

WILL “DIGITAL VISION” MEAN A BLURRY FUTURE?

Research points to the growing use of digital devices. In parallel, myopia is at epidemic levels in countries around the globe. Taking the longer view, this epidemic could have a negative impact on the lives of the myopic people, especially as they age, and will increase the economic burden that poor vision creates on the world around us.



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In 2014, Maureen Cavanagh accepted the role of 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 is a long-time member of the Optical Women's Association and has received numerous industry awards of distinction, including the OWA Pleiades Award in 2015 and Jobson's Most Influential Women in Optical 2012.



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Myopia widespread and growing; links to near vision demanding tasks and small digital screens

It's been reported that of the approximately 7 billion people in the world, more have access to a mobile phone than a toothbrush.¹

That astonishing statistic speaks to the power and pervasiveness of digital communication and information. Millions of people on this earth can use the technology to text or make a phone call, yet may not have running water and electricity in their residences.

Let's admit that there is a hypnotic quality to the digital screens that inhabit our lives. Follow someone into an elevator as they are absorbed in what they're reading on the phone. Stop to watch people on a busy street corner, exiting an office building or on public transportation – it's a safe bet that a large number will have a smartphone or other digital device in their hands.

We are turning more and more of our daily routine over to our digital devices. From getting the news, to paying for coffee, to receiving directions to reminding us of appointments – digital devices have become the personal assistants for 21st-century lives.

We are living multi-screen lives and are more productive because of it. However, have we stopped to consider how spending so much time squinting at small screens is impacting our vision? Eye health professionals are increa-

singly worried about “digital vision” and the consequences resulting from spending so much time focused on small screens. In addition to failing eye sight, there are the related health issues and socio-economic impacts to consider. While users aren’t abandoning their digital screens, eye health professionals should be aware how to better advise them to be productive and retain their healthy vision.

Myopia increasing in Asia

In parallel, we observe a rise of myopia in developed and developing nations worldwide. It’s at epidemic levels. Eastern Asia, Europe and the United States have all seen a dramatic increase in the number of people who are experiencing shortsightedness.

Myopia is an elongation of the eyeball. While not being able to see distances can be frustrating, even dangerous when driving, it can be corrected with spectacles, contact lenses and refractive surgery. However, high myopia has been associated with a higher risk for ocular disorders, including retinal detachment and glaucoma.

According to researchers, rates of myopia have doubled, even tripled, in many eastern Asia countries during the past 40 years. Hong Kong, Singapore and Taiwan have experienced rate increases hovering around 80 percent. Professor Kathryn Rose of the University of Technology Sydney and Ian Morgan with the Australian National University mentioned the prevalence of myopia in East Asia as ranging from 82% to 96% depending on age groups and countries.² Published studies confirm those figures:

LOCATION	PERCENTAGE OF MYOPIA	AGE GROUP	YEAR OF THE STUDY
Seoul	96.5%	19 yo	2010 ³
Taiwan	86.1%	18-24 yo	2010 ⁴
Guangzhou, China	84.1%	17 yo	2007 ⁵
Singapore	81.6%	17-29 yo	2009-2010 ⁶

Since 1963, Chinese students have participated in a daily routine designed to relieve eye fatigue. While seated at their desks, they massage the pressure points around their eyes. It doesn't seem to be working. Rates of myopia have been soaring in Chinese cities, nearing almost 90 percent in places.²



CHILDREN

Direct Costs of Myopia in Teenagers

In Singapore, where an estimated 74% of teenagers are myopic, a 2008 study calculated the direct costs of myopia for teenagers and their families to be \$25 million.



Source:

Singapore Quek et al. "Prevalence of refractive errors in teenage high school students in Singapore". *Ophthalmic Physiol Opt* 2004 24.

Myopia prevalence in Europe

European countries have been experiencing the impact of digital vision and myopia as well. The European Eye Epidemiology (E³) Consortium has done an extensive study of meta-data associated with eye health research which estimates that refractive error affects more than half of the continent's adult population – myopia being the leading type with 227.2 million people based on 2010 population estimates. Based on this study, the prevalence of myopia suggests that about 20.1 million Europeans are therefore at higher risk for associated complications such as retinal detachment.⁷

The E³ study also shows that younger people are more affected by myopia than their parents. According to the study, about one-half of younger Europeans are affected. After analyzing the data, the study uncovered that overall levels of myopia have increased about one-third for adults born after 1940 as compared to those born before that year.

In a news release about a King's College London research project, Katie Williams from the university's Department of Ophthalmology, said, "We knew myopia was becoming more common in certain parts of the world – almost 8 in 10 young people are affected in urban East Asia – but it is very interesting to find that the same pattern is being seen here in Europe. This has major implications for the future burden from this eye disease which can threaten sight in older age, particular in very shortsighted people."

