

COMMENTARY

Wrist Wearables: More Questions than Answers?

Commentary on Adkins et al. Predictors of intervention interest among individuals with short sleep duration. *J Clin Sleep Med*. 2019; 15(8):1143–1148.

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With global revenues exceeding two billion dollars in 2018 and estimated to increase by 7% in 2019, wearable sleep apps are here to stay.¹ Commercial popularity is rising while the academic community fails to guide the narrative. “Predictors of intervention interest among individuals with short sleep duration” by Adkins et al moves us in the right direction without being overly ambitious.² Adkins evaluated short sleepers for their preferred method of sleep extension. Comparing a digital wrist wearable to telephonic or face-to-face care they found that short sleepers, particularly those self-identified as having a sleep disorder, preferred a wrist wearable.²

Increased self-monitoring with sleep apps comes with the expectation that clinicians can manage their clinical use.^{3,4} Because sleep app users tend to be healthy and have more income, expectations are high.⁵ These technologies offer numerous benefits (volume, scope, and standardization in data tracking, patient empowerment, and personalized care). However, the manner in which sleep is determined is proprietary and patients and clinicians are not privy to the meaning behind a device’s signals and measurements. Because a device’s fate is determined by the market characteristics rather than clinical evidence, patients and clinicians may struggle to keep up (ie, a patient has a preferred device, their clinician helps them interpret it and then it gets discontinued).

The lack of evidence-based guidance on clinical use and efficacy is problematic. Validation has mostly been conducted in healthy sleepers against polysomnography and actigraphy with few studies evaluating the role in sleep disorders.⁶ Rieck et al recently compared three digital technologies (one of which was a wrist wearable) to sleep diary and actigraphy. Among healthy sleepers these devices appear to be comparable to actigraphy but may underestimate total sleep time (based on diary) by over 30 minutes.⁷ Among patients with sleep disorders, sleep estimates are inconsistent; in particular wrist wearables may overestimate sleep time among people with insomnia.^{6,8,9}

Part of the rationale for using wearables is mismatch between supply and demand in sleep medicine, which has been noted in home sleep apnea testing and computer based cognitive behavioral therapy for insomnia (CBT-I) literature. Unfortunately digital and other remote therapies are

not one size fits all. Cheung et al found patient preferences for CBT-I modalities to depend on a myriad of factors (perceived efficacy of treatment, personal commitments, lifestyle, beliefs about sleep and insomnia).¹⁰ Face-to-face treatment by a trained professional allows intangible cues to customize the interaction. On the other hand, more immediate factors like age, sex, education, occupation, commute time, motivation for change, confidence and history of using e-healthcare may translate to wearables providing more effective “personalized care.” Adkins found that the only variables predicting interest in a wrist wearable were the presence of short sleep and concurrent sleep disorders (particularly insomnia and sleep apnea). Other clinical and demographic variables were not predictive.

Although Adkins and colleagues have taken an important step in pointing out a welcoming population for wrist wearables among short sleepers, they have probably only scratched the surface. More research is needed to delineate not only what groups are interested in wrist wearables for tracking sleep, but who will actually wear them and then benefit from them in a measurable way. As we have seen with continuous positive airway pressure (CPAP) for obstructive sleep apnea, an effective therapy plus a willing patient does not necessarily equal positive adherence or a positive outcome. Moving forward it will be interesting to see if patient perceptions about wearables change over time as well as measuring rates of attrition, adherence and meaningful engagement.

A more immediately pressing consideration is that patient’s insights about sleep are often limited. Wearables and other digital interventions could be counterproductive for some patients trying to extend their sleep. This study made outstanding attempts to parse out obstacles to adequate sleep. The reasons for short sleep duration in the survey (social events, spending time on the computer/TV or phone, housework, work or homework from home in the evening, child care, sleep disrupted by partner or pet, work schedule too early/too late, insomnia or other sleep problem, or write in) offered the responder several choices that are commonly identified as reasons for insufficient sleep opportunity. Participants were able to select more than one option, which

likely allows for a more accurate representation of barriers to reported insufficient sleep.

