



Effects of Heat and Humidity on Sleep Parameters: Insights from 24.2 million Nights Using an Under-Mattress Sleep Monitoring Device

Across 24.2 million nights, warmer and more humid bedroom conditions were associated with lighter sleep, lower sleep efficiency, and higher device-estimated respiratory instability.

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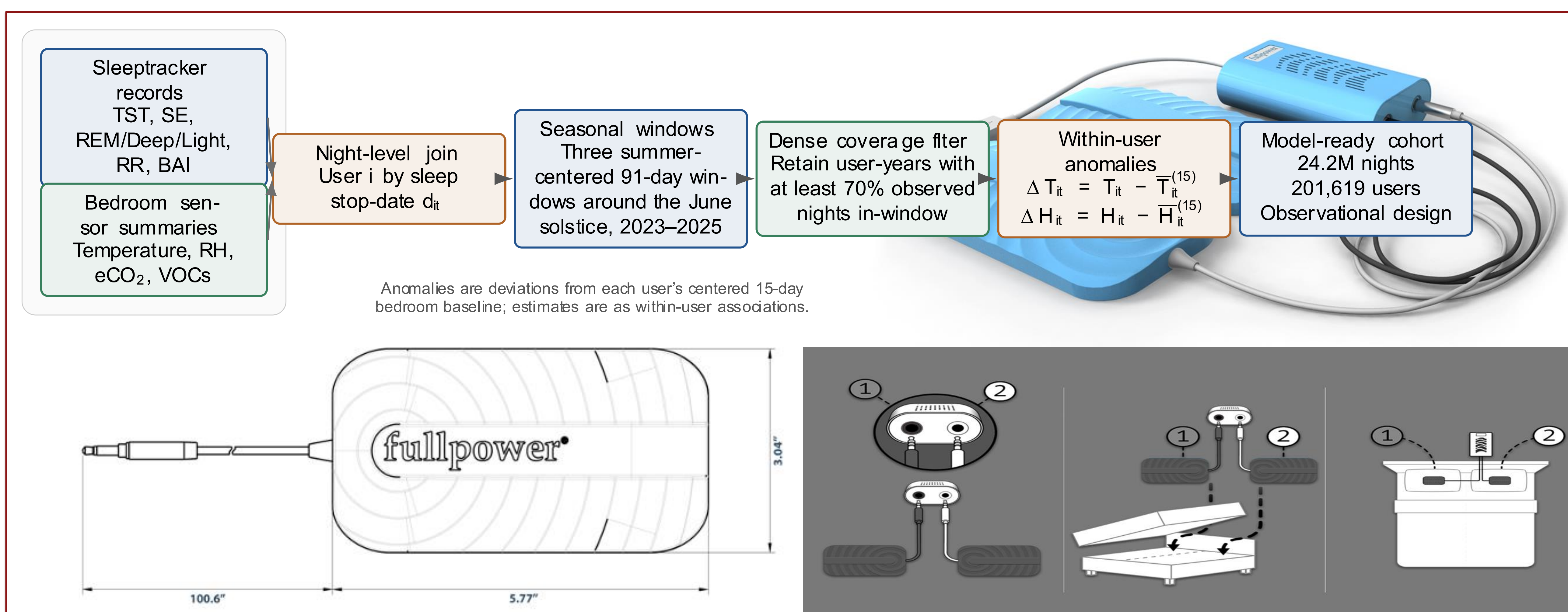
Introduction

Environmental conditions, particularly temperature and humidity, are increasingly recognized as modifiable factors influencing sleep. Amid global warming, rising temperatures and greater humidity variability make understanding these environmental effects even more essential. Leveraging under-mattress sensors, large-scale real-world datasets now allow precise quantification of night-to-night environmental perturbations and their impact on sleep parameters.

