

Preventing and slowing myopia progression will differ by geography

David A Mackey

Lions Eye Institute, University of Western Australia



Disclosures

- Funding

NHMRC, Telethon, Australian Vision Research, Stan Perron Foundation

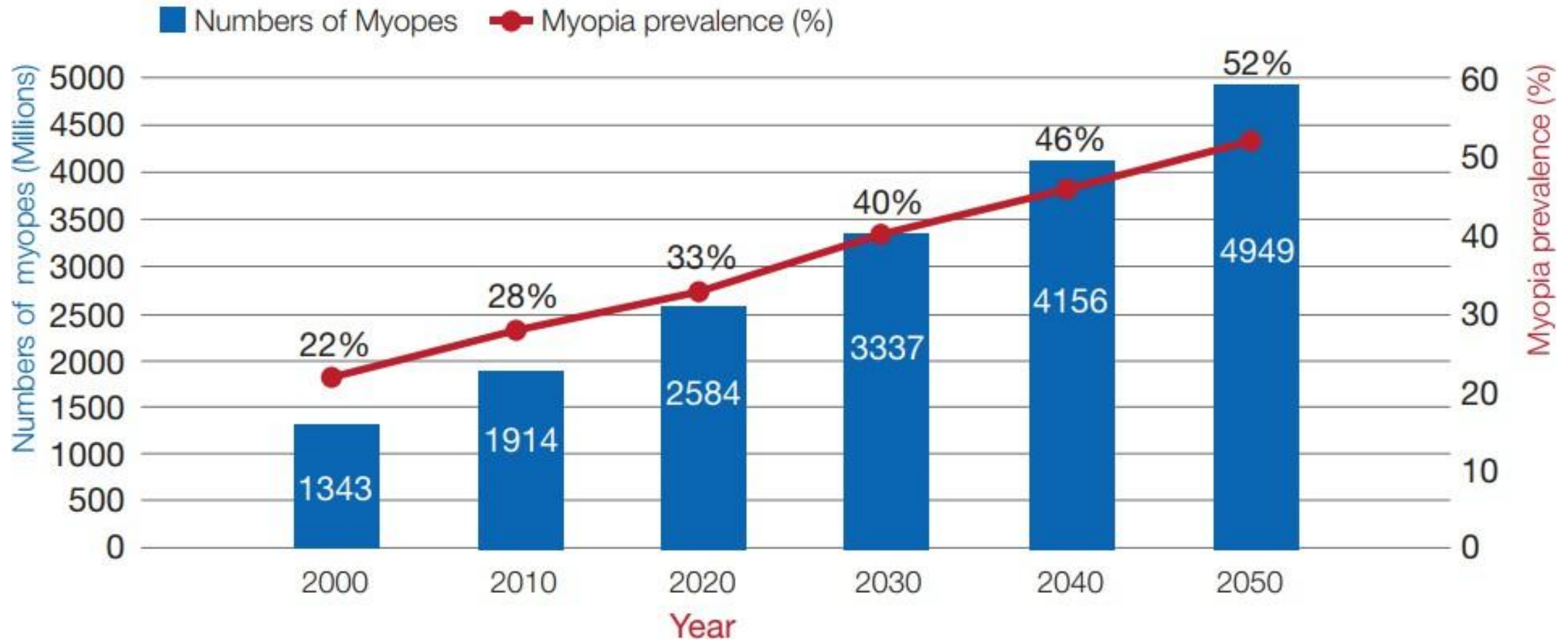
- Consultant/Advisor:

- Novartis
- PYC

- (all unrelated to myopia)

- “Could you patent the sun?” Jonas Salk

Myopia - Now and in 2050



World Health Organisation. 2017. The impact of myopia and high myopia
Adapted from Holden et al. 2016 Ophthalmology cited over 6,000 times



THE MYOPIA BOOM

SHORT-SIGHTEDNESS IS REACHING EPIDEMIC PROPORTIONS. SOME SCIENTISTS THINK THEY HAVE FOUND A REASON WHY.

BY ELIE DOLGIN

The southern city of Guangzhou has long held the largest eye hospital in China. But about five years ago, it became clear that the Zhongshan Ophthalmic Center needed to expand. More and more children were arriving with the blurry distance vision caused by myopia, and with so many needing eye tests and glasses, the hospital was bursting at the seams. So the centre began adding new testing rooms — and to make space, it relocated some of its doctors and researchers to a local shopping mall. Now during the summer and winter school holidays, when most diagnoses are made, “thousands and thousands of children” pour in every day, says ophthalmologist Nathan Congdon, who was one of those uprooted. “You literally can’t walk through the halls because of all the children.”

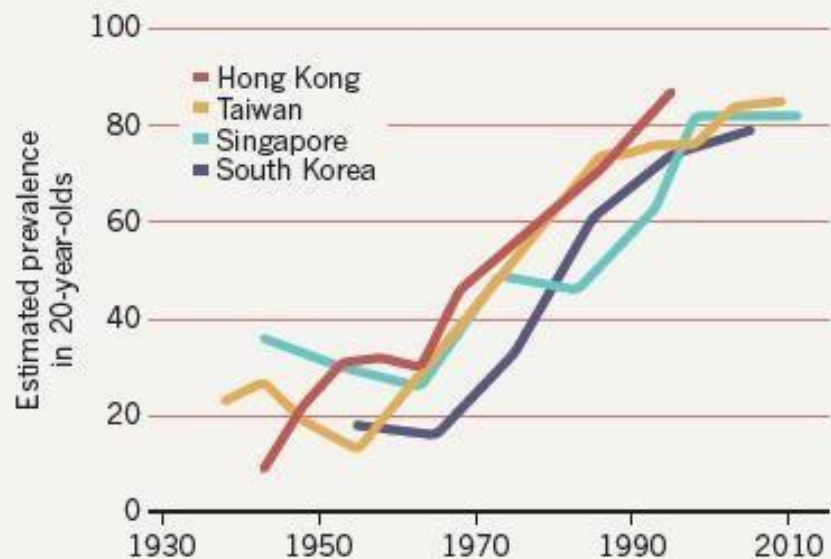
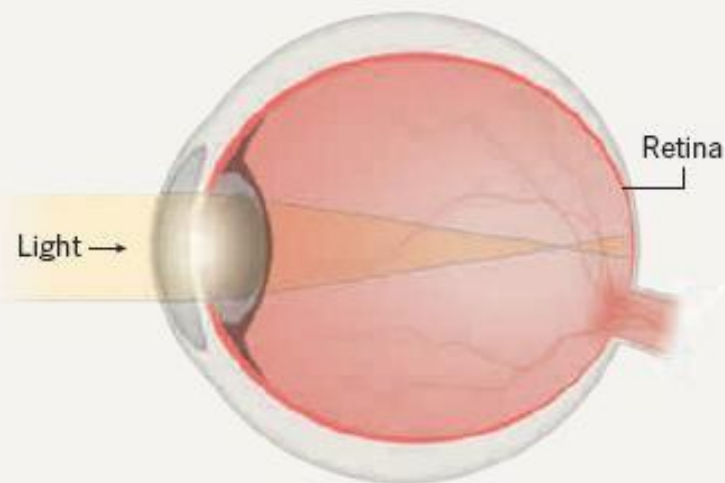
East Asia has been gripped by an unprecedented rise in myopia, also known as short-sightedness. Sixty years ago, 10–20% of the Chinese population was short-sighted. Today, up to 90% of teenagers and young adults are. In Seoul, a whopping 96.5% of 19-year-old men are short-sighted.

Glasses have become the rule, not the exception, in Chinese universities.

