

Blue Light and Screen Time Guide for Health Payers and Employers



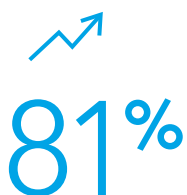
A GUIDE FOR INSURANCE PROVIDERS
AND EMPLOYERS

eyesafe®



Screen Time and Blue Light Exposure Can Lead to Numerous Health Issues with Major Impacts for Health Payers and Employers

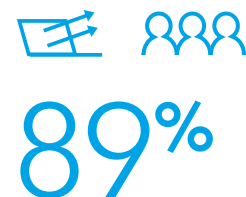
The effects of digital light are beginning to come to the forefront of our professional and personal lives. According to Nielsen data,¹ we spend over 11 hours of our day on smartphones, tablets, or computer displays and are exposed to the effects of digital light, which in turn impacts our task productivity and cognitive performance. We are just beginning to understand the potential health risks of screen time and blue light exposure.



OF EMPLOYERS BELIEVE BLUE LIGHT PROTECTION WILL IMPROVE WORKPLACE PRODUCTIVITY²



TIME SPENT PER DAY LOOKING AT SCREENS THAT EMIT DIGITAL LIGHT¹



OF EMPLOYEES BELIEVE EMPLOYERS SHOULD PROTECT WORKERS FROM BLUE LIGHT³

1. The Nielsen Total Audience Report: Q3 2018, <https://www.nielsen.com/us/en/insights/report/2019/q3-2018-total-audience-report/>

2. Exploring the Role of Monitors in Improving Employee Experience, Forrester Consulting Thought Leadership Spotlight Commissioned By Dell, July 2019

3. Survey 1: Workplace Survey; Device Use & Blue Light. Completed June 25, 2019. Released July 22, 2019

Screen Time Now Exceeds Sleeping Hours, Leading to Numerous Health Issues and Workplace Impacts



AVERAGE DAILY
SCREEN TIME

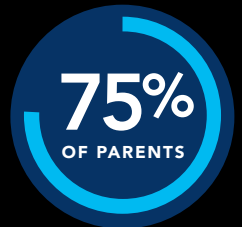
Average daily screen time is growing, and as many as 4 in 5 adults complain of digital eye strain – a direct result of extended computer and smartphone usage and prolonged exposure to the high energy blue light emitted from typical displays.



REPORT SYMPTOMS
OF DIGITAL EYE STRAIN

Health Impacts of Digital Eye Strain and Over-Exposure to Blue Light can lead to:

- Dry, irritated eyes
- Trouble sleeping
- Blurred vision
- Reduced attention span
- Irritability and difficulty concentrating



CONCERNED ABOUT
DIGITAL DEVICES AND
DEVELOPING EYES



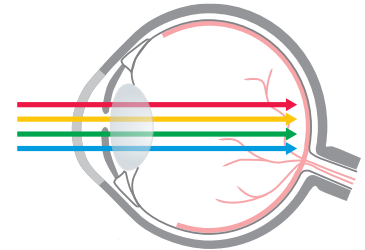
Cumulative Exposure to High-Energy Blue Light is Especially Intense for Human Health

Blue light is a part of the visible light spectrum that has been shown to contribute to digital eye strain. High-energy blue light from device screens combined with the amount of time we use devices may cause overexposure, and affect our eye health.

The light intensity of mobile devices peaks in the middle of the blue light spectrum. This intense portion of the light spectrum goes straight to the back of the retina. In young children, more blue light is transmitted to the retina due to their developing eye lens.

