Lions Eye Institute

Researchers at the Lions Eye Institute keeping a close eye on near-sightedness

FACT SHEET

Myopia, also known as near- or short-sightedness, is a common eye condition. Individuals with myopia can see near objects clearly, but objects further away appear blurry. The incidence of myopia is increasing in many countries.

The World Health Organization predicts that by the year 2050, half the world's population will be affected by myopia.

Myopia does not just involve the cost and hassle of having to wear glasses or contact lenses and the associated implications for some occupations and sports.

The greater concern is that even a moderate level of myopia is associated with **increased risk of developing blinding eye diseases** such as myopic macular degeneration, retinal detachment and glaucoma. The risk is even greater for individuals with more severe myopia known as high myopia.

Over 80% of students starting university in East Asia have myopia and similar increases are being seen in Northern Europe and Australia. Our research in Western Australia over the last decade has shown that myopia rates are between 20-30% (Raine Eye Health Study and Busselton Healthy Aging Study). Although not as high as in East Asia, these rates are higher than those found a generation earlier in the Melbourne (Visual Impairment Project and Blue Mountains Eye Study).

Our outdoor lifestyle may be keeping myopia rates down in Australia, but there is considerable concern that the COVID-19 lockdowns of 2020, which meant that children spent more time inside at home doing more near work, will create a surge in myopia in school children over the coming decade.

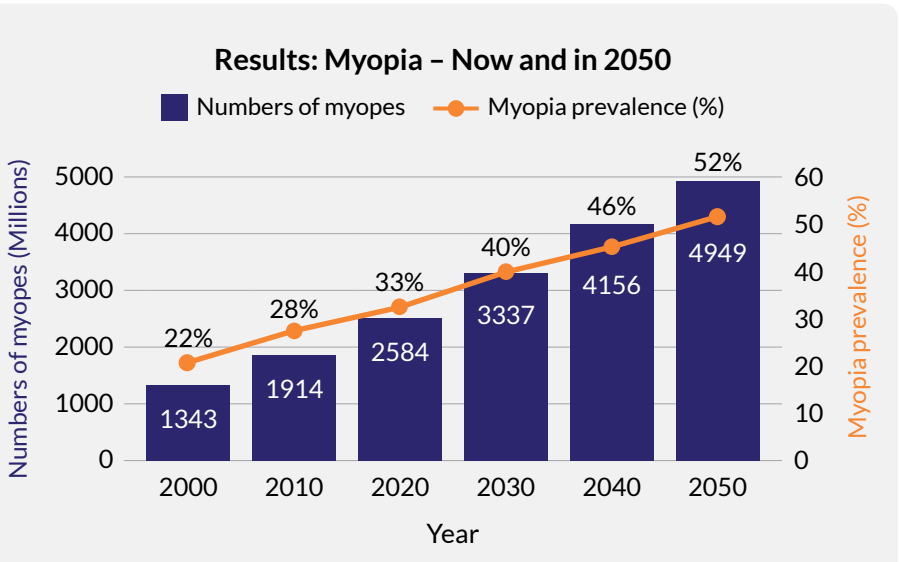
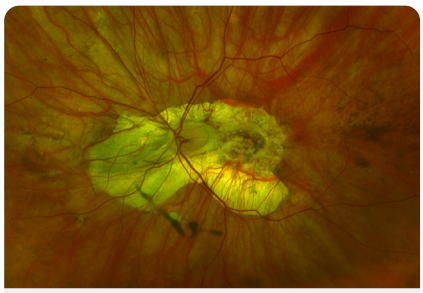


Fig 1. Numbers of cases (blue) and prevalence (orange) of myopia worldwide between 2000 and 2050.
(BrienHoldenVisionInstitute. Adapted from Holden et al. 2016 Ophthalmology.)



This image shows macular degeneration caused by myopia with a very pale/white zone around the optic disk (where the thin central vessels originate), which has obliterated the macula causing blindness. The myopia has stretched, thinned and deformed the other retinal tissue making deeper choroidal vessels easier to see.

