

Associations between sleep quality and cognitive functioning in adults with Down syndrome

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INTRODUCTION

Down syndrome (DS) is a genetic condition characterized by developmental and intellectual delays and differences in craniofacial structures. DS affects in 1 in every 700 live births in the U.S. ¹

This population is at an increased risk for sleep disorders, such as obstructive sleep apnea syndrome (OSAS). OSAS is characterized by oxygen reduction or cessation to the brain, potentially reducing cognitive performance.

- In non-DS samples, there is a higher prevalence of OSAS in biological males compared to females, however with increases in age, the magnitude of difference decreases between biological sexes ³.
- In non-DS samples, research suggests that older adults with sleep disordered breathing perform worse on measures of executive functioning and delayed memory ⁴.
- Presently, there is limited understanding of the impact of OSAS on cognitive outcomes in adults with DS ².

It is not clear if (1) there are differences in OSAS diagnosis based on biological sex or age and (2) if presence of OSAS further reduces cognitive functioning in this population.

THE CURRENT STUDY

The purpose of this study was to evaluate potential sex and age differences in the presence of OSAS in adults with DS and evaluate the impact of OSAS on cognitive function. We hypothesized that there would be no observable difference in OSAS diagnosis given age and biological sex differences, and that an increase in OSAS severity would correlate to worse cognitive performance.

METHOD

Data for this study used a subsample of a larger, longitudinal study tracking biomarkers associated with Alzheimer's disease in adults with DS.

Participants:

- 82 adults [25 to 61 years; mean age 39.17(8.374)] with DS, 96.3% White
- 54.9% male, 45.1% female
- At least 8 participants have diagnosis of mild cognitive impairment or dementia

Procedure:

- Participants completed a set of cognitive assessments in a day-long visit and used a WatchPAT300 device for one night's sleep

Measures:

- Sleep
 - Apnea hypopnea index (pAHI)
 - Total sleep time
 - REM (rapid eye movement) sleep
- Cognition
 - Visual-Motor Integration (VMI)
 - Down Syndrome Mental Status Examination (DSMSE)
 - Rivermead Picture Recognition

RESULTS

- Age was positively correlated with pAHI ($r = .229$, $p = .039$)
- Males had a higher severity of OSAS than females ($t = 1.983$, $p = .050$)

