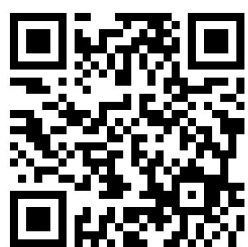


Sleep Variability Moderates the Association Between Menopausal Symptoms and Episodic Memory

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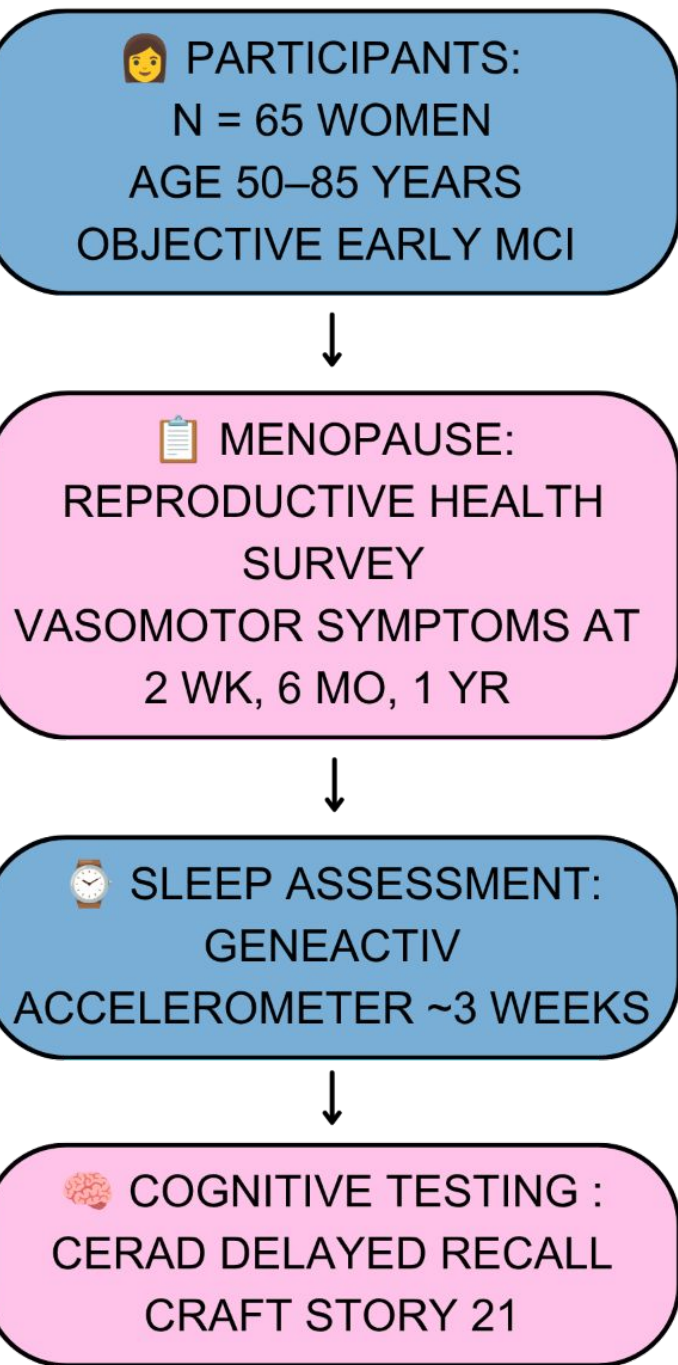
Introduction

- Vasomotor symptoms and sleep disturbances are common during the menopause transition.
- Sleep variability has emerged as a risk factor for poorer cognitive outcomes.
- Whether sleep variability modifies the relationship between menopausal symptoms and episodic memory remains unknown.

Objective

To determine whether **sleep duration variability moderates** the association between **menopausal vasomotor symptoms** and **episodic memory** performance in women with objective early mild cognitive impairment.

Methodology



Characteristic	N = 65 [†]
Age, years	65.09 ± 8.06
Education, years	15.86 ± 4.89
BMI	27.14 ± 5.30
CERAD Delayed Recall	6.94 ± 1.66
CRAFT Delayed Recall	12.89 ± 4.79
Sleep Duration Variability	21.48 ± 8.72
Sleep Midpoint Variability	3.94 ± 1.45
1-Year Menopause Symptom Score	3.51 ± 4.81
1-Year Vasomotor Symptom Score	1.02 ± 1.93

