Optimizing Behavioral Sleep Strategies

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PRACTICE ISSUES

CONTINUUM AUDIO INTERVIEW AVAILABLE ONLINE

ABSTRACT

Patients are increasingly looking to optimize sleep as a health and wellness strategy. Sleep health is often individualized based on three elements that correspond to overall physical and mental well-being: (1) sleep quality, which refers to the continuity and depth of sleep as well as a feeling of restoration upon awakening; (2) sleep quantity, which refers to the duration of sleep that is appropriate for a given age group; and (3) timing of the sleep window, which refers to the positioning of sleep that is aligned with an individual's circadian rhythm for sleep or an ideal circadian zone. In the past, prescribing hypnotic medications was considered the primary approach for improving sleep. However, there has been a recent paradigm shift to favor behavioral approaches, particularly in the case of insomnia where cognitive-behavioral therapy has been shown to have a more favorable benefit-to-harm profile than medications. The clinical vignette is presented here as a springboard for discussion regarding the latest evidence and efficacy for sleep behavior techniques and consumer monitoring devices developed to improve sleep health and awareness for clinicians to consider when educating their patients on maximizing sleep health behaviors.

CASE

A 45-year-old woman presented for consultation on strategies to maximize her sleep health behaviors. She had a history of hypertension that was well managed with low-dose lisinopril, and she had no other active medical problems. She had a previous history of menstrual migraines in her teens that had been minimal in frequency and severity over the past 10 years and no longer required treatment. Her family history was notable for mild cognitive impairment, heart disease, stroke, and diabetes mellitus. She was a married mother of two children and primarily worked from home as a graphic designer. She tried to stay active and follow healthy eating and exercise practices that she tracked with an application (app) and wearable device. She admitted that her life was "hectic," balancing the demands of work and caring for her family, including her 75-year-old mother. Her average sleep duration ranged from 5.5 to 7 hours nightly. She was particularly concerned about the association between sleep and cognitive function and, in light of her mother's diagnosis of mild cognitive impairment, felt it important to see a neurologist to learn about the evidence-based approaches she could adopt to be the "best sleeper she can be."

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RELATIONSHIP DISCLOSURE:
Dr Ong has served on the board of directors for the Society of Behavioral Sleep Medicine; on the medical advisory boards for the Hypersomnia Foundation, the Narcolepsy Network, and Wake Up Narcolepsy, Inc; and on the editorial boards for *Behavioral Sleep Medicine*, the *Journal of Clinical Psychology*, and *SLEEP* and has received personal compensation for serving as a consultant for Headspace, Inc. Dr Ong has received grant/research support from the American Academy of Sleep Medicine, Harmony Biosciences, LLC, the National Institutes of Health (K23AT003678, R21NS081088, R01HL114529, and R3AT009551), and Wake Up Narcolepsy and publishing royalties from the American Psychological Association. Dr Gamaldo has served on the board of directors for the American
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DISCUSSION

As depicted in the case, patients are increasingly looking to optimize sleep as a health and wellness strategy. Poor sleep health is a major public health problem that is associated with cardiometabolic consequences, cognitive impairment, and psychiatric comorbidities. Both experimental and observational studies have found that insufficient sleep quantity and poor sleep quality are linked to increased sympathetic nervous system activity, increased blood pressure, pro-inflammatory activity, and endothelial dysfunction.[1–7] Sleep and circadian disturbances have also been associated with mild cognitive impairment and dementia.[8] Finally, poor sleep can also be associated with psychiatric comorbidities.[9]