The same rise in myopia is happening in the United States. The American Academy of Ophthalmology estimates that the current rate of myopia has risen to 40 percent from 25 percent in the 1970s.^{8, 9}

Link between myopia and education

Another interesting finding in several research studies is the association between level of education and the incidence of myopia. The research suggests that the more educated the person – regardless of where they live – the more likely they are to suffer from shortsightedness.

“Eye health professionals are increasingly worried about “digital vision” and the consequences resulting from spending so much time focused on small screens”

GLOBAL POPULATION

Corrected Vision Could Save Millions Per Year

The total economic cost of myopia in adults over 40 years old in Singapore is estimated to be approximately \$755 million per year.



Source: The Economic Cost of Myopia in Adults Over 40 Years in Singapore, Oct. 2013.
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This is significant because it points to lifestyle factors as having a role in the rise of myopia.

The E³ analysis of studies, which looks at more than 60,000 people, shows that the rate of myopia is about twice as much higher in people with college degrees compared to those whose education stopped with primary school.⁹

One of the studies included in the E³ analysis was what is known as the Gutenberg Health Study from the University Medical Center in Mainz, Germany. By examining 4,685 people ranging in age from 35-74 without cataracts or refractive surgery, the results show that myopia increases as education increases.⁹

LEVEL OF EDUCATION	PREVALENCE OF MYOPIA
No high school or other training	24 percent
High school or vocational school graduates	35 percent
University graduates	53 percent

The question is then natural: Is there a link between myopia development and the use of digital devices? Although

no study has shown a direct link, it has been shown that when using handheld video games, children adopt a closer working distance which in turn may favor Myopia onset and progression.⁷ Indeed, near work behavior appears to be highly linked to myopia prevalence. Epidemiological studies showed that higher amount of near work results in a high prevalence of myopia in children.^{10,11,12}

The digital vision “antidote”

This rapid rise in myopia is alarming, especially as it affects younger people the most. Are we raising a global generation that will suffer from poor vision throughout their lives?

There is research that indicates that sunshine can be an antidote to digital vision. An Australian research project from 2003-2005 shows that time spent outdoors in natural light significantly affected the presence of myopia in children.¹³ Longer time of outdoor activity, such as sports and leisure activities, were associated with more hyperopic refractions and lower myopia rates in the 12-year-old students studied. Those who combined longer time of near work with shorter time of outdoor activity

“In addition to failing eye sight, there are the related health issues and socio-economic impacts to consider”

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had the least hyperopic mean refraction, while the students who combined low levels of near work with high levels of outdoor activity had the most hyperopic mean refraction. The lowest odds for myopia were found in groups reporting the highest levels of outdoor activity.

Chinese schools are testing various methods to improve that country’s myopia epidemic. Some schools are experimenting with transparent classrooms – the walls and ceilings are constructed of see-through material to allow for as much light as possible – to determine if that helps improve the students’ eyesight.

Other schools are forcing children to be outside more during the day and away from near vision demanding tasks including small digital screens. Students are sent outside during lunch and recess with the doors locked to keep them there.¹⁴

The role of sunlight in our eye health is not completely understood as of yet. A theory suggests that the healthy wavelengths on the blue light spectrum from the sun (the good blue) releases dopamine in the retina which would

prevent the eyeball from elongating, thus preventing from myopia. These wavelengths are also protective to vision and other health functions. And the cumulative effect of the damaging wavelengths of blue-violet light (the bad blue) has been linked to retinal cell death, and possibly to AMD. The sources such as artificial light (cold LED), computer screens and handheld devices are rich in harmful blue-violet light and may source potential risks.

In addition to good old-fashioned outdoor playtime for children, the importance of an annual eye examination by a trained vision professional can’t be over emphasized. With the increased use of digital devices and rising rates of myopia, an annual exam is the best way for parents to have poor vision diagnosed – and then corrected as needed – in their children.

Promising research

Promising researches from specialized centers in Australia and China do offer hope. The Vision Cooperative Research Center (Vision CRC) is a partnership between the Brien Holden Vision Institute at the University of New South Wales and the University of Houston College of Optometry.



“Let’s not give up the digital devices, but let’s be sure to take care of users’ eye health while advising both an annual comprehensive eye examination and frequent breaks from “digital vision” to take in a longer view.”