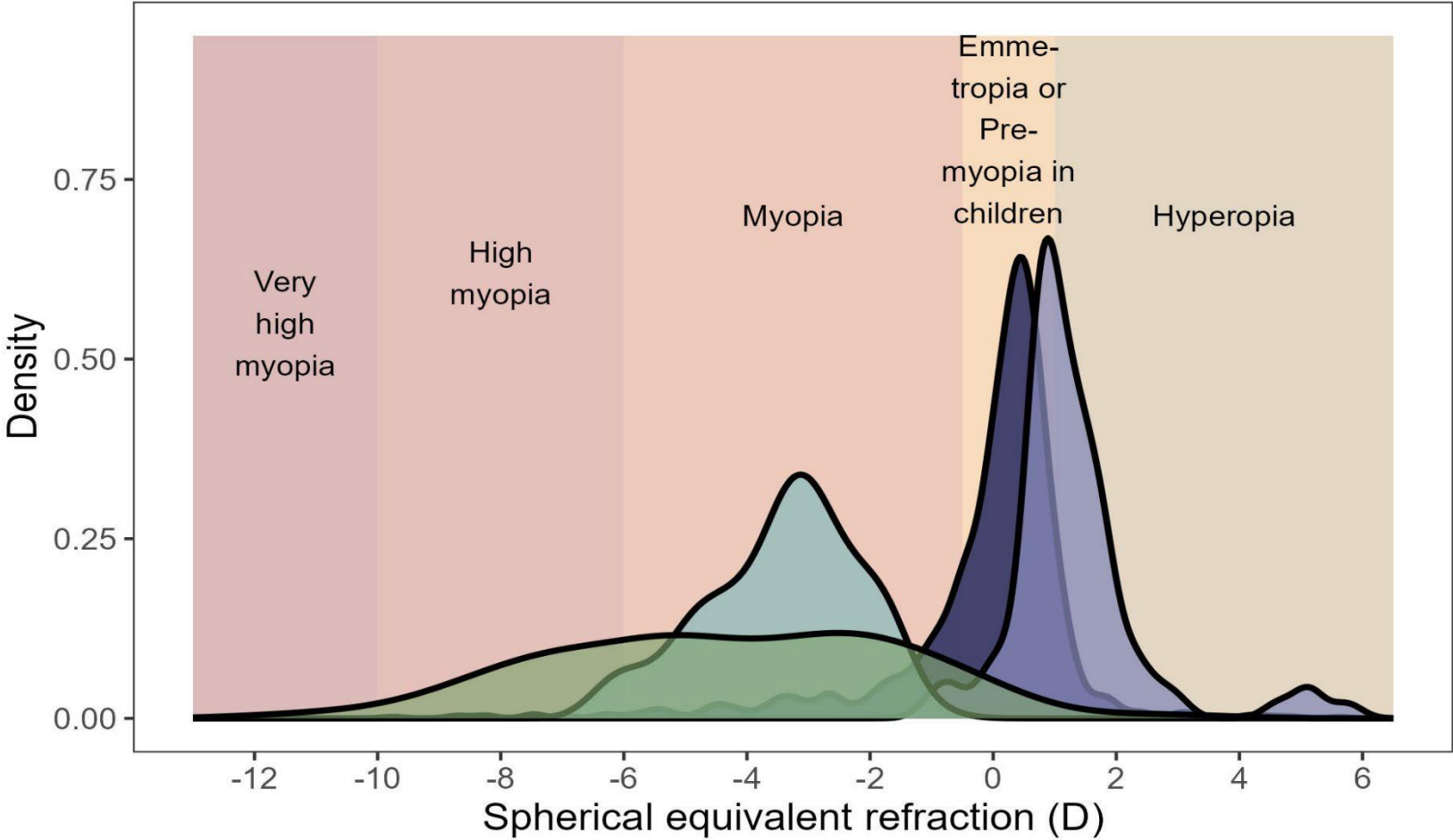
Other parts of the world have also seen a dramatic increase in the condition, which now affects around half of young adults in the United States and Europe — double the prevalence of half a century ago. By some estimates, one-third of the world’s population — 2.5 billion people — could be affected by short-sightedness by the end of this decade. “We are going down the path of having a myopia epidemic,” says

THE MARCH OF MYOPIA

East Asian countries have seen a steep rise in short-sightedness over the past 50 years. The condition is caused by a slightly elongated eyeball, which means that light is focused just in front of the retina instead of on it.

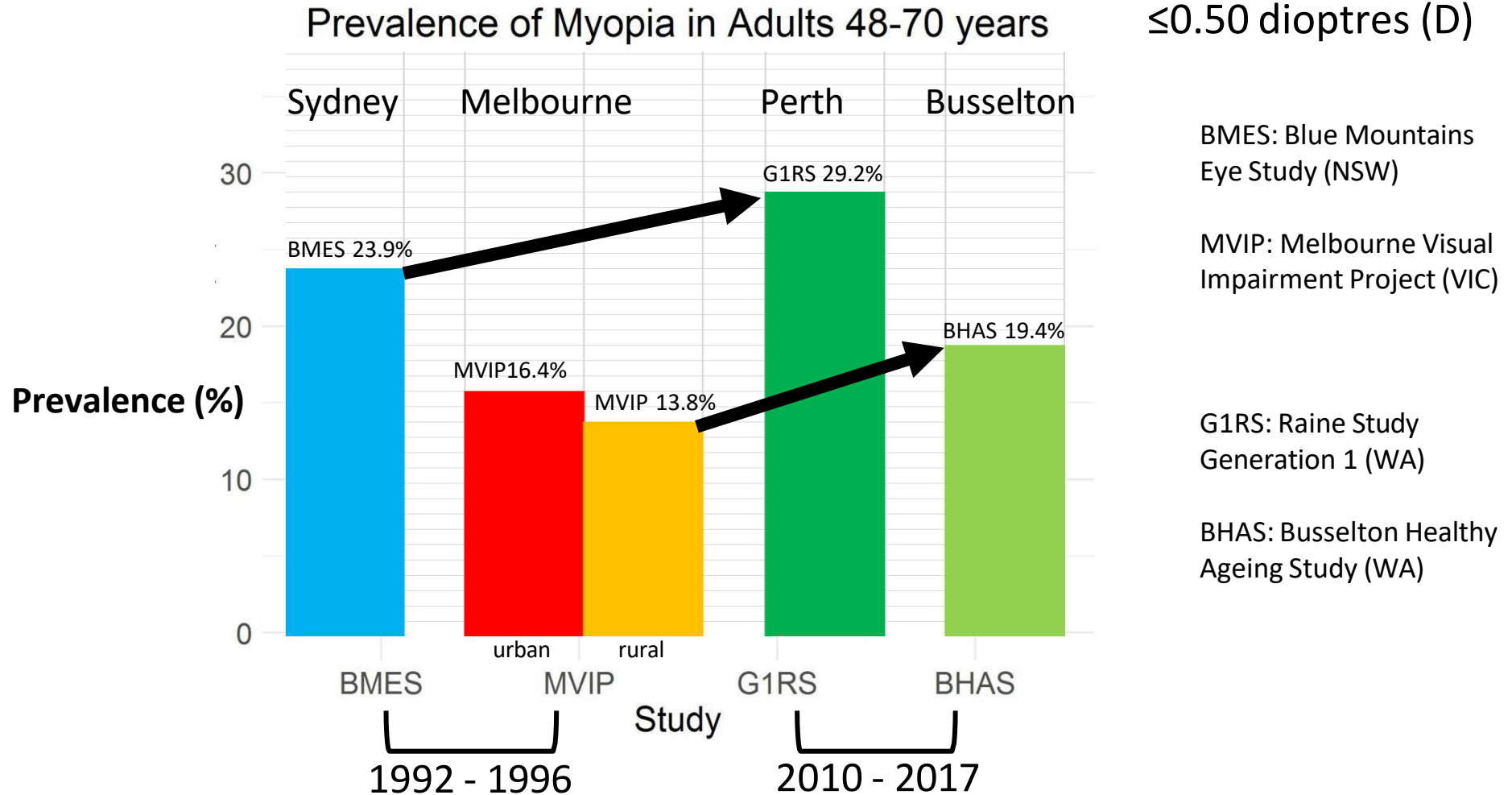


Myopia Australia versus China



Australian Rates of Myopia over time

Older adults



Myopia in Younger Australians

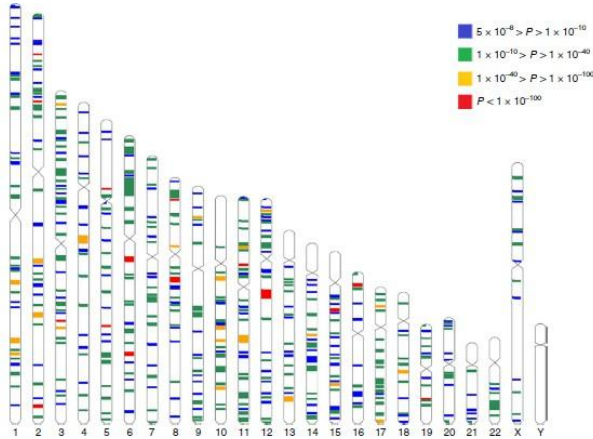


Fig. 1 | All GWAS-associated regions from the main meta-analysis. Each band is a true scale of the genomic regions associated with refractive error that are listed in Supplementary Table 1 (+250 kb on each side to make smaller regions more visible). The different color codes represent the significance (P value) for the genetic variant within that region that displays the strongest evidence for association.

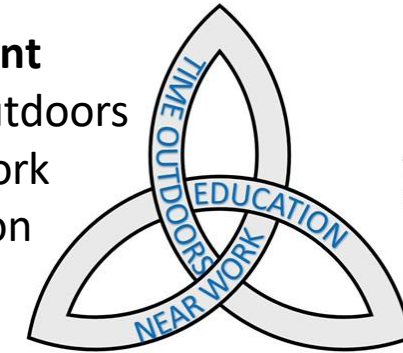


CREAM has identified over 400 loci
Included Australian Twin Studies

Affects **25%** of
20-year-olds
in Australia

Environment

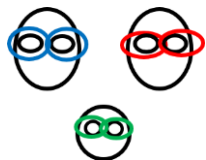
- ↓ Time Outdoors
- ↑ Near Work
- ↑ Education



Three Intertwined
Risk Factors

Genes

Mum & Dad with myopia



- 0 parents myopia risk = **20%**
- 1 parent myopia risk = **33%**
- 2 parents myopia risk = **44%**



Hysi PG, et al. Nat Genet 2020;52:401–407.

Lee SS-Y, et al. JAMA Ophthalmol 2022;140:162–169.