[†] Mean ± SD

Sleep Variability x Six-Month Vasomotor Symptoms

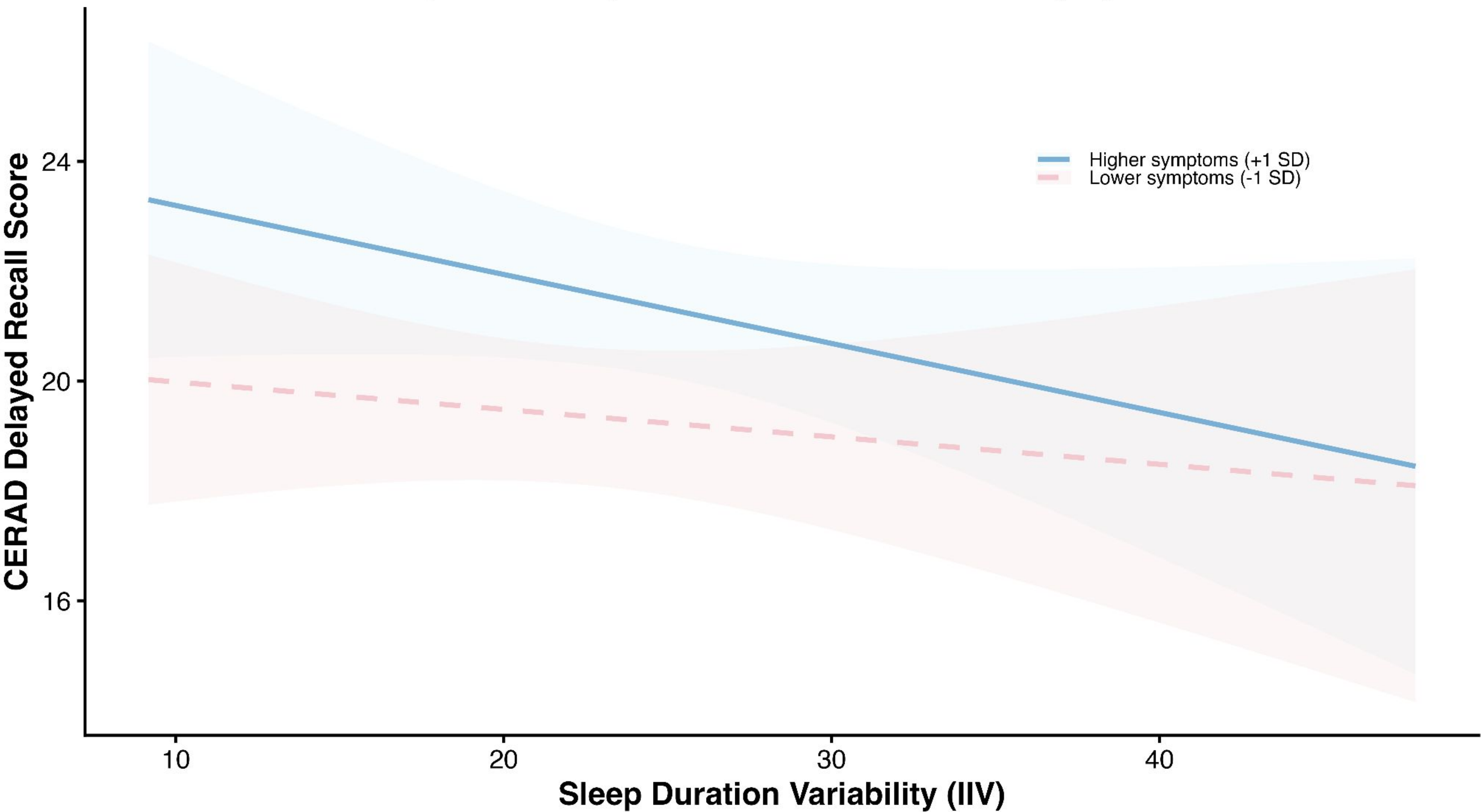


Figure 1. Sleep variability moderates the association between six-month vasomotor symptoms and CERAD delayed recall. Interaction: $\beta = -0.013$, $p = .020$
Sleep duration variability was calculated with intra-individual variation (IIV), which is calculated by the standard deviation/mean $\times 100$ (also known as coefficient of variation); it is unitless [1]

Key Finding*

Greater sleep variability was associated with poorer CERAD delayed recall among women with higher vasomotor symptoms.

