

How to Save Eyesight: Recommendations from Review Studies

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Abstract

Objectives: The aim of this article is to synthesize current evidence on childhood myopia and unify key findings and recommendations for its prevention or mitigation.

Methods: A review of studies examining myopia prevalence and progression in school-age children was conducted, focusing on age, gender, family history, screen time, sleep duration, near-work demands, and ergonomic factors in school settings.

Results: Myopia was more common in older children, in girls, and in those with a parental history of myopia. Increased near work—reading, writing, and digital device use—was strongly linked to progression, while poor posture and inadequate lighting further contributed. Interventions such as regular outdoor activity, reduced recreational screen use, and maintaining proper reading distance showed beneficial effects.

Conclusion: Childhood myopia is shaped by both genetic and environmental influences. A multifactorial approach, including proper ergonomics, balanced academic load, outdoor time, and healthy sleep routines, appears most effective, though further research is needed to refine prevention strategies.

Keywords: Children. Ergonomics. Myopia.

Introduction

The development of vision in children is a dynamic and gradual process that unfolds throughout early childhood and typically stabilizes around the age of 7–8 years. At birth, the visual system is immature, and its refinement depends on an interplay of genetic predispositions, environmental stimulation, and lifestyle-related habits. Adequate exposure to natural light, balanced alternation between near and distance visual tasks, and diverse daily physical and cognitive activities are essential for healthy visual maturation. During school-age years, visual demands increase significantly, influencing how the visual system adapts and functions. Over recent decades, however, the global rise in childhood myopia has become a major public health concern. The most alarming prevalence is reported in East Asia, where 60–70% of school-aged children are myopic, with rates reaching up to 90% in urban regions [1,2]. Key contributing factors include high academic pressure, extensive near work, reduced outdoor activity, and widespread digital device use [3–6]. Although genetic susceptibility remains an important baseline determinant, environmental influences clearly dominate both the onset and progression of myopia [3,7]. These environmental influences frequently interact with school ergonomics—such as desk height, posture, and reading distance—demonstrating the need for a comprehensive prevention framework. This review synthesizes findings from 22 studies focusing primarily on Asian school-aged populations, where myopia prevalence is highest, with the aim of identifying modifiable ergonomic and behavioral factors relevant to clinical practice, school policy, and public health planning.

Methods

A narrative review was conducted using ScienceDirect, Web of Science, and PubMed. Search terms included combinations of myopia/nearsightedness, children/adolescents, ergonomics/

posture, and China. The search was restricted to the last 10 years. From 36 initial records, automated filtering reduced the dataset to 26, and after full-text screening, 22 studies focusing on child and adolescent populations met inclusion criteria. Extracted variables included prevalence, ergonomic and behavioral risk factors, sleep duration, outdoor activity, and school-based intervention outcomes. A descriptive synthesis was used to identify consistent findings across studies.

Results

1. Prevalence Trends

Across the included studies, myopia prevalence demonstrated a robust and consistent increase with both age and school grade. Early school-aged children (typically 6–9 years) showed relatively moderate prevalence levels ranging from 25–35%, but these values escalated dramatically during later school years, reaching 70–90% among secondary school students [8–12]. This trajectory underscores the cumulative influence of prolonged near-work exposure and academic demands.

A notable and repeatedly confirmed pattern was the higher prevalence in girls compared with boys [13–15]. Although the mechanism remains uncertain, several authors hypothesize differences in study habits, reading posture, or time spent outdoors as potential explanations.

Furthermore, urban populations exhibited significantly higher levels of myopia than rural populations [10,12]. This urban–rural disparity is likely multifactorial, linked to differences in lifestyle, academic intensity, built environment, and access to outdoor spaces. These consistent gradients across sex, location, and age further support the central role of environmental pressure in myopia development.

2. Environmental and Behavioral Risk Factors

The reviewed studies showed striking consistency in identifying risk factors that influence both onset and progression of childhood myopia.

Excessive near-work duration, including reading, writing, and screen use, was one of the most frequently reported predictors [16–25]. However, several studies emphasized that not only duration but also quality of near work matters. Children who habitually maintained short working distances (<30–33 cm) experienced higher levels of visual strain and faster myopic shifts [16,18,20,23].

Poor posture—specifically forward head posture and increased cervical flexion—was another widely reported risk factor [16,17,21,26]. These postural patterns reduce working distance and increase accommodative demand.

Environmental characteristics of school settings also played a major role. Inadequate desk and chair height often forced children into suboptimal viewing positions [22,27], while insufficient daylight exposure combined with limited outdoor activity further amplified the risk [17,19,22,24,27].

