

Hormonal Modulation of Sleep Quality and Perivascular Space Volume Across the Menstrual Cycle

An Observational Dense-Sampling Study

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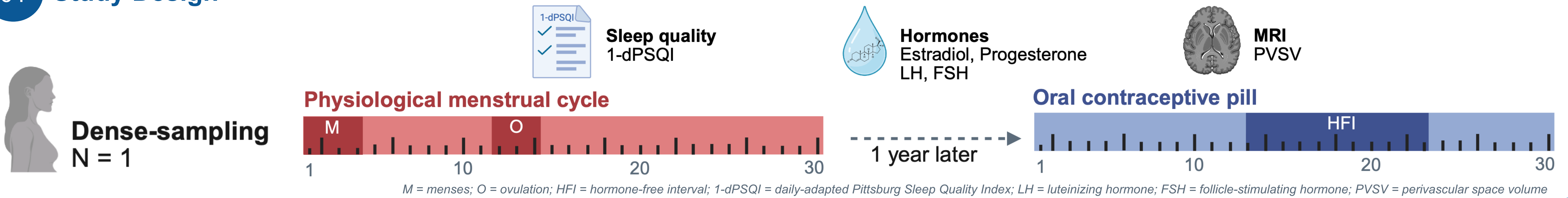
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TAKE-HOME MESSAGE

1 Ovulation constitutes a critical timepoint altering sleep quality and PVSV.

2 OCP use attenuates sleep quality variability, consequently altering sleep quality–PVSV dynamics.

01 Study Design



02 Background

- **Hormonal fluctuations** (and their suppression) across the **menstrual cycle** may alter **sleep quality** [1]
- **Glymphatic system** (GS): brain waste clearance during NREM sleep [2]
- GS operates via perivascular pathways, facilitating cerebrospinal-fluid (CSF) flow [3]
- **Perivascular space volume** (PVSV) considered as a putative correlate of CSF inflow [4]

03 Aims

- 1** Are **hormonal fluctuations** associated with changes in sleep quality and PVSV? Do hormones **moderate** the sleep quality–PVSV association?
- 2** Does **hormonal suppression** via oral contraceptive pill (OCP) use affects **sleep quality–PVSV day-to-day dynamics**?

