Exposure to early evening sunlight in spring creates teenage night owls

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In the spring, later sunset and extended daylight exposure delay bedtimes in teenagers, according to researchers at Rensselaer Polytechnic Institute's Lighting Research Center (LRC).

"Biologically, this increased exposure to early evening light in the spring delays the onset of nocturnal melatonin, a hormone that indicates to the body when it's nighttime," explains Mariana Figueiro, Ph.D., associate professor. "This extended exposure adds to the difficulties teens have falling asleep at a reasonable hour."

Over time when coupled with having to rise early for school, this delay in sleep onset may lead to teen sleep deprivation and mood changes, and increase risk of obesity and perhaps under-performance in school, according to Figueiro.

"This is a double-barreled problem for teenagers and their parents," says Figueiro. "In addition to the exposure to more evening daylight, many teens also contend with not getting enough morning light to stimulate the body's biological system, also delaying teens' bedtimes."

The new findings detailing the impact of early evening light in spring on melatonin onset and sleep times have just been published in *Chronobiology International* by Figueiro and LRC Director Mark Rea, Ph.D. The study found that 16 eighth-grade students from Algonquin Middle School in upstate New York experienced a delay in melatonin onset by an average of 20 minutes measured in one day in spring relative

to one day in winter. Melatonin levels normally start rising two to three hours prior to a person falling asleep. The students also kept sleep logs as part of the study, which collectively showed a 16-minute average delay in reported sleep onset and a 15-minute average reduction in reported sleep duration measured in one day in spring relative to one day in winter.

Setting the Body's Clock

Patterns of light and dark are the main cues for synchronizing our internal biological clock with the 24-hour solar day. Daylight is rich in short-wavelength (blue) light, which maximally stimulates our biological clock. This internal clock is responsible for regulating the timing of our sleep and other daily biological cycles, called circadian rhythms.

The results of the Algonquin Middle School study demonstrated that it was the extended daylight hours due to the seasonal change, not evening electric lighting after dark in the home, that had the biggest impact on delayed sleeping patterns. According to Figueiro, these results underscore the importance of measuring the 24-hour circadian light and dark patterns in order to draw valid inferences from field studies of this kind.

"This latest study supplements previous work and supports the general hypothesis that the entire 24-hour pattern of light/dark exposure influences synchronization of the body's circadian clock with the solar day and thus influences teenagers' sleep/wake cycles," explains Figueiro. "As a general rule, teenagers should increase morning daylight exposure year round and decrease evening daylight exposure in the spring to help ensure they will get sufficient sleep before going to school."

Measuring "Circadian Light"

In the study, the Algonquin Middle School students were exposed to significantly more "circadian light" in the early evening during spring than in winter, resulting in both delayed melatonin onset and shorter self-reported sleep durations. Each subject wore a Daysimeter, a small, head-mounted device developed by the LRC to measure an individual's exposure to daily "circadian light," as well as rest and activity patterns. The definition of circadian light is based upon the potential for light to suppress melatonin synthesis at night, as opposed to measuring light in terms of how it stimulates the visual system.

This study, sponsored by the U.S. Green Building Council (USGBC) and, in part, by a grant from a Trans-National Institutes of Health Genes, Environment and Health Initiative (NIH-GEI), is the first to relate field measurements of circadian light exposures to a well-established circadian marker (the rise in evening melatonin levels) during two seasons of the year.

In a previous field study, also funded by USGBC and NIH-GEI and published in *Neuroendocrinology Letters*, Figueiro and Rea examined the impact of morning light on teen sleep habits and found that removing short-wavelength (blue) morning light resulted in a 30-minute delay in sleep onset by the end of a five-day period.

More information: Link to paper published in Chronobiology International: informahealthcare.com/eprint/e … hNRRT/full?tokenKey=

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