Daily Stress and Objective Sleep Outcomes in a Real-World Sample of over 83,000 U.S. Adults

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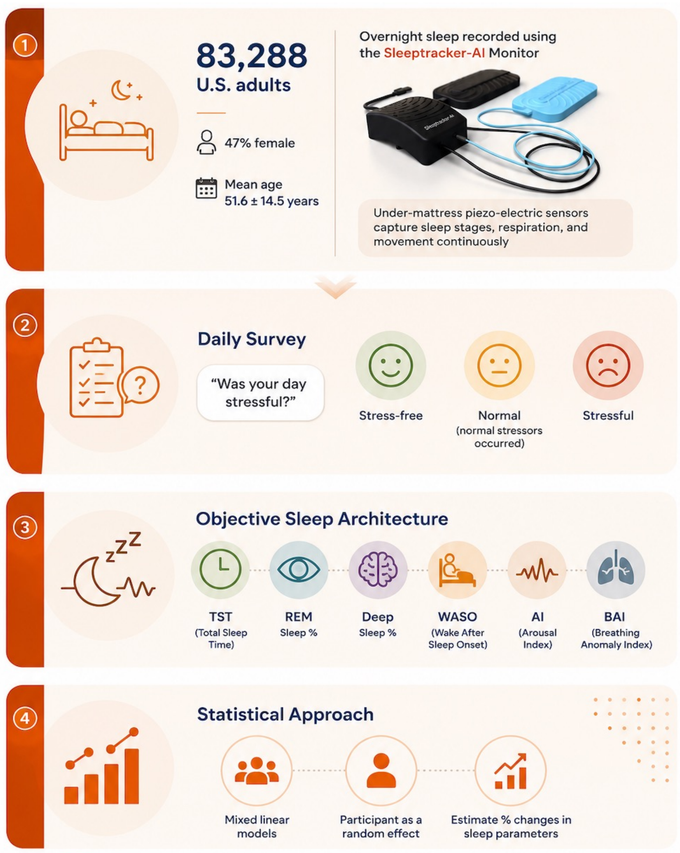
Introduction

- Poor sleep quality (often defined as high WASO, low REM, etc.) is associated with adverse health outcomes
- Stress activates the HPA axis
  - Releases cortisol and adrenaline
  - Limits sleep quality
- Sleep deprivation:
  - Raises baseline cortisol levels
  - Increases amygdala sensitivity up to 60%
- Current literature reveals stress-sleep association
  - Gap persists: limited studies on real-world populations with objective sleep architecture

Methods



Results

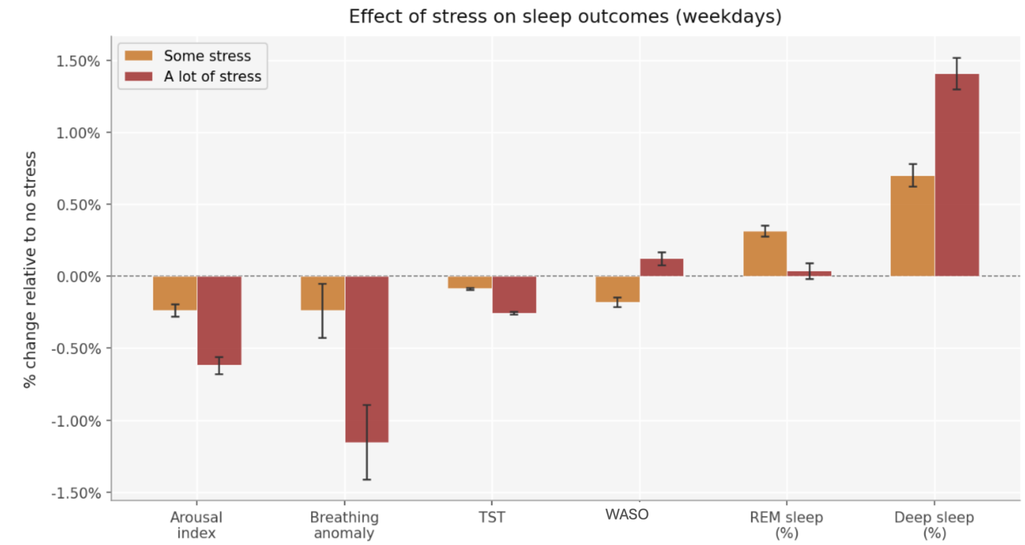


Figure 1 . Mixed-effects regression estimates (% change relative to no stress) for six sleep outcomes comparing some stress and a lot of stress. Error bars = 95% CI. TST declined monotonically (−0.86%, −2.56%); WASO reversed direction at high stress (−1.41% to +0.92%); deep sleep increased consistently, peaking at +1.41% under high stress.

