MYOPIA RISE AND VISION HEALTH ISSUES LEFT IN ITS WAKE

Myopia continues to be a growing problem around the world. A recent study[1] predicts that by 2050 about half of the world's population will be myopic. While genetics plays a role, researchers point to the increasingly digital lifestyles of young people as one culprit of the epidemic. The sheer volume of this vision impairment will have consequences not only for those with it, but also for the communities and nations where they live, work or go to school.

Maureen Cavanagh
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Maureen Cavanagh is the president of the Vision Impact Institute. She joined Essilor in 2005 and has held various executive leadership positions within the company. Cavanagh has extensive experience in vision healthcare, having worked for Johnson & Johnson's Vistakon and Spectacle Lens divisions before joining Essilor. Cavanagh earned her bachelor's degree from Bridgewater State University. She has received numerous industry awards, including the Optical Women's Association (OWA) Pleiades Award in 2015 and Jobson's Most Influential Women in Optical 2012. Cavanagh was appointed President of the OWA in July 2016.

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As our world grows and develops, our vision is getting worse. That's the takeaway from an important body of research data about the world's vision, with a laser focus on myopia and its impact.

The statistics are alarming – myopia is projected to affect almost half of the world's population by 2050.[1] The consequences are just as unsettling, as myopia, when left uncorrected, can lead to severe vision impairment and even blindness. By mid-century, nearly 5 billion will have the vision impairment with about 1 billion suffering from high myopia. In the United States and Canada, the number of myopic is estimated to climb to 260 million, or close to half of the population, up from 89 million in 2000; and high myopia cases jump an astounding five times to 66 million by that year.[1]

These are part of the findings of a meta-analysis by the Brien Holden Vision Institute, of 145 studies covering 2.1 million people.[1] Also known as nearsightedness, myopia is a refractive error that causes items close by to be seen distinctly while distance vision is blurry. High myopia is a severe form in which the eyeball becomes too long and can lead to retinopathies or even retinal detachment.

Young people are becoming myopic at an alarming rate in many countries – insuring that they will have a lifetime of blurry vision unless they get the aid of optical prescription (eyeglasses, contact lenses, ortho-k) or have refractive surgery. This will have long-term consequences for public health around the globe, especially in less-developed regions where healthcare delivery is more challenged.

KEYWORDS
Myopia, myopic, blindness, vision impairment, eye disease, digital eye strain, digital screen(s), public health, Asia

	2000	2050
Myopia	1.4 billion	4.758 billion
	22.9 percent of world population	49.8 percent of world population
High Myopia	163 million	938 million
	2.7 percent of world population	9.8 percent of world population

TAB | Myopia estimates[1]

"Two things are extremely worrying about these projections," said Professor Kovin Naidoo, CEO of the Brien Holden Institute and Vision Impact Institute advisory board member. "First, the accelerated growth of cases of myopia is incredible, which speaks to how our contemporary lifestyles are affecting our behavior. And second is that people with myopia, especially high myopia, are at higher risk to develop other vision disorders that can lead to blindness."

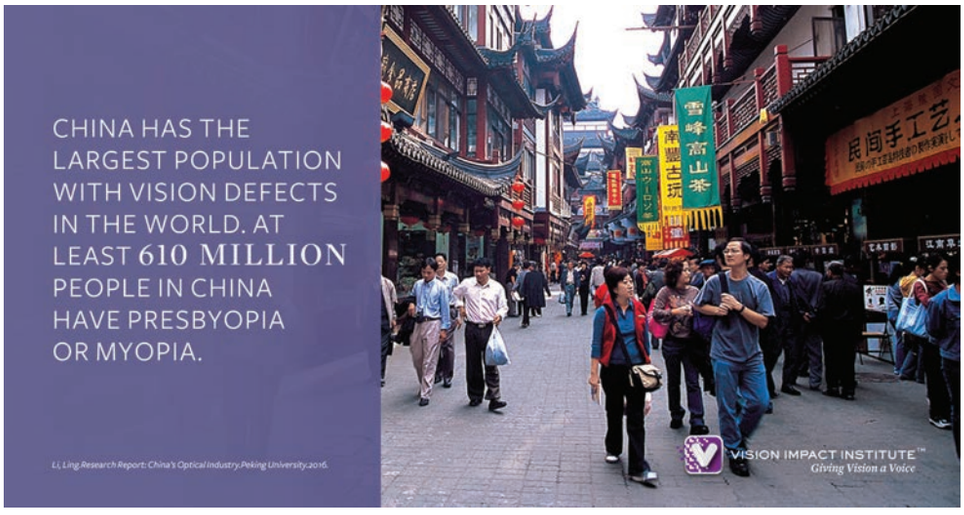
He said that 1 in 10 people worldwide will be at risk for permanent blindness by the year 2050, as high myopia especially increases the risk of cataracts, glaucoma, retinal detachment and myopic macular degeneration – all of which can cause irreversible vision loss.

