Sleep disturbances are associated with cognitive function in women living with HIV

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BACKGROUND

- HIV is associated with poor sleep quality and cognitive impairment
- Inflammation/immune activation is associated with HIV and poor sleep
- Relationship between sleep and cognition in women living with HIV (WLWH) is underexplored
- The Pittsburgh Sleep Quality Index (PSQI): validated, short (<5 min) easy to administer questionnaire.

- **Aim: Examine associations between subjective sleep quality and cognitive function in WLWH**

METHODS

- Between 2018 and 2019, 337 WLWH completed the PSQI survey and neuropsychological (NP) testing within 12 months **(Figure 1)**
- Linear regression was used to examine associations between overall sleep quality and NP performance (unadjusted T-scores were used) stratified by cognitive impairment status (global T-score <40 vs. >40)
- Follow-up analyses examined associations between modifiable sleep disturbances (e.g., mid-sleep waking, pain, snoring, sleep duration, and sleep medication use) and NP performance.
- Models adjusted for enrollment site, age, education, race/ethnicity, smoking, drinking, and menopause status; nadir CD4, log viral load, and body mass index.

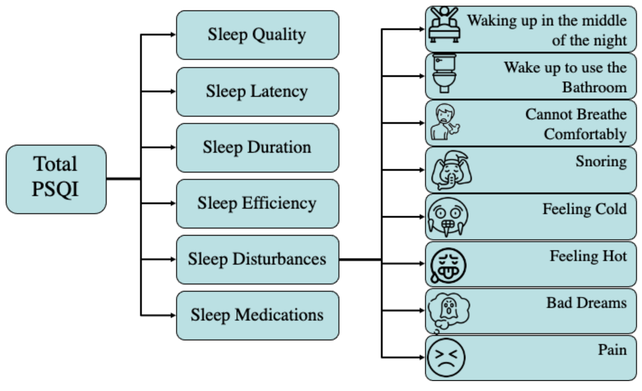


FIGURE 1. COMPONENTS AND ITEM-LEVEL REPORTS IN THE PSQI

RESULTS

- 102 women demonstrated global cognitive impairment **(Table 1)**
- Associations between total PSQI and cognitive domains were seen within globally impaired WLWH only (**Figure 2**)
- Stratified analysis within the cognitively impaired group identified subcomponents of the PSQI associated with distinct NP measures **(Table 2).**

Distinct measures of self-reported poor sleep are associated with poorer working memory, processing speed, and executive function.

	N = 337 n (%)
Cognitively Impaired	102 (30)
Age	51 (9)
Years on HAART	12.8 (6.7)
Ever reported AIDS	115 (34)
Years of Education, mean (SD)	12.41 (3.01)
Employed	127 (38)
Income > $12k	166 (50)
Elevated Depressive Symptoms	107 (32)
Drinking Category	
0-7 drinks/wk	133 (39)
>7 drinks/wk	21 (6.3)
Abstainer	183 (54)
Race	
Black	213 (63)
White	43 (13)
Hispanic	51 (15)
Other	30 (8.9)
Current smoker	118 (35)
Recent substance use	
Marijuana	76 (23)
Crack, cocaine, and/or heroine use	21 (6.2)
Body Mass Index (kg/meter^2), mean (SD)	33 (10)
Hypertension	190 (56)
Diabetes	84 (25)
Post-menopausal	148 (44)
Undetectable Viral Load	217 (65)
Viral Load (log), mean (SD)	1.73 (0.88)
Nadir CD4, mean (SD)	253 (196)
CD4 Count, mean (SD)	700 (351)
Adherence > 95%	271 (87)

TABLE 1. DEMOGRAPHICS AND DISEASE CHARACTERISTICS

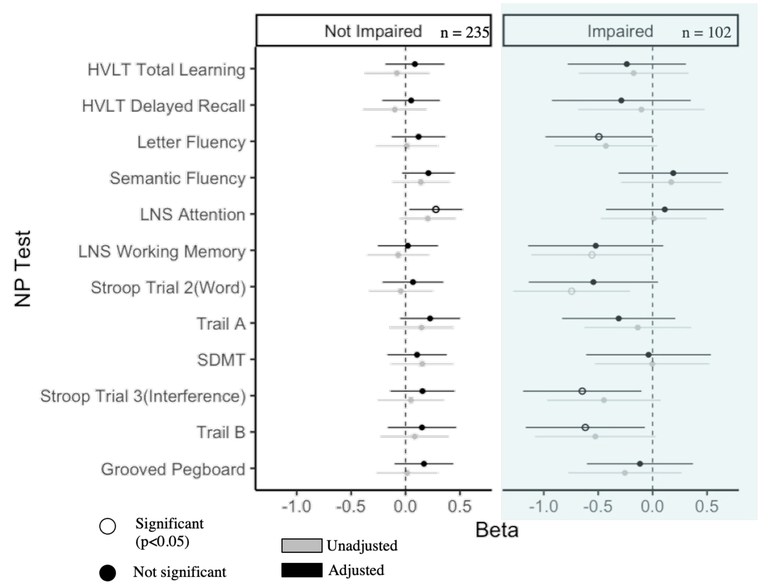


FIGURE 2. POORER OVERALL SLEEP QUALITY (PSQI TOTAL SCORE) WAS ASSOCIATED WITH WORSE NP PERFORMANCE AMONG WLWH WHO HAD GLOBAL NP IMPAIRMENT

