Exposure to light could help Alzheimer's patients sleep better

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(Medical Xpress) -- Individuals with Alzheimer's disease and related dementias (ADRD) often sleep during the day and are awake at night. The situation can turn life-threatening if they leave their homes and wander around outside. This irregular sleep schedule and night wandering, and the consequent burden on their caretakers, is a primary reason individuals with ADRD are placed in more controlled environments such as nursing homes. A new study from the Lighting Research Center (LRC) at Rensselaer Polytechnic Institute lays the

foundation for the importance of tailored light exposures as a viable treatment option for the reduction of sleep disturbances in older adults and those with ADRD.

Funded by a grant from the National Institute on Aging (NIA), the study is the first to collect circadian light exposures in individuals with ADRD. Results of the quantitative study show that individuals with ADRD experienced lower light levels, exhibited lower activity levels, and had greater disruption to their natural circadian rhythms than healthy older adults. The findings also show that people with ADRD experience lower levels of light exposure and greater levels of circadian disruption during the winter.

“We used light/dark and activity/rest patterns to assess circadian disruption and our results are consistent with previous studies. However, this is the first field study to examine the synchrony between the circadian light pattern and the activity response pattern to assess circadian disruption,” said Mariana Figueiro, associate professor at Rensselaer and director of the Light and Health Program at the LRC, who led the study. “Measurements revealed that those with ADRD experienced more circadian disruption than healthy older adults.”

Results of the study, titled “Field Measurements of Light Exposures and Circadian Disruption in Two Populations of Older Adults,” will appear in the *Journal of Alzheimer’s Disease*. Figueiro presented the research team’s findings at the Alzheimer’s Association International Conference in Vancouver on July 17.

Along with Figueiro, co-authors of the study are LRC Director and Professor Mark S. Rea, LRC Research Specialist Robert Hamner, along with Patricia Higgins and Thomas Hornick, clinicians at Case Western Reserve University and Louis Stokes Cleveland VA Medical Center in Cleveland, Ohio.

Growing evidence indicates that circadian disruption by irregular light/dark patterns is associated with reduced quality of life and increased risk of disease. Circadian rhythms are governed by the human body's master clock in what is known as the suprachiasmatic nuclei (SCN), which has an intrinsic period slightly longer than 24 hours. On average, the SCN runs with a period of 24.2 hours. Light/dark patterns on the retina, the photosensitive part of the eye, synchronizes the SCN to the 24-hour solar day, regulating biological rhythms such as when we are active and when we sleep. Without exposure to a regular, daily pattern of light and dark, circadian rhythms can become irregular.

"Biology is driven by circadian rhythms at every level, and light is the main stimulus for synchronizing the circadian system to the solar day. By quantifying an individual's light/dark exposure pattern, we can prescribe 'light treatments' promoting circadian entrainment, thereby improving health and well-being," said Figueiro.

To collect data for the study, the research team used a Dimesimeter, a dime-sized device developed by the LRC, to record how much photopic and circadian light an individual is exposed to and whether they are active or resting. The data-logging device records these light and activity levels continuously over many days, and can be easily attached to shirt collars, lapels, hats, wristbands, or eyeglasses. The Dimesimeter enables researchers to examine light/dark and activity/rest patterns in those experiencing circadian sleep disorders, such as Alzheimer's patients. Data from the device can be downloaded to a computer and processed to calculate a cross-correlation of the activity/rest and light/dark exposure data, a measure of circadian entrainment/disruption.

"The Dimesimeter system allows researchers to accurately measure light/dark exposure and activity/rest patterns to quantify circadian disruption. In this way, we can collect ecological data on populations who suffer from circadian sleep disorders," said Rea. "This new study

using the Dimesimeter is a major step toward the goal of better understanding the impact of circadian disruption on human health."

For the new NIA-funded study, the research team enlisted 16 healthy older adults and 21 adults with ADRD to wear a Dimesimeter on their wrists for one week. The research team in Cleveland collected data from those with ADRD and the research team in Troy collected the data from healthy older adults. From the resulting data, the researchers calculated two metrics for each subject: relative activity (RA) to measure activity, and phasor magnitude to measure both light exposure and activity. The analysis revealed that during winter, those with ADRD exhibited more circadian disruption than healthy adults as reflected by their significantly shorter phasor magnitudes and lower RA values. Those with ADRD studied in winter also had significantly shorter phasor magnitudes than those studied in summer. ADRD adults were less active during waking hours than healthy adults, and ADRD adults studied in winter were exposed to less light than healthy adults in winter and ADRD adults in summer. The research team is currently delivering a lighting intervention to those with ADRD and their caretakers and measuring its impact on their sleep efficiency and circadian disruption.

Looking forward, the Dimesimeter could one day allow physicians to predict the optimum timing of the light therapy necessary to resynchronize the circadian phase with the solar day. Such treatments could range from going outdoors for 15 minutes to sitting in front of a light box fitted with blue LEDs for a prescribed amount of time, according to Figueiro.

Last year, international magazine *The Scientist* named the LRC's Dimesimeter as one of the " Top 10 Innovations of 2011."

Provided by Rensselaer Polytechnic Institute