Dementia and Technology

Improving Sleep in People with Dementia: Integrating a Biosensor and Personalized Sleep Feedback with the Claris Companion Tablet Lily Haopu Ren. *Gerontechnology* 25(s)

PURPOSE: We aim to address the following objectives: (1) To determine how well commercially available environmental sleep sensors agree in reporting Total Sleep Duration (TSD) and number of nighttime awakenings, (2) To develop a personalized, non-pharmacological sleep intervention framework that addresses poor TSD, frequent nighttime awakenings, and inconsistent bedtimes, and to integrate these interventions into the Claris Companion tablet using evidence-based strategies for people with dementia. **METHOD:** In Phase I, we conducted six semi-structured interviews with six participants, including people with lived experience of dementia (n=1) and clinical experts (n=5) to identify areas where we could expand Claris Companion to improve health outcomes of those with dementia. Findings were analyzed using reflexive thematic analysis and synthesized with existing literature to highlight sleep health as a concern for people with dementia. In Phase II, we conducted an observational, single-night, validation study in an at-home setting with seven participants (1 male, 6 female, ranging from 23 to 59 years old). Four environmental sleep sensing devices (TochTech Sleepsense, Withings Sleep, SleepCycle App, Google Nest Hub) were set up in each participant's bedroom to facilitate a "free-living" condition. Participants were asked to keep a sleep diary and follow their typical bedtime routine, while the devices passively collected data throughout the night. At an aggregate level, pairwise differences, and their mean, standard deviation, and 95% confidence interval were calculated for TSD and nighttime awakenings as reported by each device. Self-reporting also was considered for nighttime waking, as participants could reliably record when they got out of bed during the night. In Phase III, we synthesized the literature to find personalized, non-pharmacological sleep health recommendations aimed at improving sleep for people with dementia. User interface mock-ups were developed built on evidence-based strategies (i.e., appreciative inquiry and gamification) to portray information to older adults and was built on an existing program in Claris Companion. **RESULTS AND DISCUSSION:** The Google Nest Hub, Withings Sleep, and TochTech Sleepsense showed greatest agreement for TSD with mean pairwise differences from 3-9.5 minutes with standard deviations between 25 to 35 minutes (Figure 1). The Google Nest Hub and Withings Sleep most closely agreed in reporting nighttime awakenings with the self-reported sleep diaries, with mean pairwise differences of 0 and -0.14, respectively. TochTech and SleepCycle both overreported nighttime awakenings in comparison with the sleep diary, with mean pairwise differences of -1 and -0.43, respectively. A total of 4 sleep health frameworks, across 3 sleep metrics, were developed, leading to 11 intervention options and 1 general educational module to improve sleep health. TochTech had the tendency to overreport nighttime awakenings in comparison to all devices. The SleepCycle app showed moderate agreement with the Google Nest Hub and Withings Sleep Analyzer (Figure 2). A total of 41 user-interface screen mock-ups were developed. Future work should evaluate the sleep sensors, personalized interventions, and the Claris Companion interface directly with people living with dementia to assess usability and real-world impact to their sleep health.
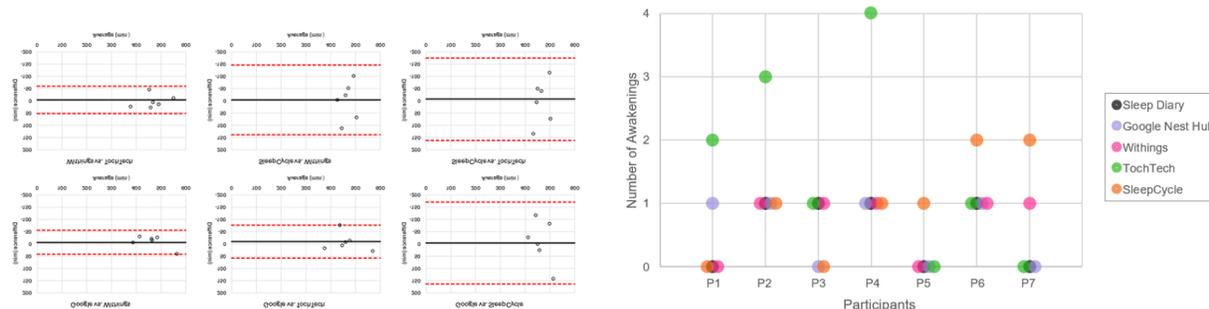
Figure 1: Agreement in total sleep duration for all sensor pairs with mean pairwise agreement (black) and 95% confidence interval (red).
Figure 2: Number of nighttime awakenings reported by each participant and device with slight jitter added for clarity.