

Daytime Cognitive Performance in Response to Sunlight or Fluorescent Light Controlling for Sleep Duration

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Abstract

Light is a primary synchronizer of the human circadian rhythm and also has acute alerting effects. Our study compares the alertness, performance, and sleep of participants working in two different office settings. The NASA Ames Sustainability Base which uses sunlight as its primary and a traditional office building located at NASA Ames which uses overhead fluorescent lighting. It is a 24-hour cycle, in response to the light and restricts the amount of sleep participants sleep.

Materials

- We collected sleep data using actigraphy (Figure 1) and daily sleep/work diaries (Figure 2)
- Participants wore the actigraphy on the wrist
- Sleep data can be estimated through periods of relative inactivity
- Self-reported sleep data derived from the sleep diaries

Methods

- Study participants were recruited from the NASA Ames Sustainability Base, also known as the “Green” Building
- Control participants were recruited from traditional office buildings located at NASA Ames
- Participants were asked to fill out questionnaires including the Morningness-Eveningness Questionnaire, Fatigue Severity Scale, and Epworth Sleepiness Scale
- Participants wore the actigraphy on the wrist and completed the sleep/work diary on a daily basis
- Participants completed the cognitive test battery (Figure 3) in a five-minute test battery
- Participants completed the cognitive test battery daily
- In year 2 of the study, participants were asked to stay in bed for four hours, do not eat, and monitor the impact of sleep on their performance

Preliminary Results (Year 1)

- Pre-study questionnaires were administered to all participants in both settings
- We measured light intensity using light meters to evaluate lux
- We also evaluated performance using the Digit Symbol Substitution Test (DSST) and the Multiple-Choice Reaction Time Task (McRT)
- We assessed cognitive function using the Digit Symbol Substitution Test
- We measured light intensity using light meters to evaluate lux

Conclusion

- In Year 1 analysis, sleep duration was shorter than expected in both types of buildings
- Light intensity is not sufficient to produce alerting effects when sleep duration is restricted
- Year 2 analysis may be necessary to evaluate the impact of light on alertness and performance with prolonged sleep duration of 6 hours

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Further Information

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