



Krupa Philip
Research Scientist:
Brien Holden Vision
Institute, Sydney,
Australia.



Xiangui He
Independent
researcher in eye
disease prevention
and treatment.



**Padmaja
Sankaridurg**
Head: Global
Myopia Centre,
Brien Holden Vision
Institute, Sydney,
Australia.

Can myopia be prevented?

Increasing children's time outdoors, and reducing near work, can delay the onset of myopia – which reduces the risk of high myopia and its complications.

Children who develop myopia at an early age have a greater risk of eventually developing high myopia (≤ -5 dioptres [D] of correction). High myopia increases the risk of retinal detachment, macular degeneration, open-angle glaucoma and cataract. One of the most cost effective ways to reduce this is to prevent or delay the onset of myopia.

The rapid rise in myopia prevalence in recent decades is likely due to environmental factors, such as living spaces (urban versus rural locations),^{1,2} indoor versus outdoor activity^{3,4} and increased near work.⁵ However, it may be possible to modify these environmental factors in order to reduce or delay the onset of myopia. As early onset of myopia results in high levels of myopia, due to faster ocular growth and greater annual progression during the developmental years,⁶ intervention at an early age also appears to be critical.

What is the main cause?

Children who perform more near work are more likely to have myopia, and the odds of this increases with additional near work activities each week.⁷ Although the exact mechanism is unclear, researchers suggest that hyperopic defocus from accommodative impairment could be a factor.

Interestingly, studies have also found that more time outdoors delays myopia onset.⁸ Exposure during school recess to outdoor light (sunlight) totalling 11.2 hours per week⁹ or exposure to light in school hallways or under the trees for a longer duration (3.3 hours per day)¹⁰ has been effective at reducing myopia incidence. Similarly, previous data involving Caucasian and East Asian children growing up in Australia, Singapore and United States found a total of 10–14 hours per week of outdoor time was effective for delaying myopia onset.^{4,11} A recent longitudinal study conducted in Australia evaluated children's light exposure using a wearable measuring device; it observed slower eye growth in children exposed to more light each day.¹² The intensity of artificial indoor light is substantially less than outdoors,¹³ and it also consists of a different spectrum of frequencies. The levels of dopamine, which may play a role in inhibiting eye growth, have also been shown to increase with exposure to light.¹⁴

Evidence suggests that a multi-pronged approach with reduced near work (especially for young children), living spaces with more natural light as well as promoting time



Posters by the government of Singapore encourage children to spend more time outdoors. SINGAPORE

outdoors could be beneficial in delaying or preventing myopia onset. These strategies also have other health benefits, such as reduced risk of obesity and improved physical activity and mental health, so all children will benefit if these are implemented.

References

- 1 Wu, X., et al., Housing type and myopia: the mediating role of parental myopia. *BMC Ophthalmol* 2016. 16(1):151.
- 2 Choi, K.Y., et al., Childhood exposure to constricted living space: a possible environmental threat for myopia development. *Ophthalmic Physiol Opt* 2017. 37(5):568-575.
- 3 Rose, K.A., et al., Myopia, lifestyle, and schooling in students of Chinese ethnicity in Singapore and Sydney. *Arch Ophthalmol*, 2008. 126(4):527-30.
- 4 Rose, K.A., et al., Outdoor activity reduces the prevalence of myopia in children. *Ophthalmology* 2008. 115(8):1279-85.
- 5 Huang HM, Chang DST, Wu PC. The association between near work activities and myopia in children: a systematic review and meta-analysis. *PLoS One* 2015;10(10):e0140419.
- 6 Sankaridurg, P.R. and B.A. Holden, Practical applications to modify and control the development of ametropia. *Eye (Lond)*, 2014. 28(2): p. 134-41.
- 7 Huang, H.M., D.S. Chang, and P.C. Wu, The Association between Near Work Activities and Myopia in Children-A Systematic Review and Meta-Analysis. *PLoS One*, 2015. 10(10): p. e0140419.
- 8 Xiong, S., et al., Time spent in outdoor activities in relation to myopia prevention and control: a meta-analysis and systematic review. *Acta Ophthalmol*, 2017. 95(6): p. 551-566.
- 9 Wu, P.C., et al., Outdoor activity during class recess reduces myopia onset and progression in school children. *Ophthalmology*, 2013. 120(5): p. 1080-5.
- 10 Wu, P.C., et al., Myopia Prevention and Outdoor Light Intensity in a School-Based Cluster Randomized Trial. *Ophthalmology*, 2018. 125(8): p. 1239-1250.
- 11 Jones, L.A., et al., Parental history of myopia, sports and outdoor activities, and future myopia. *Invest Ophthalmol Vis Sci*, 2007. 48(8): p. 3524-32.
- 12 Read, S.A., M.J. Collins, and S.J. Vincent, Light Exposure and Eye Growth in Childhood. *Invest Ophthalmol Vis Sci*, 2015. 56(11): p. 6779-87.
- 13 Norton, T.T. and J.T. Siegwart, Jr., Light levels, refractive development, and myopia—a speculative review. *Exp Eye Res*, 2013. 114: p. 48-57.
- 14 Feldkaemper, M. and F. Schaeffel, An updated view on the role of dopamine in myopia. *Exp Eye Res*, 2013. 114: p. 106-19.