Lee SS-Y, et al. Invest Ophthalmol Vis Sci 2023;64:28.

Lingham G, et al. Sci Rep 2021;11:6337.

Young Adult-onset Myopia

Research

JAMA Ophthalmology | Original Investigation

Incidence and Progression of Myopia in Early Adulthood

Samantha Sze-Yee Lee, PhD; Gareth Lingham, PhD; Paul G. Sanfilippo, PhD; Christopher J. Hammond, MD; Seang-Mei Saw, MBBS, PhD; Jeremy A. Guggenheim, PhD; Seyhan Yazar, PhD; David A. Mackey, MD

Multimedia
Supplemental content

IMPORTANCE Myopia incidence and progression has been described extensively in children. However, few data exist regarding myopia incidence and progression in early adulthood.

OBJECTIVE To describe the 8-year incidence of myopia and change in ocular biometry in young adults and their association with the known risk factors for childhood myopia.

DESIGN, SETTING, AND PARTICIPANTS The Raine Study is a prospective single-center cohort study. Baseline and follow-up eye assessments were conducted from January 2010 to August 2012 and from March 2018 to March 2020. The data were analyzed from June to July 2021. A total of 1328 participants attended the baseline assessment, and 813 participants attended the follow-up assessment. Refractive information from both visits was available for 701 participants. Participants with keratoconus, previous corneal surgery, or recent orthokeratology wear were excluded.

EXPOSURES Participants' eyes were examined at ages 20 years (baseline) and 28 years.

MAIN OUTCOMES AND MEASURES Incidence of myopia and high myopia; change in spherical equivalent (SE) and axial length (AL).

RESULTS A total of 516 (261 male [50.6%]) and 698 (349 male [50.0%]) participants without myopia or high myopia at baseline, respectively, were included in the incidences analyses, while 691 participants (339 male [49%]) were included in the progression analysis. The 8-year myopia and high myopia incidence were 14.0% (95% CI, 11.5%-17.4%) and 0.7% (95% CI, 0.3%-1.2%), respectively. A myopic shift (of 0.50 diopters [D] or greater in at least 1 eye) occurred in 261 participants (37.8%). Statistical significance was found in longitudinal changes in SE (-0.04 D per year; $P < .001$), AL (0.02 mm per year; $P < .001$), and lens thickness (0.02 mm per year; $P < .001$). Incident myopia was associated with self-reported East Asian vs White race (odds ratio [OR], 6.13; 95% CI, 1.06-35.25; $P = .04$), female vs male sex (OR, 1.81; 95% CI, 1.02-3.22; $P = .04$), smaller conjunctival ultraviolet autofluorescence area (per 10-mm² decrease, indicating less sun exposure; OR, 9.86; 95% CI, 9.76-9.97; $P = < .009$), and parental myopia (per parent; OR, 1.57; 95% CI, 1.03-2.38; $P = < .05$). Rates of myopia progression and axial elongation were faster in female participants (estimate: SE, 0.02 D per year; 95% CI, 0.01-0.02 and AL, 0.007 mm per year; 95% CI, 0.00-0.011; $P \leq .001$) and those with parental myopia (estimate per parent: SE, 0.01 D per year; 95% CI, 0.00-0.02 and AL, 95% CI, 0.002-0.008; $P \leq .001$). Education level was not associated with myopia incidence or progression.

CONCLUSIONS AND RELEVANCE These findings suggest myopia progression continues for more than one-third of adults during the third decade of life, albeit at lower rates than during childhood. The protective effects of time outdoors against myopia may continue into young adulthood.

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- The Raine Study
20 years -> 28 years
- Myopia progression in 1/3 during third decade
- 8-year incidence= 14.0%
- 1/3 of the population have myopia approaching 30 years of age

Treatments to Prevent Myopia Progression



- Low-Concentration Atropine Drops: Daily (0.01% to 0.05%) \$\$



- Orthokeratology (Ortho-K) Lenses: Rigid, gas-permeable contact lenses worn only at night to temporarily reshape the cornea, providing clear vision during the day without glasses \$\$

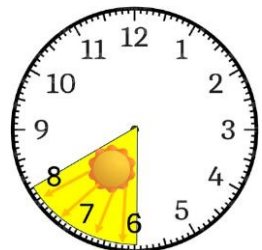


- Specialized Spectacle Lenses: DIMS (Defocus Incorporated Multiple Segments) or HALT technology (like Hoya MiYOSMART or Essilor Stellest) \$\$\$

- Multifocal/Dual-Focus Soft Contact Lenses: Daily disposable lenses MiSight \$\$\$



- Red Light Therapy \$\$\$



- Lifestyle Changes: Spending more time outdoors (2 hours per day) and reducing prolonged indoor screen time



Perth



Busselton



Melbourne

Blue Mountains Eye Study

Melbourne Vision Impairment Project

Increased Time Outdoors Prevents Myopia

Outdoor Activity Reduces the Prevalence of Myopia in Children

Kathryn A. Rose, PhD,¹ Ian G. Morgan, BSc, PhD,² Jenny Ip, MBBS,³ Annette Kifley, MBBS, MAppStat,³ Son Huynh, MBBS, MMed (ClinEpi),¹ Wayne Smith, BMed, PhD,⁴ Paul Mitchell, MD, PhD⁵

Objective: To assess the relationship of near, midworking distance, and outdoor activities with prevalence of myopia in school-aged children.

Design: Cross-sectional study of 2 age samples from 51 Sydney schools, selected using a random cluster design.

Participants: One thousand seven hundred sixty-five 6-year-olds (year 1) and 2367 12-year-olds (year 7) participated in the Sydney Myopia Study from 2003 to 2005.

Methods: Children had a comprehensive eye examination, including cycloplegic refraction. Parents and children completed detailed questionnaires on activity.

Main Outcome Measures: Myopia prevalence and mean spherical equivalent (SE) in relation to patterns of near, midworking distance, and outdoor activities. Myopia was defined as SE refraction ≤ -0.5 diopters (D).

Results: Higher levels of outdoor activity (sport and leisure activities) were associated with more hyperopic refractions and lower myopia prevalence in the 12-year-old students. Students who combined high levels of near work with low levels of outdoor activity had the least hyperopic mean refraction (+0.27 D; 95% confidence interval [CI], 0.02–0.52), whereas students who combined low levels of near work with high levels of outdoor activity had the most hyperopic mean refraction (+0.56 D; 95% CI, 0.38–0.75). Significant protective associations with increased outdoor activity were seen for the lowest ($P = 0.04$) and middle ($P = 0.02$) tertiles of near-work activity. The lowest odds ratios for myopia, after adjusting for confounders, were found in groups reporting the highest levels of outdoor activity. There were no associations between indoor sport and myopia. No consistent associations between refraction and measures of activity were seen in the 6-year-old sample.

Conclusions: Higher levels of total time spent outdoors, rather than sport per se, were associated with less myopia and a more hyperopic mean refraction, after adjusting for near work, parental myopia, and ethnicity. *Ophthalmology* 2008;115:1279–1285 © 2008 by the American Academy of Ophthalmology.

Myopia is an eye condition that poses significant costs for optical correction and costs due to associated cataract^{1–3} and glaucoma^{4–6} in the longer term. In the latter part of the 20th century in highly urbanized East Asian regions,^{7–9} the prevalence of myopia has increased dramatically and, in some highly educated groups, now exceeds 80%.^{10–12} In parallel with the increase in overall myopia, there has been a rise in the prevalence of high myopia (≤ -6 diopters [D]),¹³ which is associated with increased levels of visual impairment and blindness,¹⁴ primarily due to chorioretinal degeneration and retinal detachment. Furthermore, myopia is appearing with greater prevalence in young children,^{13,15} which places

these children at greater risk of developing high myopia, with its associated complications.

Due to these trends in the prevalence of myopia, there has been a research focus on factors that could increase the risk of myopia. It is well established that the prevalence of myopia in children is greater if their parents are myopic.^{16–21} East Asian ethnicity has also been proposed as a possible risk factor. Although these 2 factors could indicate a genetic contribution, myopia is generally believed to have a multifactorial etiology, and the rapid rise in prevalent myopia suggests that rapidly changing environmental factors are predominant in determining the current patterns of myopia.²²

The Sydney Myopia Study is supported by the National Health & Medical Research Council, Canberra, Australia (grant no. 253732), and Westmead Millennium Institute, University of Sydney, Sydney, Australia. Dr Morgan's contribution was supported by the Australian Research Council, Canberra, Australia (grant no. COE561903). The sponsors and funding organizations had no role in the design or conduct of the research. No conflicting relationship exists for any author.

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Review

How does spending time outdoors protect against myopia? A review

Gareth Lingham,¹ David A Mackey,¹ Robyn Lucas,^{1,2} Seyhan Yazar,^{1,3}

► Additional material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bjophthalmol-2019-314675>).