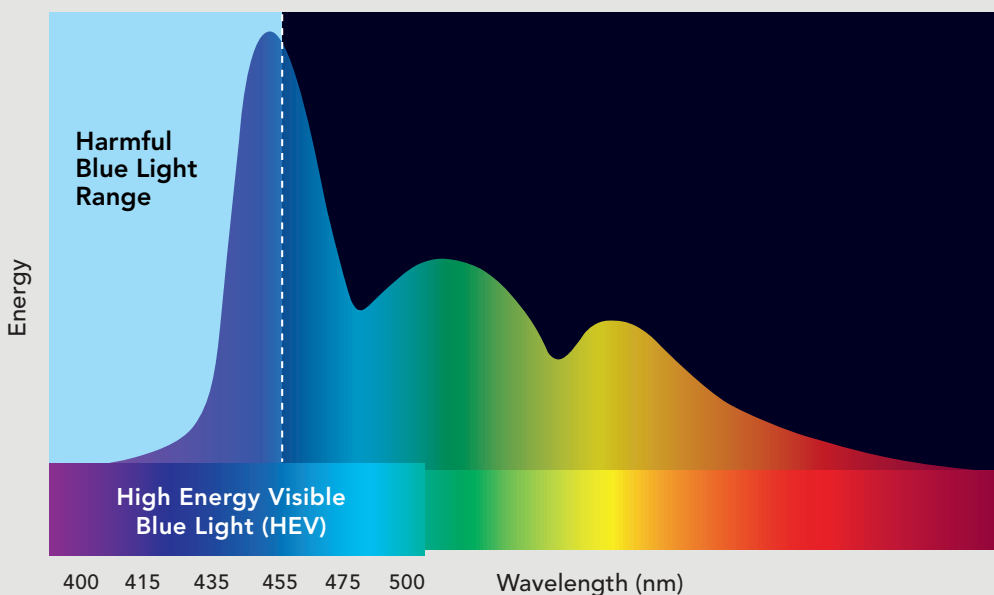
Chronic exposure to high-energy blue light from devices has been connected with:

- Digital Eye Strain
- Circadian Rhythm Disruption and Melatonin Suppression
- Potential long-term retinal damage, AMD (Macular Degeneration) and other physiologic impacts



Visible light is transmitted to the retina from natural and artificial light sources, between the range of 400-700 nm.

Find a summary of impacts and recent research at eyesafe.com/research.



Typical Industry Displays Emit High Amounts of Blue Light

High-energy visible (HEV) blue light ranges from 380 to 500 nm. The blue light rays that border UV (at 380 nm) have the highest energy.

WORLD LEADING HEALTH ORGANIZATIONS ARE TAKING POSITIONS ON IMPACTS OF SCREEN TIME ON HUMAN HEALTH



The American Medical Association adopts guidance to reduce harm from high intensity high-energy visible blue emitting LED street lights. “Discomfort and disability from intense, blue-rich LED lighting can decrease visual acuity and safety, resulting in concerns and creating a road hazard. In addition to its impact on drivers, blue-rich LED streetlights operate at a wavelength that most adversely suppresses melatonin during night. It is estimated that white **LED lamps have five times greater impact** on circadian sleep rhythms than conventional street lamps. Recent large surveys found that brighter residential nighttime lighting is associated with reduced sleep times, dissatisfaction with sleep quality, excessive sleepiness, impaired daytime functioning and obesity.



The American Academy of Pediatrics recently published screen time guidance for children and families, citing blue light: the recommendations cite a study in regard to blue light’s impact on children. For industry, AAP recommends to “Develop systems embedded in devices that can help parents monitor and limit media use.”

Because of the below AAP recommends:

For children younger than 18 months: avoid screen use

For children 2-5 years: 1 hour per day

For children 6 and older: set reasonable limits



American Optometric Association published “Blue Light Impact in Children” which identifies that children may be at higher risk for blue light retinal damage than adults. The juvenile lens absorbs less short-wavelength light than the adult lens, allowing more blue light to reach a child’s retina. Also that exposure “is able to stimulate blue-light-sensitive ganglion cell photoreceptors that regulate circadian rhythms. As a result, cellular telephone, tablet and personal computer use before bedtime can delay sleep onset, degrade sleep quality and impair alertness the following day. Extended use of these devices has also been shown to cause symptoms of **dry eyes, blurred vision and headaches.**”



