohorts. Forty distinct prevalence data points were extracted from urban and rural settings, age-specific and gender-specific groups, and optical service datasets across Punjab. Extracted variables included geographic location, sample age range, myopia prevalence (defined as ≤−0.50 D), study design, and reported risk factors. Quality of Refractive Error Care (Q.REC) findings were incorporated to evaluate the adequacy of spectacle dispensing and refractive services. A qualitative synthesis was performed to identify common behavioral, demographic, and environmental determinants.

Results: Myopia prevalence ranged widely, from 3.35% in Rawalpindi to 67.7% in Lahore's hospital-based refractive error cohorts. Urban school children showed significantly higher prevalence—up to 52% in high schools—compared with 28% in rural cohorts. Age-stratified findings showed a progressive increase: 20.5% at 12 years, 35.1% at 14 years, and 42.9% at 16 years. Private schools reported myopia frequencies of 40.8–46.58%, while public schools ranged from 26.1–59.2%. Q.REC assessments revealed that only 42.7% of spectacles dispensed met optimal quality standards. Prolonged near work, high digital screen exposure, limited outdoor time, and female gender were consistently reported as key risk factors.

Conclusion: Childhood myopia in Punjab is escalating rapidly, driven predominantly by modifiable lifestyle and environmental factors, with significantly higher rates in urban and academically demanding settings. Targeted actions—such as mandatory annual vision screening, daily outdoor activity promotion, and strengthened refractive care quality—are urgently required to mitigate early onset, slow progression, and minimize long-term ocular morbidity.

Keywords: Child, Myopia, Prevalence, Punjab, Refractive Errors, Risk Factors, Vision Screening.

INTRODUCTION

The global rise in childhood myopia has emerged as a major public health concern, and Punjab, Pakistan is witnessing a similar trajectory. An increasing proportion of children aged 4–16 years are developing myopia, driven largely by rapidly changing lifestyles, heavier academic loads, prolonged indoor activities, and reduced sunlight exposure (1,2). Early-onset myopia is particularly worrisome because children who become nearsighted at a young age tend to experience faster progression, ultimately placing them at heightened risk for sight-threatening complications in adulthood, including myopic maculopathy, glaucoma, and retinal detachment (3,4). This escalating burden reflects a complex interplay of genetic predisposition and environmental exposures, particularly the amount of time spent outdoors, duration of near work, screen use, and the visual environment during critical periods of ocular development (5,6). Urbanization and the rapid expansion of digital learning may be further accelerating this trend in Punjab, where school screening programs often remain inconsistent or insufficient (7). While global estimates consistently demonstrate rising prevalence across both high-income and low-income settings, emerging studies from Pakistan—especially from Punjab—have reported substantially higher rates of myopia among school-aged children compared with earlier decades (7–9). These findings raise concern regarding long-term visual outcomes and quality of life for affected children (10,11).

Despite the growing recognition of this issue, available evidence within Punjab remains fragmented, with considerable variability across rural and urban settings, school types, and different age groups (12,13). Such heterogeneity underscores the need for a consolidated overview to guide public health policy and clinical decision-making. A comprehensive understanding of the burden and determinants of childhood myopia is crucial for designing effective prevention strategies. Evidence suggests that timely interventions—including increased outdoor activity, balanced near-work routines, routine school vision screenings, and targeted treatments such as low-dose atropine or specialized optical lenses—can slow myopia progression and potentially avert long-term complications (14-16). However, the lack of coordinated efforts and context-specific guidelines remains a major barrier to early detection and management in Punjab. Therefore, this review aims to synthesize existing literature on the prevalence of myopia among children aged 4–16 years in Punjab, identify associated risk factors, and outline feasible preventive strategies to support future public health planning and pediatric eye-care research.

METHODS

This review was conducted using a systematic approach to identify and synthesize published evidence on the prevalence, determinants, and distribution of childhood myopia in Punjab, Pakistan. A structured search strategy was employed to retrieve peer-reviewed articles from PubMed, Google Scholar, ResearchGate, and institutional repositories, covering publications from January 1, 2015, to October 1, 2025. The search process combined Medical Subject Headings (MeSH) and free-text keywords, including “Myopia,” “Refractive Error,” “Prevalence,” “Incidence,” “Epidemiology,” “Children,” and “Pakistan,” as well as city-specific terms such as “Lahore,” “Faisalabad,” and “Punjab.” Boolean operators (AND/OR) were used to refine the search. Reference lists of retrieved articles and regional reviews were also hand-searched to capture additional studies and gray literature that were not indexed in major scientific databases. Eligibility criteria were defined prior to study selection to ensure consistency and relevance. Studies were included if they reported prevalence or frequency of myopia, defined as a Spherical Equivalent Refraction of ≤−0.50 Diopters, or if myopia constituted the majority of refractive errors reported. Eligible studies were required to involve children or adolescents aged 4 to 16 years within the geographical boundaries of Punjab, Pakistan. Publications from 2015 onward were prioritized; however, highly cited studies from 2014 were incorporated when they provided essential contextual information. All observational designs—including school-based surveys, population-based cross-sectional studies, cohort studies, and institutional epidemiological reports—were considered eligible, along with Quality of Refractive Error Care (Q.REC) assessments used as proxy indicators for unmet refractive needs. Studies were excluded if they predominantly involved participants older than 18 years, originated from regions outside Punjab, or represented case reports, editorials, expert opinions, or clinical trials focused solely on therapeutic interventions. Non-English articles, animal studies, and unpublished data were also excluded to maintain methodological reliability.

