Relationship Between Sleep and Cognition in Caucasians and African Americans at Risk for Alzheimer's Disease

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Purpose

Alzheimer's disease (AD) is a non-reversible brain disorder that develops over a period of years, leading to the loss neurons in brain areas responsible for learning and memory.[1] The disease has become one of the most prevalent neurological disorders and the only disease in the top 10 causes of death that cannot be prevented, cured, or even slowed.[1] It is estimated that one in every 10 people 65 and older have AD, with African-Americans 64 times as likely to get the disease.[1] Sleep habits and sleep quality play crucial roles in the brain's activity, are potential adjustable risk factors.[2 3] In this study, we investigated the relationship between sleep quality and cognitive test performance in individuals at high risk for AD, by virtue of parental history.

Participants

Eighty one participants with a parental history of AD enrolled in an ongoing NIH funded study. Of the 81 participants, sleep and cognitive measures were completed by 29 Black and 45 White individuals. All participants provided written informed consent.

Cognition

Participants undergo approximately 1-hour of cognitive testing, which consists of a number of standardized assessments designed to test several cognitive domains (memory, executive function, working memory, verbal and visuospatial ability). The cognitive testing battery includes tests specific to early cognitive changes in individuals at risk for AD.

Sleep

Sleep patterns and disruptions were collected through the RedCap Sleep Questionnaire. The validated Sleep Questionnaire is comprised of 31 questions and takes 10 minutes to complete. Participants are asked to rate how often they experience specific sleep behaviors and disturbances, ranging from "almost never" to "almost always."

Results

Table 1: Participant Demographics by Race

	Black (29 participants)	White (45 participants)
Age	59.41 +/- 8.118	58.53 +/- 6.178
Sex	Female: 86.2%; Male: 13.8%*	Female: 57.8%; Male: 42.2%*
College Graduate or Greater Level of Education	89.7%	82.2%
Hours of Sleep During Work Week	5.8276 +/- 1.23*	7.051 +/- 1.072*

Table 2: Cognitive Testing Data for All Participants by Race

	Black	White
Moca	25.44 +/- 2.15*	26.8 +/- 2.37*
Benson Immediate	15.4 +/- 1.11	15.8 +/- 0.50
Trails A Seconds	35.8 +/- 10.9*	29.7 +/- 8.6*
Trails B Seconds	107.8 +/- 86.97*	78.62 +/- 40.89*
Digit Span Forward Correct	10.35 +/- 2.449	10.69 +/- 2.401
Digit Span Backward Correct	5.93 +/- 2.235	6.71 +/- 2.928
Mental Rotation	16.4 +/- 5.18	17.6 +/- 5.96
Benson Delay	10.55 +/- 3.66	10.53 +/- 3.24
Buschke Delay	5.45 +/- 3.22*	7.11 +/- 2.85*
MINT	29.3 +/- 2.23*	30.5 +/- 2.57*

Table 3: Pearson's R Correlation Between Cognition and Sleep by Race

	Awaken from gasping	Stop breathing	Disruptive movements	Sleep quality rate	Active in morning
MOCA					
Black	-0.028	-0.336	-0.208	-0.102	-0.057
White	0.089	0.133	0.235	-0.116	0.2
Trail A Seconds					
Black	**0.429***	-0.292	0.008	-0.179	-0.061
White	-0.232	-0.008	-0.118	-0.173	0.099
Trail B Seconds					
Black	-0.248	0.214	-0.11	-0.002	0.016
White	-0.107	-0.088	-0.005	**-.314***	-0.088
Span Forwards Correct					
Black	0.058	0.014	-0.057	0.346	0.165
White	0.002	0.098	0.107	0.129	-0.04
Span Backwards Correct					
Black	-0.089	-0.364	-0.001	0.078	0.094
White	0.128	0.119	**.297***	-0.093	0.193
MRT					
Black	0.112	0.188	-0.025	0.246	0.106
White	0.027	**-0.331***	0.069	0.116	-0.077
Benson Delay					
Black	0.258	0.188	-0.103	-0.01	0.153
White	0.289	**-0.369***	0.136	-0.171	0.128
Buschke Delay					
Black	0.199	-0.092	0.109	-0.046	0.154
White	0.145	-0.008	-0.047	-0.151	**.364***
MINT					
Black	**.413***	-0.078	0.085	-0.001	0.18
White	-0.016	0.05	0.176	-0.075	**.339***

Controlled for age, education, and gender

Table 1 shows our at risk sample is middle aged, majority female, and has achieved a college degree or greater. However, Blacks reported getting significantly less sleep that Whites. The difference in sleep is possibly because the higher risk of AD in Blacks causes more Black women to be caregivers for a family member with AD.[4]

Table 2 shows results from our cognitive testing battery. Blacks and Whites performed significantly different on cognitive measures, including MOCA, Trails A and B, Buschke Delay, and MINT. Whites outperformed Blacks on 9 out of the 10 tasks. The tasks tested visuospatial and verbal memory, working memory, and executive memory.

Sleep and Cognition

Table 3 shows correlations between cognitive testing and sleep by ethnicity. A number of correlations were found between sleep abnormalities and cognitive function, suggesting sleep may be related to cognitive function. Statistically significant differences in cognitive function between Blacks and Whites may be partially explained by deviations in sleep.

- Statistically significant racial differences in visuospatial ability (MRT, r=-0.0331, p-0.026), visuospatial memory (Benson Delay, r=-0.369, p-0.013) and working memory (Trails A, r=0.429, p-0.02 and Trails B, r=-0.314, p-0.036) cognitive tests are present within our cohort of individuals at risk of AD.
- Significant relationship between sleep and cognitive performance in visuospatial ability, memory, and working memory tasks, such that more sleep disruptions were related to poorer cognitive performance.

Conclusion

- Racial differences in cognitive performance were observed within our cohort of individuals at high risk of AD.
- There is a relationship between cognitive function and sleep, and cognitive decline may be attributed, in part, to poorer sleep quality and these differences may vary by race.

Future Directions

- Research examining cognitive test performance should also consider the potential impact of sleep patterns. Interventions targeting sleep and appropriate diagnostics via this modifiable risk factor are needed.

REFERENCES

[1]Alz.org(2017). 2017 Alzheimer's Disease Facts and Figures.

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[3]Why Do We Sleep, Anyway? (2007) http://healthysleep.med.harvard.edu/healthy/matters/benefits-of-sleep/why-do-we-sleep

[4]http://w.alz.org/africanamerican (2017) African-Americans and Alzheimer's