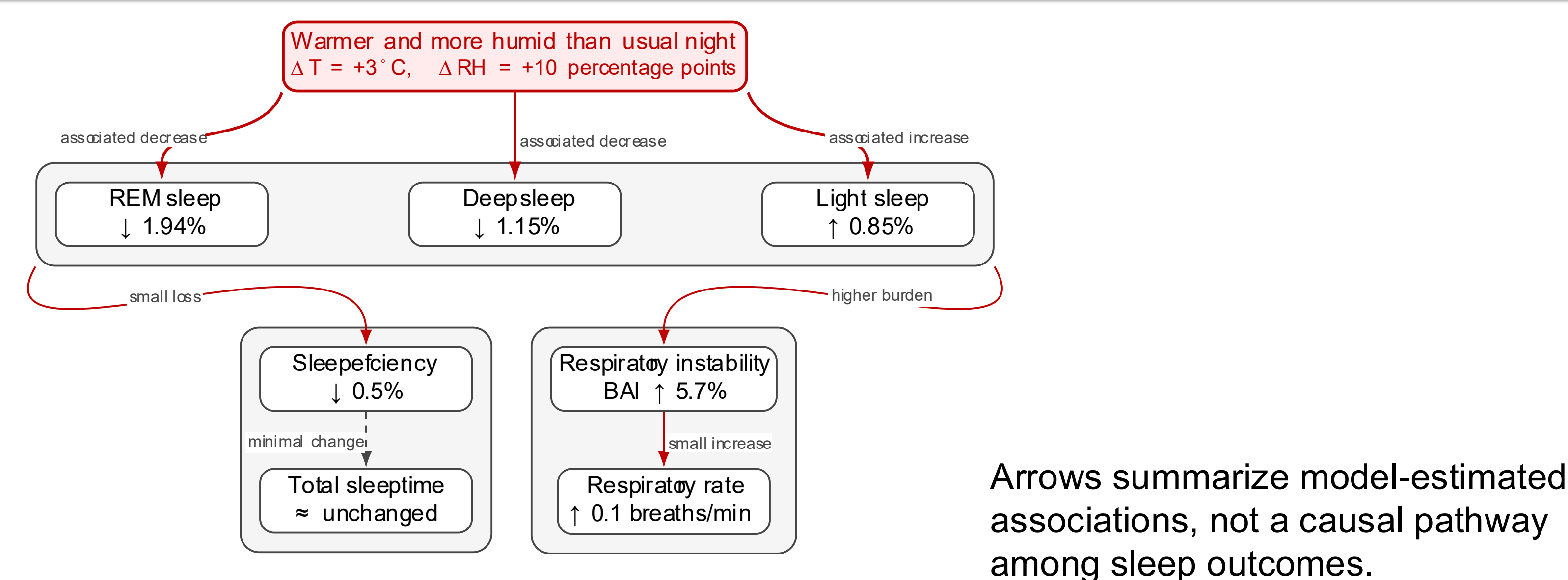
Study Design

- 24.2 million nights from 201,619 users
- Summer-centered windows from 2023–2025
- Under-mattress sleep monitoring with bedroom environmental sensing
- Temperature and RH modeled as within-user deviations from usual bedroom conditions
- Mixed-effects models estimated associations with sleep stages, sleep efficiency, TST, and device-estimated AHI
- Estimates are relative changes; absolute per-night effects are small