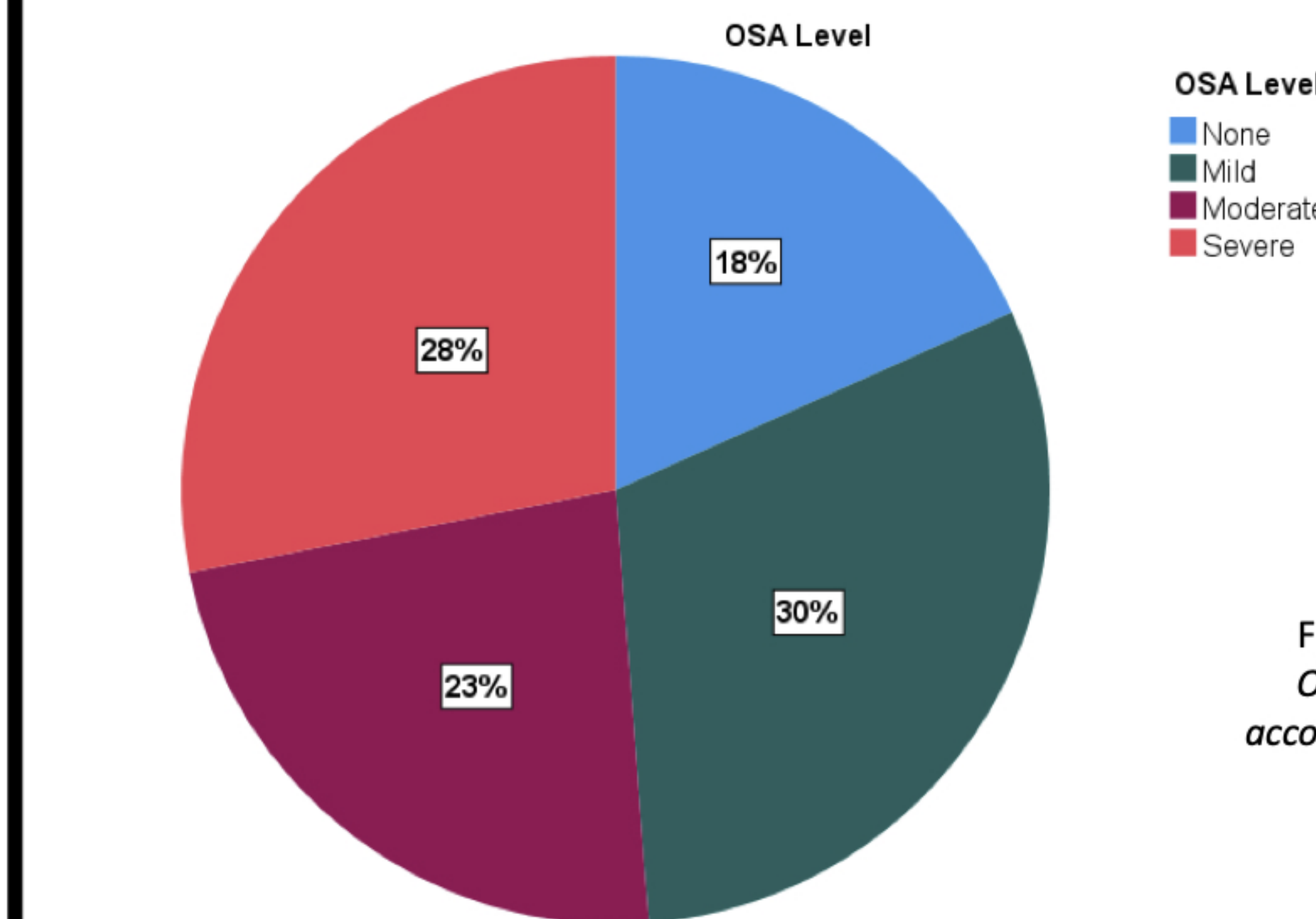


Figure 1. Distribution of OSAS diagnosis severity