Effects Of Nighttime Light Radiance On The Sleep Of The General Population

Author: Maurice M. Ohayon, MD, DSc, PhD1, Cristina Milesi, PhD2.

1Stanford Sleep Epidemiology Research Center, Stanford University, Palo Alto, CA, USA,
2NASA Ames Research Center, Moffett Field, CA, USA.

Abstract:
Introduction: The objectives of this study is to verify if the exposure to greater nighttime
radiance is associated with changes in the sleep/wake schedule and with greater sleep
disturbances. Methods: The target population was the adults (18 years and older) living
in California, USA. This represents 24 million of inhabitants. A total of 3,104 subjects
participated in the survey (participation rate 85.6%). The participants were interviewed
by telephone using the Sleep-EVAL system. The interviews covered several topics
including sleeping habits, sleep quality, sleep disturbances, physical symptoms related to
menopause. Chronic insomnia was defined as difficulty initiating or maintaining sleep for
at least 3 months. Global nighttime light emissions have been collected by the Defense
Meteorological Satellite Program’s Operational Linescan System (DMSP/OLS) sensors.
We extracted the radiance calibrated nighttime lights corresponding to the date of the
interviews for a three by three window centered on each coordinate corresponding to an
interview address. Results: Dissatisfaction with sleep quantity and/or quality was
associated with an increased nighttime radiance (p=0.02). Similarly, excessive
sleepiness accompanied with impaired functioning was significantly associated with an
increased nighttime radiance (p<0.0001). The association remained significant after
controlling for age, gender and use of a night lamp in the bedroom. Confusional arousals
were also significantly associated with an increased nighttime radiance (p< .0001).
Bedtime hour was linearly increasing with the intensity of nighttime radiance: the later
the bedtime, the greater the nighttime radiance (p<0.0001). Similarly, wakeup time
became progressively later as the nighttime radiance increased (p<0.0001). Both
associations remained significant after controlling for age, gender and use of a night lamp
in the bedroom. Circadian Rhythm Disorders were the only sleep disorder significantly
associated with increased nighttime radiance (p<0.0001).
Conclusion: Exposure to increased nighttime light radiance appeared to cause a shift in
the sleep/wake schedule, excessive sleepiness and Circadian Rhythm Disorders.