



## The Relationship between Screen Time and Myopia in Children: A Narrative Review

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### ABSTRACT

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**Background:** There are concerns that children are increasingly spending time on media screens like smartphones, TVs, and computers, and at the same time, the incidence and prevalence of myopia are also on an upward trend among children.

**Aim:** This review investigated the relationship between screen time (ST) and myopia in children.

**Methods:** PubMed, Web of Science, Cochrane Library, and Google Scholar were searched on November 30, 2024. Studies were considered eligible if they were longitudinal, experimental, or case-controlled. Studies published between 2000-2024 in the English language only were considered eligible.

**Results:** Seven longitudinal studies conducted in various countries met the eligibility criteria. Four studies investigated the prevalence, incidence, and progression of myopia before and after the COVID-19 pandemic. Before the pandemic, it was considered a non-exposure period. In contrast, during the pandemic, it was considered an exposure period because students were learning using digital devices, and due to home confinement, they spent more time on screen. The four studies found that the prevalence, incidence, and myopia progression increased significantly during the pandemic compared to before the pandemic. The other three studies were conducted long before the pandemic. They also revealed that ST was a significant predictor of myopia in children.

**Conclusion:** All seven longitudinal studies revealed a significant association between ST and myopia development among children. Therefore, policies should be formulated to increase public awareness amongst parents regarding ST regulation for children.

### KEYWORDS:

Myopia, screen time, children

### INTRODUCTION

Young children, compared to adults, are more prone to visual impairments like myopia following the prolonged use of screen media like smartphones, computers, and TVs (Wang et al., 2020). A study found that children at 12 months of age spent a median time on screen (smartphone or computer or television) of 30 minutes per day, and by the time they were age 3, the median time had increased to 120 minutes per day (Trinh et al., 2020). In a different study,

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researchers found that average screen time (ST) among children increased over the years (Chen & Adler, 2019). For children aged 0-2 years, ST rose from 1.32 hours per day in 1997 to 3.05 hours per day in 2014. Similarly, for children aged 3-5 years, it increased from 2.47 hours in 1997 to 2.56 hours in 2014 (Chen & Adler, 2019). That is above the recommendations of the American Academy of Child & Adolescent Psychiatry (AACAP): children aged 2-5 years should spend a maximum of non-educational ST of less than 1 hour on a weekday and 3 hours at a weekend, and children below should not spend ST at all (AACAP, 2024). ST among children might have increased significantly during the COVID-19 pandemic confinement related to reduced outdoor activities (Wang et al., 2021). Spending too much time on screen can affect not only their vision but also the

achievement of their developmental milestones (Madigan et al., 2019).

Most studies linking ST to myopia development in children are based on correlations and associations without effectively establishing a causal relationship (Lanca et al., 2022; Lanca & Saw, 2020; Zong et al., 2024). Studies included in reviews are mostly cross-sectional and cohort studies and often reveal conflicting findings regarding the association between myopia and ST in children (Khalaf et al., 2024; Yang et al., 2020). The studies do not account for confounding factors like genetic disposition, which can result in biased research findings. Indeed, there is an opinion in the literature that ST alone has not contributed to eye problems in children. Instead, the societal shift towards indoor activities that involve the use of these devices has contributed to myopia and other vision problems in children (Zadnik & Mutti, 2019). Therefore, studies establishing a causal relationship can be more informative, and their findings can shape policy and practice development in eye care during childhood.

This narrative review aimed to explore if there is a causal relationship between myopia and ST in children up to the age of 10 years. PubMed, Web of Science, Cochrane Library, and Google Scholar were searched on November 30, 2024. Studies were considered eligible if they used a sample of children under 10 years old. Eligible studies must also be either longitudinal, RCT, quasi-experimental, case-control, or Mendelian randomized to be considered eligible. Studies must also be published in the English language and post-2000.

## REVIEW

### Study Characteristics

A total of seven eligible studies were reviewed. All the studies are longitudinal and conducted in various countries. Most of the studies were conducted in China (Hu et al., 2021; Ma et al., 2021; Mu et al., 2023), and the rest in the Netherlands (Enthoven et al., 2020), India (Saxena et al., 2017), Hong Kong (Zhang et al., 2022), and the United Kingdom (Williams et al., 2019). The follow-up period of the studies ranged between 4 months and 16 years.