Of particular interest is the finding that participants with greater sleep disturbance and/or a diagnosis of insomnia or other sleep disorders were more likely to indicate an interest in interventions using wearable sleep monitors. On one hand, it is encouraging that these participants with self-reported short sleep duration and greater sleep disturbance and/or a diagnosis of insomnia express interest in sleep extension. Wearable technology to assist with sleep improvements is an exciting area of ongoing development. Similar to the “fitbit steps” phenomenon, the self-monitoring aspect of a wearable could potentially alert the user to just how little sleep they may allow for each night, encouraging adjustments to “add minutes to sleep” with an identified goal. This would mirror the creative ways people have incorporated to increase daily steps to achieve an established fitness (step) goal. This form of wearable application could be useful for participants with short sleep duration due to insufficient sleep opportunity. On the other hand, a wearable as a tracker may be less useful for participants who allow for adequate sleep opportunity, but are unable to achieve sufficient sleep duration due to the presence of untreated sleep disorders such as insomnia¹¹ and/or obstructive sleep apnea. That is, participants who may be at greatest risk for potential health consequences of insufficient sleep (ie, insomnia symptoms and objective insufficient total sleep time)^{11,12} express greater interest in a wearable device, which, as the authors state, is a technology with a lack of validated interventions to date. Overall, this study suggests interest in wearables in participants with identified short sleep duration and greater sleep disturbance and/or a diagnosis of insomnia. Perhaps future developments in wearable devices will lead to their inclusion in validated treatment interventions in this vulnerable population.

The authors acknowledge the potential pitfalls inherent in advocating for a wider role for wearables. There is a lot of interest from patients, but not much evidence that they can deliver effective interventions. Despite the lack of clinical validation these devices should improve communication between patients and providers by coupling data on sleep trends to individual concerns.¹³ Adkins et al have taken us in a positive direction by guiding investigators toward a willing population while generating more questions about what we still need to know.

CITATION

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REFERENCES

1. The Home Sleep Screening Devices Market is Expected to Expand at an 8.4% CAGR Over 2018 to 2028 - Future Market Insights. Cision PR Newswire website. <https://www.prnewswire.com/news-releases/the-home-sleep-screening-devices-market-is-expected-to-expand-at-an-8-4-cagr-over-2018-to-2028-future-market-insights-300830623.html>. Published April 11, 2019. Accessed June 19 2019.
2. Adkins EC, DeYonker O, Duffeey J, Hooker S, Baron KG. Predictors of intervention interest among individuals with short sleep duration. *J Clin Sleep Med*. 2019;15(8):1143–1148.
3. Shelgikar AV, Anderson PF, Stephens MR. Sleep tracking, wearable technology, and opportunities for research and clinical care. *Chest*. 2016;150(3):732–743.
4. Van den Bulck J. Sleep apps and the quantified self: blessing or curse? *J Sleep Res*. 2015;24(2):121–123.
5. Who uses phone apps to track sleep habits? Mostly the healthy and wealthy in US. Science Daily website. <https://www.sciencedaily.com/releases/2018/01/180117085748.htm>. Published January 17, 2018. Accessed June 19, 2019.
6. Baron KG, Duffeey J, Berendsen MA, Cheung Mason I, Lattie EG, Manalo NC. Feeling validated yet? A scoping review of the use of consumer-targeted wearable and mobile technology to measure and improve sleep. *Sleep Med Rev*. 2018;40:151–159.
7. Rieck TM, Gaz DV, Peterson NW, et al. Comparison of commercially-available sleep tracking devices with sleep diary and actigraphy. *Sleep*. 2019;42(suppl_1):A404–A405.
8. Bianchi MT. Sleep devices: wearables and nearables, informational and interventional, consumer and clinical. *Metabolism*. 2018;84:99–108.
9. Lee JM, Byun W, Keill A, Dinkel D, Seo Y. Comparison of wearable trackers' ability to estimate sleep. *Int J Environ Res Public Health*. 2018;15(6):1265.
10. Cheung JMY, Bartlett DJ, Armour CL, Laba TL, Saini B. Patient perceptions of treatment delivery platforms for cognitive behavioral therapy for insomnia. *Behav Sleep Med*. 2019;17(1):81–97.
11. Vgontzas AN, Fernandez-Mendoza J, Liao D, Bixler EO. Insomnia with objective short sleep duration: the most biologically severe phenotype of the disorder. *Sleep Med Rev*. 2013;17(4):241–254.
12. Vgontzas AN, Fernandez-Mendoza J. Insomnia with short sleep duration: nosological, diagnostic, and treatment implications. *Sleep Med Clin*. 2013;8(3):309–322.
13. Wicklund E. Can mHealth Wearables Help Patients Talk to Their Docs About Sleep? mHealth Intelligence website. <https://mhealthintelligence.com/news/can-mhealth-wearables-help-patients-talk-to-their-docs-about-sleep>. Accessed June 14, 2019.

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DISCLOSURE STATEMENT

The authors report no conflicts of interest.