Device and Data Setup



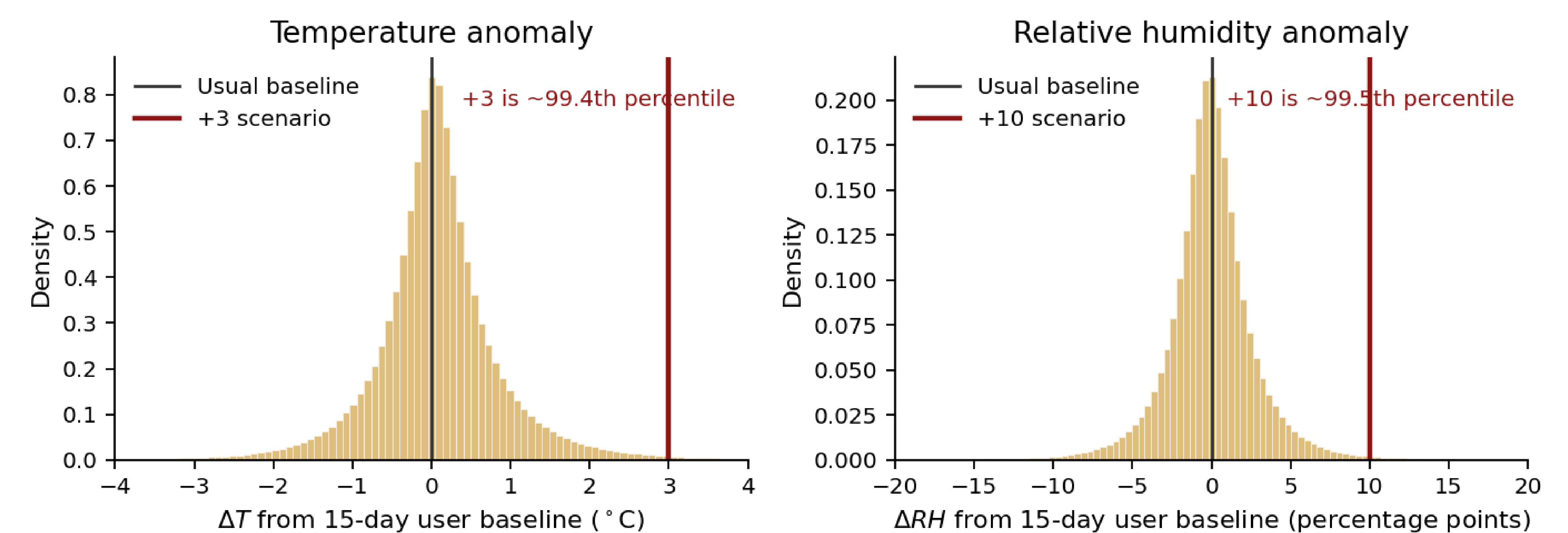
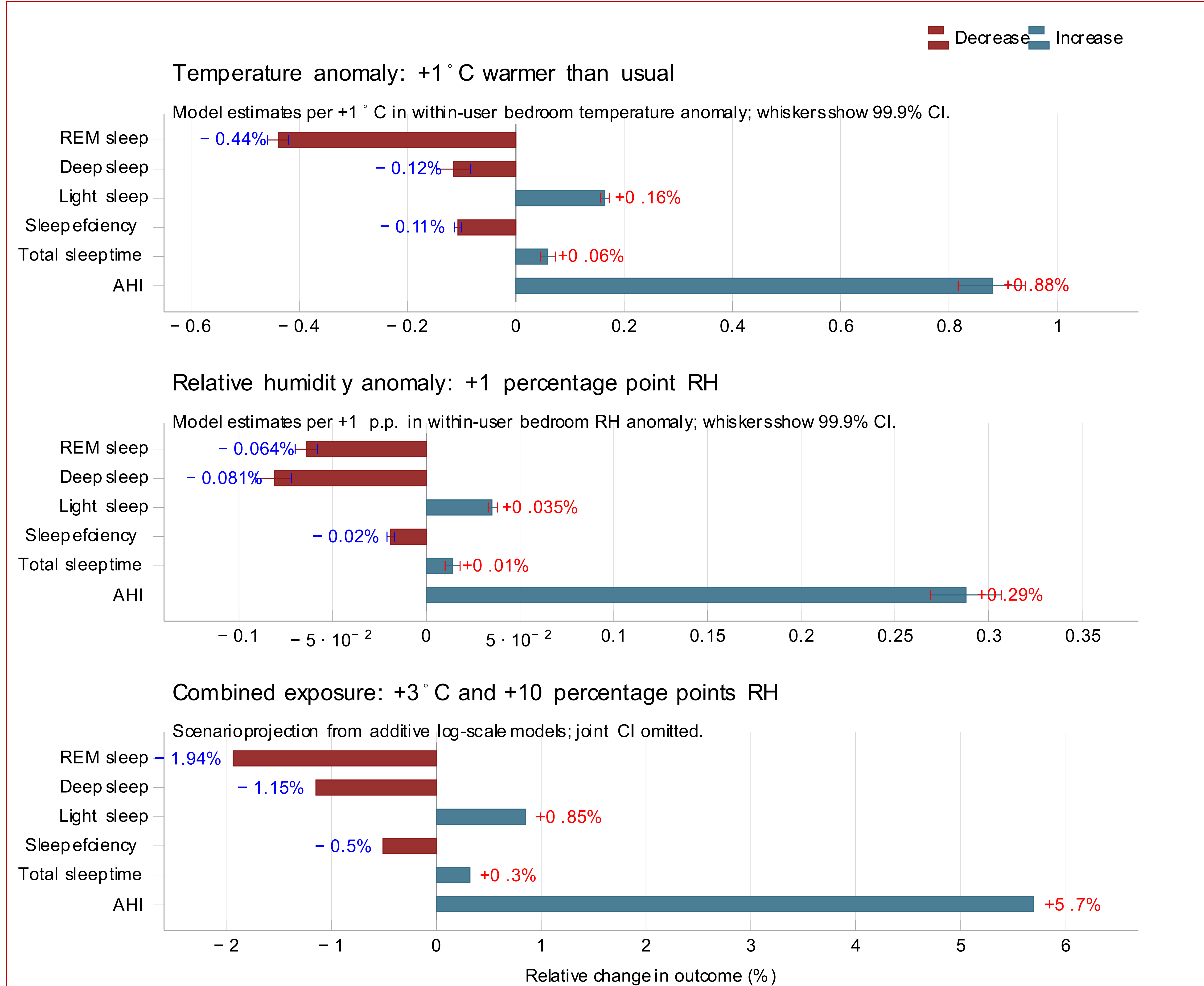
Conclusions



In this population-scale real-world study, warmer and more humid nights shifted sleep toward lighter stages and increased respiratory burden. These findings highlight the physiologic sensitivity of sleep to small environmental changes and the importance of microenvironment monitoring in sleep research and clinical care. As global warming accelerates such fluctuations, these effects are likely to become increasingly relevant for population sleep health.

Results

Effect of Temperature on Sleep Architecture and Physiology



References

Ding F, Cotton-Clay A, Fava L, Easwar V, Kinsolving A, Kahn P, Rama A, Kushida C. Polysomnographic validation of an under-mattress monitoring device in estimating sleep architecture and obstructive sleep apnea in adults. *Sleep Med.* 2022 Apr 22;96:20-27. doi: 10.1016/j.sleep.2022.04.010. Epub ahead of print. PMID: 35576830.