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Screening and Evaluation Tools for Sleep Disorders in Older Adults

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Abstract

The negative effects of impaired sleep on physical and mental well-being in older adults have recently been recognized by health care professionals. However, researchers and clinicians may be unaware of reliable and valid screening and evaluation tools for evaluating sleep disorders in older adults. The purpose of this article is to present subjective and objective instruments that measure sleep quality, excessive daytime sleepiness, obstructive sleep apnea, insomnia and restless leg syndrome that are appropriate for use in adult and older adult patients.

Keywords

insomnia; restless leg syndrome; sleep apnea; questionnaires; actigraphy; polysomnography

Sleep is a complex physiological and behavioral process that is composed of two distinct states, non-rapid eye movement (NREM stages 1–3) and rapid eye movement (REM), each with unique characteristics. Older adults experience age-related changes in sleep architecture including less slow-wave sleep (NREM stage 3) and REM sleep that result in lighter, more fragmented sleep¹. In addition to changes in sleep architecture, circadian rhythm-related changes are also present in older adults, with many having an advanced phase rhythm resulting in an early bedtime and rise time¹. Age-related changes in sleep combined with medical and psychiatric conditions that accompany older age lead to many older adults having sleep complaints, with approximately 50% reporting difficulty sleeping². Sleep complaints in older adults are often symptoms of insomnia, including difficulties initiating and maintaining sleep and early morning awakenings. Insomnia can be a primary sleep disorder; however, in older adults, it is often co-morbid with medical and psychiatric illnesses and medications and other sleep disorders such as obstructive sleep apnea (OSA) and restless legs syndrome (RLS)¹. OSA and RLS are more common in older than younger adults^{3,4}. Sleep disorders can have significant consequences for the elderly, including

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increased risk for psychiatric disorders and serious medical conditions, reduced quality of life, cognitive impairment, increased risk for falls, and increased risk for mortality^{4,5}.

Poor sleep and excessive daytime sleepiness can occur in association with various sleep disorders, medical and psychiatric conditions, and sleep deprivation or due to medication effects. Excessive daytime sleepiness in older adults is associated with cognitive impairment, depressive symptoms, impairments in daily function, and an increased risk for cardiovascular mortality⁶. Impairments in cognitive function associated with excessive sleepiness can result in motor-vehicle accidents⁷.

The importance of sleep to optimal physical and mental health has been increasing recognized by clinical researcher. Unfortunately, identification of sleep problems by health care providers largely depends on patients' disclosure of these problems and older adults may assume that changes in their sleep are due to normal aging. Given the high prevalence of sleep disorders, an assessment of sleep is recommended as a routine component of geriatric care and as an important component of research involving older adults. Having knowledge of assessment tools for common sleep disorders is important for assessment of impaired sleep and development of subsequent interventions, which can have a significant impact on patient's quality of life.

Purpose

There are many questionnaires that can be used to assess sleep depending on what aspect one is interested in evaluating. This article presents some of the most widely used questionnaires and provides information about psychometric properties, patient burden, instrument accessibility and administration. Although subjective assessments are often faster and less expensive, objective measures of sleep (actigraphy, in-laboratory and in-home polysomnography (PSG), and the Multiple Sleep Latency Test [MLST]) are used for diagnosis and evaluation of many sleep disorders. Nurse researchers and clinicians must carefully consider their objective when determining which method to use for assessment of sleep. Whereas the ease of administration and low cost associated with questionnaires and sleep diaries make these subjective sleep measures applicable for both individual evaluation of patients in clinical practice and population-based screening in clinical research, objective measures of sleep may have limited utility for clinical research given the cost and complexity. The purpose of this article is to present subjective and objective assessment tools for four common sleep disorders found among older adults, insomnia, excessive daytime sleepiness, OSA, and RLS, that can be used in clinical practice and potentially clinical research with older adults and adults of any age.

Subjective Sleep Measures and Sleep Diary

Sleep quality and daytime function

Table 1 lists subjective sleep measures for assessment of sleep quality, daytime sleepiness, and functional outcomes. A general assessment of sleep quality can be obtained using the Pittsburgh Sleep Quality Index (PSQI) or the Patient-Reported Outcomes Measurement Information System (PROMIS) sleep disturbance instrument, which will be discussed

below. Excessive sleepiness is characterized by difficulty in maintaining a desired level of wakefulness¹. Two commonly used questionnaires for assessment of daytime sleepiness and functional impairments associated with daytime sleepiness are also discussed, the Epworth Sleepiness Scale (ESS) and Functional Outcomes of Sleep Questionnaire (FOSQ).