Myopia epidemic in parts of Asia

Research indicates there are regional variations in the prevalence of myopia. Asia – the world's largest and most populous continent – is perhaps where its impact is more widespread. And East Asia – comprised of China, Japan, Hong Kong, Mongolia, North Korea, South Korea and Taiwan – is experiencing an epidemic with reports as high as 40 percent in Japan and 50 percent in Taiwan.[2] The prevalence of myopia is more than two times higher among East Asians than white people of the same age.[2]

China is especially hard hit. As it is the most populous country on Earth, it also has the largest population with vision defects. The results of the recent domestic white paper on China's National Vision Health, (conducted by Prof. Li Ling, Head of the China Center for Health Development) are alarming. In 2012, close to 500 million people over the age of five had an uncorrected visual defect in China, among which 450 million had myopia. By 2020, nearly 700 million people are expected to have myopia in China – twice the population of the United States. Undeniably, there is a huge increase from 60 years ago when the country was still isolated from the global economy and only 10-20 percent of its population had myopia[2].

A comparative study of six- and seven-year-old students of Chinese ethnicity in Singapore and Sydney had interesting results when it explored the prevalence of myopia among the focus population and possible risk factors.[4] The major finding was that myopia was more prevalent in Singapore



(29.1 percent) and significantly lower in Sydney (3.3 percent). Hereditary influences were about the same in both locations: one or more parents reported having myopia for 68 percent of the students in Sydney and 71 percent in Singapore parents. The primary lifestyle difference between the two student groups was that the children in Sydney spent more time outdoors each week (average of 13.75 hours) than those in Singapore (3.05 hours on average). The researchers also hypothesized that academic pressure in Singapore schools played a role in the difference.

However, myopia is not limited to Asian nations. A retrospective examination of 13 repeated prevalence studies analyzed data about the changing prevalence of myopia over 13 years with Israelis from 16 to 22 years old.[5] The overall occurrence of myopia increased significantly to 28.3 percent in 2002 from 20.3 percent in 1990. The causes of this increase were not certain; however, evidence pointed to genetic as well as environmental components, such as higher amounts of near work and more years of education.

Research shows similar results in the United States. One study compared myopia rates from 1971-72 to the period of 1999-2004, with the later period showing substantially higher myopia rates than 30 years earlier.[6]

Some regions and ethnicities report very low rates of myopia, such as among Australian Aborigines and Solomon Islanders, where occurrence was in the 2-5 percent range. And a comparative study of urbanites in the United States showed that African-Americans were significantly less likely to have myopia than whites.[5]

Lifestyle factors into the spread of myopia

Once thought to be only a matter of genetics, several of the studies point to lifestyle and environmental considerations as contributing to the increasing occurrence of myopia.

According to the Brien Holden Institute meta-analysis of myopia research data[1], "The projected increases are widely considered to be driven by environmental factors (nurture), principally lifestyle changes resulting from a combination of decreased time outdoors and increased near-work activities, among other factors."

Many researchers are pointing to the advent of digital devices in the past 30 years as contributing to the prevalence of myopia (due to short working distance). There are now more mobile devices in use around the globe than there are people on the planet.[7]

The Holden study points to the under-40 age group, especially in Asia, as being extremely susceptible to myopia because of reliance on smartphones, personal computers and related technology for communications, entertainment, news and education.[1]

The competitive education systems in Singapore, Korea, Taiwan and China are another factor, according to the study, causing students to spend more time studying at

> **"Myopia will have long-term consequences for public health around the globe, especially in less-developed regions where healthcare delivery is more challenged."**

computers. The comparative study of young students in Sydney and Singapore also referred to this, noting the competitive academic environment of the island city-state.[4]

Socio-economic impact of myopia

While the direct socio-economic impact of myopia has not been determined yet, the effect of poor vision on the global economy is well documented. This myopia epidemic creates a significant public health problem around the world. The economic burden of uncorrected refractive error (URE), largely caused by myopia, is estimated to be more than $269 billion per year[8], and that number will grow as the epidemic spreads. It is affecting developing nations as well as the developed world. Actually, the Brien Holden study mentions that developed nations are seeing a faster rise in myopia because of increased urbanization and development, which usually means more digital device use and higher education levels.