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ABSTRACT

Myopia is an increasingly common condition that is associated with significant costs to individuals and society. Moreover, myopia is associated with increased risk of glaucoma, retinal detachment and myopic maculopathy, which in turn can lead to blindness. It is now well established that spending more time outdoors during childhood lowers the risk of developing myopia and may delay progression of myopia. There has been great interest in further exploring this relationship and exploiting it as a public health intervention aimed at preventing myopia in children. However, spending more time outdoors can have detrimental effects, such as

possibly progression in children and adolescents.^{6–8} Spending more time outdoors may reduce the risk of myopia by a number of pathways (figure 1). Identifying the factors behind this relationship might allow interventions to be targeted, thereby avoiding potentially detrimental effects associated with spending time outdoors, such as sunburn and an increased risk of skin cancers.⁹ The means by which spending time outdoors might lower myopia risk have been briefly discussed in broader reviews, as well as comprehensively in reviews on individual elements (online supplementary table 1). However, the rapid expansion of studies warrants an updated

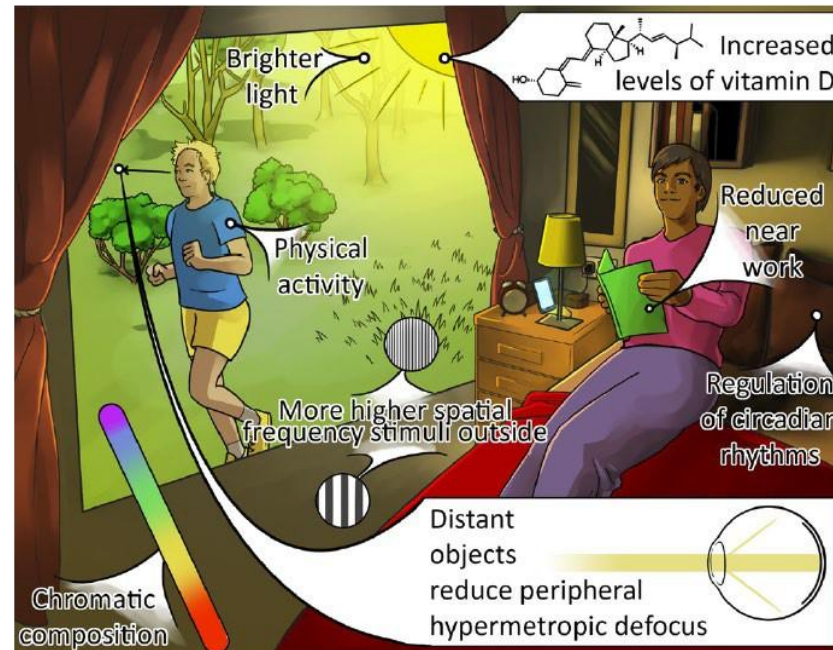
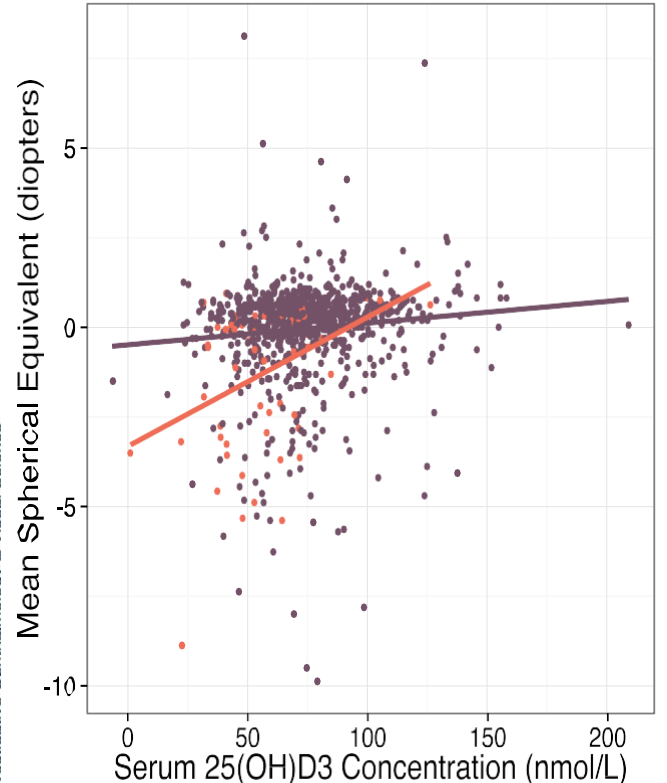


Figure 1 Spending more time outdoors may reduce risk of myopia via multiple means.

Clinical and Epidemiologic Research

Myopia Is Associated With Lower Vitamin D Status in Young Adults

Seyhan Yazar,¹ Alex W. Hewitt,^{1,2} Lucinda J. Black,³ Charlotte M. McKnight,¹ Jenny A. Mountain,³ Justin C. Sherwin,⁴ Wendy H. Oddy,³ Minas T. Coroneo,⁵ Robyn M. Lucas,^{5,6} and David A. Mackey¹



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4552

**Myopia and skin cancer are inversely correlated:
results of the Busselton Healthy Ageing Study.
Franchina M et al. Med J Aust. 2014;200:521-2.**



143/1,861 participants (7.7%) with a previous history of either cutaneous melanoma, squamous cell carcinoma or basal cell carcinoma

	Controls	Skin cancer history [#]	p-value
Age in years (Range)	56.2 (45.7 -66.4)	57.0 (45.5-65.7)	0.117*
Gender (%Male)	958 (53.8%)	74 (50.1%)	0.473**
Known ocular pathology			
<i>Diabetes-related</i>	32 (1.8%)	2 (1.4%)	1.000 [†]
<i>Macular degeneration</i>	42 (2.4%)	1 (0.7%)	0.251 [†]
<i>Glaucoma</i>	39 (2.2%)	3 (2.1%)	1.000 [†]
<i>Cataract</i>	97 (5.4%)	4 (2.7%)	0.242 [†]
<i>Eye injury/trauma</i>	32 (1.8%)	1 (0.7%)	0.509 [†]
<i>Other</i>	62 (3.5%)	8 (5.5%)	0.243 [†]
Myopia (mean SE both eyes \leq -0.50D)	391 (21.9%)	17 (11.6%)	0.003**

[#]Includes cutaneous melanoma, SCC, BCC.



Has the Sun Protection Campaign in Australia Reduced the Need for Pterygium Surgery Nationally?

Louis J. Stevenson^{a,b}, David A. Mackey^a, Gareth Lingham^b, Alex Burton^a, Holly Brown^a, Emily Huynh^a, Irene J. Tan^a, Maria Franchina^a, Paul G. Sanfilippo^c, and Seyhan Yazar^a

^aLions Eye Institute, Centre for Ophthalmology and Visual Science, University of Western Australia, Nedlands, Western Australia; ^bFaculty of Medicine and Health, University of Sydney, Camperdown, New South Wales, New South Wales, Australia; ^cCentre for Eye Research Australia, University of Melbourne, Royal Victorian Eye and Ear Hospital, East Melbourne, Victoria, Victoria, Australia

ABSTRACT

Background: The Slip! Slop! Slap! Sunsmart safety campaign was an Australian initiative implemented in the 1980s. To assess this campaign's effect on pterygium, we examined the rate of pterygium surgery across Australia and described the prevalence and associations of pterygium in Perth, Australia's sunniest capital city.

Methods: The rate of pterygium surgery was examined using Australian Medicare data. A cross-sectional analysis of the Generation 1 (Gen1) cohort of the Raine Study was performed to investigate the prevalence of pterygium in Perth. We investigated the association between pterygium and conjunctival ultraviolet autofluorescence (CUVAF) area, an objective biomarker of sun exposure, and demographics and health variables derived from a detailed questionnaire.

Results: Between 1994 and 2017, the rate of Medicare funded pterygium surgery in Western Australia fell 11%, well below the national average decline of 47%. Of the 1049 Gen1 Raine Study participants, 994 (571 females; mean age 56.7 years, range = 40.9–81.7) were included in the analysis. The lifetime prevalence of pterygium was 8.4% (n = 83). A higher prevalence of pterygium was associated with outdoor occupation (p-trend = 0.007), male sex (p-trend 0.01) and increasing CUVAF area (p-value <0.001).

Conclusions: The effect of Australia's Slip! Slop! Slap! Sunsmart safety campaign on pterygium been mixed. Since 1994, the rate of private pterygium surgery has declined significantly in all Australian states except Western Australia. Perth, Western Australia, has the highest pterygium prevalence of any mainland-Australian cohort. Higher CUVAF area, male sex, and outdoor occupation were associated with an increased risk of pterygium.

