Methods: Twenty-two healthy adults (M_{age} = 29.3, SD_{age} = 11.4) had one night of sleep measured by polysomnography and each activity monitor simultaneously in a laboratory. Minute-by-minute data were extracted and compared. Wilcoxon signed-ranks tests assessed statistical differences between measures, and Bland-Altman analyses examined clinically meaningful differences between measures, using cut-offs of ±30 minutes for TST and ±5% for SE.

Results: Compared to polysomnography, all activity monitors significantly overestimated TST and SE. Differences between polysomnography and each monitor were also clinically meaningful, as Bland-Altman upper and lower limits of agreement for TST exceeded cut-offs for ACT (-64.7 min to +116.1 min), FB (-66.1 min to +189.2 min), and JB (-103.6 min to +186.2 min). Similarly, upper and lower limits of agreement for SE exceeded cut-off limits for ACT (-13.0% to +34.0%), FB (-13.1% to +38.5%), and JB (-20.7% to +37.9%). Compared to ACT, only FB significantly overestimated TST and SE. However, differences between ACT and each of FB and JB were clinically meaningful. For FB, Bland-Altman upper limits of agreement exceeded cut-offs for TST (-18.7 min to +40.2 min) and SE (-3.8% to +8.1%). For JB, upper and lower limits of agreement exceeded cut-offs for TST (-100.4 min to +79.3 min) and SE (-20.1% to +16.0%). Agreement between devices decreased as TST and SE decreased. All monitors demonstrated poor specificity (18.8–35.6%), but high sensitivity (94.2–99.2%).

Conclusion: Results suggest these models of ACT, FB, and JB cannot be used interchangeably with polysomnography. When activity monitors must be used, such as in field settings, FB and JB cannot replace research-grade ACT. Overall, users should account for each monitor’s potential to overestimate or underestimate TST and SE to an unacceptable degree. Future research should examine within-subject variability over time to determine whether monitors can be used to track long-term sleep patterns.

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0780 WEARABLE SLEEP EPIDEMIOLOGY IN THE FRAMINGHAM HEART STUDY

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Introduction: Wearable devices for sleep assessments offer a cost-effective and convenient alternative to traditional measures of sleep. Devices are now available to measure oxygenation, respiration, electrocardiogram, and electroencephalogram in the home environment. This study assessed standard (oximetry) and novel (cardiopulmonary coupling) measures of sleep state in a well-established epidemiology cohort.

Methods: Data were collected from 846 participants of the Framingham Heart Study’s second generation and Omni cohort (mean age: 67.9; 484 female). Sleep studies were mailed to each participant, with a single-lead ECG device manufactured by MyCardio, LLC (www.sleepimage.com), an oximetry device manufactured by Nonin, and a brochure to direct the application of the devices. The FDA approved M1 measures electrocardiogram, body position, trunk activity, and snoring. The analysis uses cardiopulmonary coupling to generate the following measures: high and low frequency coupling (HFC and LFC, stable and unstable NREM, respectively), and a biomarker of high loop gain (narrow-band elevated low frequency coupling). The mean, standard deviation, and intra-class correlation coefficient (ICC) were calculated for HFC, LFC, oxygen desaturation index (ODI), and time with oxygen saturation below 90%.

Results: A total of 972 participants agreed to participate. 126 participants were unable or refused to complete the study. 830 and 836 participants obtained at least 4 hours of data with the M1 and oximetry device for at least one night, respectively. 574 participants wore both devices for 2 consecutive nights (803 wore M1, 695 wore Ox for 2 consecutive nights). The mean (SD) were as follows: HFC 43.5% (18.8), LFC 37.28% (17.03), ODI 83.85%, oxygen saturation below 90% 48.1 (77.24) minutes, and 52.5% of the sample had narrow band coupling. The ICC for these variables ranged from 74.5%-99.9%, suggesting high night to night data and physiological signal stability. Associations with common medical co-morbidities will be presented.

Conclusion: Results suggest that home/wearable assessment of sleep is 1) feasible, cost-effective, and yields reliable results; 2) inter-individual differences are stable; 3) measures can be readily repeated; 4) in-person visits are not required, markedly simplifying data collection. Both standard and novel measures can be collected.

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0781 A UNIQUE NON-CONTACT METHOD TO ASSESS SLEEP QUALITY BY DETECTING BODY MOVEMENTS VIA MONITORING AIR-BORNE PARTICLES IN AN ULTRACLEAN SPACE

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Introduction: Although polysomnography (PSG) is the gold standard test for diagnosing sleep disorders, it is labor-intensive and requires a variety of monitoring devices that may affect sleep quality. We recently proposed a novel Clean Unit System Platform (CUSP) to establish a dust/microbe-free environment for various purposes. Tent-type CUSP enables us to detect fluctuation in air-borne-particle counts as bio-kinetic signals reflecting body movements during sleep, which we designated as “kinetosomnogram” (KSG). Our goal is to investigate whether the KSG is of any use in evaluating sleep quality.

Methods: We validated air-cleansing capacity of the tent CUSP and recorded changes in particle counts (sum of all particles with diameter > 0.5μm) in response to various body movements. We volunteer with a PSG equipment stayed in the tent CUSP overnight to record a KSG (the experiments were repeated three times). The KSG was compared with PSG sleep stages, and was subjected to power spectral analysis.

Results: Air quality was improved from 50000–150000/cubic feet (cf) to 0–300/cf in 5 minutes. A bout of body rolling causes a surge of air-borne particles with a peak of 3000–6000/cf in a minute, and raising a hand or a leg does the same with a peak of 1000–2000/cf. Each surge in the KSG appears to have a corresponding arousal response (stage W) in the PSG. Moreover, there is a significant peak of power spectral density at 80–100 minutes suggesting of REM periods.

Conclusion: The tent CUSP provides us with ultraclean environment for sleep and would be of significant help to assess sleep quality in a non-invasive and non-contact manner.

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