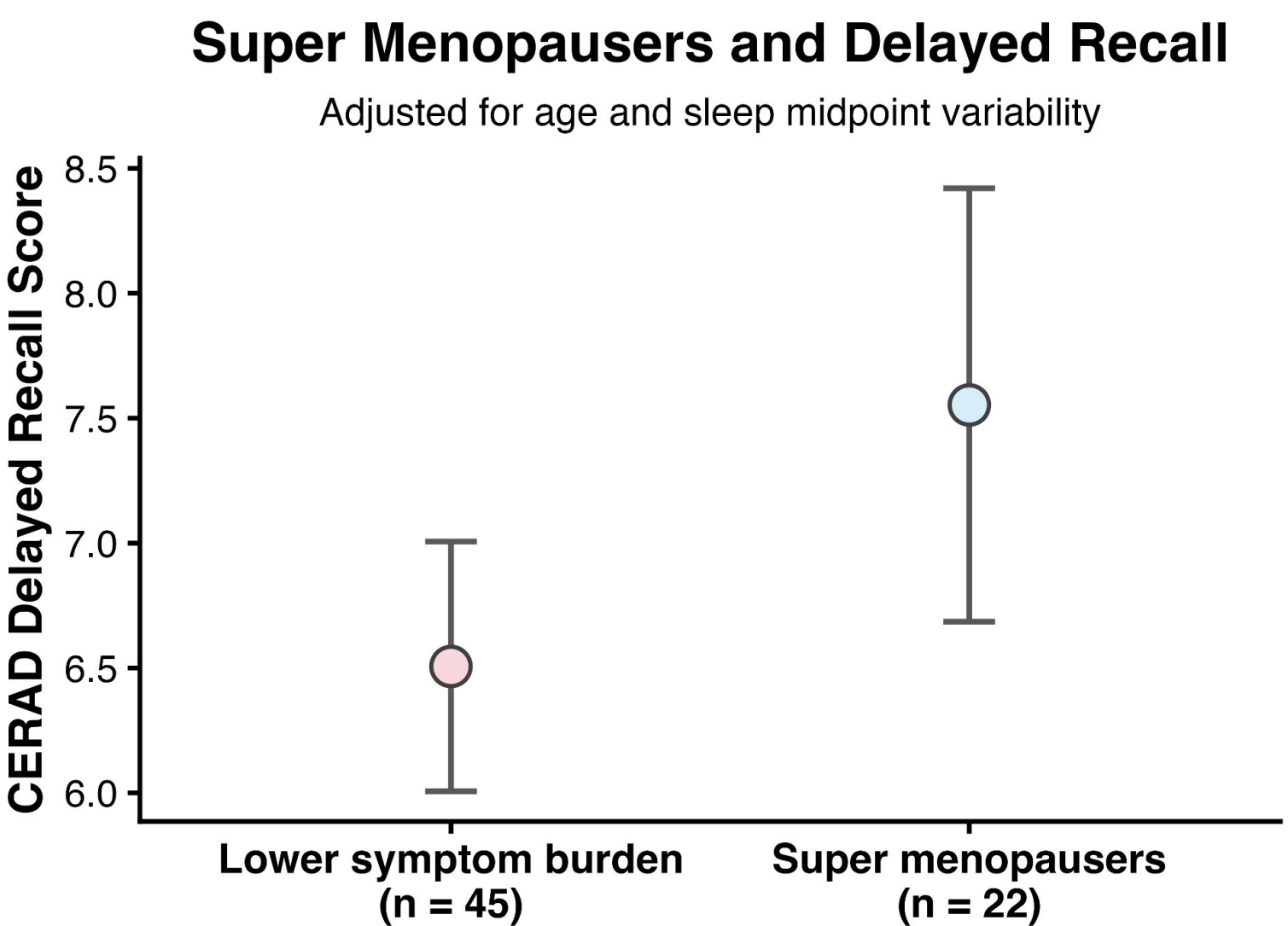


Figure 2. A separate analysis of super menopausers, defined by upper-quartile menopausal symptom burden, demonstrated significantly better delayed recall independent of age and sleep variability ($\beta = 1.05$, $p = .041$).

Results

Main Findings

- ✓ Significant interaction for CERAD delayed recall scores (*not significant for any CRAFT scores)
- ✓ Significant across 2-week, 6-month, and 1-year vasomotor symptom windows
- ✓ Strongest effect observed for six-month symptoms

Vasomotor Timeframe	Interaction p-value
2-week	.045
6-month	.020
1-year	.030

Conclusion

Sleep variability moderates menopause-related memory performance.

- Women differ in cognitive resilience during the menopause transition.
- Sleep regularity may represent a modifiable intervention target.
- “Super menopausers” may represent a resilient phenotype characterized in part by preserved memory performance independent of sleep variability

Future Directions

- Examine reproductive hormone levels as biological mediators.
- Determine whether sleep interventions reduce menopause-related cognitive vulnerability.
- Evaluate longitudinal associations with Alzheimer's disease biomarkers.

References

[1] Whittle, C., Jobson, S. A., & Smith, N. (2025). Intra-Individual Variability in Sagittal Plane Kinematics During Indoor Cycling Time Trial. *Sports*, 13(4), 110. <https://doi.org/10.3390/sports13040110>