It has announced a new technology that slows the progression of myopia in children. Vision CRC has been conducting large-scale clinical trials in Australia and China designed to control in participating children the position of the central and peripheral retinal image points. Therefore, corrective lenses can be made to control myopic progression by changing the retinal image position at the periphery without affecting the image at the center of the retina. Professor Brien Holden (1942 - 2015) has been quoted saying, “What we need are treatments that effectively slow the progress of myopia which will significantly reduce the prevalence of high myopia. A reduction in the rate of myopia of 33% could produce a 73% reduction in myopia above 5.00 D.”¹⁵

To strengthen research on myopia, Essilor International and the Wenzhou Medical University in China, opened in 2013 a joint research laboratory: the Wenzhou Medical University-Essilor International Research Center (WEIRC).

“What makes it all the more important is that the link between the severity of myopia and the risk of associated conditions is exponential. Slowing the development of myopia by only 50% reduces the risk of conditions that can lead to blindness (retinopathy, retinal detachment, etc.) by a factor of 10,” explains Dr. Björn Drobe, Essilor Group Researcher and Associate Director of WEIRC.

The laboratory works on three different approaches. The first is to gain a clearer understanding of the mechanisms that cause children to develop myopia. The second focus for research relates to the predictability of myopia, and more particularly involves a study conducted with a group of 1,000 children from urban and rural environments. Lastly, the laboratory is working to identify new ways of controlling the development of myopia through a clinical trial involving 210 children.

“Ultimately, the new knowledge gained will enable us to make our products more effective in terms of slowing the development of myopia with offerings that are suitable for all children and are attractively designed, as well as enabling the development of innovative solutions to counter the myopia pandemic,” summarizes Dr. Björn Drobe.

Socio-economic impact of myopia

Impaired vision is the most common disability in the world, affecting 4.3 billion around the globe.¹⁶ The good news is that 80 percent of those impairments can be avoided or cured. However, that much vision impairment comes with a price tag.

While the global direct socio-economic impact of myopia hasn’t been determined yet, the effect of poor vision on the global economy is well documented. A 2012 review by the Boston Consulting Group and Essilor found that:¹⁷

- Approximately 33 percent of the world’s working population has uncorrected vision problems that result in a \$272 billion loss of productivity to businesses globally.

GLOBAL

Global Scope of Poor Vision

An estimated 2.5 billion people with vision problems do not benefit from corrective measures.



Source:

United Nations, Essilor

- Poor vision slows the education of school-aged children, resulting in academic under-achievement and risk of reduced adult literacy. In fact, 30% of children worldwide need vision correction and don't have it.
- Impaired vision is associated with 60 percent of driving accidents around the world.
- Globally, poor eyesight multiplies by seven the risk of falls and hip fractures in the elderly.

The National Medical Research Council of Singapore commissioned a study on 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), with the median cost at \$83.33 (U.S. dollars) per student.¹⁸ It also showed that the cost of refractive surgery equaled the cost of buying and wearing contact lenses for 10 years. Beyond the cost for children, with a myopia rate of 39% in adults over 40, a 2013 study estimates the total cost of myopia for this population to be approximately SGD\$959 (USD\$755) million per year in Singapore.¹⁹

What it means for the future

Research has indicated that myopia is rapidly rising in East Asia, Europe and the United States, especially among younger people. And research points to factors other than genetics, such as behavior and environment, as causing this epidemic. Is the common denominator among these the time spent using digital devices at near?

The global use of these devices is only going to grow as we

increasingly rely on them to connect with friends, get our news, make financial transactions, and simply make our lives easier and more productive. As a planet, we spend 3 billion hours a week playing video games.¹⁰ That means that we will spend more time in "digital vision" mode - fixated on small glowing screens using our eyes for near vision more often.

There will be consequences.

Yes, the majority of myopia cases can be corrected with spectacles, contact lenses or refractive surgery. And the research centers such as Vision CRC and WEIRC, as well as the technology development, give us hope for a better-seeing future. However, with so many young people dealing with shortsightedness, as they age the cost and impact of poor vision is likely to increase from such things as loss of productivity,^{21,22} motor vehicle accidents, falls, and social isolation. Add to that the significant increased risk people with high myopia have for related vision diseases.

Let's not give up the digital devices, but let's be sure to take care of users' eye health while advising both an annual comprehensive eye examination and frequent breaks from "digital vision" to take in a longer view. •



KEY TAKEAWAYS

- An epidemic of myopia is circling the globe, with Eastern Asia, Europe and the United States seeing rising rates of shortsightedness, especially in young people.
- Research shows that there is a link between education level and myopia rates – those with more education are more likely to be myopic.
- Corresponding to the increase of myopia is also an increase in near vision demanding tasks including the use of small digital devices as people rely on them more not only to communicate, but also to access news, information and entertainment.
- “Digital vision” will likely have a socio-economic impact on the world, especially as young people with myopia grow older.

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