High Energy Visible Blue Light: How Much Are We Actually Getting?

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Purpose

This study was done to compare the retinal illuminance for high-energy visible blue light emitted from different forms of lighting including incandescent lights, ambient sunlight and LED display screens on computers and other media devices.

Introduction

Damage to ocular tissue from sunlight has been a concern to eye care providers for decades. However, the increasing prevalence of light emitting diode (LED) lights and the potential damage they can cause has spiked the interest of researchers and ophthalmic lens companies. These LED diodes are used to illuminate the screens of media devices such as televisions, smartphones and tablets. With an increase in the prevalence of media devices, researchers have become concerned about the effects that this light can have on the human visual system.

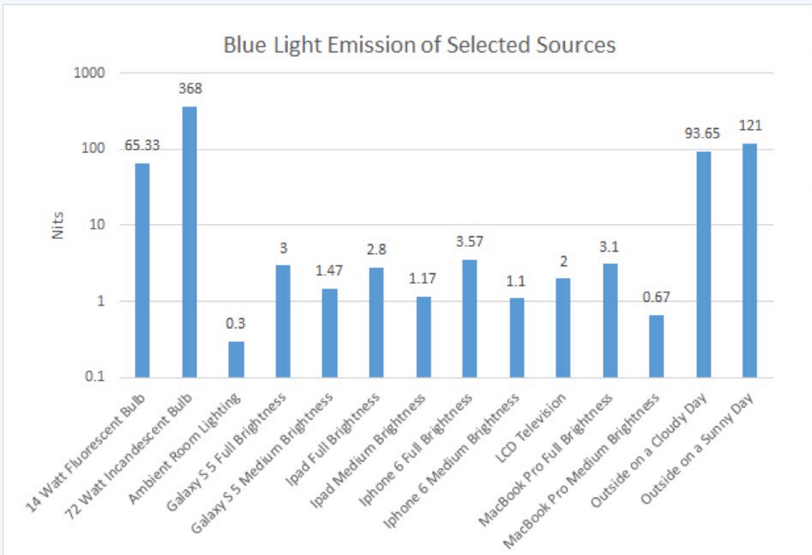

Figure 1. Logarithmic representation of the amount of high energy blue light emitted from different light sources

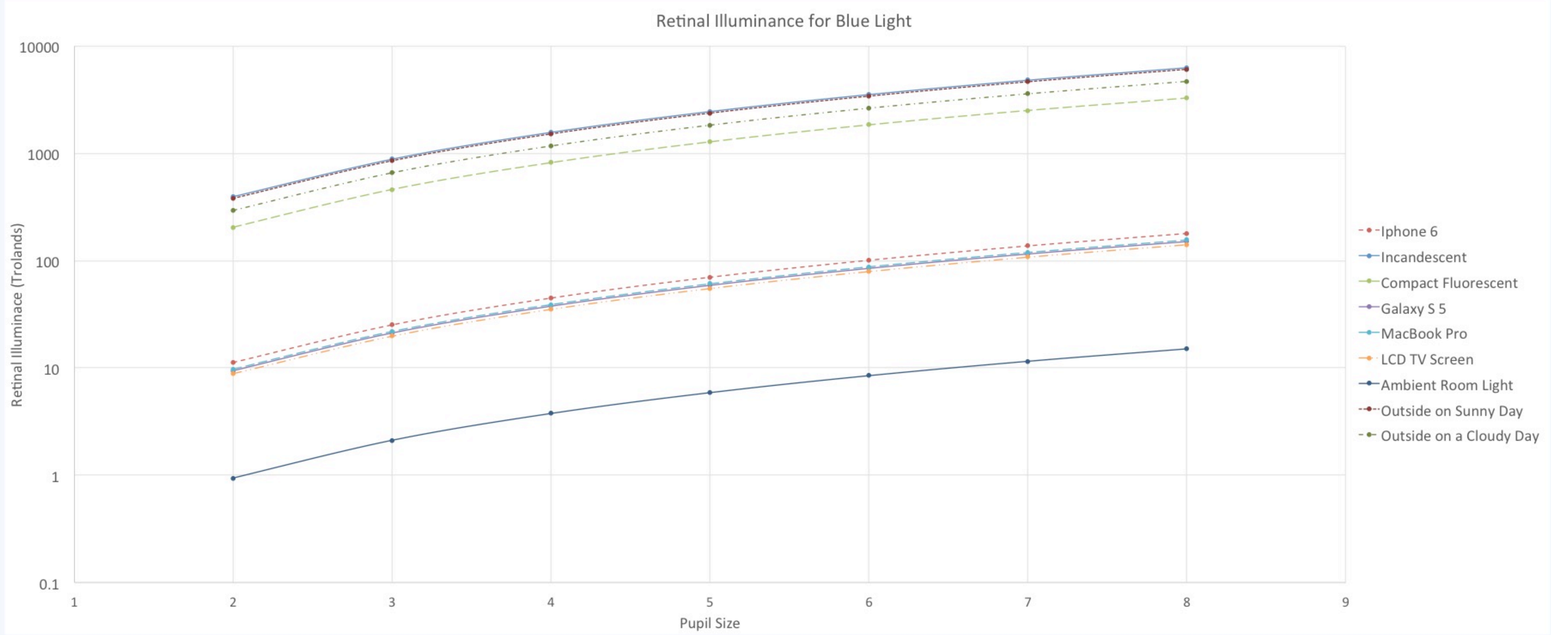

Figure 2. The amount of blue light from different light sources falling onto the retina as pupil size varies

Methods

We used a Konica Minolta LM-1 luminance meter to collect our data. In order to filter out the wavelengths other than the high energy blue light we used a B-390 UV-Vis Bandpass filter from Edmund Optics Inc. and placed it over the luminance meter. We took an average of three readings from each source with the filter present. This can be seen to the left in Figure 1.

References

1. Miller D, Scott CA. Light damage to the eye. In: Yanoff M, Duker JS, eds. Ophthalmology, 4th ed. Philadelphia: Elsevier; 2014:28-31
2. Youn HY, Chou BR, Cullen AP, Sivak JG. Effects of 400 nm, 420 nm, and 435.8 nm radiations on cultured human retinal pigment epithelial cells. J Photochem Photobiol B 2009;95:64-70.
3. Osborne NN, Núñez-Álvarez C, del Olmo-Aguado S. The effect of visual blue light on mitochondrial function associated with retinal ganglions cells. Exp Eye Res 2014;128:8–14.
4. Wu J, Seregard S, Algvere P. Photochemical damage of the retina. Surv Opthalmol 2006;51:461–81.
5. Revell VL, Arendt J, Fogg LF, Skene DJ. Alerting effects of light are sensitive to very short wavelengths. Neurosci Lett 2006;399:96-100.

Results and Discussion

The data in Figure 2 represents the retinal illumination of each source as dependent upon pupil size. The logarithmic scale makes comparing illumination and pupil size easier. **The total amount of illumination by high energy visible blue light that reaches the retina while outside on a sunny day through a 2 mm pupil is more than the amount of retinal illumination present when looking at an iPhone screen on maximum brightness with an 8 mm pupil.** A person who works outdoors all day is at a much higher risk for possible damage from high energy visible blue light than a person who spends all day staring at a computer screen. With all the research being done on the effects of blue light on the visual system and the mass marketing campaigns promoting blue blocking lenses, our data can be used to better quantify the possible benefits of such filtering devices. The data can also give insight to eye care providers and their patients on which light sources have the most potential to cause damage to the retina.