Pittsburgh Sleep Quality Index—The PSQI assesses self-reported sleep quality and disturbances over the last one month time period⁸. The PSQI includes 19 items to measure seven domains of sleep quality: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, daytime dysfunction, sleep disturbance and use of sleeping medications. Four items have free-entry responses to assess usual bed and wake times, number of minutes to fall asleep, and hours slept per night. The remaining items use 4-point Likert scale responses, with higher scores indicating worse sleep quality. Five additional items are included in the questionnaire that are completed by a bedpartner but are not included in the calculation of the global sleep quality score. A global sleep quality score is obtained by summing the seven domain scores, with higher scores indicating worse sleep quality (range = 0–21). A PSQI score greater than 5 indicates a “poor” sleeper. An early evaluation of the PSQI by Buysse and colleagues (1991)⁹ concluded that sleep quality frequently decreases among older adults; however, the majority of persons 80+ years old were found to have PSQI scores indicating “good” sleep quality. More recently, the PSQI was evaluated in samples of older men and women and was affirmed as being a reliable and valid instrument to evaluate subjective sleep quality in older adults¹⁰.

PROMIS Sleep—The PROMIS sleep disturbance item bank (e.g., 27 questions in total) assesses self-reported perceptions of sleep quality, sleep depth, and satisfaction with sleep over the past week¹¹. More specifically, these items evaluate difficulties getting to sleep and staying asleep, refreshment upon waking, and worry over falling sleep. Not included in the PROMIS sleep disturbance items are symptoms of specific sleep disorders (sleep apnea, narcolepsy) or subjective estimates of time (time to fall asleep, total hours asleep). The instrument uses five-item Likert scales to assess sleep variables. The PROMIS sleep disturbance instrument and scoring instructions can be obtained on the PROMIS website through Assessment Center (www.assessmentcenter.net). Although the PROMIS sleep instrument was developed and pilot tested in samples that included older adults, the reliability and validity of the instrument needs further validation in older adults.

Epworth Sleepiness Scale—The ESS is a 8-item questionnaire that assesses subjective daytime sleepiness¹². The ESS assesses the likelihood of dozing in different common situations using a 4-point Likert response format (scored from 0 to 3 with higher scores indicate more severe sleepiness). Item responses are summed to obtain a total scores ranging from 0 to 24, with a score greater than 10 indicating excessive daytime sleepiness¹². The ESS is routinely used in research and clinical practice to evaluate the presence and severity of excessive daytime sleepiness in older adults. The ESS was recently evaluated in samples of men and women ages 70 years and older and was found to be a reliable and valid instrument for evaluation of subjective sleepiness¹⁰. However, another study of older adults (mean age 78.9 ± 6.0 years) found that almost 60% had difficulty answering at least one question on the ESS and only 25% who complained of sleepiness had abnormal scores on

the ESS¹³. In addition, the participants rated their sleepiness with the ESS less severe than did a close relative, and this discrepancy in ESS was most pronounced in older adults with impaired cognitive status. This suggests that the reliability and validity of the ESS may need further evaluation and that multiple sources of appraisal of sleepiness may be appropriate in the cognitively impaired older adult.

Functional Outcomes of Sleep Questionnaire—The FOSQ-30 assesses the impact of disorders of excessive sleepiness on functional outcomes of daily activities and quality of life¹⁴. The FOSQ-30 consists of 30 questions about difficulty in performing daily tasks due to sleepiness that are rated on a 4-point Likert scale (score from 1 to 4 with higher scores indicating better functional status). Respondents can also indicate that they do not engage in the activity for reasons other than being sleepy or tired. The FOSQ-30 addresses the following five domains – 1) activity level, 2) vigilance, 3) intimacy and sexual relationships, 4) general productivity, and 5) social outcomes. A shortened, 10-question version, called the FOSQ-10, has been developed and tested¹⁵. Both the FOSQ-30 and FOSQ-10 are scored by calculating an average score for each subscale and then totaling the 5 subscales to produce a total score. Higher scores indicate better functional status. The FOSQ was able to differentiate functional outcomes sensitive to sleepiness (general productivity, vigilance, activity level, social outcomes, and total functioning) between older adults (ages 65 and older) with daytime sleepiness compared to those older adults without daytime sleepiness⁶.

Subjective Measures for Insomnia

Table 2 lists the evaluation tools for assessing insomnia. The measures include the Consensus Sleep Diary (CSD) and the Insomnia Severity Index (ISI).