according to WatchPAT300

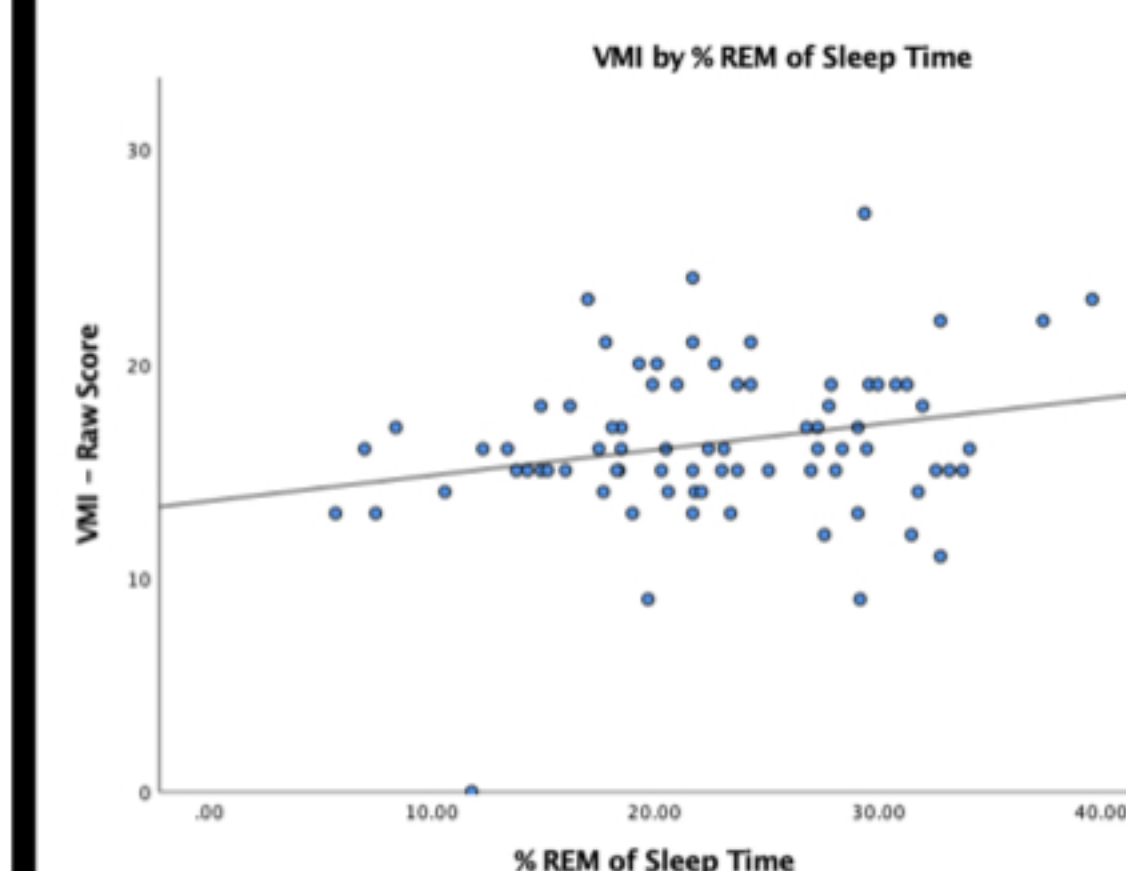


Figure 2. Associations