Prevent Blindness has identified that “Almost all visible blue light passes through the cornea and lens and reaches the retina. This light may affect vision and could prematurely age the eyes. Early research shows that too much exposure to blue light could lead to: **Digital eyestrain:** Blue light from computer screens and digital devices can decrease contrast leading to digital eyestrain. Fatigue, dry eyes, bad lighting, or how you sit in front of the computer can cause eyestrain. Symptoms of eyestrain include sore or irritated eyes and difficulty focusing. Retina damage: studies suggest that continued exposure to blue light over time could lead to damaged retinal cells. This can cause **vision problems like AMD.**”



The Vision Council states: “With an increase in digital technology, there has been an increase in blue light exposure. In turn, many individuals suffer from the physical eye discomfort after screen use for longer than two hours at a time, also known as digital eye strain.” While **78.3 percent** of parents are somewhat or very concerned about the impact of digital devices on their child(ren), only **29.1 percent** report taking their child(ren) for an annual eye exam as part of back-to-school preparation.”

Survey Results Finds Serious Health and Productivity Impacts of Screen Time and Blue Light in the Workplace

Extended periods of high energy visible (HEV) light exposure from digital displays can affect our ability to maintain clear vision, interpret images and avoid stressful symptoms including ocular fatigue and headache. This fatigue has an impact on our work-life balance also, particularly how we spend our working day.

In 2019, Dell Computer commissioned Forrester Consulting group to analyze the correlations between employee experience on monitors and the resulting customer experience.¹ Forrester analyzed 450 people including employees, employers and health care professionals across small, medium and large businesses in the USA, UK and China. The findings of the survey conducted deduced that specific monitor features improve employee productivity, their well-being, and induced a sense the company cares about their needs.

Key findings of the survey pointed to three areas impacting employee experience resulting in critical impacts on customer experience. Monitors have a significant role in creating an ideal workspace especially through ergonomics, front of screen performance (consisting of color, resolution, and light emissions) and connectivity. One of the areas of focus in particular was on the front of screen performance of employees. 88% of employees believe that aspects like better resolution will improve productivity on the job, and 81% believe reduced blue-light emission enables this further. A majority of respondents also found high resolution monitors reduced eye strain (91%) and the ability to view sharp clear images provides the high-level detail needed to work effectively (79%).

Healthcare professionals recognize the importance of front of screen experience on overall well being.

66% of employees believe that reducing blue light emissions from displays would improve their overall well-being especially in the UK (70%), worldwide commercial (72%) and enterprise companies (78%).¹



OF EMPLOYERS BELIEVE BLUE LIGHT PROTECTION WILL IMPROVE WORKPLACE PRODUCTIVITY¹

1. Exploring the Role of Monitors in Improving Employee Experience, Forrester Consulting Thought Leadership Spotlight Commissioned By Dell, July 2019