Finally, several studies identified systemic lifestyle factors, such as short sleep duration (<8 hours per night) [14,25,28] and high academic workload with long homework hours [13,17,22,27,28], as contributors to elevated myopia risk. These findings highlight the multifactorial nature of modern visual stress.

3. Protective Factors

Despite the heavy influence of near-work demands, several protective behaviors were consistently shown to lower myopia risk.

The strongest and most reproducible protective factor across studies was regular outdoor activity, typically 1.5–2 hours per day [17,19,24]. Outdoor light exposure is believed to contribute to dopamine-mediated inhibition of axial elongation, directly counteracting myopia progression.

Maintaining a reading distance greater than 30 cm also demonstrated substantial protective potential [16,18,20], particularly when combined with proper posture and ergonomically adjustable school furniture [16,18,22].

Regular breaks during near-work activities—roughly every 20–30 minutes—were associated with reduced accommodative load and slower myopia progression [17,24].

Other protective factors included adequate lighting during reading [17,22,27], sufficient sleep (>8 h) [14,25,28], and in some cases structured eye exercises, though evidence for the latter remains mixed [24].

4. Effectiveness of School-Based Interventions

One of the most important findings in the reviewed studies was the positive impact of multi-component school-based interventions. These interventions often incorporated posture reminders, structured class breaks, increased outdoor time, and individualized adjustment of desks and chairs.

Collectively, these strategies reduced myopia incidence and progression by approximately 20–30% [24], with the strongest effects observed in children who were non-myopic at baseline. This highlights the crucial importance of early prevention and indicates that myopia trajectories can be significantly altered before progression becomes rapid.

5. Ergonomic Findings

The ergonomic data across studies reinforced the notion that visual behaviors and posture are tightly interwoven with myopia development.

Myopic children consistently chose shorter reading distances compared to non-myopic peers [16,18,20], suggesting either an accommodative preference or early axial elongation influencing near-work behavior.

Poor posture, particularly forward head posture, appeared to be both a predictor and consequence of myopia [16,17,21].

Handheld devices were repeatedly associated with the shortest viewing distances and fastest myopia progression [16,20], reflecting how modern digital habits intensify visual demand.

Evidence regarding reading while lying down remained inconsistent due to varying definitions across studies (lying on the back vs. side vs. stomach) [17,26].

6. Role of Family History

Family history was a strong and consistent predictor of childhood myopia across nearly all included studies [13–15,22,25,27–29]. Children with one or two myopic parents had significantly higher risk of developing myopia.

However—and importantly—environmental and ergonomic factors still substantially modified this genetic risk, indicating that preventive habits are worthwhile for all children, regardless of hereditary predisposition. This finding underscores the powerful influence of environmental modulation.

Author	Date	Children	Desing of study	Results
Bao et al.	2015	120	Observe	Short reading distance ↑ myopia
Huo et al.	2024	5 216	Cros-secitonal	eye exercises, more outside, long reading distance ↓ myopia and homework more than 4 hours per day, reading lying down ↑ myopia
Chen et al.	2024		Cros-secitonal	more outside, short reading distance ↑ myopia
Cheng et al.	2023	1 722	Cros-secitonal	head down, short reading distance, little sleep ↑ myopia and reading lying down ↓ myopia
Jiang et al.	2022a	1 524	Intervence	long reading distance, eye exercises ↓ myopia
Jiang et al.	2022b	3 256	Cros-secitonal	more readign distance than 33 cm ↓ myopia
Kajalas-Tilga et al.	2021	22	Observe	head down ↑ myopia
Liang et al.	2022	382	Comparative	higher education of parents ↓ myopia
Liu et al.	2021	1 463	Longitudinale	go to school after 7 year ↓ myopia
Lu et al.	2021	556	Cros-secitonal	right high of table ↓ myopia
Morgan et al.	2022		Comparative	more outside ↓ myopia
Pan et al.	2018	4 778	Cros-secitonal	more outside, less homework ↓ myopia
Pärssinen et al.	2016	240	Randomized	short reading distance, head down ↑ myopia and read lying on back ↓ myopia
Shi et al.	2021	6 883	Cros-secitonal	short reading distance, head down, read lying down ↑ myopia
Shi et al.	2023	8 319	Cros-secitonal	more outside, right high of table ↓ myopia
Tang et al.	2023	2 363	Cros-secitonal	Short reading distance ↑ myopia
Wei et al.	2023	3 596	Cros-secitonal	less homework behind weekend ↓ myopia
Xiao et al.	2022	1 159	Cros-secitonal	more outside ↓ myopia
Zhang et al.	2023	34 644	Cros-secitonal	eye exercises, more outside, more sleeping ↓ myopia
Zhao et al.	2 024	31 880	Cros-secitonal	more outside, right ergonomics, right lighting ↓ myopia
Zhou et al.	2016	1 858	Longitudinale	girls, older children ↑ myopia
Zhuang et al.	2022	35 614	Cros-secitonal	less sleep, more homework ↑ myopia and eye exercises ↓ myopia