In the past, clinicians typically prescribed hypnotic medications as the primary approach for improving sleep. However, a recent paradigm shift favors behavioral approaches, particularly in the case of insomnia, where cognitive-behavioral therapy (CBT) has been shown to have a more favorable benefit-to-harm profile than medications.[10] Furthermore, patients now have access to many options outside of the medical system for monitoring and improving sleep health using technology. For example, many people who might not have a diagnosed sleep disorder will seek out digital sleep health tools with the intent to modify their sleep that will result in improved cognitive or physical performance. These include sleep-monitoring devices or applications (apps) to improve sleep quality or quantity. In the process of evaluating patients seeking medical advice from this vantage point, neurologists can be uniquely poised to serve concurrently as health advocates, preventative health care managers, and, when warranted, diagnosticians of previously unrecognized sleep disorders. In some cases, patients might not initially present with complaints of poor sleep, but further examination of their history and symptoms could reveal a primary sleep disorder. Fortunately, sleep is a modifiable risk factor for several common comorbid chronic (and "silent") medical conditions such as hypertension, metabolic disorders, stroke, and cardiovascular disease; as such, improvements in sleep health can have both immediate and long-term benefits on mental and physical health.

PRACTICAL BEHAVIORAL STRATEGIES TO IMPROVE SLEEP HEALTH

Given the importance of sleep health, many patients will attempt to use behavioral or self-help strategies. Moreover, the popularity of digital health has led to a number of apps and devices that claim to improve sleep. The following sections provide guidance for clinicians in discussing these strategies with patients.

Behavioral Strategies in the Clinic

Most neurology practices will not have a behavioral specialist available, and a referral to a sleep specialist may sometimes be limited in terms of accessibility or practicality. Therefore, several key principles could be discussed with patients in a neurology clinic. Similar to the patient in the case, many adults have erratic sleep schedules and durations; thus, implementing core behavioral principles can be a helpful first step in optimizing sleep health.

WAKING UP AT THE SAME TIME EVERY DAY, EVEN ON THE NON–WORKDAYS.

The regulation of the rise time (the time that one arises every day to start the day) is strongly associated with proper regulation and timing of circadian rhythms. Conversely, variability in the rise time can create circadian

misalignment. By recommending a consistent rise time, patients will be able to better align their sleep phase with their circadian rhythms. Over time, this will allow them to experience sleepiness around the same time every day, which will invariably lead to a regular bedtime and an overall more regimented sleep pattern.

SETTING ASIDE SUFFICIENT TIME FOR SLEEP BUT NOT SPENDING EXCESSIVE TIME IN BED. In addition to proper timing of sleep, it is important to make sure that the duration of the time spent in bed is optimized for proper sleep health. Most adults need about 7 to 8 hours of sleep, and time spent in bed should be enough to get 7 to 8 hours of sleep without having significant time awake (eg, more than 30 or 45 minutes). Doing other waking activities in bed, such as using electronics or watching television, counts as time awake, so it is generally helpful to avoid these activities in bed.

AVOIDING SCREEN TIME AND STIMULATING ACTIVITIES BEFORE BEDTIME. Using electronic devices, such as smartphones and tablets, close to bedtime can delay circadian rhythms, and other stimulating activities such as talking on the phone, texting, or playing video games can also be cognitively stimulating, all of which make it more difficult to relax and fall asleep. A 2016 study found particularly longer sleep latency, worse sleep efficiency, more sleep disturbance, and more daytime dysfunction in adults (age range of 18 to 94 years) who used a mobile phone after lights out.[11] Although no steadfast guidelines regarding bedtime electronic use exist, it is generally best to avoid these types of activities closer to bedtime.

Lifestyle Factors: Sleep and Diet

The increase in sleep awareness has also resulted in an increased interest in dietary strategies to optimize sleep health. Evidence suggests that sleep initiation and maintenance can be impacted negatively if an individual attempts to fall asleep with an overly full or empty stomach since both have been shown to negatively impact sleep quality. A full stomach may increase the risk of gastroesophageal reflux disease or gastrointestinal stasis. Sleep initiation may also be impacted by alerting effects that come with hunger. Recent evidence also suggests a greater risk of weight gain, particularly when eating close to bedtime under bright-light conditions.[12] Greater attention to the composition of food that may enhance sleep quality has also gained some notoriety in recent years as consumers seek to integrate better health and wellness strategies through their lifestyle choices. Several foods across the various food groups have now been recognized to naturally possess sleep conducive substances such as melatonin (eg, tart cherries), magnesium (eg, pumpkin seeds), and tryptophan (eg, parmesan cheese, soybeans) that may be useful for patients seeking to optimize their dietary choices to enhance their sleep health.