between % REM sleep and VMI scores

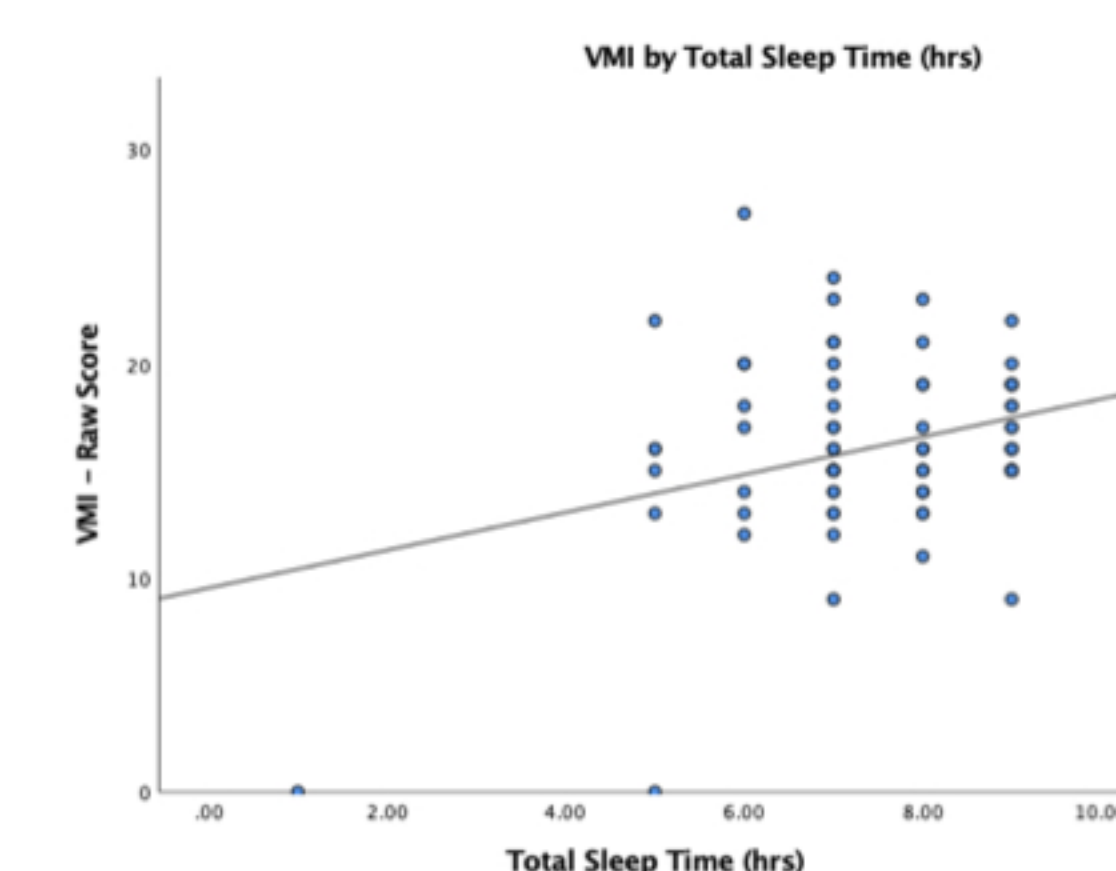


Figure 3. Associations