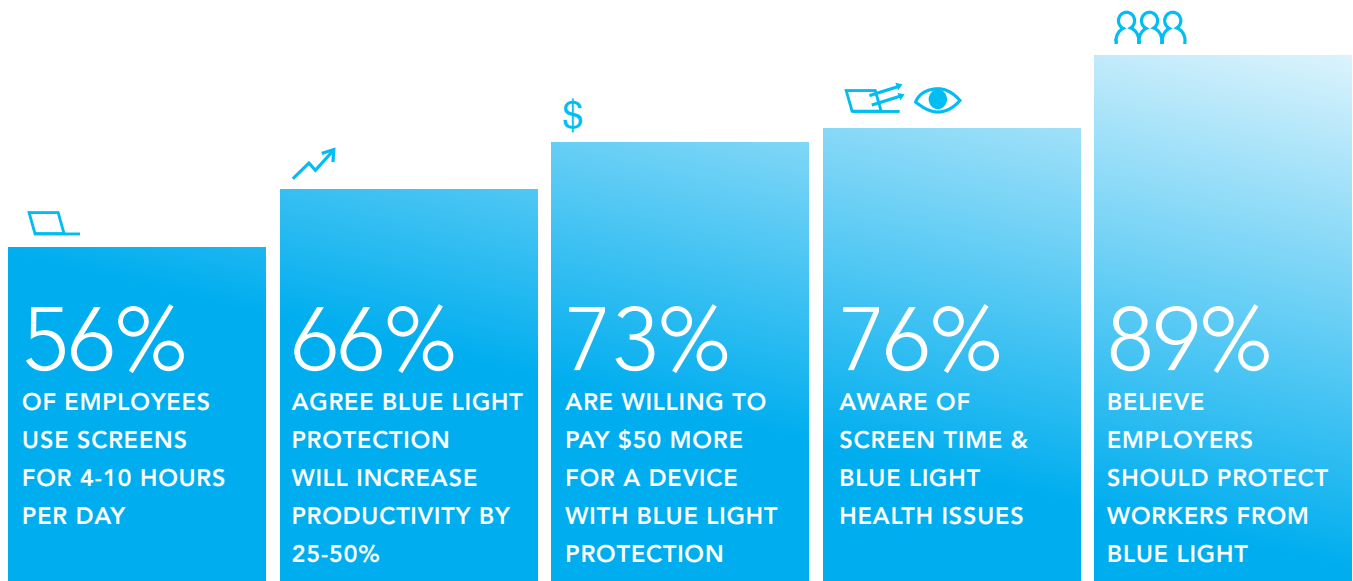
SURVEY RESULTS:

Impacts of Device Use on Employee Health & Performance – Survey Results

A new survey of full-time and part-time employees reveals concerns around impacts of device use and blue light exposure in the workplace. Survey results of 600 respondents from AYTМ (Ask Your Target Market) and Eyesafe identifies that the majority of device users are on screens up to 10 hours per day, aware of health issues from device use, and believe that protection from blue light will increase their productivity in the workplace.

Headlines:

- Most employees are on Devices 4-10 Hours Per Day (56%) and 34% report using devices 8-14 hours per day^{1,2}
- 76% are aware of health issues of screen time and blue light^{1,2}
- 66% believe blue light protection from devices will lead to a 25-50% increase in their productivity^{1,2}
- 73% are willing to spend at least \$50 more for a device with effective blue light protection^{1,2}; and
- 89% believe that employers should be providing options¹



1. Survey 1: Workplace Survey; Device Use & Blue Light. Completed June 25, 2019. Released July 22, 2019

2. Survey 2: Workplace Survey; Monitor Use & Blue Light. Completed July 4, 2019. Released July 22, 2019

New Requirements are Providing Guidance for Employers and Health Payers for Blue Light Health and Safety




REQUIREMENTS & STANDARDS

In collaboration with leaders in the eye and healthcare community, Eyesafe® Display adheres to Requirements established with leaders in the eye and healthcare community, the latest research, and recognizing industry standards.



Look for Eyesafe®

Products achieving Eyesafe® Requirements include the Eyesafe® mark.

HIGH-ENERGY BLUE LIGHT	SAFETY STANDARDS	COLOR PERFORMANCE
 <ul style="list-style-type: none"> ✓ Blue Light Toxicity Scaling requirement based on ICNIRP ✓ Blue light toxicity factor [Blue light toxicity ($\mu\text{W}/\text{cm}^2$)] vs. total lux must be less than 0.085 ✓ The ratio of light in the range from 415-455nm compared to 400-500nm must be less than 50% 	 <ul style="list-style-type: none"> ✓ Photobiological Safety ✓ The product must meet exempt group limits as outlined in IEC/EN 62471 	 <ul style="list-style-type: none"> ✓ Color Gamut % ✓ Gamut must be 72% of NTSC⁽ⁱ⁾ or greater ✓ The CCT shall be within in the range of 5500K to 7000K

