

## FAQ's BLUE LIGHT

- 1. What is new in the new paper published in *Environmental Health Perspectives*?**
  - It's among the very few studies examining individual light exposure rather than doing population comparison
  - The researchers have used a new methodology that can become widely available for other studies globally. It is the first study to use images taken by astronauts that can be used to identify light spectrum
  - It shows an association with hormone related cancers using extensive light and individual risk data. More exactly, the findings show an association of blue light with increased breast and prostate cancer risk
- 2. What is blue light?**
  - Blue light is a range of the visible light spectrum emitted by most white LEDs and many tablet and phone screens. Sources of blue light include the sun, digital screens (flat TVs, computers, laptops, smartphones and tablets), electronic devices, and fluorescent and LED lighting.
  - Blue light has a wavelength of between approximately 380nm and 500nm; making it one of the shortest, highest-energy wavelengths.
- 3. Why is exposure to blue light at night important?**
  - We know that depending on its intensity and wave length, artificial light, particularly in the blue spectrum, can decrease melatonin production and secretion more than other light spectrums. Melatonin plays a key role in regulating the day-night cycles and has several other key functions, for example it is a powerful anti-oxidant and has also an anti-inflammatory function.
  - It is also important because exposure to this light spectrum has rapidly increased both in public and private places due to the massive use of LED and of indoor sources such as tables and smartphones.
  - Surveys in north America and Europe indicate that nearly three-quarters of adolescents spent at least two hours a day watching TV and using a computer (older surveys did not ask for use of smartphones).
  - However, exposure to blue light during the day, through the exposure of artificial sources of light or receiving adequate daily doses of natural, full-spectrum sunlight, results in a more welcome boost to alertness and reduction to fatigue, which stand to benefit both daytime function and night time rest.
- 4. What about other sources of light in the house? Do TVs emit blue light?**
  - Flat TVs also emit blue light. We do not have a good quantitation of which are the most important sources of blue light in a population, also because these sources have changed and are changing dramatically in recent years.

5. **What about “normal” light, is it a problem?**
  - The blue spectral content in “normal” light bulbs is less than in white-LEDs but it is still present. Different experiments have tested the impact in melatonin suppression of different light sources finding a significant role of wavelength compared with light intensity. It is not that blue light is the only one to affect circadian disruption, but it is the one affecting most.
6. **Your findings are surprising, do you really believe that LEDs outside the house can increase cancer risk by, say, 50%**
  - They are surprising but they are based on solid methods (at least at this point in time these are the best light exposure models we can get). Our study lies on a biological hypothesis based on experimental studies and was performed on a large sample size.
  - We are cautious, however, in our interpretation because we know that many times the first study to identify and association tends to overestimate the risk. This has happened with passive smoking for example and with many other exposures. In other occasions the association of an exposure to a disease risk is later verified but the risk estimations differ from those of the first study. Though there is always a chance component in these differences, it is also true that as research develops, the methodology develops as well and usually later findings are based on bigger studies using more elaborate methods. So we are looking forward to replication of our findings by other studies.
7. **So should we take preventive measures, and which should these be?**
  - The important aspect of our study that we have opened the way to evaluate this association in more detail. This will allow to take evidence-based preventive measures in the near future.
  - This said, the hypotheses we tested were not arbitrary, but are based on biology and on light physics. We carried out this study knowing that many children are highly exposed to blue light because of the extensive use of light emitting devices. We were also aware that the population at large is more exposed because most cities are changing (classical lights to LED (and mostly “hard” LEDs that emit more blue light spectrum( for efficiency reasons.
  - While new studies bring stronger evidence in humans, cities should consider limiting emission of blue light outdoors. There are several ecological studies that show an environmental impact on wildlife. That is why several institutions, including the EU-Joint Research Center, the American Medical Association, and in Spain the Junta de Andalucía and the Generalitat of Catalunya recommend the limitation of the blue emission at different levels.
8. **What else do we know about breast and prostate cancer?**
  - We know that they are hormone related cancers. We know that breast cancer is associated with reproductive history, for example age of menarche, breastfeeding, age of birth of first child. Also with alcohol consumption, obesity (in postmenopausal women only), lack of physical activity. We know little about environmental exposures affecting breast cancer, except for the risk associated with night shift work and exposure to light at night. For prostate cancer we know very little except for the importance of genetic

factors. Prostate cancer has also been associated with night shift work and light at night.

- Regarding the association between breast/prostate cancer and melatonin suppression. The mechanism of action underlying the anti-oncogenic activity of melatonin has not been completely established, with several biologic pathways having been suggested.

## 9. What can we do to protect ourselves from blue light exposure?

- Our eyes' natural filters do not provide sufficient protection against blue light rays from the sun, or blue light emanating from electronic devices or from blue light emitted from LEDs. The most obvious measure is to limit exposure and these kind of measures have to be taken both at a societal levels (e.g. city lights), industry levels (e.g. brightness of PCs etc) and individual level (e.g. hours working with e-devices, lighting in houses etc). People might consider for example avoiding bright lights, 1-2 hours before bedtime, and use dimmer switches.
- Overall, software applications seem to offer, at the present time, the best option for controlling the light spectra emitted by existing devices. Such tools should be included as a standard feature on any self-luminous device and that their default settings should be established according to the best available knowledge on the circadian effects of light.

## 10. Can the results of Madrid and Barcelona be extrapolated to other cities around the world?

- Madrid and Barcelona have unique features that might affect the results of the study. For instance, they are some of the most illuminated cities of Europe, also some of the high population density and with an extremely uniform illumination structure. That is why effects that are found in Madrid and Barcelona might be less pronounced in other places.

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