between Total sleep time and VMI scores

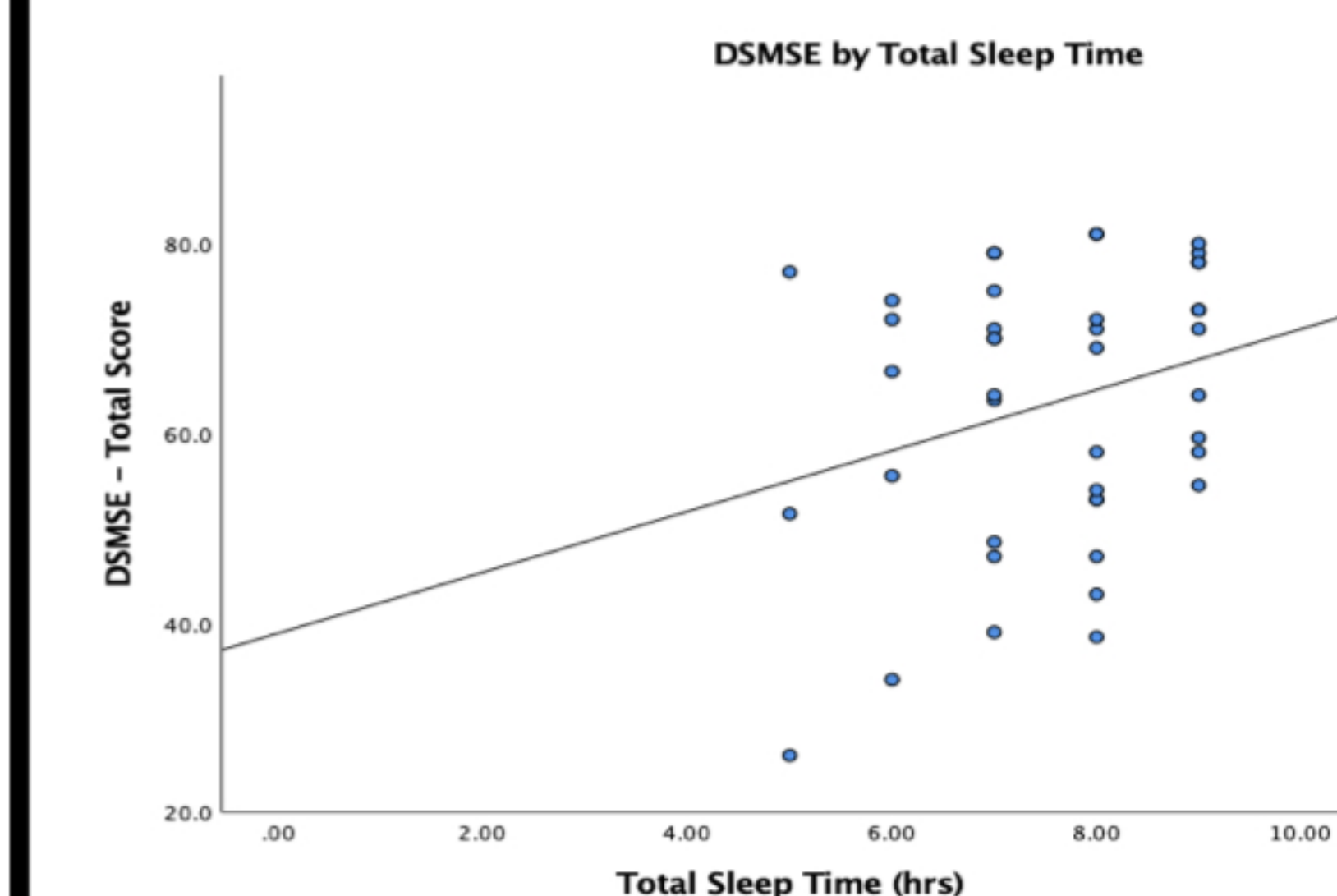