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The study selection process was carried out in accordance with PRISMA guidelines. All retrieved titles and abstracts were screened independently by two reviewers to minimize selection bias. Full texts of potentially eligible studies were assessed against the predefined inclusion and exclusion criteria. Any disagreements between reviewers were resolved through discussion or consultation with a third reviewer when necessary. EndNote software was used for reference management, duplicate removal, and documentation of screening decisions. A PRISMA flow diagram was constructed to illustrate the number of studies identified, screened, excluded, and ultimately included. Data extraction was performed independently by the reviewers using a structured template. Extracted variables included study location, sample size, age range, study design, diagnostic criteria for myopia, prevalence estimates, and reported risk factors. For large-scale studies presenting multiple subgroup results, distinct data points—such as urban versus rural prevalence or age-specific estimates—were treated as separate entries to build a comprehensive dataset comprising 40 prevalence findings. Risk factors were categorized qualitatively into behavioral, demographic, and environmental domains. Findings were synthesized narratively due to heterogeneity in study designs and measurement approaches, enabling the identification of recurring trends and contextual influences on childhood myopia within Punjab.

Myopia Prevalence in Punjab's School-Aged Children (4–16 Years)

Evidence from Punjab demonstrates substantial variation in the prevalence of myopia among children and adolescents, with marked differences across cities, school types, and age groups. Data synthesized from 40 Punjab-specific findings show that prevalence ranges widely—from as low as 3.35% in Rawalpindi to as high as 67.7% among hospital-based refractive error cases in Lahore—reflecting the diverse socio-environmental conditions of the province. Urban districts such as Lahore, Faisalabad, and Bahawalpur consistently report higher myopia prevalence, particularly among school-going children aged 10–16 years, where rates frequently exceed 50%. By contrast, rural cohorts show comparatively lower prevalence, such as the 28% reported in rural Punjab populations. Age-specific findings from Lahore further illustrate the progressive nature of myopia, with prevalence increasing from 20.5% at age 12 to 42.9% at age 16, reinforcing the role of academic intensity and developmental stages in its progression. Optical service data from districts including Jhang, Khanewal, and Sahiwal also reveal a high burden of myopic prescriptions among children under 18, ranging from 45% to 60%, providing additional indirect evidence of rising refractive needs in the region. Collectively, these findings underscore a growing myopia epidemic across Punjab, particularly within densely populated urban centers (1–4).

KEY FINDINGS AND ASSOCIATED RISK FACTORS (4–16 AGE GROUP)

Escalating and Urban-Dominant Prevalence

A prominent theme across reviewed studies is the strong association between urban living, academic pressure, and higher myopia prevalence. Cities such as Lahore consistently report rates surpassing 40–60%, significantly higher than those recorded in rural settings. This urban–rural disparity mirrors international evidence suggesting that environmental exposures, lifestyle patterns, and schooling demands contribute substantially to myopia development in children (5–7). Urban areas in Punjab, characterized by competitive educational environments, dense housing, and reduced access to natural outdoor play spaces, appear to intensify visual demands during crucial developmental years. The clear age-related increase identified across multiple cohorts, particularly between the ages of 12 and 16, further suggests that cumulative exposure to near work and limited outdoor activity amplifies risk during the early adolescent period. Such trends align with global findings where older schoolchildren consistently demonstrate higher myopia prevalence due to prolonged academic engagement and sustained accommodation demands (12-14).

Dominant Modifiable Risk Factors

The literature consistently identifies several modifiable behavioral and environmental risk factors contributing to the rising prevalence of childhood myopia in Punjab. Prolonged near work—including intensive study schedules, extended homework hours, and frequent reading at close distances—emerges as a dominant factor, especially in urban schools where academic workload is significantly higher. Increasing dependence on digital devices, such as mobile phones, tablets, and computers, has exacerbated visual strain among school-aged children, particularly during and after the shift toward digital education in recent years. Limited outdoor activity and reduced exposure to natural daylight represent another critical set of modifiable risk factors. Global evidence supports the protective effect of outdoor time on delaying myopia onset, yet children in major Punjab cities often spend most of their day indoors due to urban lifestyle constraints, safety concerns, and academic commitments (15-17). Gender differences have also been noted, with female students

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showing slightly higher myopia prevalence, potentially reflecting socio-cultural routines that favor more indoor activities and near work among girls compared to boys (18).

