

Supplemental Digital Content

Screening for and Assessment of Sleep Health

Prior to the inclusion of sleep in LE8, researchers made clinical recommendations to include guidelines for healthy sleep and suggestions for ways to screen for things like sleep duration and disorders in clinical settings, along with directions for future research to develop and assess easy screening tools to be used in a clinical setting.¹

When comparing data from studies where insomnia was assessed, researchers and clinicians are encouraged to be aware that there is variation in the way insomnia is defined and measured, leading to unstandardized reporting of results.² The most common ways of measuring insomnia are through objective data collection (such as polysomnography or actigraphy) and self-report measures (including sleep diaries and self-report questionnaires). However, polysomnography is a reference standard for the diagnosis of sleep breathing disorders, while insomnia is diagnosed using a structured clinical interview by a trained clinician.³

Objective measures of sleep quality and duration are the most reliable. Although they are expensive, time-consuming, and may be impractical to employ in a routine clinical setting, polysomnography and wrist actigraphy measures provide rich biological measures of an individual's sleep pattern throughout the night, allowing clinicians an opportunity to examine sleep behaviors that are otherwise subconscious.

The most common questionnaires used in research studies assessing insomnia include the Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Athens Insomnia Scale, Jenkins Sleep Scale, and the Bergen Insomnia Scale.³ Sleep clinics often employ the Epworth Sleepiness Scale, another self-report questionnaire used to measure a patient's daytime sleepiness.^{4,5} The ISI tends to be the most flexible scale that has been used in a number of clinical settings, including where patients with cardiovascular conditions are seen.

The PSQI, most commonly used and considered the gold standard for measuring insomnia, is a robust 19-item measure designed to assess patterns of sleep dysfunction in patients over a one-month period and provide a score of number and severity of sleep disturbances.^{6,7} It provides vital information regarding patient self-awareness of their sleep quality and the impact it has on their daily functioning.⁴

Given the large impact on quality of life, routine screening is encouraged for patients with cardiovascular disease.² Most importantly, screening for sleep opportunity allows providers to identify and address the source, whether it is insomnia, depression, shift work, or comorbid health concerns. If the opportunity for sufficient sleep is not the issue, sleep quality as a result of sleep disorders and other conditions leading to non-restorative sleep should be examined.

The **Table** summarizes and provides references for the major tools used to assess sleep.

Treatment of Insomnia: CBT-I

Cognitive Behavioral Therapy for Insomnia (CBT-I) is an evidence-based psychotherapeutic treatment utilized for the treatment of chronic insomnia and has been adopted as the gold standard by the American Psychological Association and the European Sleep Association.^{8,9} It can be administered in five to eight sessions with two main components – cognitive and behavioral. The cognitive component focuses on decreasing rumination and restructuring maladaptive beliefs about sleep while the behavioral component focuses on sleep restriction, stimulus control, and sleep hygiene.⁸ Several meta-analyses have explored this treatment's efficacy for insomnia and found consistent, long-lasting resulting in improving sleep quality, sleep latency, and wakening after sleep onset and was particularly effective in middle-age and older adults.^{10,11} Internet-delivered CBT-I was found to be comparable to face-to-face with improvements in "insomnia severity, sleep efficiency, subjective sleep quality, wake after sleep onset, sleep onset latency, total sleep time, and number of nocturnal awakenings at post-treatment".¹²

CBT-I has becoming increasingly accessible as a result of a mobile application version, CBT-I Coach. This patient-centered smartphone app, designed by the Veterans Affairs National Center for PTSD, Stanford School of Medicine, and the Department of Defense's National Center for Telehealth and Technology, as a means of supplementing and enhancing traditional CBT-I.⁹ Created with the CBT-I protocol in mind, it includes the major components of sleep restriction, stimulus control, arousal reduction, sleep-focused cognitive therapy, sleep hygiene, and relaxation exercises. CBT-I Coach was created in a way that made it easy and feasible for patients to complete their sleep diaries daily, uses the data to automatically calculate the sleep variables, and allows for easy communication/sending of the weekly data to their therapist or clinician.⁹

