Impact of lifestyles and daily experiences on nocturnal heart rate variability and heart rate among 100,000 adults

Sasha Milton[1], Andrew Cotton-Clay[2], Susan Baron[2], Laura Fava[2], Venkat Easwar[2], Arthur Kinsolving[2], Philippe Kahn[2], Jennifer Zitser[3], Clete Kushida[4], Yue Leng[1]

1. Department of Psychiatry and Behavioral Sciences, University of California, San Francisco, CA; 2. Fullpower Technologies, Inc., Santa Cruz, CA; 3. Department of Neurology, Tel Aviv Sourasky Medical Center, Israel; 4. Division of Sleep Medicine, Stanford University, Stanford, CA

Introduction

- Both heart rate (HR) and heart rate variability (HRV) are influenced by autonomic nervous system activity.
- Lifestyle choices, such as alcohol use and smoking, may impact autonomic activity at night.

Figure 1. The Sleeptracker-AI Monitor under-mattress device

Aim:

Use a large, real-world sample comprising adult users of an under-mattress sleep sensor (Figure 1) to **determine how nocturnal HRV and HR are impacted by daily behaviors and experiences.**

Conclusions

- Daily behaviors, particularly lifestyle choices such as drinking alcohol and smoking, are associated with decreased nocturnal HRV and increased nocturnal HR.
- Noninvasive sleep technologies will be invaluable in further uncovering the relationship between daily behaviors and nighttime autonomic activity.

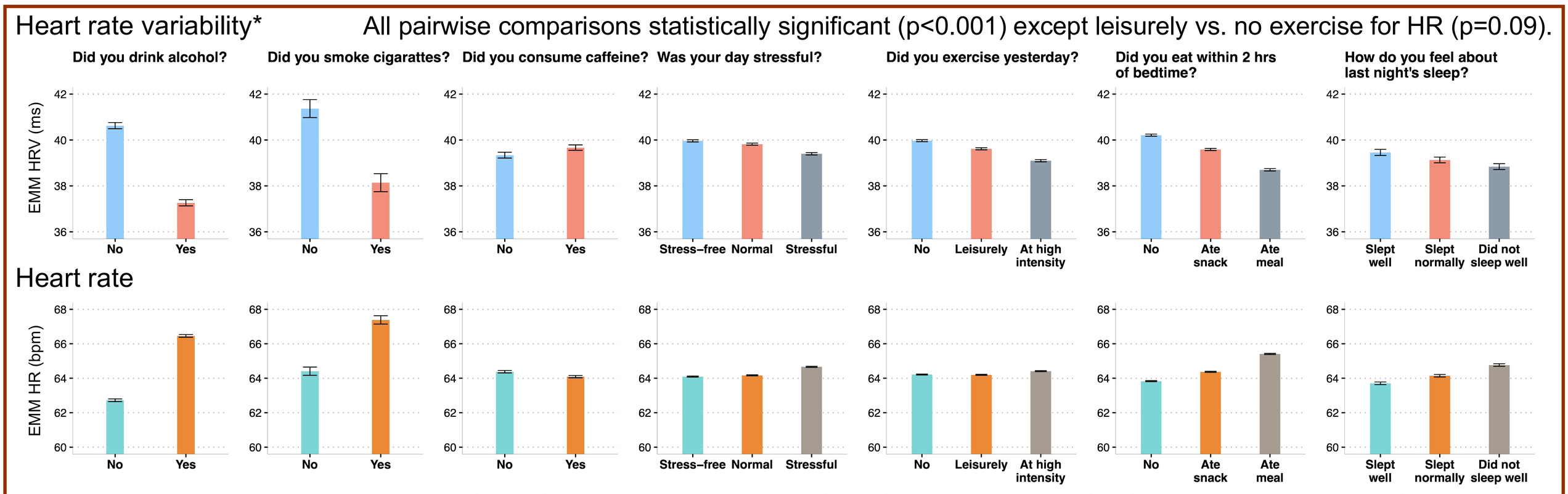

Figure 2. Estimated marginal mean (EMM) heart rate variability (HRV) and heart rate (HR) by responses to self-report questions. *For HRV, results are presented for SDNN; all results are highly similar for RMSSD.

Methods

- From 9/1/2023-9/30/2024, overnight HRV and HR were measured continuously with a commercially available, noninvasive, at-home device (Sleeptracker-AI Monitor, Fullpower Technologies Inc., California, USA) that uses under-mattress piezo-electric sensors (Figure 1).
- HRV metrics:
  - SDNN (standard deviation of NN intervals): overall HRV influenced by sympathetic, parasympathetic, and other activity
  - RMSSD (root mean square of successive NN interval differences): parasympathetic activity
- Participants answered daily questions on alcohol use, caffeine use, smoking, stress, exercise, eating, and sleep quality.
- We compared HRV (means across whole night) and HR (median across whole night) across question responses using mixed linear models (with participant as a random effect), calculated estimated marginal means (EMMs), and performed pairwise comparisons.
- Further analyses:
  - Age/gender adjustment
  - Exclusion of participants who answered questions the same way every time (completely within-subjects).

Results

- Sample size differed by analysis:
  - Largest (HR by exercise): 100,990 participants, 1,765,500 nights
  - Smallest (RMSSD by smoking): 1,145 participants, 12,519 nights
  - Mean across all analyses: 35,120 participants, 571,650 nights
- Full sample mean age: 48.9±13.2 yrs; 47.3% female
- SDNN, RMSSD, and HR differed significantly ($p<0.001$ for all pairwise comparisons) across responses to all self-report questions except the comparison of HR between leisurely exercise and no exercise ($p=0.09$; Figure 2).
- For all three metrics, alcohol use and smoking showed the largest effect sizes (Figure 2).
- Similar results after age/gender adjustment and in the completely within-subjects analysis

MoonLAIT (PI: Dr. Yue Leng)
Dept. of Psychiatry and Behavioral Sciences, UCSF
Scan to go to our website (https://moonlait.ucsf.edu)
@YueLengsleep
yue.leng@ucsf.edu