ARTICLE HISTORY

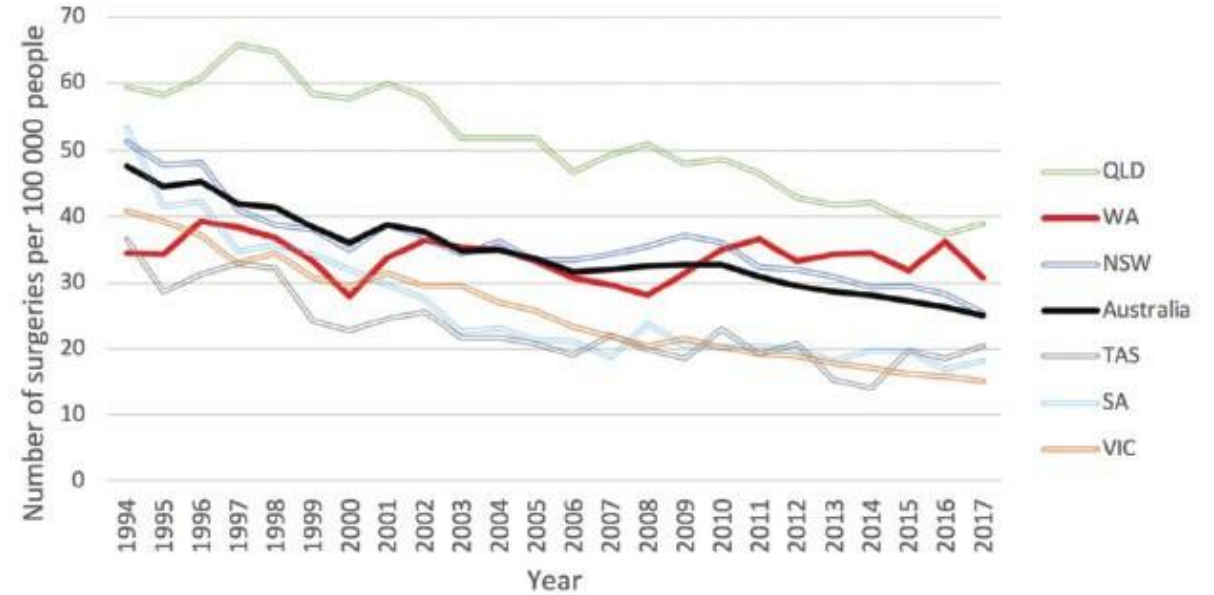
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KEYWORDS

Epidemiology; ultraviolet radiation; Raine study; pterygium

Raine Gen 1
8.4% Pterygium

Rate of private pterygium surgery in Australia between 1994 and 2017



Introduction

Pterygium is a wing-shaped fibrovascular growth of the bulbar conjunctiva that extends across the limbus onto the cornea.¹ Visual impairment can result from direct occlusion of the visual axis or astigmatism induced by corneal deformation.² The pathophysiological changes leading to pterygium development are incompletely understood; however, ultraviolet radiation (UV) exposure has been identified as the single most important risk factor.^{3–6} Reflecting this relationship, pterygium is also strongly associated with malignancy. Ocular surface squamous neoplasia, including squamous cell carcinoma, occurs simultaneously in 10% of cases,⁷ and the presence of pterygium is associated with a 24% increase in the lifetime risk of cutaneous melanoma.⁸ Pterygium imposes a significant public health burden, with pterygium excision being the second most commonly performed ophthalmic surgical procedure after cataract surgery.⁴

which melanin pigment in the cornea to protect against UV radiation. Seagraves et al.³ In 2000, Seagraves et al.³ reported that the burden of pterygium is increasing in Australia.

Table 3. Summary of the prevalence of pterygium in Australia.

Author	Study	Year of publication	Age mean	Latitude (degrees south)	Males	Females	Overall
Sherwin <i>et al.</i> ¹⁹	Norfolk Island Eye Study	2013	54.1	29 (Norfolk Island)	15.0%	7.7%	10.9%
Landers <i>et al.</i> ³⁰	Central Australian Ocular Health Study	2011	48.4	26–20 (South Australian/Northern Territory border – Tanami)	No significant difference		7.8%
Panchapakesan <i>et al.</i> ³¹	Blue Mountains Eye Study	1998	Not reported	33 (Blue Mountains)	11.0%	4.5%	7.3%
			All participants >49 years.				
McCarty <i>et al.</i> ³²	Melbourne Visual Impairment Project	2000	60.6	37 (Melbourne)	4.6%	1.8%	2.83%
Moran and Hollows ³	National Trachoma and Eye Health Program Indigenous cohort	1984	Not reported	Variable – study sites distributed across entirety of Australia	2.7%	2.3%	2.5%
	Non-indigenous cohort				3.5%	3.3%	3.4%
					1.5%	0.65%	1.1%
McKnight <i>et al.</i> ³³	The Raine Study (Gen 2)	2015	20.0	31 (Perth)	2.0%	0.3%	1.2%

All Randomised Control Trials of Time Outdoors to Prevent Myopia are from China

Table 2 Previous RCTs of outdoor interventions in China.

Author	Year	Length	Setting	Target outdoor time ^a	Measured outdoor increase ^a	Myopia incidence ^b (%)	Axial length change ^b (mm)	Refractive error change ^b (D)
He	2009-2012	3 years	School	>+40	+3.2	-9.10%	-0.03	0.17*
He	2016-2018	2 years	School	1) +40 2) +80	1) +21 2) +21	1) -16%* 2) -11%*	1) -0.10* 2) -0.08*	1) +0.20* 2) +0.13*
Jin	2012-2013	1 years	School	+40	N.S.	-4.8%*	-0.05*	+0.17*
Li	2017-2018	1 years	Home	N.S.	+12	-3.80%	-0.04*	+0.09*
Wang	2020-2021	1 years	School	+120	N.S.	-1.90%	-0.03	+0.04
Wu	2013-2015	1 years	School	≥+40	+70.6	-3.0%	-0.05*	+0.12*

*p<0.05 for intervention vs control group difference; N.S.: Not specified.

^aminutes/day; ^bBetween-group difference (intervention – control)

Slowing & Preventing Myopia

Public Health

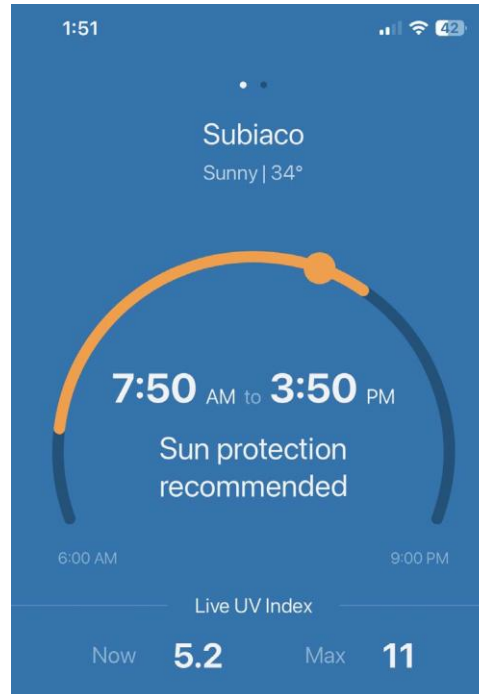
Inexpensive and Easier

- Increased time outdoors - 2 hours per day
- But need to follow SunSmart® recommendations



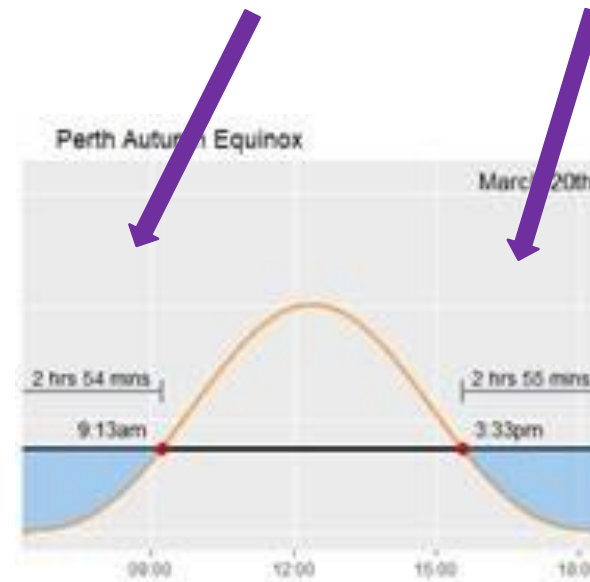
SunSmart Global UV App

Australia has some of the highest rates of skin cancer and pterygium in the world



