Wearable Devices for Sleep Tracking

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Background

What do we know?

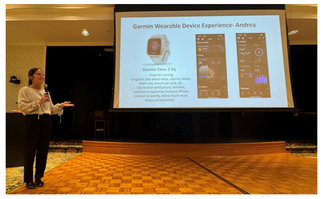
- Sleep quality can significantly affect physical stability, with poor sleep linked to an increased risk of falls among the elderly.
- Wearable technologies such as Oura Ring have been developed to monitor sleep. In conjunction with balance assessments, they can help us achieve our overarching aim:

Study aim: To gain a better understanding of how wearable devices are used for sleep monitoring, specifically studying older adults

Objectives

1. Conduct a literature review on the use of wearable devices to monitor sleep in older adults.
2. Develop an IRB-protocol for using Oura Ring for longitudinal sleep tracking.
3. Compare sleep tracking by different wearable devices over 2-4 weeks.

Workshop



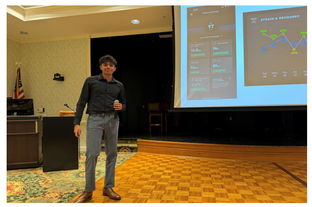


Image 1, 2: Andrea and Sanjeev presenting at Oak Hammock Retirement community

- Hosted a workshop at Oak Hammock where we presented our proposed user protocol and personal experiences with Garmin and WHOOP.
- Described personal experiences with wearables.
- Gained insight into older adults' relative familiarity and acceptance of wearable technology.

Literature Review Analysis

We converted the data from 29 articles into binary data indicating:

- **Sensors** used in each wearable and **sleep variables** from each article
- Ran logistical tests due to binary variables. Independent: sensor presence, Dependent: sleep variable presence.
- Cannot conclude that any of these sensors significantly affect the **number** of sleep outcomes measured.

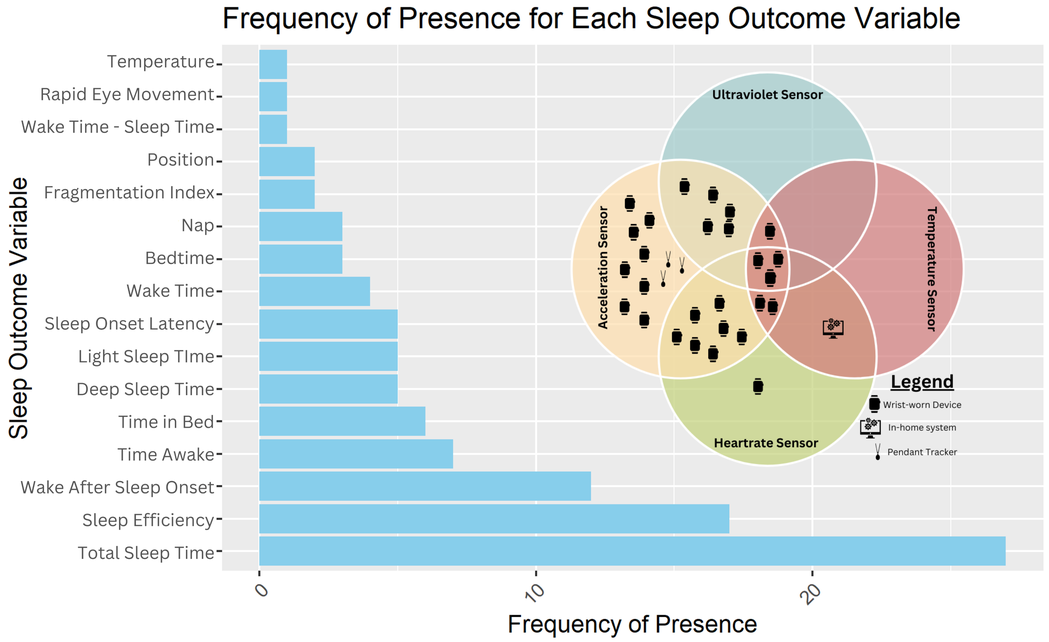


Figure 1 and 2: Frequency of presence of sleep outcome variables ; Venn diagram describing presence of sensors in sleep tracking devices.

Most common variables:

- Total sleep time
- Sleep efficiency
- Wake after sleep onset

Goal:

To determine whether a device having a specific sensor is indicative of a sleep outcome variable being measured.

Most common sensors:

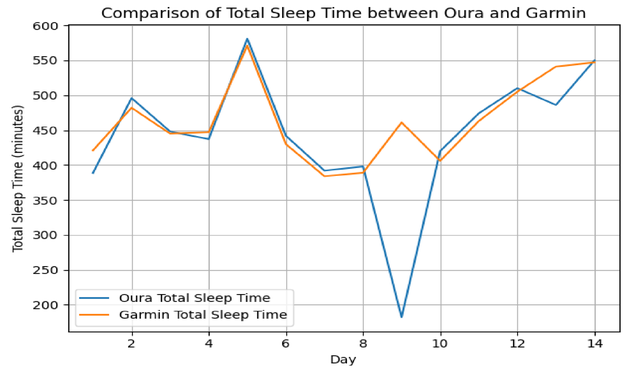
- Accelerometer
- Heart rate

- For **Deep Sleep Time**, **Light Sleep Time**, **Awake time** and **Sleep Onset Latency**, presence of a heart rate sensor is a significant indicator of these sleep variables being included.
- For **Sleep Efficiency (SE)**, presence of an ultraviolet sensor is a significant indicator of the sleep variable being included in the article.

Sensor	Outcome	Coef	p-value
Heart Rate	Deep Sleep Time	3.27	0.014
Heart Rate	Light Sleep Time	3.27	0.014
Heart Rate	Awake Time	5.34	0.001
Heart Rate	Sleep Onset Latency	2.59	0.033
Ultraviolet	Sleep Efficiency	2.67	0.026

Figure 5: The predictor variable, response outcome, coefficient and p-values associated with the significant logistic regressions.

Case Study



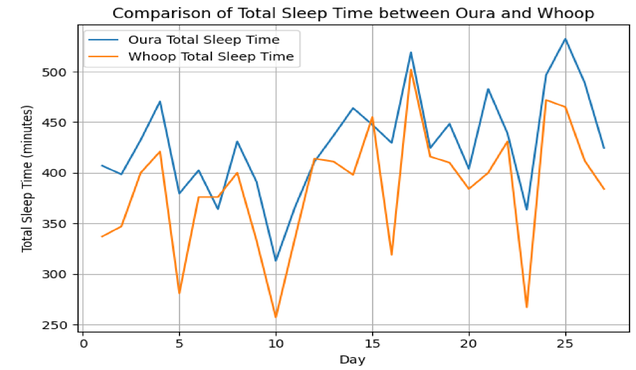


Figure 3 and 4: Comparison of total sleep time measured in two individuals (Garmin vs Oura) and (WHOOP vs Oura)

- Sleep tracked by Oura Ring was compared against the sleep tracked by Garmin Venu 2 sq and WHOOP 4.0 (Figures 3 and 4 respectively).
- Oura reported a higher total sleep time when compared to both Garmin and WHOOP.
- Users should be cautious when interpreting data from wearable devices in contexts requiring precise sleep analysis.

Next Steps

- The literature review, case studies, user protocol, and workshop all lay the preliminary groundwork as part of our preparation for a forthcoming study.

References

Scan QR code for full statistical analysis and study details.