Using Technology to Improve Sleep Health

The digital health space has expanded dramatically with sleep health serving as a target for many devices and apps. Consumers have an array of devices and programs that are intended to monitor and improve sleep. Popular smartphone apps use calming sounds or meditation. Wearables and sleep monitoring devices are just as popular. The advantages of using these consumer products

include the noninvasive nature of sleep monitoring, the ability to track progress over time, and the accessibility of using a mobile device to promote sleep while lying in bed. The following is a summary of the various digital sleep health devices and programs and a brief discussion about the science that is available.

SLEEP MONITORING DEVICES. Sleep monitoring devices include both wearable and nonwearable devices that use one or more sensors to measure sleep (PRACTICE TABLE 1[13–19]). These are popular products used by people in the general public with or without sleep disturbances. Wearable devices are worn on the wrist or finger and typically use an accelerometer to measure sleep. Other devices are worn as a ring and use multiple sensors (ie, pulse rate, heart rate

PRACTICE TABLE 1 **Popular Sleep Monitoring Devices**

Device	Method	Modality	References	Comments
Fitbit Charge (Fitbit, Inc)	Wearable (wrist)	Unisensor[a]	Lee and colleagues[13] (2017), Dickinson and colleagues[14] (2016)	These two studies compared Fitbit to wrist actigraphy in young adults. Fitbit was significantly correlated with actigraphy on most sleep measures. However, Fitbit overestimated sleep duration by 20–60 minutes compared with actigraphy.
Pulse HR (Withings)	Wearable (wrist)	Unisensor[a]	Mantua and colleagues[15] (2016)	Compared with ambulatory polysomnography, total sleep time was significantly correlated, but sleep efficiency was not.
Oura (Oura)	Wearable (ring)	Multisensor[b]	de Zambotti and colleagues[16] (2017)	Compared with in-laboratory polysomnography, no significant differences were found on total sleep time, sleep-onset latency, or wake time after sleep onset. Epoch-by-epoch analyses revealed 96% sensitivity to detect sleep but 48% specificity in detecting wake.
Beddit (Apple Inc)	Nonwearable (bed pad)	Unisensor[c]	Tuominen and colleagues[17] (2019)	Compared with in-laboratory polysomnography, Beddit had relatively good agreement on sleep-onset latency but significantly overestimated total sleep time and underestimated wake time after sleep onset and had low agreement with polysomnography for classification of sleep stages.
S+ (ResMed)	Nonwearable (bedside table device)	Unisensor[d]	Weinreich and colleagues[18] (2017), Schade and colleagues[19] (2019)	Compared with in-laboratory polysomnography, S+ had about 87% accuracy, with sensitivity >90% and specificity between 70% and 75%. S+ was weakest in detection of wake time after sleep onset. Compared with actigraphy, S+ had significantly higher specificity and significantly lower sensitivity. S+ also had high correlations with polysomnography on the apnea-hypopnea index and periodic limb movements.

[a] Accelerometer (heart rate is also a feature).
[b] Pulse rate, heart rate variability, pulse amplitude, motion, and body temperature.
[c] Piezo force/capacitive touch.
[d] Low-power radio waves.

variability, pulse amplitude, motion, and body temperature). Nonwearable devices use a mattress pad or biomotion technology. PRACTICE TABLE 1 also provides references to several validation studies conducted on these devices. For the wrist-worn devices, the general pattern across validation studies is that the sensitivity is high but the specificity is low when comparing these devices with actigraphy or polysomnography. Also, these devices tend to be more accurate in healthy sleepers compared with those with more sleep disturbance, such as insomnia. Therefore, when discussing the use of sleep monitoring devices with patients, neurologists should acknowledge the limitations of these devices in people with significant sleep disturbances.