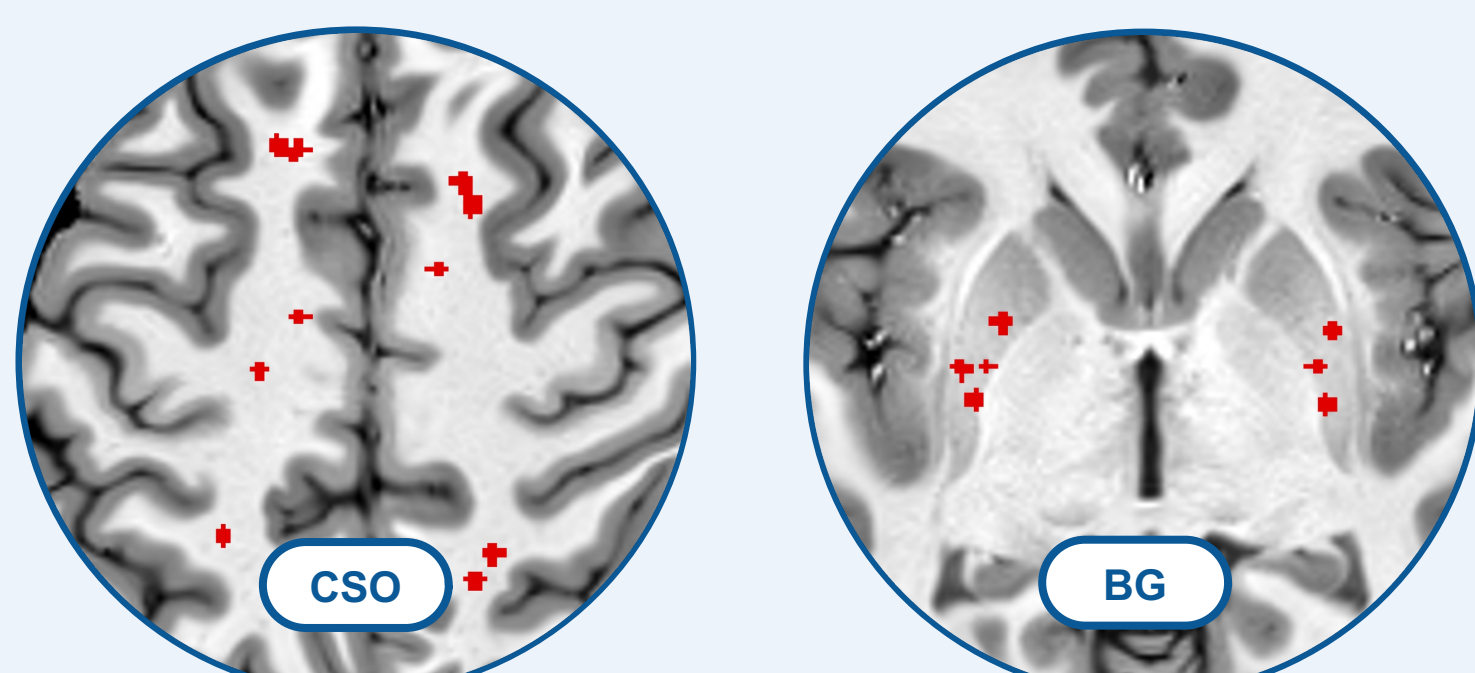
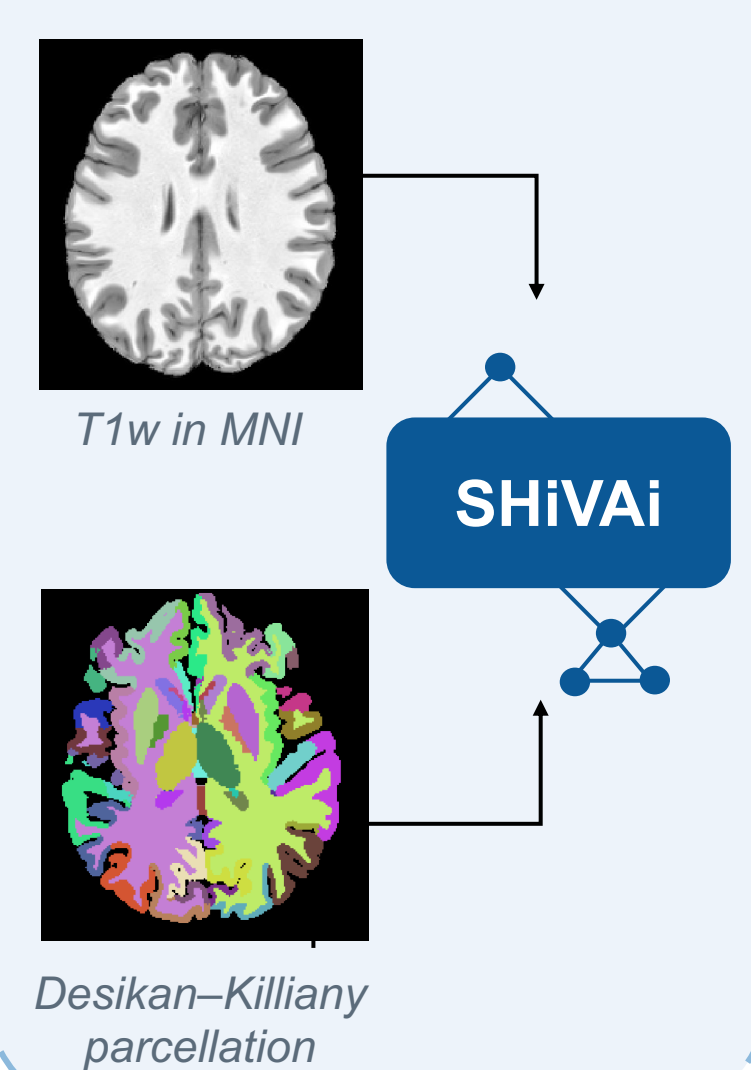
04 Methods