Figure 4. Associations between Total sleep time and DSMSE scores

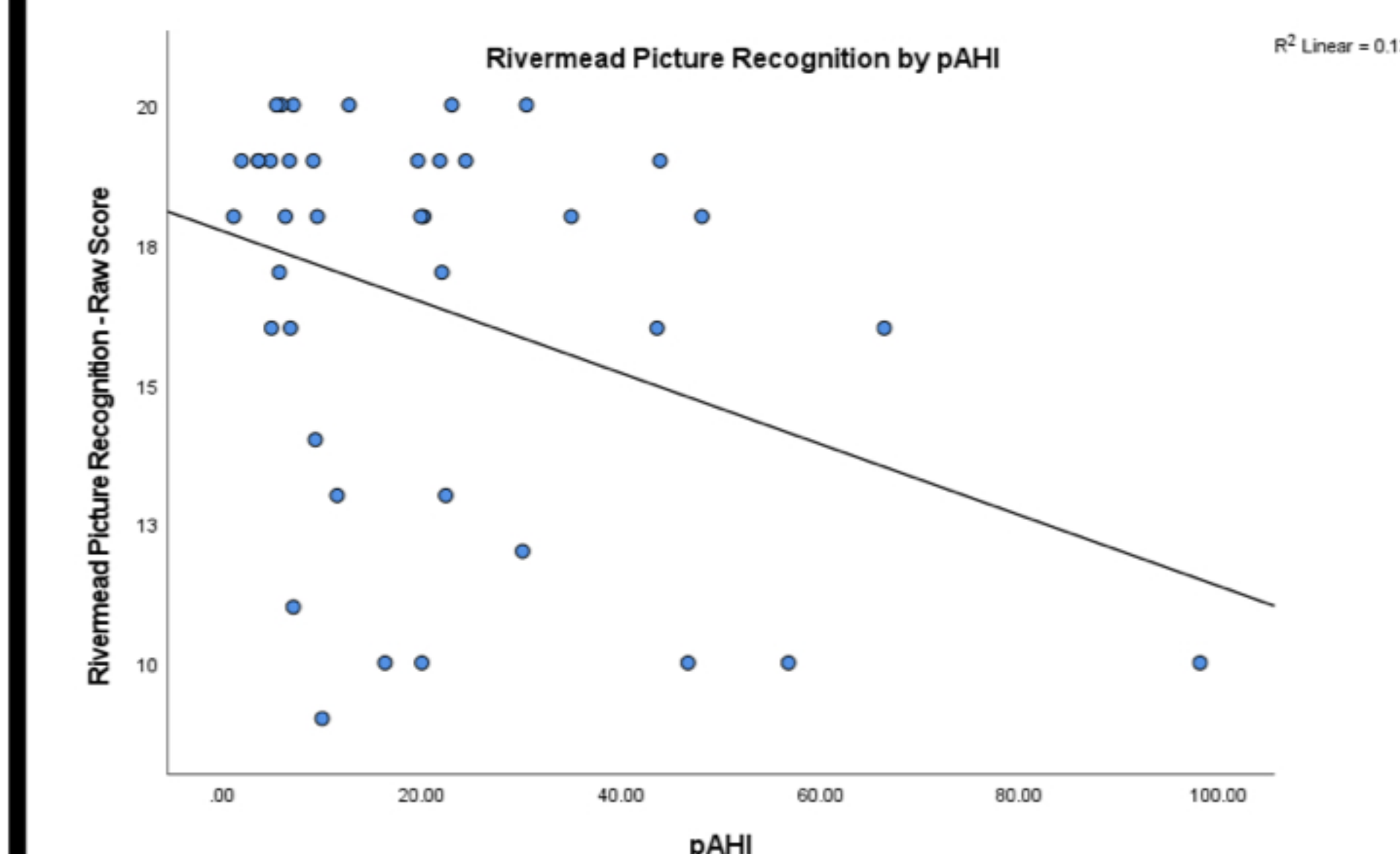