Insomnia

Insomnia can be defined as a symptom or as a disorder denoting insomnia symptoms and associated daytime impairment. Subtypes of insomnia have been characterized based on frequency, duration (acute vs. chronic), and etiology. An estimated one-third of all U.S. adults experience insomnia symptoms (i.e., difficulty falling asleep, difficulty staying asleep, early awakenings, or unrefreshing or nonrestorative sleep); 6–10% meet diagnostic criteria for chronic insomnia¹⁶. In a study of over 9,000 community-dwelling adults aged 65 years or older, over half of the sample reported having at least one insomnia symptom most of the time¹⁷. Psychological, health, lifestyle, and environmental factors have been identified as precipitants of insomnia¹⁸. Medical disorders and psychiatric conditions, in particular anxiety and depression, and associated medications can have a profound impact on sleep and lead to comorbid insomnia. Stressful events and changes in the sleeping environment can also precipitate insomnia. Adopting habits such as maintaining an irregular sleep schedule, consuming caffeine or alcohol before bed, exercising close to bedtime, napping, and using the bed for activities other than sleeping and sex can hinder the ability to fall asleep and stay asleep. Maladaptive beliefs about sleep and preoccupation with sleep during daytime hours can maintain chronic insomnia¹⁸. Insomnia increases the risk of developing serious medical conditions such as depression, diabetes, hypertension, and cardiovascular disease¹⁸.

Consensus Sleep Diary—The CSD was developed in 2008 by a committee of insomnia experts with the objective to create a standardized sleep diary for research and clinical use¹⁹. The purpose of the CSD core diary is to gather information on time to bed, time to fall asleep, number and length of awakenings, time of final awakening, qualitative rating of sleep quality, and comments. Two optional versions exist with additional questions asking if the final awakening was earlier than planned and by how much, whether one felt well-rested, napping or dozing behavior during the day, alcohol or caffeinated beverage consumption, and use of over-the-counter or prescription sleep medications. Use of a sleep diary should be considered when assessing for insomnia in older adults. A study of older adults (N = 119, mean age = 71.7 ± 7.2 years) found that a sleep diary was more sensitive to identifying older adults with insomnia compared to actigraphy²⁰.

Insomnia Severity Index—The ISI is a self-report instrument designed to evaluate the severity and impact of insomnia symptoms over the past 2 weeks²¹. The ISI consists of 7 items assessing the degree of difficulty in falling asleep, staying sleep, and waking up too early using a 5-point Likert scale. Patients are asked about their satisfaction with their current sleep pattern, whether their sleep problem is noticeable to others, and whether it causes worry or distress to them or interferes with their daytime functioning. Total scores range from 0 to 28, with higher scores indicating greater insomnia severity.

Subjective Assessment Measures for Obstructive Sleep Apnea and Restless Leg Syndrome

Table 3 lists the subject measures for obstructive sleep apnea (i.e., Berlin Questionnaire and the OSA50) and restless leg syndrome (i.e., International Restless Legs Syndrome Scale).

Obstructive sleep apnea

OSA is an increasingly prevalent sleep disorder characterized by repetitive apneas (pauses in breathing) and hypopneas (very shallow breaths) caused by intermittent airway collapse during sleep with resultant sleep fragmentation. OSA affects 3%–7% and 2%–5% of middle-age men and women, respectively²². Comparatively, in a sample of 427 older adults, 62% were found to have a respiratory disturbance index (RDI, number of apneas and hypopneas per hour of sleep) ≥ 10 indicating mild to severe sleep apnea³. Risk factors for OSA include male gender, older age, obesity, smoking, nasal congestion, menopause, and craniofacial and upper airway abnormalities²³. The classic symptoms of OSA are loud snoring, gasping and choking, witnessed apneas, and excessive daytime sleepiness. OSA is diagnosed by in-laboratory or in-home PSG based on an apnea-hypopnea index (AHI, number of apneas and hypopneas per hour of sleep) greater than 5. Untreated OSA can result in a variety of adverse medical and daytime consequences, including excessive daytime sleepiness, psychological symptoms, cognitive and performance impairments, reduced quality of life, and increased risk for cardiovascular disease and mortality²⁴. The following screening questionnaires for sleep apnea will be discussed: Berlin Questionnaire and OSA50.