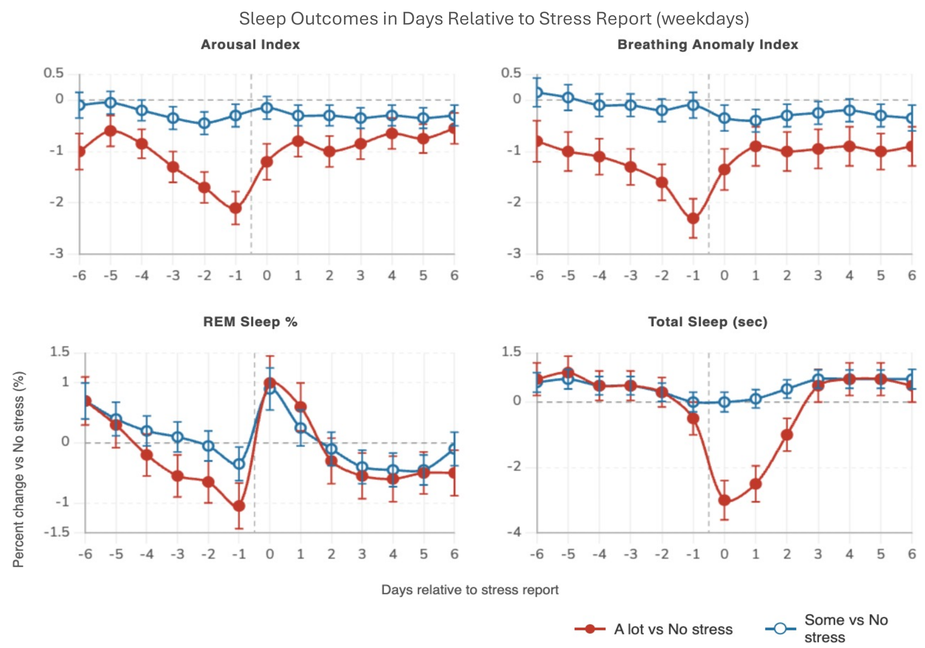
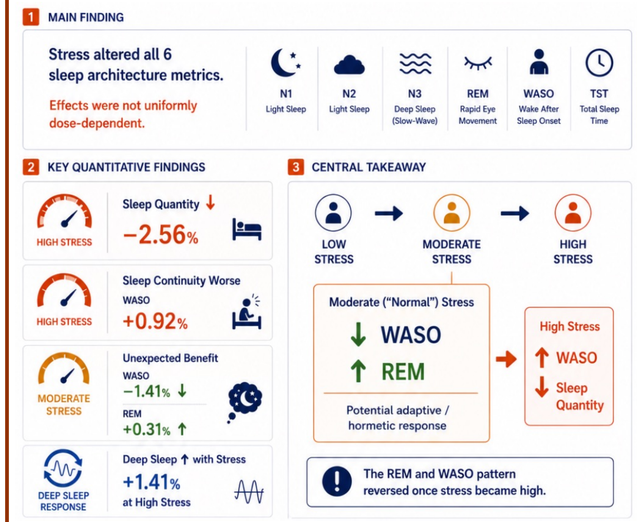


Figure 2. Longitudinal line graphs measuring sleep outcomes aligned to days surrounding a weekday stress report. Error bars = 95% CI. Across panels, higher stress is associated with a clear dip around the stress day (day 0) in arousal and breathing anomaly indices, and a marked reduction in total sleep time, with partial recovery in subsequent days.

Results



Key Takeaway

- Moderate or "normal" stress **reduced** WASO and **increased** REM
- High stress **increased** WASO and **reduced** REM
- Stress continues to affect the sleep profile beyond day of stress occurrence

Conclusion

- These non-linear, outcome-specific patterns demonstrate that stress does not uniformly "worsen" sleep:
  - Effects depend on both stress severity and the sleep metric examined
- Findings highlight the value of large-scale continuous wearable monitoring for detecting real-world stress-sleep dynamics
  - At home- accessibility improves sample diversity and generalizability
- Future work should examine:
  - Divergent sleep architecture signatures between chronic and acute stress
  - Stressor-type dependent sleep outcomes

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