We Are All Healthier Under a Starry Sky

By Mario Motta, MD, FACC

ight pollution is a subject that naturally interests many of the readers of the *Reflector*, given that our viewing of the wonders of a natural dark night sky is limited by excessive outdoor lighting. Many are also aware of some of the environmental harm of light pollution as well. What is less well-known is the adverse human health effects of severe light pollution, yet that is one of the more compelling reasons to bring light pollution under control. I became interested in this issue in 1990 through the pioneering work of Dr. Richard



Mario Motta in his observatory.

humans or the environment, and were downright hostile toward the published science. Happily, since then, most have come around and the latest Illuminating Engineering Society (IES) handbook in 2022 has come to endorse much of what the AMA first proposed in 2016. Now many (though not all) lighting engineers do attempt to limit severe light pollution and glare in their lighting designs and applications.

In early 2024, the *Journal of the AMA* asked me to produce an article that updates

Stevens, an epidemiologist from the University of Connecticut. He hypothesized that light pollution's suppression of melatonin could lead to significant adverse health effects. Since that pivotal insight and publication, thousands of scientific studies have been published showing he was correct in his hypothesis, and this is now a burgeoning field of study.

In 2012, as an elected member of the American Medical Association (AMA)'s council of science, I formulated a white paper in collaboration with some leading researchers in the light pollution field on the dangers of human health effects by excessive lighting, especially including outdoor lighting. This was published by the AMA to alert physicians and the public ("Light Pollution: Adverse Health Effects of Nighttime Lighting," 2012). This paper summarized the already extensive worldwide literature on the subject up to that time. It piqued general interest but was mostly ignored by the lighting industry. In 2016 with the United States about to embark on wholesale replacement of then-prevalent high-pressure sodium outdoor lighting with new energy-efficient LED lighting, I edited a report that the AMA council of science published to alert physicians and the general public of the adverse human health effects of excessively blue LEDs ("Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting," 2016). Note this publication stated we should adopt LED lighting to curtail high energy use and allow us to diminish wasteful fossil fuel use, but that they should be the right type of LED lighting. Specifically, the AMA called on the United States to use LEDs that are of color temperature 3,000 K or less, in outdoor lighting replacements, avoiding the 4,000 K lighting then prevalent (35% vs. 21% blue emission). Many cities adopted this limit, much to the ire of the lighting industry at that time. Lighting companies then denied any of their products could harm either

and summarizes the current state of the field, and I was happy to oblige. The full article was published on October 2, 2024, and is now available online (see the link at the end of this article). It is titled "We're All Healthier Under a Starry Sky," and is a full peer-reviewed article, with 42 peer-reviewed references. As a bonus, for any physicians reading this, you can obtain one AMA continuing medical education credit (CME) by reading it, and then answering a few questions that will satisfy your state CME requirements! I hope you enjoy reading this article, which summarizes the latest advances in this burgeoning field. It will also give you additional information to push for light pollution mitigation efforts when attending your local town halls, and is now free to share.



Whirlpool Galaxy. All images by author.



I will briefly summarize this paper here. First, glare is a serious issue that impedes safe driving at night. While glare is a problem for all, it is especially significant for older drivers. As we age, the lenses in our eyes develop microcalcifications (affecting nearly everyone by age 45), and with time these can slowly coalesce into cataracts as we age. Unshielded lights can

scatter in the eye from these calcifications, and cause disability glare. What is worse, blue light, which comprises 35% of the emission from 4000 K lighting, scatters the most: 10 times



the mount that red light scatters (just like sunlight in our atmosphere; the physics is the same). Yet this is easily fixed. Demand all streetlights and businesses shield lights so no direct light hits drivers, demand low correlated color temperature lighting (for example, no more than 3000 K; preferably 2700 K or less). As I tell many elderly attendees at my presentations, if you have trouble driving at night, the fault is not so much in your eyes, as it is with simply bad engineering. Public lighting

should not create hazardous driving conditions or adverse human health effects.

The second issue is an increase in endocrine-related cancers with excessive light pollution. This is actually a well-researched subject these days. It is not that a photon causes a cancer directly; it is that light at night, including streetlights that shine through your bedroom window, suppress your nightly melatonin production from your pineal gland. Surprisingly little light can do this, as low as 2 microwatts. Melatonin is an immune system adjuvant that stimulates B and T lymphatic cells to find and destroy abnormal cells that we all produce daily. If we diminish our immune system with light in our bedrooms at night, then we have a small incremental increase in certain cancers tied to the endocrine system. Many large-scale studies have now proven this statement to be true. For example, a study that followed 130,000 nurses for over 20 years found a 15% increase in breast

cancer in those exposed to outdoor light at night compared to more rural, less light polluted, areas. This has been replicated by 25 additional large-scale studies worldwide, including the most recent from Spain. Men have a similar increase in prostate cancer with light pollution. Recent studies out of Texas now show similar issues with pancreatic and thyroid cancers. These are all large-scale epidemiological studies, and that is the same level of proof as lung cancer studies regarding smoking.

Light pollution leads to higher levels of sleep disturbances, as you would expect, but that can lead directly to higher levels of psychosis and psychiatric disturbances, depression, and anxiety issues. Recent studies have linked light pollution to abnormal metabolism by disrupting leptin and other digestive hormones, leading to an increase in obesity and a subsequent increase in diabetes in outdoor light polluted areas. That has consequences with an increase in negative cardiovascular outcomes as well.

Excessive blue light (primarily indoor lighting in this case) can exacerbate macular degeneration; thus, you are well advised to limit excess blue light in indoor lighting. The iPhone does this automatically in its evening removal of blue emission. Indoor night lighting should not exceed a color temperature of 2400 K, which emits about 10% blue emission.

Finally, it is beyond the scope of this brief article or my paper to detail the immense environmental harm of excessive (and especially high levels of blue) light on our environment. Numerous articles detail this issue. I will point you to many articles in *Nature* magazine, especially those written by Travis Longcore of UCLA. Light pollution is contributing to an annihilation event on insects dubbed an "insect apocalypse" with dire consequences to our food



supply via effects on pollination. Light pollution also has led to a dramatic reduction in bird life, turtle hatchlings, and nocturnal animals. Light pollution is bad for our planet, not just for our own personal health.

I do hope you read and enjoy the

article in the link below, and use it to convince your local town and street lighting company to limit blue light at night, mitigating both human and environmental harm. As a beneficial side effect, we all get darker skies as a result!

Link to AMA journal article: *journalofethics.ama-assn.org/article/were-all-healthier-under-starry-sky/2024-10.*

References:

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