- **Sample:** 1 healthy female subject; “28andMe” dataset
- Daily-adapted Pittsburgh Sleep Quality Index: **1-dPSQI**
- Daily blood draws: **Estradiol, progesterone, LH, FSH**
- **PVS segmentation:** **SHiVAi** U-net based segmentation (centrum semiovale (CSO), basal ganglia (BG))

Statistics

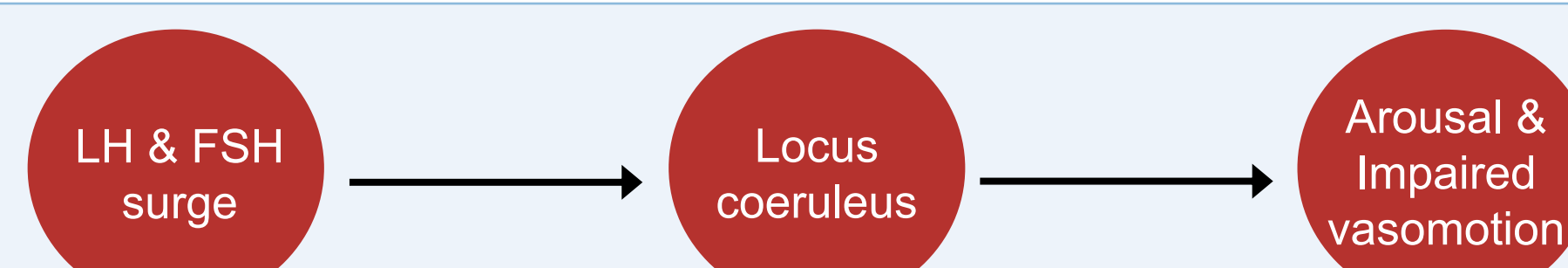
- 1** PVSV ~ 1-dPSQI x Hormone
- 2** Δ PVSV $\longleftrightarrow$ Δ 1-dPSQI; Spearman ρ ; block permutation