Research Has Found Cognitive Health Benefits of Eyesafe vs. Baseline LED Display

STUDY FROM PEC UNIVERSITY FINDS COGNITIVE HEALTH BENEFITS OF EYESAFE VERSUS BASELINE LED SCREEN

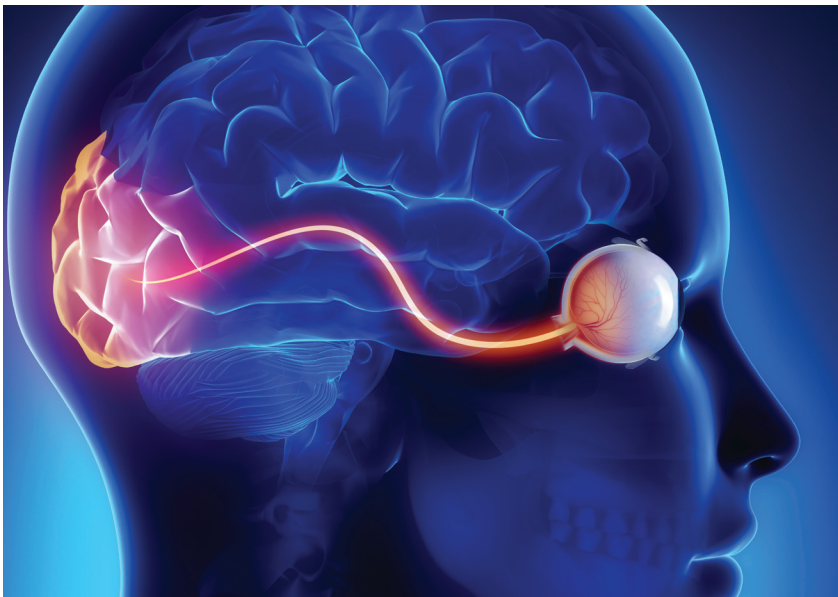
PEC University of Technology in India has completed a comprehensive study on the effects of blue light exposure on human cognitive performance. Specifically, study participants were exposed to LED screen with Eyesafe RPF30 compared to baseline LED screen.

The results of this study may be found here and are highlighted below. Prolonged exposure to blue light from LED was found responsible for:

- unpleasant mood
- inducing sleep disorders
- increased inability to hold information i.e. it affects memory
- decrease in the reaction time during certain tasks given

Use of Eyesafe RPF30 was shown to reduce the above effects. These results are positive and open up additional areas of future study.

“Results have shown that there was a significant difference in EEG delta theta activity, mood, sustained attention (action time task), short term memory (verbal memory task), and active memory (visual memory task) for two types of screen interfaces. Continuous exposure to LED screen has led to decrease in frontal region delta theta activity and increased alertness. Exposure to (Eyesafe RPF30) blue light filter has elevated memory performance and mood in participants. Thus continuous exposure to blue light, emitted by LED screens was found harmful for mood, memory performance, attention and sleep.”



1. *Effects of Blue Light on Cognitive Performance International Research Journal of Engineering and Technology (IRJET) 2017, 04(06). N. Bansal et al. <https://eyesafe.com/report-on-health-impacts-of-cumulative-blue-light-exposure-from-digital-devices-on-cognitive-performance/>*

Color Does Not Need to be Compromised for Device Health and Safety

A color gamut defines all the colors the display can produce. The bigger the gamut, the greater the palette of colors of the display.

sRGB – “standard Red Green Blue,” introduced in 1996, is an international standard very widely used in the digital industry.