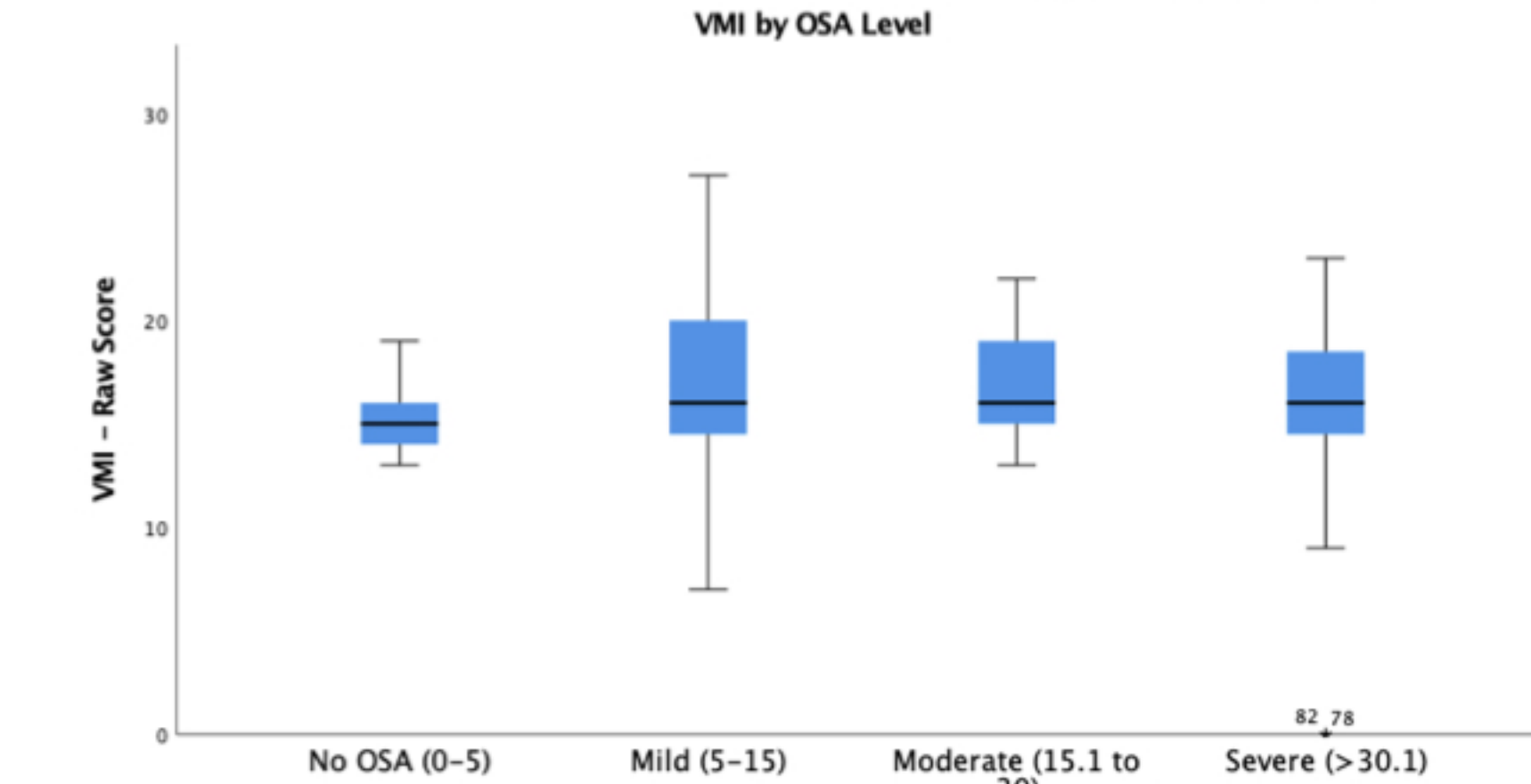
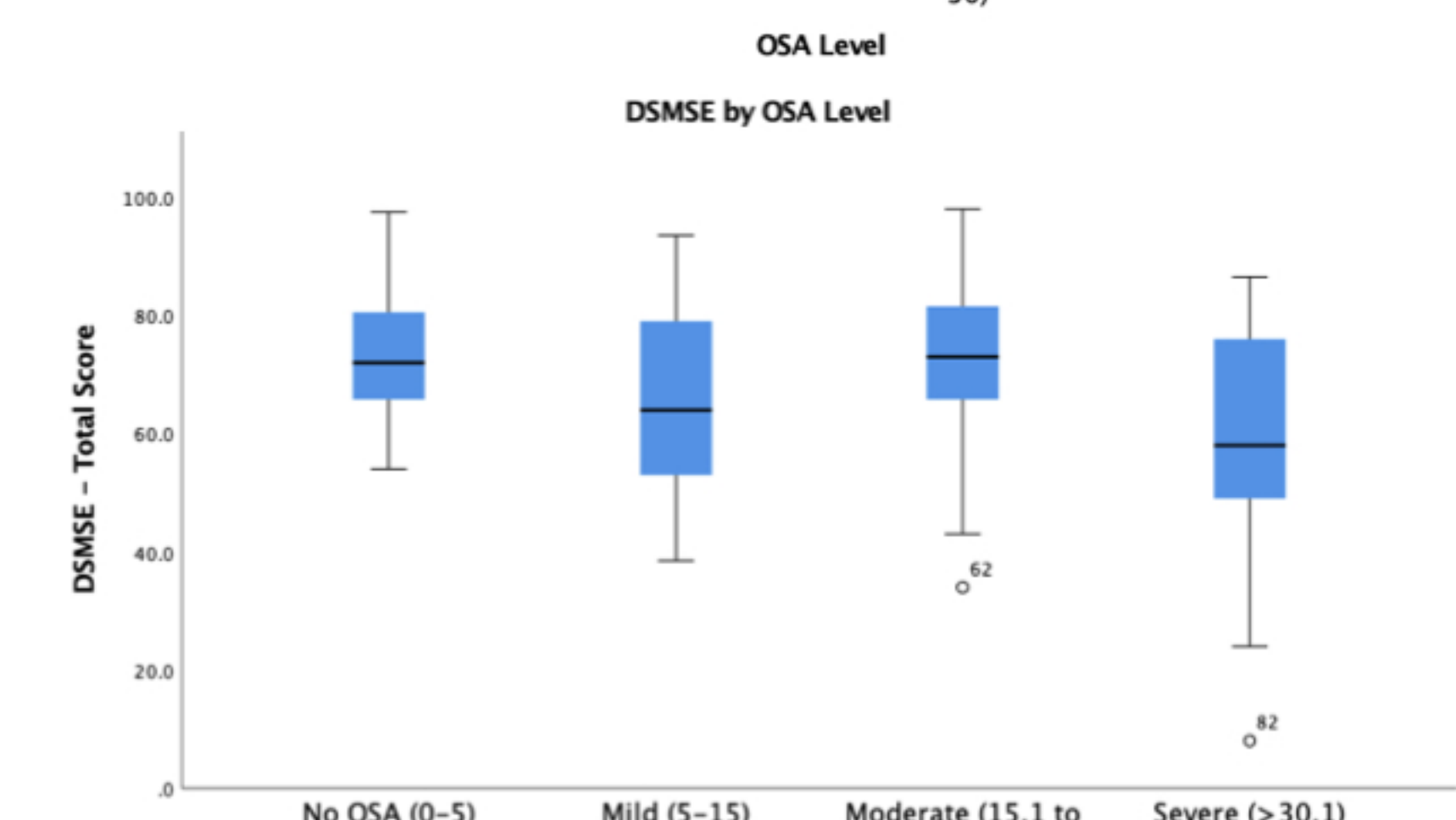