Safest time to be outside is when
the UV Index is below 3

During the first 3 hrs & last 3 hrs of daylight



Protect yourself



Slip



Slop



Slap

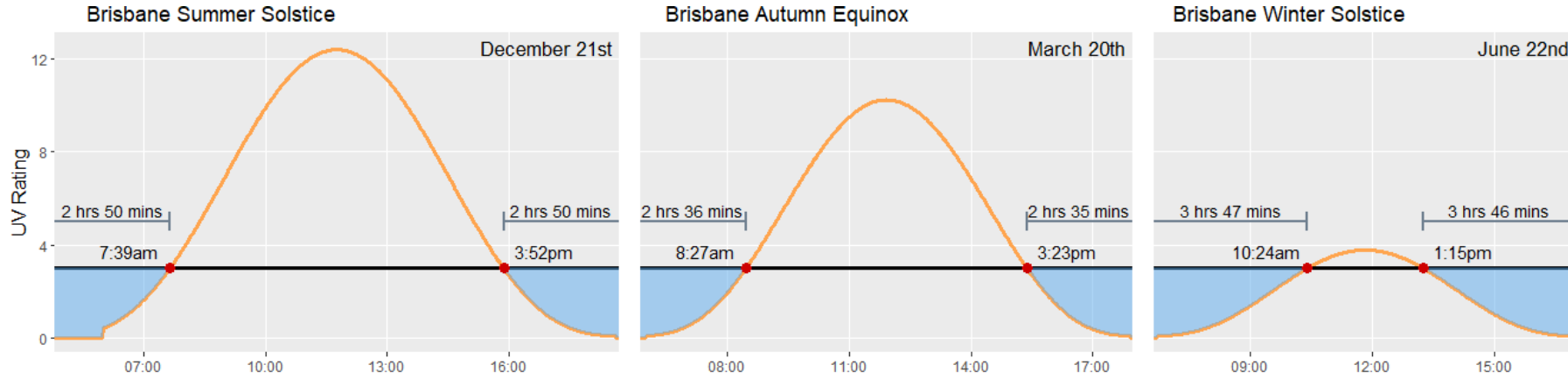


Seek

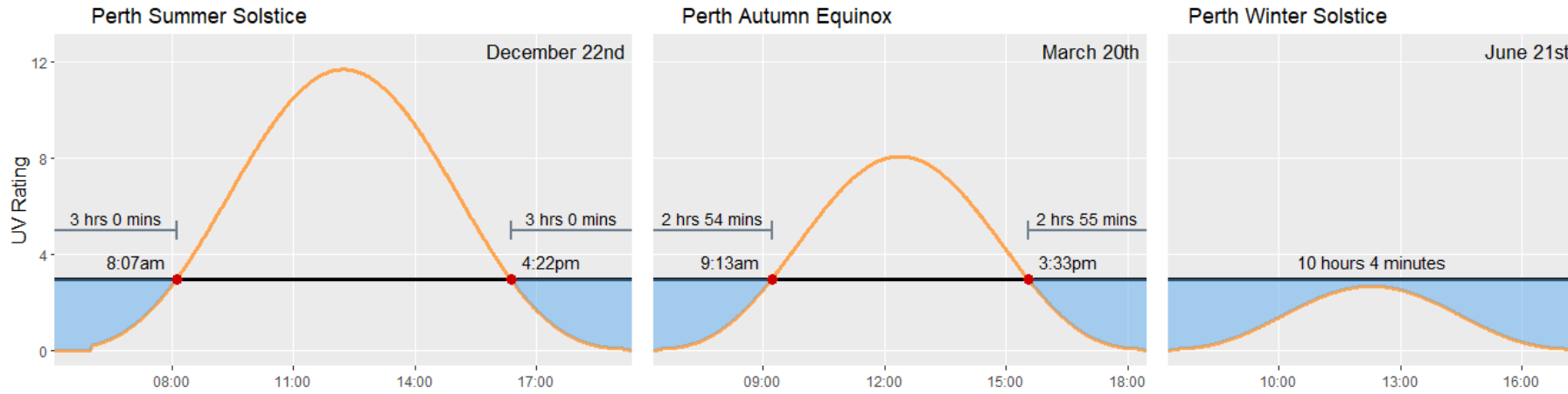


Slide

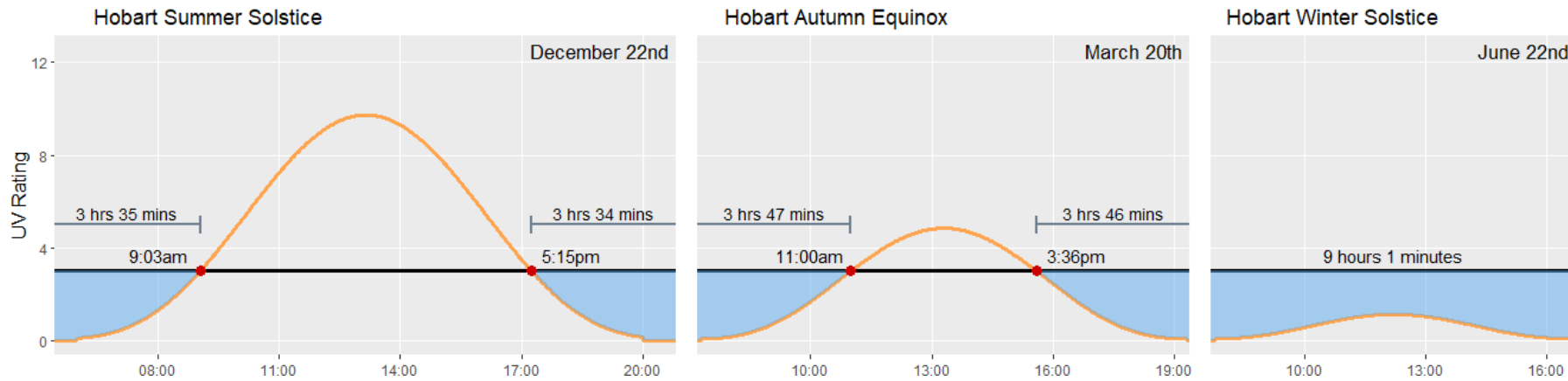
27deg S



32deg S



42deg S



Slowing & Preventing Myopia



- Before and After School outdoor time
- Walking or Riding to and from School
 - Organised Outdoor Sports
(e.g. football, soccer, athletics, cricket, tennis, swimming)
 - Having evening meals outside

Safe **T**ime **O**utdoors **P**revents **M**yopia

Getting kids more outdoor

Eye Health, Physical Health, Mental Health

- At School?
 - Teachers say they are too busy and do not want to contradict the current protection measures
 - “No hat, no play”
- Before and after School?
 - Need to make a parental responsibility
 - Engage with sporting activities
 - Make outdoor space at the home comfortable and child-friendly





26%

1.25 million Australian children aged 0-14 (26%) participate in an organised activity (sport- and/or non-sport-related) in a public space or at free community facilities.

Top sports being played in public space or at free community facilities (0-14 years)

	Estimated participants
 Football/soccer	235,000
 Swimming	170,000
 Basketball	115,000
 Running/jogging	111,000
 Australian football	103,000
 Cycling	100,000
 Cricket	62,000
 Athletics, track and field	60,000

PARTICIPANT PROFILE

Heath* is 10 years old and lives in Western Australian with his parents and twin sister. Outside of school hours, Heath plays soccer with the local club at their sports ground for six months of the year. Year round, he also takes swimming lessons once a week at the leisure centre in the next town. Both are sport-related activities.

*This profile illustrates some of the most popular activities for someone in this age group and the way they participate. It is not based on a real person.



PARTICIPANT PROFILE

Lily* is 6 years old and lives in South Australia with her mum and grandmother. She is already a competent swimmer, having taken lessons since she was two years old. She still goes to her swimming lesson once a week at her mum's gym after school (sport-related activity) but now also attends a dance class at a local studio on a Saturday morning (non-sport-related activity).

*This profile illustrates some of the most popular activities for someone in this age group and the way they participate. It is not based on a real person.