The World Health Organization (WHO) reports that URE for distance is the main cause of low vision and the second leading cause of blindness after cataracts. WHO estimates point to URE as a bigger cause of productivity loss globally than any other preventable vision disorders, with 0.8-4.0 percent of the world's population affected by visual impairment in 2007 at an estimated cost of more than $269 billion per year.[8]

Research from 2006 showed that more than 3.6 million Americans suffered from visual impairment, blindness or other eye diseases in 2004 – creating a financial burden totaling $35.4 billion. And $8 billion of that total was loss of productivity. The annual impact to the U.S. government budget was $13.7 billion.[9]

The National Medical Research Council of Singapore commissioned a study of the economic cost of myopia. In 2009, the mean annual direct cost of myopia for school-aged children in Singapore was $148 (U.S. dollars) annually, with the median cost at $125 (U.S. dollars) per student.[10]

Public health consequences

This spreading myopia scourge will have a long-term impact on public health and productivity around the world in the decades ahead. While the number of myopia cases may be rising faster in developed nations, the impact could be greater in less-developed countries, where corrected vision could be the key to getting an education for a child or an escape from poverty for an adult.

More research is required to determine the exact causes and consequences of myopia. The projections of the spread of myopia are cause for concern for public health officials worldwide. As the young people with myopia grow into middle age, they will be more susceptible to the pathological effects of the condition, especially those with high myopia, which will have an impact on public health services. Officials should start planning and budgeting now for the coming need.

The antidotes

The growing body of research about the spread of myopia is giving us reason for hope. The overwhelming majority of myopia cases can be corrected with prescription eyeglasses, contact lenses or refractive surgery.

Beyond optical solutions that correct myopia, research points to increased time outside in sunlight as the antidote to the condition. In one study, a randomized clinical trial in Guangzhou, China, researchers followed 952 children in the intervention group and 951 in the control group with a mean age of 6.6 years. The cumulative rate of myopia was 30.4 percent in the intervention group and 39.5 percent in the control group. The important finding was that 40 minutes of additional activity outside in natural light resulted in a reduced incidence of myopia during the next three years.[11]

More time spent outside playing also means less time inside in front of a computer or smartphone screen. Modern lifestyles spent in front of digital screens do have an impact on vision. The Vision Council reports that 75 percent of Americans who use two or more devices simultaneously report digital eye strain symptoms, such as blurry vision and eye fatigue.[12]

Admittedly, people around the globe are not going to give up their digital devices. We are hooked. However, certain precautions can help avoid digital eye strain, according to the Vision Council. For students and desk-bound workers, the optimal optical arrangement is to have the computer screen at an arm's length (20-24 inches) distance from the eyes. Computer eyewear can filter out the potentially harmful blue light that digital screens emit, as well as eliminate glare and alleviate eyestrain.[13]

Finally, we need to remember that the most important action in the fight against myopia and its related damage is to visit a trained eyecare professional for an annual comprehensive eye examination. This is especially important for children as their eyes are still developing and early intervention is key. •