SHiVAi workflow

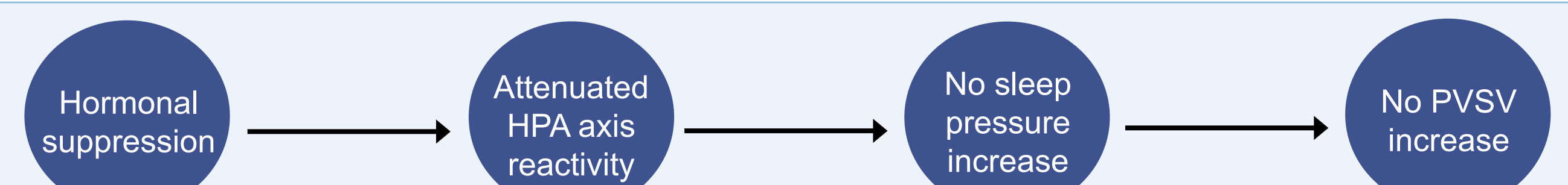


06 Interpretation

1 Putative **noradrenergic modulation** of sleep quality–PVSV dynamics in the periovulatory window.

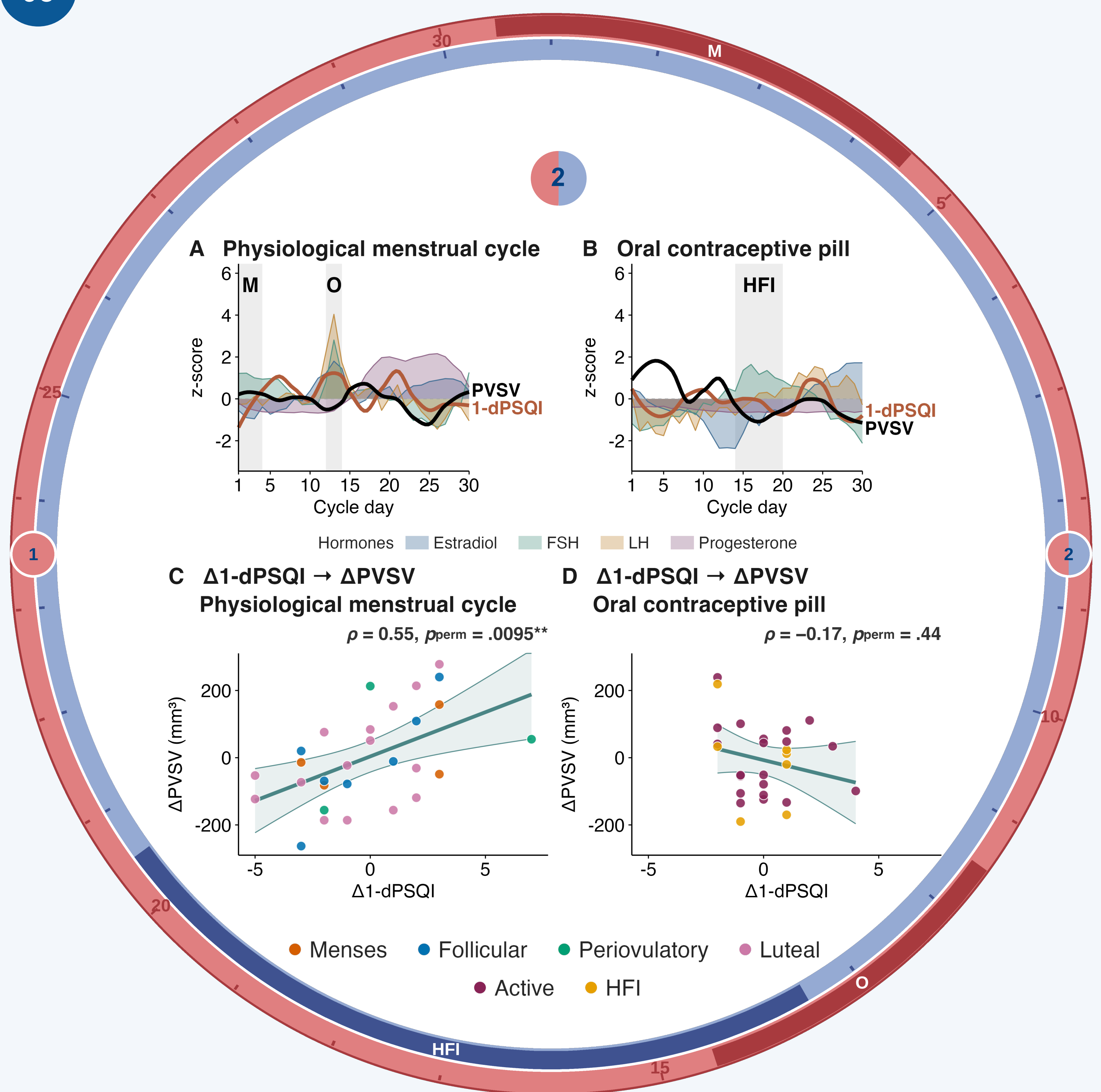


2 Reduced sleep quality variability may attenuate the **PVSV increase associated with elevated sleep pressure** following a night of poor sleep.



? How do hormonal fluctuations translate into alterations in sleep quality and PVSV? **?**

05 Results



AT THE WINDOW

1 **Periovulatory** attenuation of sleep quality–PVSV association

2 Blunted sleep quality–PVSV day-to-day association during **OCP** use



References

- [1] Pierson et al. (2021) *Nat Hum Behav.*
- [2] Hauglund et al. (2025) *Cell.*
- [3] Iliff et al. (2012) *Sci Transl Med.*
- [4] Holstein-Ronsbo et al. (2023) *Nat Neurosci.*

Conflict of interest & data

Conflict of interest: There is no conflict of interest to declare.
Data: OpenNeuro ds002674
openneuro.org/datasets/ds002674/versions/1.0.6
Code: github.com/d-apter/sleep_pvs_cycle

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