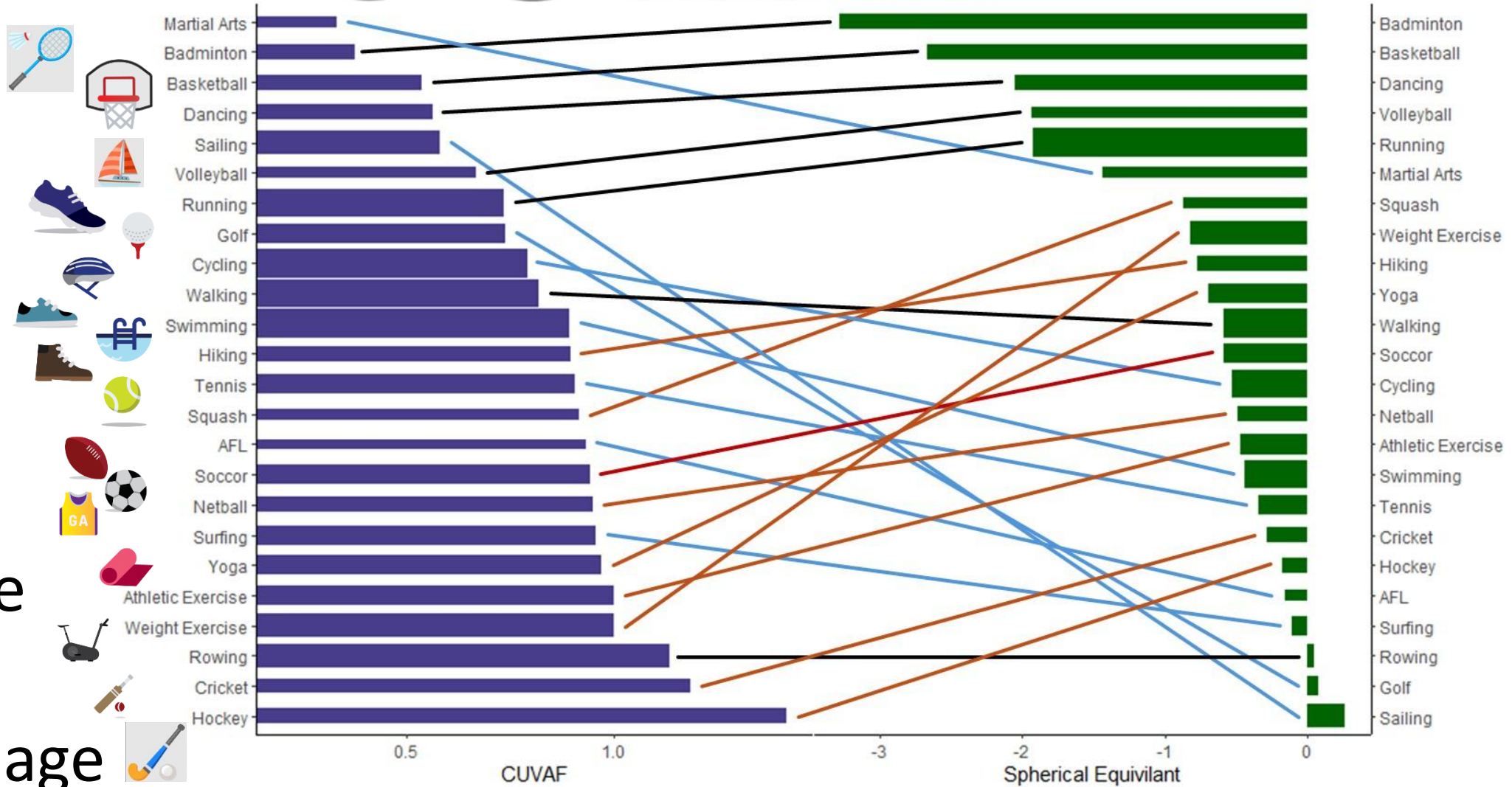


WA Eye Protection Study – Adolescents/Young Adults

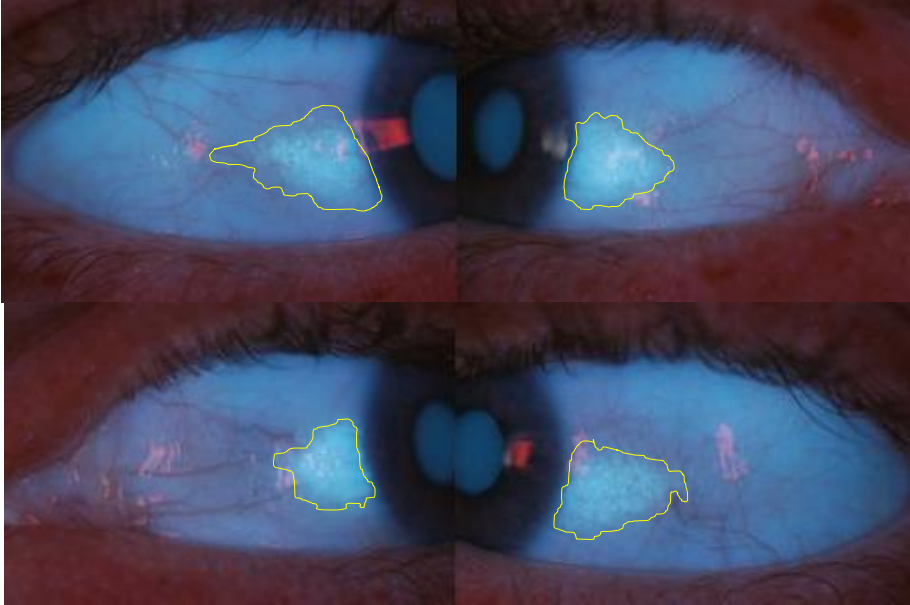


More Myopia

Eye Morphologies between Sports



Conjunctival Ultraviolet Autofluorescence (CUVAF)



← UVAF evident in all four quadrants



No UVAF evident →

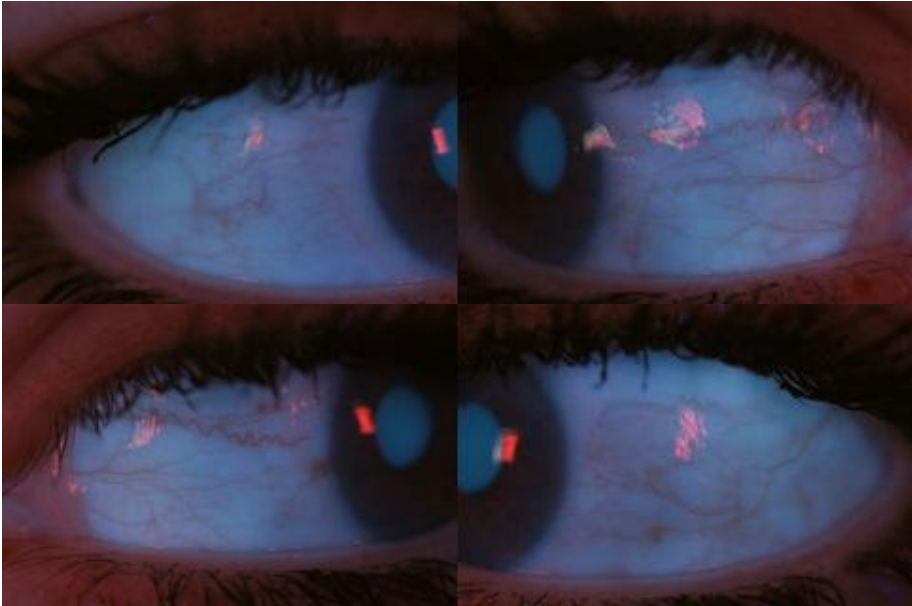
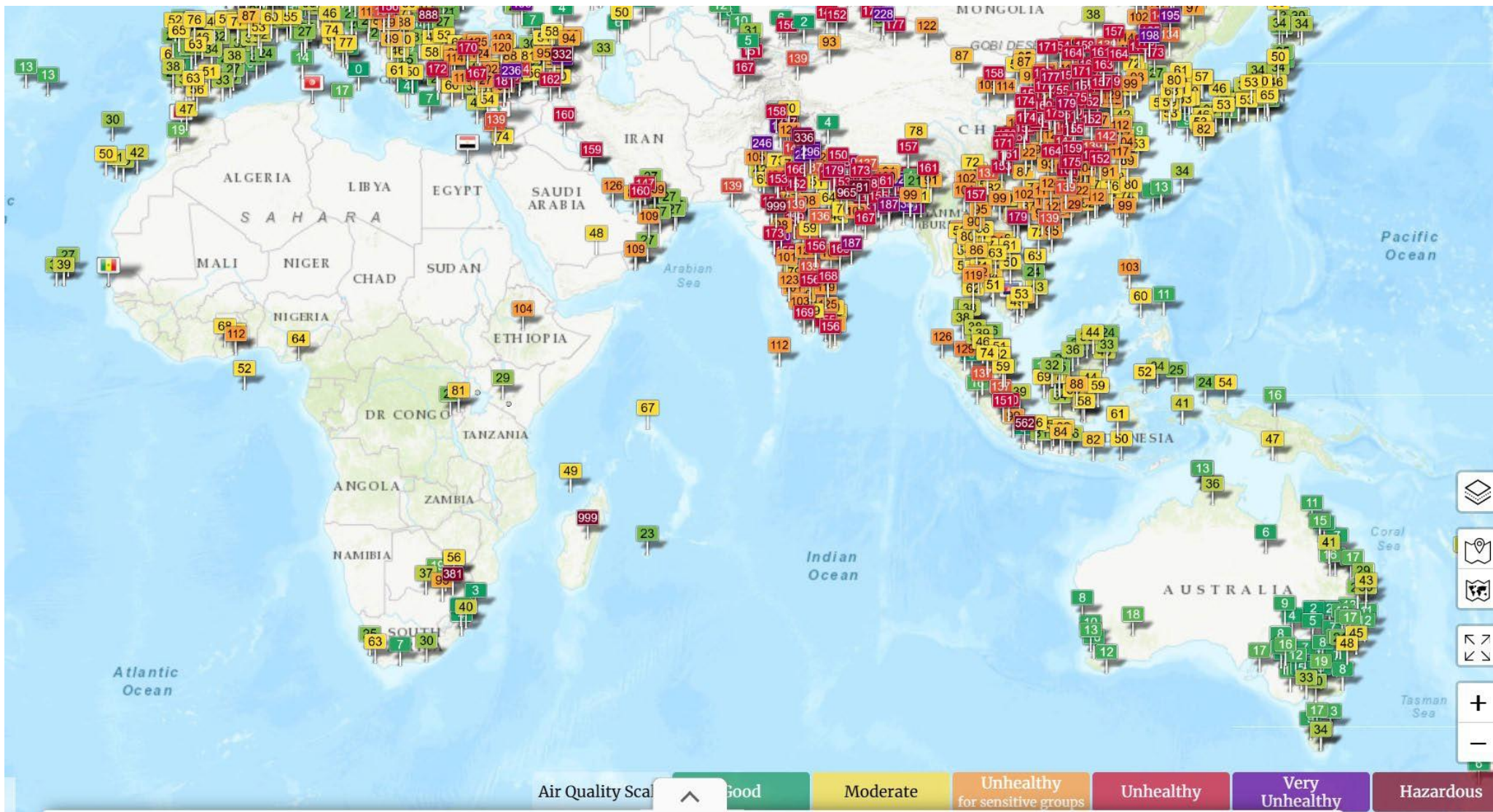


Figure 1 Photograph of UVAF system used in the Norfolk Island Eye Study demonstrating the seating of a model participant.