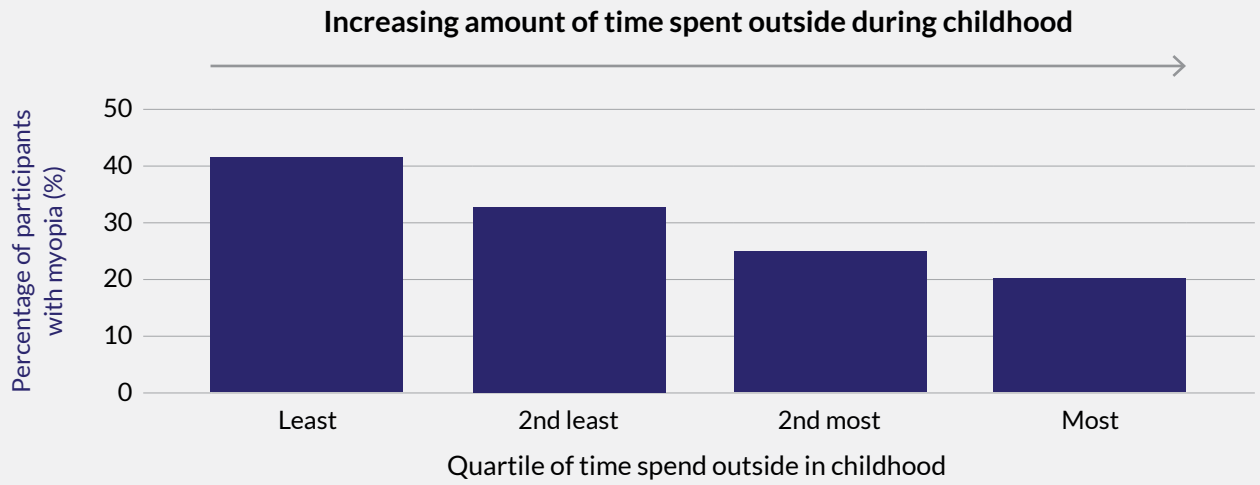


Fig 2. Percentage of participants with myopia grouped by amount of time spent outside during childhood in participants of the Western Australian Kidskin Young Adult Myopia Study.

In collaboration with the Centre for Eye Research Australia in Melbourne, **we aim to determine the impact of different levels of COVID-19 lockdowns on myopia rates**.

ORIGINS Project

To determine the very early changes in the eye that occur before myopia can be detected, we plan to study the eyes of preschool children who are part of the ORIGINS project based here in Perth.

> Once we have proven treatments, research from the ORIGINS project will enable us to know which children (based on family history and genetic risk factors) need to be examined more often and when we need to initiate treatments to prevent or treat myopia.

We plan to follow the Raine Eye Health Study and Kidskin Sun Safety Project into the future to determine the number of people who develop the complications of myopia (myopic macular degeneration, retinal detachment and glaucoma) in adult life.

Genes

Although we know that spending too much time inside and doing near work can increase a person's risk of developing myopia, we still do not know exactly what causes myopia. To better understand this, we have been investigating genes involved in the risk of developing myopia, as part of the Consortium for Refractive Error and Myopia (CREAM), the largest international genome-wide association study. Earlier this year, we identified over 400 genes involved in the process of vision contributing to myopia.

Now that we have identified these genes, we can study the impact that changes (mutations) in these genes can have on myopia in research models such as the zebrafish. The zebrafish eye is nearly transparent. This means its structures can be examined with a microscope while the zebrafish is alive and developing.

We mimic the environment our children are exposed to and investigate its impact on the eye. In collaboration with researchers at the University of Melbourne, we are currently investigating the interaction of varied levels of lighting and environment with different gene mutations. This will help us better understand how the **bright light from the sun may help to prevent myopia** and determine potential ways to prevent myopia and its progression.

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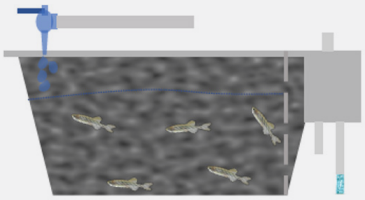
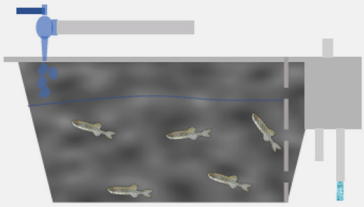


Detailed tank imagery mimics outdoor distance setting



Bland tank imagery mimics close, indoor setting

Fig 3. Using zebrafish to study myopia development and the relation between genetics and environmental factors.

Clinical Trials

We are conducting a clinical trial to test a potential treatment for preventing progression of myopia.

In collaboration with parallel studies in Singapore, Hong Kong, the UK and Ireland, we are conducting the Western Australian Atropine for Myopia study (WA ATOM study).

In this study, 100 children with early myopia are receiving very low-dose atropine eyedrops for two years to see if this slows the progression of myopia.

If successful, this treatment will **prevent children developing high myopia and its associated blinding eye conditions**.

It is hoped the genetic and zebrafish studies will give us clues to identify other drugs that may be more effective in treating myopia.

Lions Eye Institute myopia discovery and treatment platform

The Lions Eye Institute recognises that myopia is a major contemporary health problem that develops in childhood and has lifelong consequences.

The Lions Eye Institute is committed to expanding and combining our myopia-related research to form a myopia discovery and treatment platform. This will be a unique platform of integrated research which will expand our understanding of myopia and lead to new treatments. We already have the essential and established building blocks:

- Well-established **myopia gene discovery** research program
- Well-established and ongoing surveys of children and young adults clarifying the **environmental risk factors**
- **Emerging skills** in genetically modified zebrafish studies where environment and genes are modified to study impact on the eye and potential new therapies
- **Experience in clinical trials** for myopia therapies – WA ATOM study

Myopia research is required now, to prevent people losing vision in the future. Like many diseases, the risk of myopia is determined by both genetic and environmental factors that interact with one another. Our work will develop techniques for dissecting the interaction between genes and the environment in eye and other diseases.

Approximately one in four Western Australian adults have myopia, with this proportion surely increasing without our action. **Now we need to seize this opportunity to develop new treatments to slow the spread of this global threat to vision.**

If you would like to know more about our research into myopia please get in touch (08) 9381 0777 or carecentre@lei.org.au