Evening light exposure to computer screens disrupts human sleep, biological rhythms, and attention abilities

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The use of electronic devices with light-emitting screens has increased exponentially in the last decade. As a result, humans are almost continuously exposed to unintentional artificial light. We explored the independent and combined effects of two aspects of screen illumination, light wavelength, and intensity, on sleep, its biological regulation, and related functional outcomes. The 2×2 repeated-measure design included two independent variables: screen light intensity (low ([LI] versus high [HI]) and wavelength (short [SWL] versus long [LWL]). Nineteen participants (11F, 8M; mean age 24.3±2.8 years) underwent four light conditions, LI/SWL, HI/SWL, LI/LWL, and HI/LWL, in counterbalanced order. Each light exposure lasted for two hours (21:00–23:00), following which participants underwent an overnight polysomnography. On each experimental night, oral temperature and urine samples (for melatonin analysis) were collected at multiple time points. Each morning, participants filled out questionnaires and conducted a computerized attention task. Irrespective of light intensity, SWL illumination significantly disrupted sleep continuity and architecture and led to greater self-reported daytime sleepiness. SWL light also altered biological rhythms, subduing the normal nocturnal decline in body temperature and dampening nocturnal melatonin secretion. The light intensity seemed to independently affect sleep as well but to a lesser degree. Both light intensity and wavelength negatively affected morning attention. In sum, light wavelength seems to have a greater influence than light intensity on sleep and a wide range of biological and behavioral functions. Given the widespread use of electronic devices today, our findings suggest that screen light exposure at evening may have detrimental effects on human health and performance.

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