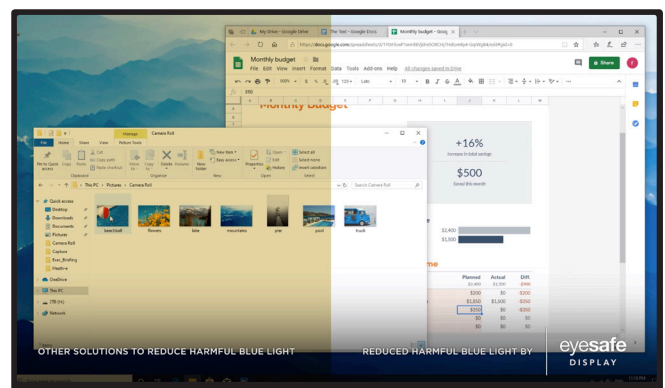
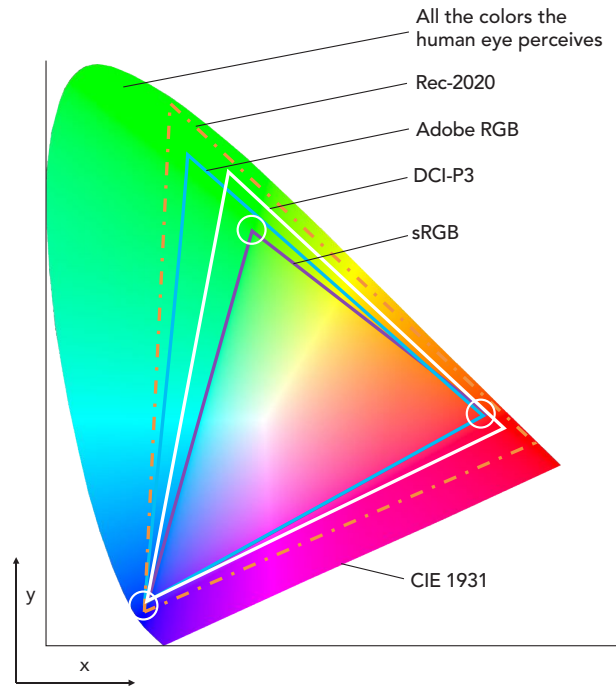
NTSC – The NTSC color gamut was developed with television, in 1953, now mainly used for comparison, rating monitors as a percentage of the NTSC color gamut. Most displays 70-75% of the NTSC.

72% of NTSC is roughly equivalent to 100% of the sRGB color gamut.

Adobe RGB – enhanced color gamut, advantageous for color printing, facilitating more vivid printed colors. Adobe RGB, however, requires software supporting this standard as well as an adapted digital display.

DCI-P3 – Introduced by Digital Cinema Initiatives (DCI) to fit the range of colors used in cinema. Since more and more movies are displayed on digital displays, manufacturers have started to align their color arrays to DCI-P3

Rec 2020 – As technology evolves, new standards emerge, such as Rec 2020 for UHD TV (Ultra High Definition 4K and 8K). At this point no display has yet fully covered the Rec 2020 color gamut.



Solutions for reducing blue light include software that limits color gamut and shifts color to warmer hues

Eyesafe Display Color Requirements are designed to maintain color integrity

Eyesafe Developed with World Leaders in Eye Care

The Eyesafe Vision Health Advisory Board are comprised of leading eye care professionals across ophthalmology and optometry focused on public health advocacy, industry research and standards development. This group of internationally recognized eye doctors are actively involved in product and standards development. For more information: eyesafe.com/vhab

The Vision Health Advisory mark may be used in association with Eyesafe® products.