Fig. 1 Results of review studies

Discussion

The evidence synthesized across the 22 included studies strongly reinforces the central role of environmental, ergonomic, and behavioral factors in shaping the onset and progression of myopia in school-aged children. While genetic predisposition provides a baseline risk, it is consistently overshadowed by modifiable daily habits that reflect the demands of modern schooling. The convergence of evidence across multiple regions—particularly in East Asia, where academic expectations are exceptionally high—demonstrates that myopia is not an unavoidable developmental outcome but a condition driven predominantly by lifestyle and environmental conditions. One of the most prominent themes emerging from the reviewed studies is the excessive visual load placed on schoolchildren. The combined burden of long hours spent on reading and writing, increased homework, and the pervasive use of digital screens forms a continuous chain of near-work activities [16–25]. Importantly, several studies show that near-work intensity is not simply a matter of duration but also biomechanics. Children often adopt short reading distances and forward-leaning head posture, placing additional strain on the accommodative system and contributing to axial elongation [16,17,21,26]. Outdoor activity consistently appears as a powerful protective factor. Even 1.5–2 hours of daily outdoor time is associated with significantly lower myopia incidence and slower progression [17,19,24]. Retinal dopamine release under natural light is hypothesized to play a major role in inhibiting excessive axial elongation, but outdoor activity also reduces the total time spent on near tasks—providing a double protective effect. Yet, dense urban settings, limited green spaces, and heavy academic schedules frequently restrict children's opportunities for outdoor play. Ergonomic factors, particularly those related to school furniture and posture, also contribute substantially to myopia risk. Improper desk and chair height encourages forward head posture and reduced reading distances, especially in younger children [16,18,22,27]. Myopic children naturally tend to adopt closer working distances, meaning ergonomic interventions must be proactively implemented rather than waiting for symptoms to develop. An emerging and particularly interesting theme is the role of sleep. Short sleep duration (<8 h) appears to be associated with higher myopia prevalence and progression [14,25,28]. Although the underlying mechanisms remain speculative—ranging from melatonin dysregulation to prolonged evening near work—sleep hygiene may represent an underutilized yet meaningful component of prevention strategies. Family history remains a strong determinant of risk, but environmental factors significantly modify this susceptibility. Children with two myopic parents still benefit noticeably from increased outdoor time, proper posture, and structured breaks [13–15,22,25,27–29]. This reinforces a hopeful message: even in high-risk groups, lifestyle adjustments can meaningfully change outcomes. School-based interventions provide some of the most promising results, with combined ergonomic and behavioral strategies reducing progression by up to 30% [24]. These programs are scalable, low-cost, and easily embedded within existing educational systems. Their effectiveness among non-myopic children highlights the importance of early preventive approaches. Certain inconsistencies remain in the literature, such as mixed findings regarding reading while lying down. These discrepancies stem largely from methodological inconsistencies

and unclear definitions (e.g., lying on back vs. side). Further research is needed to standardize ergonomic assessment tools and clarify the interaction between posture, lighting, screen use, and myopia development. Overall, the evidence strongly supports a multifactorial prevention strategy. Near-work behavior, posture, lighting, sleep, and outdoor exposure jointly shape refractive development. Future research should prioritize longitudinal designs, standardized ergonomic assessments, and evaluation of multi-component school interventions across culturally diverse settings.

Conclusion

Childhood myopia is becoming one of the most significant public health challenges of the 21st century, particularly in regions with high educational demands. Across 22 reviewed studies, ergonomic, visual, and lifestyle factors consistently emerged as key determinants of both onset and progression. While genetic predisposition influences susceptibility, modifiable behaviors—maintaining proper posture, optimizing reading distance, ensuring adequate sleep, reducing excessive academic load, and increasing daily outdoor activity—offer clear and practical prevention pathways. School-based programs that incorporate ergonomic adjustments and regular outdoor breaks show strong potential to reduce myopia incidence and progression. Although most evidence originates from Asian populations, the underlying mechanisms are universal, making these recommendations applicable to children worldwide. Continued research is necessary to better understand the interactions between posture, sleep, and visual hygiene and to develop effective, culturally adaptable prevention models.

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