

Implications of sleep disparities for cognitive test performance among African American and White older adults: Preliminary evidence from two Wisconsin cohorts.

Megan Zuelsdorff, PhD; Barbara B. Bendlin, PhD; Ozioma C. Okonkwo, PhD; Kate E Sprecher, PhD; Lindsay R Clark, PhD; David T Plante, MD, PhD; Mary F. Wyman, PhD; Nathaniel A. Chin, MD; Susan Flowers Benton, PhD, CRC; Nickolas H. Lambrou, PhD; Sanjay Asthana, MD; Sterling C Johnson, PhD; Carey E. Gleason, PhD

Background: Growing evidence suggests that sleep disturbance associates with Alzheimer's disease pathology and that sleep may play a role in later-life cognitive health. New research suggests widening racial disparities in sleep: African Americans of all ages report getting less nightly sleep than their white counterparts. In older adults, sleep likely links to cognition through multiple pathways shaped by socioenvironmental and physiological contexts. We examined relationships of sleep quantity and quality with cognitive test performance in middle-aged and older, cognitively normal African Americans and non-Hispanic whites.

Method: Participants (N=1,579; 7.9% African American) self-reported on sleep and completed comprehensive neuropsychological testing. Key predictors included nightly sleep duration and a duration quadratic to assess non-linearity, perceived adequacy of sleep, and daytime somnolence. Cognitive outcomes included measures of executive function (Trails A and B times, log-transformed) and episodic memory (Rey Auditory Verbal Learning Test, Trials 1-5 & Delayed, summed and log-transformed). We stratified by race before using mixed-effects regression to assess predictor-outcome relationships while controlling for demographics and waist-hip ratio.

Results: Daytime somnolence did not differ by race, but African Americans (n=125) reported poorer sleep adequacy and shorter sleep duration per night than non-Hispanic whites (n=1,454; Table 1). Somnolence and sleep adequacy predicted cognitive performance only among whites (Tables 2 and 3), and cognitive associations with sleep duration also varied by race. In African Americans, shorter sleep duration appeared associated with poorer performance on all tests, though precision was limited due to sample size. Directionality was reversed within the white sample: longer sleep predicted poorer executive function. Non-linearity of relationships can be seen in Figure 1.

Conclusions: Racial sleep disparities reported elsewhere were also seen in our cohorts. Moreover, relationships between indicators of sleep dysregulation and cognitive health differed substantially by race. If replicated in larger samples, these differences have crucial implications for the clinical utility of self-reported sleep data as a source of modifiable risk or preclinical marker. Our findings highlight the need for longitudinal studies of upstream (e.g., social stressors) and downstream (e.g., amyloid burden) sleep correlates, powered for stratification. Such studies will clarify directionality in population-specific risk pathways, and inform targeted interventions to mitigate impairment.

Table 1. Sample characteristics^a

	Range, whole sample	African American participants	Non-Hispanic white participants
<i>N</i>		125	1,454
Age, years, M (SD)	39 – 96	63.36 (9.14)	62.95 (7.07)
Female, N (%)		91 (73%)	984 (68%)
Education, years, M (SD)	8 – 20	14.89 (2.59)	16.21 (2.42)
APOE ε4 carrier, N (%)		44 (41%)	535 (38%)
Waist-hip ratio, M (SD)	0.50 – 2.54	0.93 (0.09)	0.89 (0.12)
Sleep duration, hours/night, M (SD)	2 – 10	6.30 (1.22)	7.14 (1.02)
Sleep adequacy^b, M (SD)	0 – 10	5.57 (2.57)	6.41 (2.23)
Somnolence ^b , M (SD)	0 – 15	3.64 (2.84)	3.33 (2.66)
Trails A Time, seconds, M (SD)	10 – 150	36.49 (19.02)	24.96 (8.83)
Trails B Time, seconds, M(SD)	19 – 300	109.5 (62.9)	61.4 (26.8)
RAVLT Total^c, M (SD)	15 – 90	47.94 (13.90)	61.12 (11.97)

^a Characteristics at first WRAP/ADRC visit with complete sleep data

^b Sleep quality assessed with the Medical Outcomes Study (MOS) Sleep Scale

^c Trials 1-5 and Delayed

^d **Bolded** rows show differences by race that are significant at the $p < .05$ level

Table 2. Results from mixed-effects regression testing relationships between sleep and cognitive test performance in African Americans (N=125)

	Trails A time		Trails B time		RAVLT Total	
	β (95% CI)	p	β (95% CI)	p	β (95% CI)	p
Sleep Adequacy	-0.06 (-0.23 to 0.11)	0.49	-0.04 (-0.19 to 0.11)	0.60	0.01 (-0.15 to 0.18)	0.87
Somnolence	-0.02 (-0.21 to 0.17)	0.83	-0.00 (-0.17 to 0.17)	0.99	-0.42 (-0.27 to 0.12)	0.42
Sleep duration	-0.20 (-0.35 to -0.04)	0.02	-0.12 (-0.27 to 0.03)	0.11	0.16 (-0.007 to 0.33)	0.06
Sleep duration ²	0.03 (-0.05 to 0.11)	0.48	0.03 (-0.06 to 0.12)	0.55	-0.01 (-0.09 to 0.08)	0.90