Figure 5. Associations between pAHI and Rivermead picture recognition scores

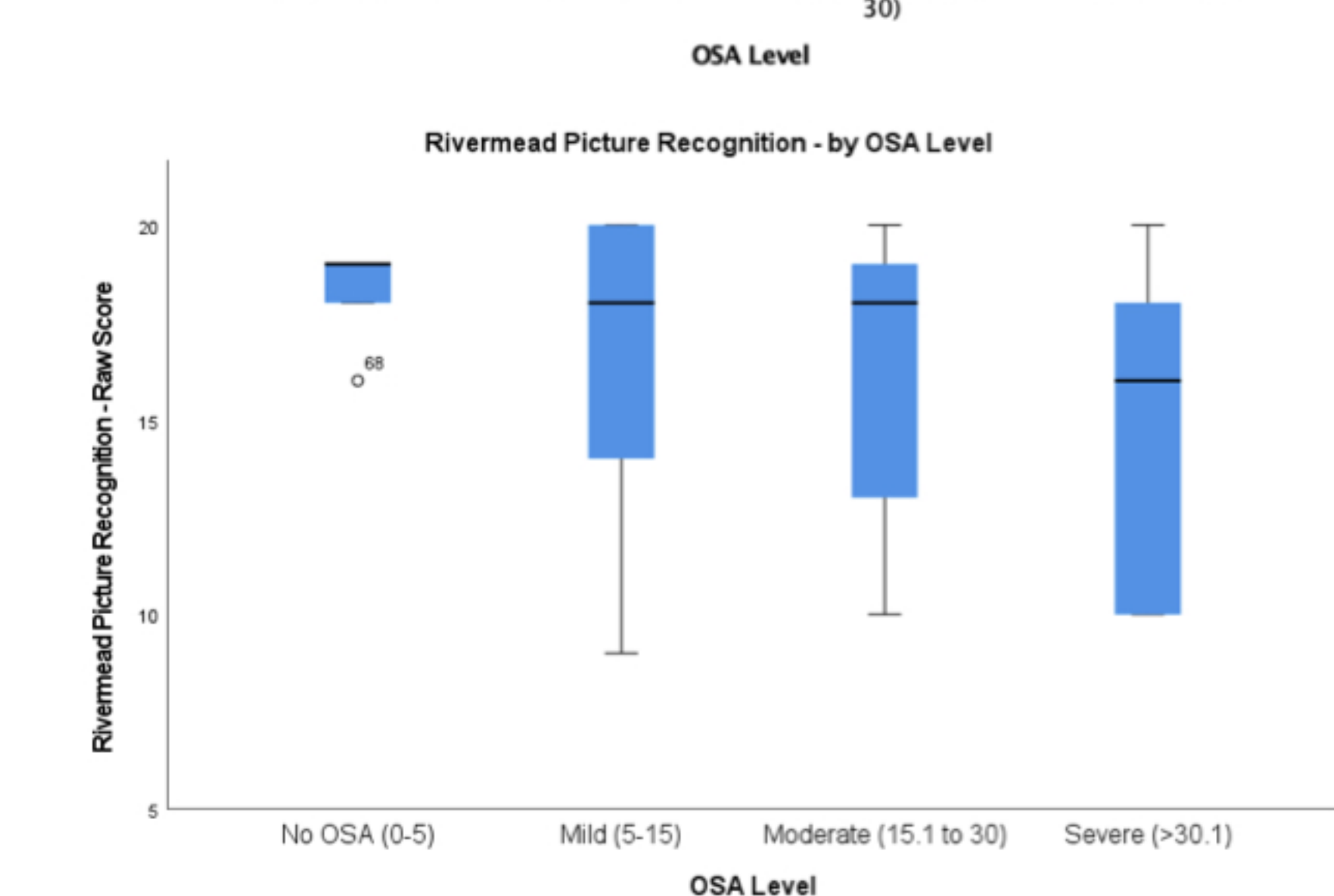
RESULTS



OSAS severity level does not appear to impact VMI scores



Severe level of OSAS related to lower DSMSE scores



Severe level of OSAS related to lower Rivermead picture recognition scores

CONCLUSIONS

- These findings indicate that there is a high prevalence of OSAS in adults with DS. Older adults with DS have more severe OSAS compared to younger adults. Males were more likely to have more severe levels of OSAS compared to females.
- More impaired sleep (decreased total sleep time, decreased REM sleep, and higher pAHI) was related to worse cognitive functioning.
- Findings are based on cross-sectional data. Longitudinal data is needed to track the time ordered effect of OSAS on cognitive functioning in the DS population. Future research should incorporate larger samples and aim to include a more diverse sample.
- Interventions that can reduce OSAS could have implications for improving cognitive functioning and everyday life in adults with DS.

REFERENCES

- Centers for Disease Control and Prevention. (2022, November 18). *Facts about Down syndrome*. <https://www.cdc.gov/ncbddd/birthdefects/downsyndrome.html>
- Fernandez, F., & Edgin, J.O. (2014). Poor sleep as a precursor to cognitive decline in Down syndrome: A hypothesis. *Journal of Alzheimer's disease & Parkinsonism*, 3(2), 124. <https://doi.org/10.4172/2161-0460.1000124>
- Kim, S.-W., & Taranto-Montemurro, L. (2019). When do gender differences begin in obstructive sleep apnea patients? *Journal of Thoracic Diseases*, 11(9), 1147-1149. <https://doi.org/10.21037/jtd.2019.04.37>
- Yaffe, K., Falvey, C.M., & Hoang, T. (2014). Connections between sleep and cognition in older adults. *The Lancet. Neurology*, 13(10), 1017-1028. [https://doi.org/10.1016/S1474-4422\(14\)70172-3](https://doi.org/10.1016/S1474-4422(14)70172-3)