Physicians who were trained in CBT-I and utilized the application with their patients found it assisted with homework completion and increased adherence.⁹ While there are several mobile applications on the market aimed at treating insomnia, CBT-I Coach is one of the few that incorporates all components of CBT-I and does so in a high-quality manner.¹³ CBT-I Coach is also the only application to have been tested in randomized clinical trials; when used as a supplement to face-to-face CBT-I, participants consistently engaged with it, reported high satisfaction, and endorsed significant improvements in their sleep.¹³

Acceptance and Commitment Therapy for Insomnia (ACT-I) is another behavioral therapy that aims to increase one's ability and willingness to experience distress associated with insomnia, with the goal of decreasing arousal and encouraging sleepiness. ACT-I focuses on values-based actions that work to identify and deter dysfunctional patterns of avoidance, a contrast to CBT-I's focus on changing and controlling cognition. Outcomes from ACT-I interventions found improvements in insomnia severity, sleep efficiency, sleep onset latency, and subjective sleep quality.⁸

Despite promising results of both CBT-I and ACT-I, they are not without limitations. These treatments require significant lifestyle changes that patients may find too taxing to

implement, reducing the likelihood of adherence.¹⁴ Sleep restriction at the start of treatment becomes particularly challenging as a result of the temporary sleep deprivation and increased daytime sleepiness, making it difficult for patients to buy into the long-term benefits. Nevertheless, behavioral interventions offer useful approaches to treating insomnia without the side effects that come along with pharmacological approaches such as function impairment, dependency, or worsened sleep after stoppage.

Table: Major Assessment/Screening Tools

Tool	Description	Domains Measured
Objective		
Polysomnography	Measure of physiological changes during sleep, evaluating brain activity, eye movement, muscle movement, heart rate using EEG	Sleep disorders, sleep wake-cycles, breathing patterns, heart rate, brain waves, muscle movement
Actigraphy	Measure of sleep cycles and sleep activity using non-invasive methods	Sleep disorders, sleep wake-cycles, sleep latency, wake after sleep onset
Self-report		
Pittsburgh Sleep Quality Index (PSQI) ¹	19-item scale evaluating patterns of sleep dysfunction and severity of sleep disturbances	Sleep quality, sleep duration, sleep latency, habitual sleep efficiency, sleep disturbances, sleep medication, and daytime dysfunction
Insomnia Severity Index (ISI) ²	7-item scale evaluating nature and symptoms of sleep problems	Sleep quality, symptoms severity, sleep satisfaction, distress as a result of sleep, interference with daily functioning
Athens Insomnia Scale (AIS) ³	8-item scale evaluating insomnia severity using ICD-10 diagnostic criteria	Sleep quality, sleep latency, sleep time, night and early-morning waking, distress as a result of insomnia, interference with daily functioning
Bergen Insomnia Scale ⁴	6-item scale evaluating sleep and tiredness	Sleep latency, daytime dysfunction, sleep satisfaction
Jenkins Sleep Scale ⁵	4-item scale evaluating frequency and intensity of sleep difficulties	Frequent awakenings, trouble falling/remaining asleep, daytime fatigue
Epworth Sleepiness Scale (ESS) ⁶	8-item scale evaluating daytime sleepiness	Overall daytime sleepiness
Morningness-Eveningness Questionnaire ⁷	19-item scale evaluating alertness throughout the day	Sleep/wake time preferences, "peak" alertness during the day

¹Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;28(2):193-213. doi:10.1016/0165-1781(89)90047-4

²Bastien CH, Vallières A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Med.* 2001;2(4):297-307. doi:10.1016/s1389-9457(00)00065-4

³Soldatos CR, Dikeos DG, Paparrigopoulos TJ, Soldatos CR, Dikeos DG, Paparrigopoulos TJ. Athens Insomnia Scale. *Journal of Psychosomatic Research*. 2003;55:263-267.

⁴Pallesen S, Bjorvatn B, Nordhus IH, Sivertsen B, Hjørnevik M, Morin CM. A new scale for measuring insomnia: the Bergen Insomnia Scale. *Percept Mot Skills*. 2008;107(3):691-706. doi:10.2466/pms.107.3.691-706

⁵Jenkins CD, Stanton BA, Niemcryk SJ, Rose RM. A scale for the estimation of sleep problems in clinical research. *J Clin Epidemiol*. 1988;41(4):313-321. doi:10.1016/0895-4356(88)90138-2

⁶Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*. 1991;14(6):540-545. doi:10.1093/sleep/14.6.540

⁷Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol*. 1976;4(2):97-110.

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