Quality of Care Deficits

Beyond the prevalence of myopia itself, notable deficiencies in refractive error care further compound the burden on affected children. Findings from Quality of Refractive Error Care (Q.REC) assessments in districts such as Jhang, Khanewal, and Sahiwal highlight that only 42.7% of dispensed spectacles met optimal standards. The implications are significant: even when myopia is detected, substandard refraction or poor-quality spectacles can limit visual improvement, hinder academic performance, and fail to slow the progression of refractive errors (19). These quality-of-care gaps may also lead to persistent under-correction, which is known to accelerate myopic progression in some children. The variation in care standards across public, private, and informal optical centers points to systemic challenges in professional training, regulatory oversight, and public accessibility to high-quality refractive services (20,21). Overall, the thematic synthesis reveals an escalating and unevenly distributed burden of childhood myopia across Punjab, driven largely by modifiable environmental and behavioral exposures, compounded by shortcomings in refractive care quality. These findings highlight the need for a more coordinated provincial response to early detection, prevention, and effective management of myopia among school-aged children.

Table: Prevalence of Myopia Among School-Aged Children (4–16 Years) Across Districts of Punjab, Pakistan

Data Point	Geographic Location	Age Range (Years)	Study/Cohort Focus	Myopia Prevalence Finding
1	Faisalabad	4–15	School Children	51.5% (of total sample)
2	Lahore	9–18 (Mean 13.9)	Public High School	61.7% (of Refractive Errors)
3	Lahore	10–18 (Mean 13.78)	Public High School	52% (of Refractive Errors)
4	Lahore (Urban)	Primary-High School	Urban Cohort	41.6% (Overall Myopia)
5	Rural Punjab	Primary-High School	Rural Cohort	28.0% (Overall Myopia)
6	Rawalpindi	5–16	School Children	3.35% (Total High RE Prevalence)*
7	Lahore	11–19	Sheikh Zayed Hospital	67.7% (of Refractive Errors)
9	Sargodha	School Age	OPD Patients	40.0% (Myopia of total RE)
10	South Punjab	School Age	OPD Patients	17.24% (Total RE Prevalence)
11	Multan	Children	RE Patients (Hospital)	50.0% (Myopia of total RE)
12	Bahawalpur	6–12	OPD Children	57.9% (Overall Myopia)
13	Lahore (Private)	High School	Private School Cohort	40.8% (Total RE Prevalence)
14	Lahore (Public)	High School	Public School Cohort	59.2% (Total RE Prevalence)
15	Lahore (Aged 12)	12 years	Age-specific cohort	20.5% (Myopia Prevalence)
16	Lahore (Aged 14)	14 years	Age-specific cohort	35.1% (Myopia Prevalence)
17	Lahore (Aged 16)	16 years	Age-specific cohort	42.9% (Myopia Prevalence)
18	Lahore (Age 10-18)	10–18	High Schools in Lahore	52% (Total RE)
19	Lahore (Private School)	12–16	Private School	46.58% (Myopia Frequency)
20	Lahore (Public School)	12–16	Public School	26.1% (Myopia Prevalence)

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Data Point	Geographic Location	Age Range (Years)	Study/Cohort Focus	Myopia Prevalence Finding
21	Jhang	$<$18 years	Optical Services Data	55% (Myopic prescriptions)**
22	Khanewal	$<$18 years	Optical Services Data	45% (Myopic prescriptions)**
23	Sahiwal	$<$18 years	Optical Services Data	60% (Myopic prescriptions)**
24	Multan	8–14	Hospital Myopia Cases	≈52% (Myopia/Astigmatism Cases)
25	Lahore (Urban)	10–14	Students (2020 Study)	≈45% (Myopia Prevalence)

CONCLUSION

The synthesis of 40 data points across Punjab indicates that childhood myopia is increasing at an alarming pace, with prevalence levels now comparable to some of the highest reported in Asia. The evidence consistently demonstrates stronger disease burden in urban, academically competitive environments and highlights clear associations with modifiable behavioral and environmental factors such as prolonged near work, digital device use, and limited outdoor activity. Although the available literature provides a compelling depiction of the growing challenge, variability in study designs and diagnostic methods underscores the need for more standardized, population-based research to strengthen epidemiological certainty. In light of these findings, province-wide interventions—such as mandatory annual vision screening, enhanced refractive care quality assurance, and school-based prevention programs promoting outdoor time and structured near-work breaks—should be prioritized by policymakers and clinicians. Continued research is essential to refine region-specific prevention strategies, evaluate intervention effectiveness over time, and ensure early, equitable, and evidence-based management of myopia among Punjab's children.

AUTHOR CONTRIBUTION

Author	Contribution
Sidra Anwar*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Memoona Arshad	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Muhammad Anwar Awan	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Maheen Faizan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sumaira Qadeer	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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