The Association Between REM Sleep Duration and Cognitive Impairment Using Wearable Sleep Device

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Introduction

Background:

- Current methods of detecting and tracking Alzheimer's Disease (AD)—by collecting biomarkers and administering neuropsychological tests—are difficult and expensive
- Sleep quality, as determined by Rapid Eye Movement (REM) sleep duration, is another potential indicator of AD and cognitive decline[2]
- **REM sleep** = low-voltage, mixed-frequency (desynchronized) brain wave activity, rapid eye movements, and reduction in muscle tone[1]
  - Brain replenishes neurotransmitters which organize neural networks (important for memory consolidation, learning, and problem solving)[2]

Goal:

- To assess whether REM sleep duration, collected through a wearable sleep device, is associated with cognitive impairment

Hypothesis:

- Heart rate and oxygen data indicating a shorter REM Sleep Duration is associated with cognitive impairment

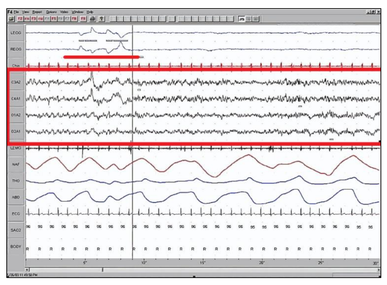

Figure 1.
The section of the EEG boxed in red displays brain activity during REM sleep.[3] It shows mixed-frequency brain wave activity including theta activity which is associated with recall.[1]

Methods

Analyses: Multivariable Logistic Regression (adjusted for age and sex using one night of ring data)

Exposure variable: REM Sleep Duration

Outcome variable: Cognitive Impairment

- 112 participants from the Boston University Alzheimer's Disease Research Center
- The ring collects heart rate and oxygen data to calculate REM sleep duration
- The odds ratios, 95% confidence intervals, and p-value were calculated and reported

Figure 2.
SleepImage Ring.[4]

Demographics Table			
Variable	**Not Cognitively Impaired N = 106**	**Cognitively Impaired N = 6**	**All N = 112**
Age, m (sd)	72.77 (9.21)	65.33 (9.61)	72.38 (9.34)
Sex			
Male (N%)	47 (44.34)	1 (16.67)	48 (42.86)
Female (N%)	59 (55.66)	5 (83.33)	64 (57.14)
Education in years, m (sd)	17.104 (2.08)	16.33 (1.51)	17.063 (2.06)
Sleep duration in hours (sd)	7.13 (2.2)	7.64 (0.95)	7.15 (2.15)
REM Sleep Duration in hours, m (sd)	1.30 (0.55)	1.64 (0.76)	1.32 (0.56)

Results

- Of the 112 study participants, only 6 were cognitively impaired
- There was no statistically significant association between REM sleep duration and cognitive impairment (OR = 1, 95% CI [1, 1.001], p = 0.07)

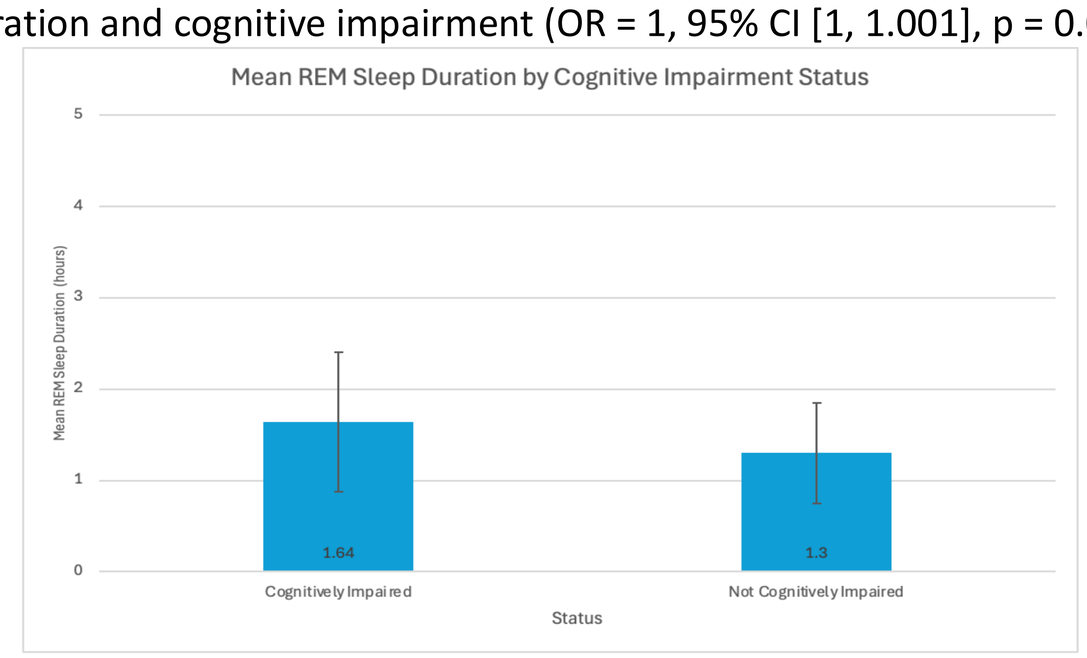

Figure 3.
Mean REM Sleep Duration by Cognitive Status.

Conclusions

Discussion:

- There was no statistically significant association between REM sleep duration and cognitive impairment

Strengths:

- The sleep device serves as a potential device to allow researchers to continually gather data and for participants to continually monitor their cognitive health over several years

Limitations:

- Limited sample size, particularly of cognitively impaired patients, skewing the results of the data

Future Directions:

- Implementation of this study on a larger sample size with more cognitively impaired cases
- Conducting a longitudinal analysis to identify whether changes in REM Sleep data over time can predict early cognitive decline

References

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