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REFERENCES

1. Holden B, Fricke T, Wilson D, et al. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050; Ophthalmology, 2016.
2. Pan CW, Dirani M, Cheng CY, Wong TY, Saw SM. The age-specific prevalence of myopia in Asia: a meta-analysis. Optometry and Vision Science: official publication of the American Academy of Optometry 2015; 92:258-66.
3. Dolgin E. The myopia boom. Nature March 2015;519:276-8.
4. Rose K, Morgan I, Smith W, Burlutsky G, Mitchell P, Saw SM, Myopia, Lifestyle and Schooling in Students of Chinese Ethnicity in Singapore and Sydney. JAMA Ophthalmology, April 1, 2008.
5. Dayan YB, Levin A, Morad Y, Grotto I, Ben-David R, Goldberg A, Onn E, Avin I, Levi Y, Benyamini O, The Changing Prevalence of Myopia in Young Adults: A 13-Year Series of Population-Based Prevalence Surveys. IOVS (Investigative Ophthalmology and Visual Science), August 2005.
6. Vitale S, Sperduto RD, Ferris III FL, Increased Prevalence of Myopia in the United States Between 1971-1972 and 1999-2004. JAMA Ophthalmology, Dec. 14, 2009.
7. Boren ZD, There Are Officially More Mobile Devices than People in the World. The Independent, Oct. 7, 2014.
8. Smith TST, Fricke KD, Holden BA, Fricke TD, Naidoo KS, Potential Lost Productivity Resulting from the Global Burden of URE. Bulletin World Health Organization, 2009.
9. Rein DB, Zhang P, Wirth K, Lee PP, Hoerger TJ, McCall N, Klein R, Tielsch JM, Vijan S, Saaddine J, The Economic Burden of Major Adult Visual Disorders in the United States. JAMA Ophthalmology, Dec. 1, 2006.
10. Lim MCC, Gazzard G, Sim EL, Tong L, Saw SM, Direct Costs of Myopia in Singapore. National Medical Research Council, 2009.
11. He M, Xiang F, Zeng Y, Mei J, Chen Q, Zheng J, Smith W, Rose K, Morgan IG, Effect of Time Spent Outdoors at School on the Development of Myopia in Children in China: A Randomized Clinical Trial. Journal of the American Medical Association, Sept. 15, 2015.
12. Eyes Overexposed: The Digital Device Dilemma, 2016 Digital Eye Strain Report. The Vision Council.
13. De Larrard B, The new range of Eyezen™ lenses: what are the benefits perceived by wearers during screen use? Points de Vue, International Review of Ophthalmic Optics, N72, Autumn 2015.

KEY TAKEAWAYS

- Myopia is projected to affect half of the world's population by 2050.
- Young people in Asia are especially susceptible to myopia.
- There are links between myopia and increasing use of digital devices, such as smartphones and personal computers.
- Research shows that increased time spent outside in sunshine can reduce the onset of myopia in young people.

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MYOPIA AND EFFECTIVE MANAGEMENT SOLUTIONS

Myopia is becoming a real public health concern across the world. The number of myopic people is increasing rapidly. The prevalence of high myopia is also expected to rise. Understanding myopia development and methods to slow its progression is currently one of the biggest stakes for researchers and clinicians from around the world. In this paper, a few Vision Scientists in Essilor have put together a general overview of myopia condition. They refresh us with the definition of myopia, its evolution and causes. They describe available solutions for myopia management and discuss the relative efficacy for each solution. Finally, they focus on Myopilux®, the specific range of ophthalmic lenses which have been proven to effectively correct and control myopia progression in children.

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Dr. Anna Yeo Chwee Hong joined Essilor R&D Asia in May 2013 as a Senior Vision Scientist after 23 years teaching in optometry in Singapore Polytechnic. Her current research interest is on adult myopia, which she conducted research internally at CI&T Asia and in collaboration with other teaching institutions such as Zhongshan University and Singapore and Ngee Ann Polytechnics. She is also a member of the Scientific Committee in Wenzhou-Essilor International Research Centre (WEIRC) for which she helps to review research protocols and scientific publication. She is appointed to be a scientific adviser in Myopia Control Lenses for Essilor AMERA 2014-2015. Currently, she is holding the portfolio as a member of the Ethics Review Committee, Singapore Polytechnic. Dr. Anna Yeo has been a member of the Optometry and Opticianry Board (OOB) in Singapore and the Chairperson for the Credentials Committee, OOB since 2008.

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Dr. Björn Drobe obtained a B.Sc. in Optometry, a M.Sc. in Cognitive Sciences and a Ph.D. in Vision Sciences in Paris, France. He joined the French Essilor Int. research team in 1998, working mainly on the interaction between ophthalmic lenses and the human visual system, as well as on progressive myopia in children. From 2007 to 2013, Dr. Drobe relocated to Essilor R&D Singapore for a higher involvement in myopia research. Since June 2013, he is the associate director of WEIRC (Wenzhou Medical University – Essilor International Research Center), managing an international research team on myopia in children.

KEYWORDS

Myopia, myopia control, myopia correction, high myopia risks, hyperopic defocus, accommodative lag, heredity, lifestyle, blue light, dopamine, atropine, Ortho-K, orthokeratology, prismatic bifocal lenses, multifocal contact lenses, progressive addition lenses, refractive surgery, outdoor light exposure, Myopilux