Seasonal and weekly patterns in sleep duration and architecture in a real-world cohort of 222,748 individuals

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Introduction

- Temporal patterns, including seasonal variation and weekly social schedules, may impact sleep architecture and quality.
- Despite research in seasonal and weekly differences in sleep patterns, evidence from large, real-world populations remains limited.

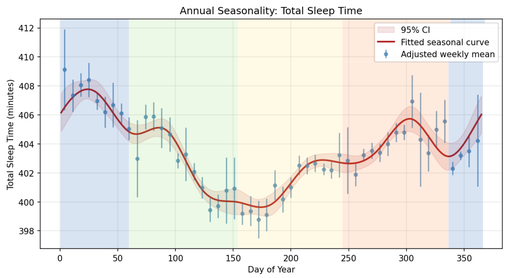
Methods

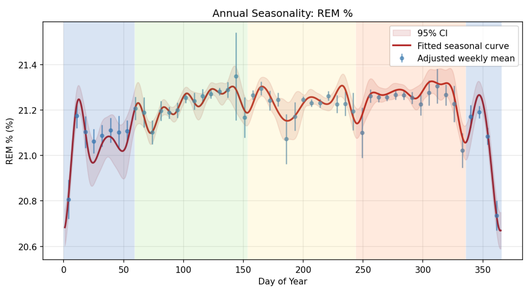
- Participants: 222,748 users (mean age 48.5±13.0 years; 46.8% female)
  - Device data from 08/16/2023-02/28/2026 (923 days) analyzed in March 2026, incorporating newly accrued data through February 2026.
- Key Sleep Metrics
  - Total Sleep Time (TST)
  - Rapid Eye Movement (REM) and Deep Sleep Percentages
  - Sleep Efficiency Percentages
- Mixed-effects linear models with participant as a random effect were used to model each metric as a function of day of year (seasonality) and day of week.
- Data were collected using a commercially available under-mattress sleep monitoring device (Sleeptracker-AI Monitor, Fullpower Technologies Inc., California,USA) that measures sleep via piezo-electric sensors.

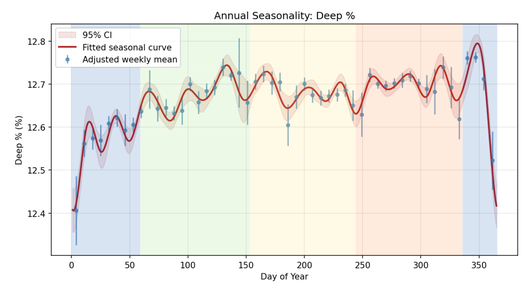
The Sleeptracker-AI Monitor under-mattress device

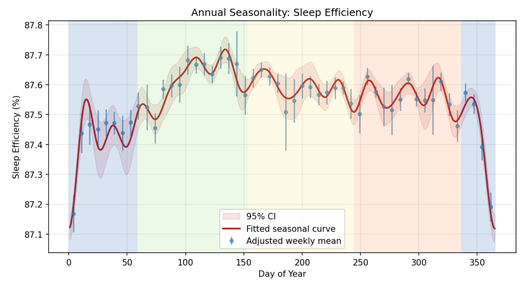
Results: Graphs

Annual Seasonality Results

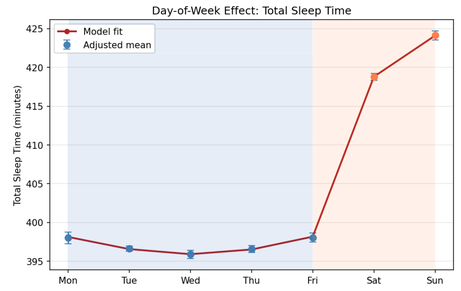


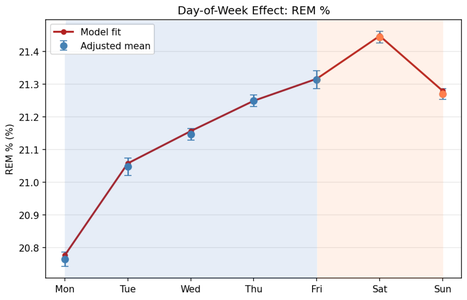


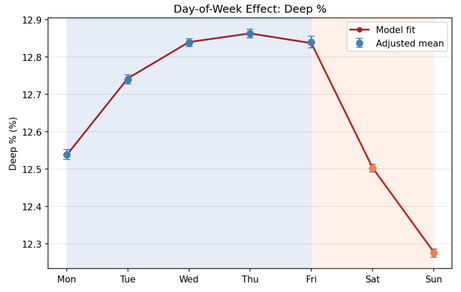


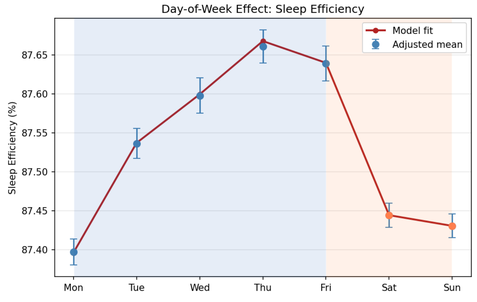


Day of Week Results









Results: Findings

- **Weekly patterns were most evident for TST**, with 23.31 minutes longer sleep on weekends compared to weekdays.
  - **Deep sleep and sleep efficiency peaked midweek.**
- Seasonal variation across all sleep metrics was statistically significant (p<0.001).
  - Mean **annual TST** was 403.8 minutes, **peaking in mid-winter** (January 24) and reaching a **trough in early summer** (June 23); peak-to-trough difference: 8.13 minutes.
  - **REM sleep, deep sleep, and sleep efficiency were all lowest around the New Year period**; peak-to-trough differences of 0.66 percentage points (pp), 0.39pp, and 0.60pp, respectively.

Conclusion

- Seasonal variation in sleep duration, architecture, and efficiency was significant but overall modest. **Weekly patterns and the New Year period showed prominent differences.**
- **Behavioral and social schedules may play a greater role than seasonal changes in shaping sleep patterns today**.
- Advancing sleep technologies shed insight onto sleep impact and can provide data for future research.

- Strengths:
  - Longitudinal
  - Large real-world sample
  - Objective measurement
- Limitations:
  - Correlational
  - Participant subgroups
  - Bed partner interference

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