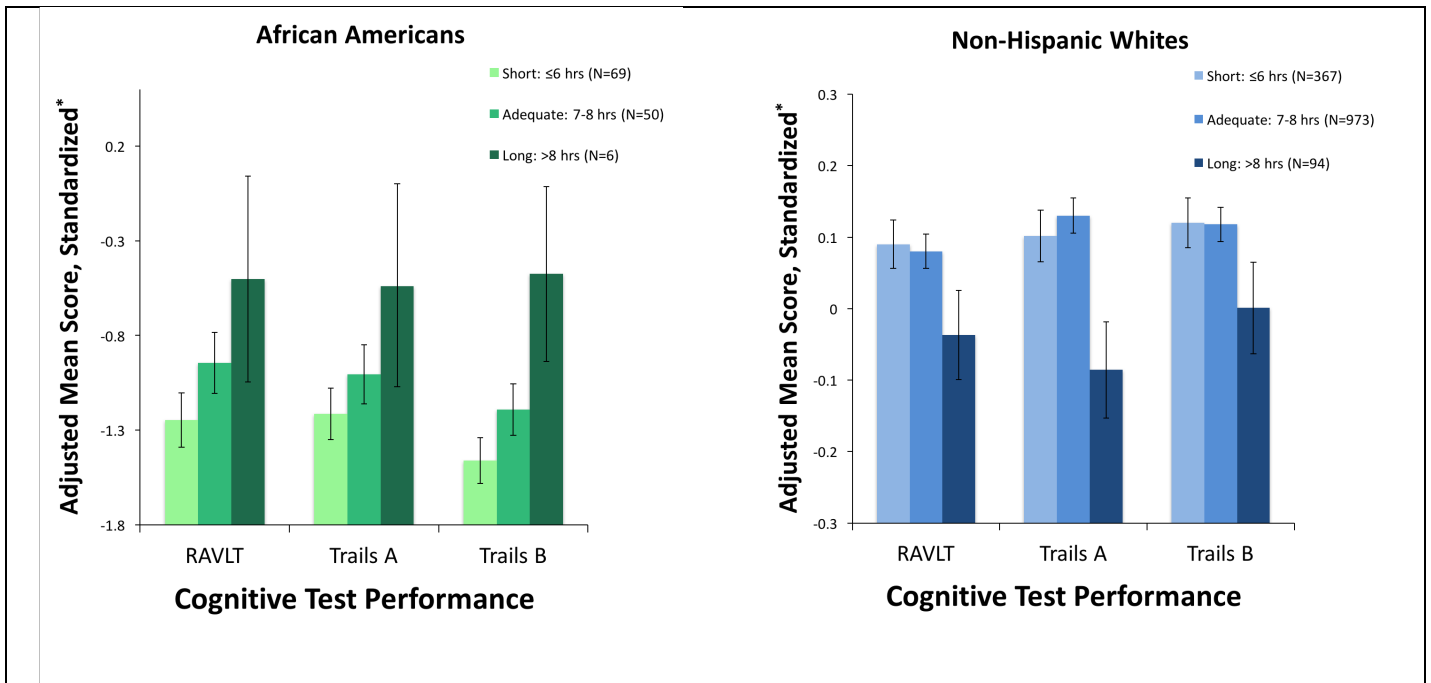
- Models adjust for age, sex, years of education, APOE e4 carrier status, waist-hip ratio, and practice effects
- For Trails A and B, higher scores represent longer time to completion (worse performance)
- Cognitive outcomes have been log-transformed and all predictors and outcomes have been standardized [$\sim N(0,1)$] prior to analysis
- Quadratic term was included in secondary analyses only and other coefficients do not reflect its contribution

Table 3. Results from mixed-effects regression testing relationships between sleep and cognitive test performance in non-Hispanic whites (N=1,454)

	Trails A time		Trails B time		RAVLT Total	
	β (95% CI)	p	β (95% CI)	p	β (95% CI)	p
Sleep Adequacy	0.01 (-0.02 to 0.05)	0.46	-0.04 (-0.07 to -0.003)	0.03	-0.001 (-0.03 to 0.03)	0.96
Somnolence	0.05 (0.01 to 0.09)	0.007	0.07 (0.03 to 0.10)	0.001	0.003 (-0.03 to 0.04)	0.85
Sleep-hours	0.04 (0.003 to 0.07)	0.03	0.02 (-0.02 to 0.05)	0.33	-0.004 (-0.04 to 0.03)	0.80
Sleep-hours ²	0.03 (0.01 to 0.05)	0.001	0.02 (0.01 to 0.04)	0.006	-0.003 (-0.02 to 0.01)	0.69

- Models adjust for age, sex, years of education, APOE e4 carrier status, waist-hip ratio, and practice effects
- For Trails A and B, higher scores represent longer time to completion (worse performance)
- Cognitive outcomes have been log-transformed and all predictors and outcomes have been standardized [$\sim N(0,1)$] prior to analysis
- Quadratic term was included in secondary analyses only and other coefficients do not reflect its contribution

Figure 1. Cognitive test performance^a among short, adequate, and long sleepers^b



^a Trails A and B times-to-completion have been reverse-scored so that higher values indicate better performance

^b Sleep duration transformed from continuous to categorical variable for Figure 1 purposes only