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A proof-of-concept and reliability study for remote, ambient spectral light sensing in the home environment: A Collaborative Aging (in place) Research using Technology (CART) substudy

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Abstract

Introduction

Aging is a significant contributor to changes in sleep patterns which have compounding consequences on the cognitive health of older adults. An environmentally modifiable factor contributing to poor sleep in aging adults is light exposure. However, methods to reliably and continuously collect spectral light levels in the home are not well established. We explored the implementability of various light sensors and feasibility of remote deployment and data collection of both spectral light levels and sleep within subjects' homes.

Methods

We tested commercially available spectral light sensors from Blue Iris, LLC (Pupil device) and Phillips Respironics (Actiwatch Spectrum Pro device). Both sensors were accurate, but the Actiwatch Spectrum sensors were more reliable and able to continuously collect data for up to 12 weeks without recharging. Actiwatch sensors were remotely deployed in the homes of healthy older adults, already enrolled in existing studies (VA-OHSU CART substudy within ORCATECH). One light sensor was placed in each of 4 rooms around the house for continuous, long-term data collection. Mattress sensors (e.g., Emfit Bedmat) were used to continuously estimate sleep time during this period.

Results

Data collected from the mattress sensors and spectral light sensors indicates a relationship between light exposure and the duration spent in bed, with light in rooms occupied more

frequently having a stronger effect. Overall, subjects reported that the equipment was easy to use and unobtrusive.

Conclusion

This proof-of-concept and feasibility data provide early evidence that spectral light sensors can be remotely deployed and implemented to assess relationships between light levels and sleep among older adults and paves the way for accurate measurement of light in future intervention studies manipulating lighting to improve sleep.