### Increased ST During COVID-19 Was Linked to Myopia

Most of the studies were conducted during the COVID-19 pandemic due to rising concerns about increased ST among children, as digital learning was highly encouraged. There was also a significant reduction in outdoor activities during this time, which can also directly contribute to indoor activities based on digital devices like computer gaming. Ma et al. (2021) conducted two follow-ups, the first one before the home quarantine and the second one four months after home quarantine. They measured myopia progression in the first and second visits, whereby they found that more time spent on screen was associated with greater myopia progression at the second visit. Similarly, Hu et al. (2021) divided school-going children into two groups,

namely the non-exposure group (before COVID-19) and the exposure group (during COVID-19) followed up between Grades 2 and 3. They found that the incidence, prevalence, and myopia progression increased significantly during the pandemic compared to before the pandemic. Their findings are consistent with another study conducted in Hong Kong, whereby the authors also divided their participants into two cohorts, namely the COVID-19 cohort and the pre-COVID-19 cohort (Zhang et al., 2023). They found that ST among children increased from an average of 2.45 hours/day before COVID-19 to 6.89 hours/day, and outdoor activities decreased from 1.27 hours/day to 0.41 hours/day. In response to this trend, the prevalence of myopia increased from 18.97% at baseline to 35.25% during COVID-19 (Zhang et al., 2023). Their findings agree with another longitudinal study, which followed Chinese students between Grades 1 and 3 from 2019 to 2021; thus, their follow-up period covered the COVID-19 pandemic era (Mu et al., 2023). Their baseline assessments were conducted in April 2019, before COVID-19-related quarantine and other restrictions were implemented in China. They also found that the prevalence of myopia increased from 23.4% in 2019 to 41.9% in 2020 and 51.9% in 2021 (Mu et al., 2023). They also found that apart from outdoor activities, parental myopia, and demographics (age and sex), ST was also significantly associated with myopia. Overall, all four studies demonstrated that the incidence, prevalence, and myopia progression increased significantly during the pandemic among children compared to before the pandemic, a phenomenon that was likely attributed to increased ST and reduced outdoor activities.

### Association Between Increased ST and the Prevalence, Incidence, and Progression of Myopia

The four studies that were conducted during the pandemic confirmed that increased ST among children was associated with higher prevalence and incidence of myopia and greater myopia progression (Hu et al., 2021; Ma et al., 2021; Mu et al., 2023; Zhang et al., 2022). Their findings are also supported by other longitudinal studies that were conducted long before the pandemic. A study followed children at ages 3, 6, and 9, whereby it was revealed that computer use at ages 3 and 9 was significantly associated with myopia development (Enthoven et al., 2020). Another longitudinal study conducted in India revealed that the use of computers/video games was a significant predictor of myopia progression in children (Saxena et al., 2017). The main temporal implications of their longitudinal study were that younger children are more likely to develop myopia than older ones and that the use of computers and video games can fasten the progression as they grow older. Finally, a study conducted in the United Kingdom revealed that early exposure to ST increases the likelihood of myopia development and that there was a significant association between ST (computer games) and myopia development (Williams et al., 2019). Generally, additional studies have confirmed that ST and myopia are significantly associated

and that, despite the lack of experimental studies that can help in establishing true causation, there is a greater propensity, based on the findings of longitudinal studies, that increased ST is a true cause of myopia, especially in critical stages of eye development in childhood.

## CONCLUSION

This narrative review aimed to establish a causal relationship between ST and myopia in children. We identified seven longitudinal studies, some with a comparative approach, especially those conducted during the COVID-19 pandemic. The lack of experimental studies made it difficult to conclude that there is a causal relationship between increased ST and the development and progression of myopia in children. However, due to the unanimous agreement between all seven longitudinal studies that ST and myopia in children are strongly interlinked, there is a higher likelihood than there is none that increased ST is a causal factor for myopia in children, especially during the critical years of eye development.

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