



KEY POINT SUMMARY

OBJECTIVES

To study the effectiveness of a 24-lighting intervention on sleep quality among elderly residents in an assisted living facility. The focus of this demonstration project was on understanding how a lighting scheme that supported high circadian stimulation during the day and low circadian stimulation during the night would affect sleep quality.

Developing Architectural Lighting Designs to Improve Sleep in Older Adults

Figueiro, M., Saldo, E., Rea, M., Kubarek, K., Cunningham, J., Rea, M. S.
 2008 / *The Open Sleep Journal*
 Volume 1, Issue 1, Pages 40-51

Key Concepts/Context

Light affects human health and well-being by affecting our ability to see the world, perceive distances and spatial relationships as well as modulating our circadian system. The circadian system which maintains the body's 24-hour cycle is entrained by the light and dark cycles of day and night as well as an internal oscillator located in the brain and a hormone melatonin. The circadian system regulates many of the body's activities including sleep. A majority of older adults in long term care facilities suffer from sleep problems. The aging of the visual and circadian system along with exposure to lower light levels than needed to regulate the circadian system are key causes for poor sleep patterns among the elderly. Lighting interventions in long term care facilities may help to improve sleep patterns among the elderly.

Methods

The demonstration project was conducted at an assisted living facility in New Jersey with seven female subjects with sleeping problems. A new lighting system was designed and implemented that complied with the installation requirements of the existing facility. The goal was to increase circadian stimulation during the daytime. This was achieved 1) by increasing the overall daytime light levels by at least two to four times the existing levels and 2) by using a 6500K lamp that was high on short wavelength content and estimated to be twice as effective in stimulating circadian system as an incandescent light. Existing low light-level incandescent table lamps were used during evening hours. The brighter lights were turned on from when residents woke up till 6:00pm in the evening.



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Sleep quality was measured before and after the intervention using the the 19 self-report items on the Pittsburgh Sleep Quality Index (PSQI). A global PSQI score of 5 or higher is associated with sleep disturbances. In addition, rest-activity rhythms were measured using an actigraph which is a small wrist activity monitor. Baseline data was collected for a two week period in 2007 where researchers interviewed participants using the PSQI and also gave them actigraphs to wear. The lighting intervention was put in place for a 4 week period and during the last two weeks, post intervention data (actigraph and interviews) was collected. Then the new lighting was turned off and after a week the subjects were asked to wear the actigraphs again.

Findings

There were no significant differences in average PSQI scores before and after installing the lighting intervention. However, the most significant reduction was seen in subjects who had the most acute problem. For example, one subject with a score of 12 before the intervention went down to a score of 7. Four subjects who had exposure to the light during the day were spending more time awake during the daytime hours and more time asleep during the nighttime hours. Sleep efficiency increased after light intervention, but did not reach statistically significant difference. The residents were overall more satisfaction with the lighting conditions in their environment after the intervention. They also agreed that they could read better under the new lighting condition and that it was not too bright for them.

Limitations

Some key limitations identified in this study include:

- A very small sample size
- Only one week was allowed to go by between turning the new lighting off and collecting the second set of post intervention data. That may not have been enough time for the body's circadian system to adjust.

Design Implications

- Light levels provided in most long term care facilities are lower than needed to stimulate circadian systems of older adults. Light levels should be evaluated.
- Consider increasing light levels in public areas and areas where residents spent considerable time during daytime hours.
- For new facilities, lighting design can incorporate timers to facilitate easy turning on and off of brighter light sources
- Lower light levels should be provided for evening hours to reduce circadian stimulation.