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KEY RESEARCH IN SCREEN TIME AND BLUE LIGHT EXPOSURE

Source	Description of Research		Link
1 <i>Light-emitting diodes (LED) for domestic lighting: Any risks for the eye?</i> Behar-Cohen F, et al. <i>Progress in Retinal and Eye Research</i> . 2011; 30(4):239-57	Review article - Comprehensive analysis of the potential risks of white LEDs, taking into account pre-clinical knowledge as well as epidemiologic studies and reports the French Agency's (ANSES) recommendations to avoid potential retinal hazards. Incl. mechanisms of light-induced damages – how does light reach the retina – abs. differences with age	The absorption spectrum of the lens changes with age. In young children, more than 65% of blue light is transmitted to the retina. At around 25 years, only 20% of the light between 400 and 460 nm and 50% of wavelengths between 400 and 500 nm are transmitted	https://doi.org/doi:10.1016/j.preteyeres.2011.04.002
2 <i>Effects of blue light on the circadian system and eye physiology</i> Tosini G, Ferguson I and Tsubota K. <i>Molecular Vision</i> . 2016; 22:61-72	Review of the effects of blue light on the circadian rhythm and eye, with overview of possible retinal damage, their mechanisms as they are understood and discussion on the spectral output, cumulative exposure to light and potential effects “studies on the safety of long-term exposure to low levels of blue light are needed to determine the effects of blue light on the eye.”	Blue light impacts the circadian rhythm Blue light sends non-image forming (NIF) signals to biological clock through retinal ganglion cells ipRGCs Light in the 460 nm range is more effective in phase-shifting the circadian system than exposure to light of longer duration and higher irradiance.	http://www.molvis.org/molvis/v22/61
3 <i>Ocular and visual discomfort associated with smartphones, tablets and computers: what we do and do not know.</i> Jaiswal S, et al. <i>Clinical & Experimental Optometry</i> . 2019; 102(5):463-477.	Review article on effects of digital displays on eye strain (tear volume), with discussion about children. Although long-term ocular effects of smartphone and handheld digital device use are unknown, this article cites short-term asthenopic symptoms with digital screens use.	“There is insufficient evidence to support the impact of handheld devices on tear volume, although this is reduced with computer use.” “The long-term ocular effects of smartphone and handheld digital device use are unknown.” “However, a range of short-term ocular surface discomfort, visual discomfort and asthenopic symptoms are reported with smartphones and tablets use.”	https://doi.org/10.1111/cxo.12851
4 <i>Protective effects of blue light-blocking shades on phototoxicity in human ocular surface cells,</i> Niwano Y, et al. <i>BMJ Open Ophthalmology</i> . 2019; 4:e000217.	This study suggests blue light as a phototoxic agent to ocular cells and investigates the protective effect of blue blocking lenses. Speculating that long-term exposure to blue light from mobile devices may cause damage to ocular health, especially in high-risk population. Results demonstrate the phototoxicity of blue light for established primary cultures of human corneal surface cells.	UV-blocking and blue-blocking shades protected the cells from phototoxicity. Long-term exposure to blue light from portable devices emitting blue light from a short distance may cause potential damage to ocular health, especially in high-risk populations, such as people with DED, contact lens users, due to accumulated oxidative stress that is a result of an imbalance between ROS generation and scavenging.	https://doi.org/10.1136/bmjophth-2018-000217
5 <i>Global rise of potential health hazards caused by blue light-induced circadian disruption in modern aging societies,</i> Hatori M, et al. <i>npj Aging & Mechanisms of Disease</i> . 2017;3:9	Perspective article on BL, circadian rhythm and its health consequences. Blue light-rich Led systems are also singled out for their potential health effects Disturbance of circadian rhythms is also associated with other health effects.	Chronic impairment of the circadian system has been shown to compromise health: disruptions of the circadian rhythms in shift workers are known risk factors for psychiatric disorders, gastrointestinal alterations, sleep and cognitive impairments, and breast cancer Blue light's impact on circadian rhythm and sleep has serious health consequences	https://www.nature.com/articles/s41514-017-0010-2
6 <i>Circadian photoreception: ageing and the eye's important role in systemic health,</i> P L Turner, M A Mainster <i>Br J Ophthalmol</i> . 2008;92:1439–1444.	This study addresses the variation of the crystalline lens transmission with age and the role of the ganglion cells in the circadian reception.	Ageing increases crystalline lens light absorption and decreases pupil area resulting in progressive loss of circadian photoreception. A 10-year-old child has circadian photoreception 10-fold greater than a 95-year-old phakic adult. A 45-year-old adult retains only half the circadian photoreception of early youth	https://doi.org/10.1136/bjo.2008.141747