	B (SE)								
Cognitive Domains	**Fluency**	**Attention/Working Memory**		**Processing Speed**			**Executive Function**		**Motor**
NP Measures	Animal Fluency	LNS Attention	LNS Working Memory	Stroop Trial 2	Trail Making Part A	SDMT	Stroop Trial 3	Trail Making Part B	Grooved Pegboard
Mid-sleep waking	-4.0 (2.2)	-0.7 (2.2)	-0.2 (2.3)	**-7.1 (2.4)****	**-4.1 (2.1)***	-2.3 (2.0)	-1.9 (2.3)	**-6.0 (2.3)***	1.5 (1.7)
Bathroom usage	0.6 (2.4)	-2.5 (2.2)	-3.8 (2.3)	-0.0 (2.7)	-1.5 (2.3)	-2.0 (2.1)	0.9 (2.5)	0.9 (2.5)	2.7 (1.8)
Trouble breathing	-1.9 (2.9)	0.7 (3.0)	-3.4 (3.0)	**-6.7 (3.2)***	0.0 (2.8)	-1.7 (2.6)	-5.9 (3.2)	-1.4 (3.2)	-0.2 (2.2)
Pain	-3.4 (2.7)	-2.2 (2. 6)	**-6.4 (2.6)***	-3.1 (3.1)	1.6 (2.6)	-2.5 (2.5)	-3.6 (2.9)	-3.9 (3.0)	-1.1 (2.1)
Snoring	0.2 (2.8)	-1.1 (2. 6)	-3.1 (2.7)	-3.5 (3.1)	0.5 (2.6)	-3.1 (2.5)	**-5.7 (2.8)***	-3.2 (2.7)	2.3 (2.1)
Feeling Cold	1.3 (3.0)	-1.8 (3.0)	-5.7 (3.1)	-3.5 (3.4)	-4.1 (2.8)	-4.3 (2.6)	-1.6 (3.1)	**-7.5 (2.9)***	1.2 (2.3)
Feeling Hot	-3.4 (2.4)	-3.5 (2.3)	-3.2 (2.5)	-1.4 (2.8)	-0.5 (2.3)	-3.2 (2.2)	-3.9 (2.5)	-2.8 (2.5)	0.6 (1.9)
Needs sleep medications *Less than once a week*	*Referent*								
Not during the past month	5.2 (3.9)	-5.1 (3.9)	5.6 (4.2)	**1.2 (4.5)***	2.8 (3.8)	**7.8 (3.7)***	-0.7 (4.7)	1.7 (4.4)	-2.2 (3.0)
Once or twice a week	**1.6 (4.9)****	0.3 (4.9)	7.2 (5.1)	**1.8 (5.6)****	7.9 (4.7)	8.2 (4.6)	3.8 (5.7)	4.4 (5.6)	-2.2 (4.0)
Three or more times a week	4.3 (4.4)	-4.3 (4.6)	3.8 (4.8)	7.1 (5.1)	-3.7 (4.3)	4.2 (4.2)	-1.8 (5.4)	-0.4 (5.0)	**-7.3 (3.6)***
Sleep Duration *6-8 hours*	*Referent*								
<6 hours	3.0 (2.7)	**-7.5 (2.3)****	-3.0 (2.6)	-0.6 (3.1)	-3.2 (2.5)	-0.8 (2.4)	-3.8 (2.7)	-0.3 (2.8)	-3.2 (2.0)
>8 hours	3.1 (3.6)	1.4 (3.1)	-4.4 (3.8)	-5.7 (4.1)	-6.6 (3.3)	-6.0 (3.2)	**-10 (3.7)****	-4.4 (4.2)	-3.5 (2.8)

Note. *p<0.05; **p<0.01; ***p<0.001; B=unstandardized beta coefficient; SE=standard error; LNS=Letter-Number Sequencing; SDMT=Symbol Digit Modalities

TABLE 2. ASSOCIATIONS BETWEEN NP PERFORMANCE AND PSQI ITEMS

RESULTS CONTINUED

- Among cognitively impaired WLWH, waking up mid sleep was associated with poorer processing speed and executive function.
- Pain disturbing sleep was associated with poorer working memory
- Snoring was associated with poorer executive function
- Bad dreams were associated with poorer processing speed
- Short (< 6 hours) and long (>8 hours) sleep duration was associated with both poorer attention and executive function.

CONCLUSIONS

- Distinct measures of poor sleep were associated with diminished working memory, processing speed, and executive function among WLWH demonstrating global cognitive impairment.
- Given that these cognitive functions are essential for managing HIV and associated comorbidities well, targeted interventions that improve these potentially modifiable aspects of sleep may prevent worsening of cognitive function as women with HIV age.

FUTURE DIRECTIONS

- Larger longitudinal studies are needed to understand causal relationships and mechanisms between sleep and cognition in the context of HIV especially among vulnerable women.
- Mechanistic studies incorporating metabolomic/ proteomic data
- Sex Differences in combined MWCCS
- Inclusion of objective sleep data (i.e. actigraphy)

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