Barriers to children spending more time outdoors raised by participant families and consumer groups

- **Risk of sunburn and skin cancer**

- Cosmetic concerns around increased **skin tanning** and **freckling** mostly a concern among parents from some Asian countries
- **Pollution**, problems of bushfire smoke or hazard-reduction-burn smoke follow public health recommendations for people with **respiratory problems** to stay indoors
In Australia only a few days a year
In big cities in Asia with chronic air pollution problems, need to use apps for indices of air quality
- Outdoors in Winter. Some parents mistakenly believe that getting cold or wet when playing outdoors predisposes children to **respiratory infectious diseases**
Need to dress appropriately for warmth and dryness
“you don’t catch a cold being out in the cold and properly dressed”



December Solstice Air pollution



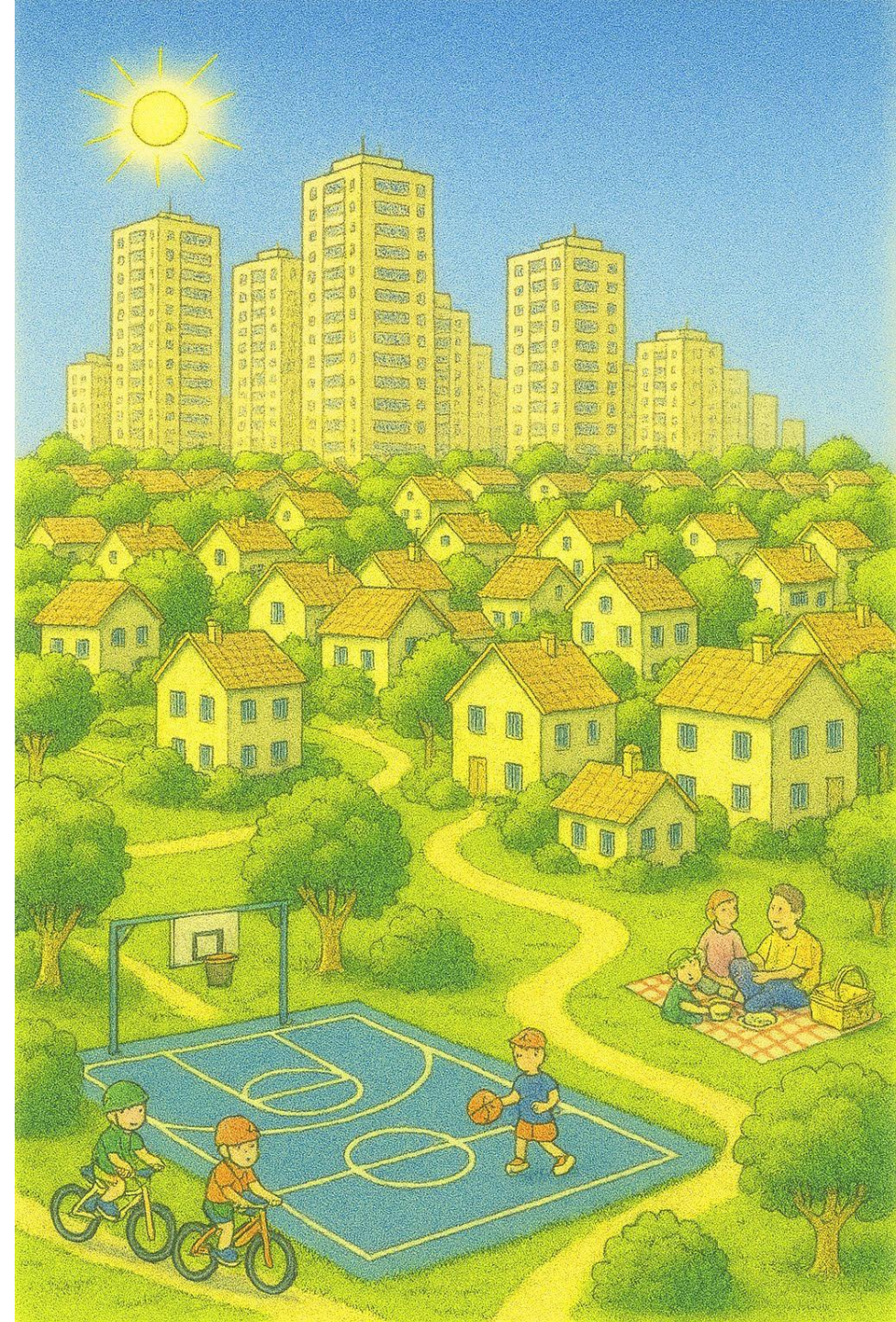
Need:

Clean Air

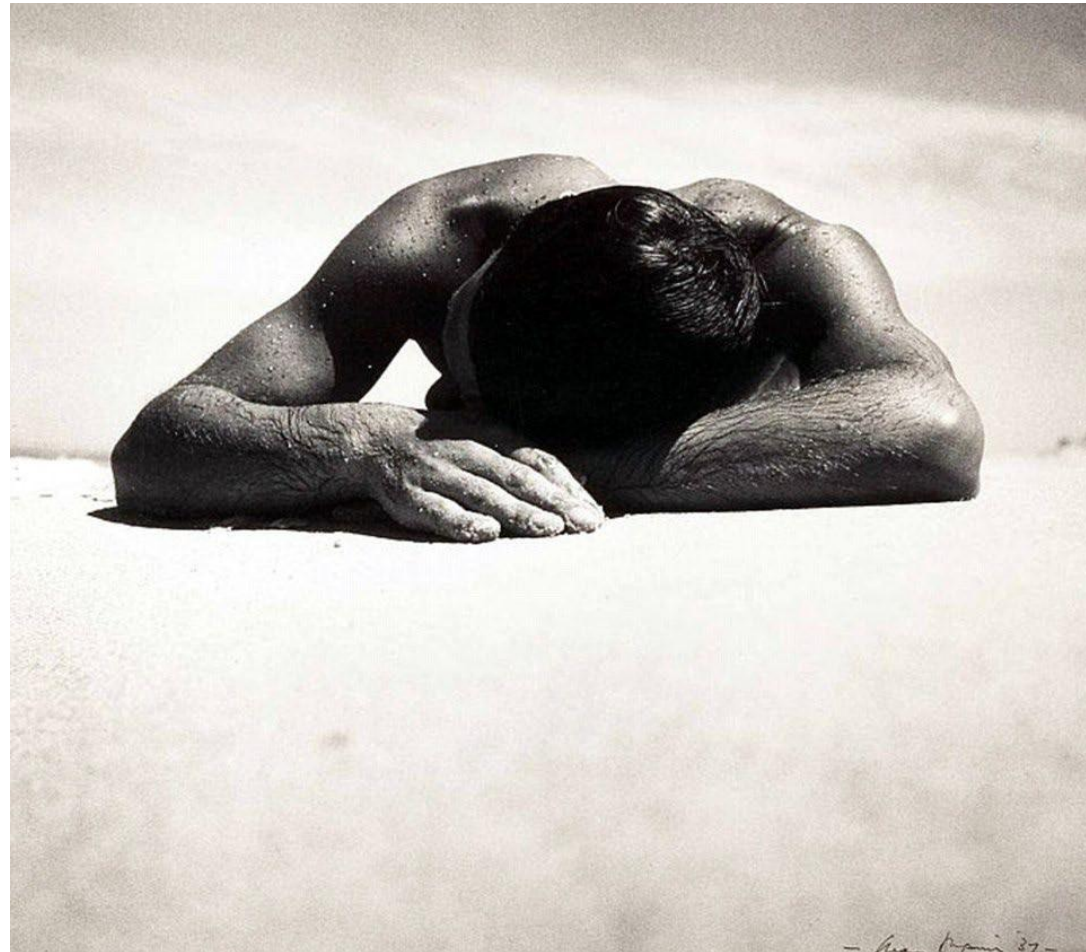
More open
green space

Outdoor sports
facilities

Outdoor cycle
& walking paths



Australia famed for its outdoor lifestyle
and as a consequence very high rates
of skin cancer and pterygium

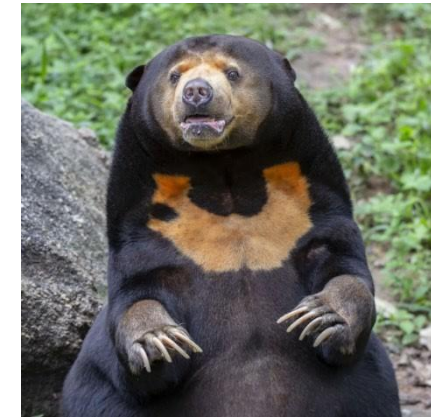


Sunbaker, 1937,
by Max Dupain

Looking at the same issue from another angle Australian sun exposure may have protected us from a myopia epidemic



What outdoors is “Just Right”
and when does it matter?



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