APPLICATIONS FOR GENERAL SELF-MANAGEMENT OF SLEEP. A second major category of sleep health devices includes apps that assist with self-management of sleep. Choi and colleagues[20] found that 45% of these apps use the accelerometer on a mobile phone to monitor sleep and that the few validation studies conducted found poor correlations with polysomnography. Therefore, these apps are not recommended as a valid clinical tool. Other apps use calming sounds (eg, white noise, stories) or meditations that are aimed at promoting a state of relaxation and calmness. These are typically used by people who have occasional sleep disturbances, but patients with chronic insomnia might also attempt to use these to help improve their sleep. Because these apps are often considered under the purposes of entertainment or "lifestyle apps," no efficacy studies have been published. While these sleep apps are often used as a relatively benign first step for self-management of sleep, currently very little evidence supports the clinical utility of these apps.

APPLICATIONS/INTERNET-DELIVERED PROGRAMS THAT USE COGNITIVE-BASED THERAPY FOR INSOMNIA STRATEGIES. In contrast to the apps above, a few programs now use specific CBT for insomnia (CBT-I) strategies that are delivered by using automated programs. Also known as digital CBT-I, these programs were designed as a scalable version of CBT-I, given the dearth of CBT-I providers relative to the prevalence of insomnia. Therefore, they are primarily intended for patients with chronic insomnia disorder, but some people who have occasional or acute insomnia might also subscribe to these programs. A meta-analysis found that digital CBT-I can produce effect sizes that are comparable to face-to-face CBT-I on many sleep parameters and self-reported measures on insomnia.[21] However, one limitation is that the rate of attrition tends to be higher in digital CBT-I compared with face-to-face CBT-I, likely reflecting a difference in motivation and engagement for an automated program that does not require human contact. Digital CBT-I can serve as a viable option for patients with an insomnia disorder when a CBT-I provider is not available in the patient's local area.

Referral to a Sleep Specialist

The recommendations above should be considered a starting point for improving patients' sleep health. If the sleep issues are acute and infrequent, these recommendations could resolve the problem, and no further action would be needed. If the sleep disturbance persists, a recommendation to a sleep specialist could be warranted.

If the sleep symptoms are consistent with an insomnia disorder, a referral for CBT-I is recommended. A list of available providers can be found at the website

of the Society of Behavioral Sleep Medicine (see the Useful Websites section). Furthermore, a certification exists for behavioral sleep medicine (Diplomate in Behavioral Sleep Medicine), which is designed for licensed providers at the masters or doctoral level who have passed a board examination and met specific training requirements in behavioral sleep medicine. The Board of Behavioral Sleep Medicine regulates the standards for the Diplomate in Behavioral Sleep Medicine and oversees the credentialing processes (more information can be found at *bsmcredential.org*).

If the sleep symptoms are consistent with sleep-disordered breathing (eg, obstructive sleep apnea) or a disorder of central hypersomnolence (eg, narcolepsy), referral to a sleep center for polysomnography is recommended (refer to the Useful Websites section for a list of sleep centers accredited by the American Academy of Sleep Medicine).

CONCLUSION

Inquiring about a patient's sleep health is important in clinical practice, as it can be linked to the patient's overall physical and mental well-being. Providing recommendations on core behavioral changes can serve as an important step in optimizing the quality, quantity, and timing of the patient's sleep. Although technology has made sleep tracking and self-management of sleep more accessible, these devices currently lack sufficient evidence to serve as valid clinical tools, except in the case of digital CBT-I for people with chronic insomnia disorder. However, given the growing digital health space, health care enterprises could soon be testing the clinical utility of these devices. If the evidence supports the validity and effectiveness of these sleep health devices, they could soon be used in medical practices in an effort to offer personalized care.

USEFUL WEBSITES

AMERICAN ACADEMY OF SLEEP MEDICINE
Patients can use this website to find accredited sleep centers.
sleepeducation.org/find-a-facility

SOCIETY OF BEHAVIORAL SLEEP MEDICINE
This website offers a list of providers for CBT-I.
behavioralsleep.org

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DISCLOSURE

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