Berlin Questionnaire—The Berlin Questionnaire is used to screen patients for OSA and was originally validated in primary care patients²⁵. The Berlin Questionnaire consists of

three different domains or categories for a total of 10 questions. Category 1 questions (5 items) ask about snoring and witnessed apneas and a person is considered to be high-risk if persistent symptoms (3–4 times per week) is endorsed on 2 or more questions. Category 2 questions (4 items) ask about daytime fatigue and sleepiness and a person is considered to be high-risk if persistent (3–4 times per week) wake-time sleepiness, drowsy driving, or both are endorsed. For category 3, a person is considered high-risk if they have a history of hypertension or a body mass index $< 30 \text{ kg/m}^2$. If two of the three categories are considered high-risk, then the patient is considered to be at high risk for OSA²⁵. A study of older adults (N = 643, mean age 65.6 ± 0.03) concluded that the Berlin Questionnaire was valuable for screening older adults for sleep study evaluation but did not have the sensitivity or specificity to diagnose OSA²⁶.

OSA50—OSA50 is a screening questionnaire for OSA that has four items, including waist circumference, snoring, witnessed apneas, and age²⁷. Patients are asked about snoring and witnessed apnea using questions from the Berlin Questionnaire. Males with waist circumferences $> 102 \text{ cm}$ and females with waist circumferences $> 88 \text{ cm}$ receive 3 points. Those who report snoring that bothers other people also receive 3 points. Those with witnessed apneas and/or age 50 years or older receive 2 points. Total maximum score is 10, with a score of 5 indicating a high probability of OSA.

Restless legs syndrome

RLS is a common neurologic disorder affecting between 9% – 20% of older adults based on diagnostic criteria⁴. RLS is characterized by unpleasant leg sensations typically at sleep onset that triggers an urge to move the legs. These sensations often occur at rest and become more severe in the evening and at night. These leg sensations can be temporarily alleviated by moving the legs. Risk factors for RLS include low iron levels, lower socio-economic status, poor health, increasing age, Parkinson's disease, and end stage renal disease²⁸. RLS is associated with insomnia symptoms, depression, and several medical conditions including cardiovascular disease, obesity, and diabetes⁴. The International Restless Legs Syndrome Scale is the most commonly used questionnaire for assessing RLS.

International Restless Legs Syndrome Scale—The International RLS scale is a self-report questionnaire designed to evaluate the severity of RLS symptoms and its impact on daily life over the past week using a 5-point Likert scale²⁹. The International RLS Scale consists of 10 items that assess the following features: overall rating of primary symptom features, intensity and frequency of related symptoms, sleep problems associated with RLS, and impact of RLS symptoms on mood and daily life. Total score range from 0 to 40, with higher scores indicating greater RLS symptoms and impact.

Objective Sleep Measures

Table 4 presents objective measures of sleep, including actigraphy, in-lab PSG, in-home PSG, and MLST.

Actigraphy

Actigraphy utilizes a portable device (actigraph) to study sleep-wake patterns and circadian rhythms by assessing movement³⁰. The actigraph is about the size of a wristwatch and is usually worn on the wrist continuously for multiple days and nights. The actigraph records the presence and/or amplitude of movement several times per second, and stores these in 30 or 60 second epochs. Data from the actigraph is downloaded using a “reader”, a device connected to a computer. Using a computer program, data is analyzed and a histogram can be printed that displays an individual’s activity levels for each epoch over each 24-hour period. Sleep-wake patterns including total sleep time, total wake time, sleep efficiency (total sleep time/total time in bed), sleep latency, and number and length of wake episodes after sleep onset are estimated based on the periods of activity and inactivity based on movement³⁰. Actigraphy can be an objective supplement to sleep diaries. Actigraphy has been found to be a reliable and valid instrument to examine ecologically valid sleep patterns in older adults especially if the device is used over a 7-to 14-day time period³¹.

In-laboratory polysomnography

The in-laboratory PSG is considered the “gold standard” for the evaluation of sleep according to the American Association of Sleep Medicine³². Prior to an in-laboratory or a home sleep study, a detailed history and physical examination is recommended including evaluation of sleep patterns and symptoms of sleep disorders. An in-laboratory PSG is attended by a trained polysomnographic technologist and usually includes the recording montage first described by Rechtschaffen and Kales³³ of central electroencephalogram (EEG) (C3 or C4), reference occipital EEG (O1 or O2), right and left electro-oculogram (EOG), mental or submental electromyogram (EMG), thoracic effort, abdominal effort, nasal and oral airflow, a microphone to record snoring, pulse oxygen saturation, EKG, and video recording to document body positions during sleep. The equipment is calibrated prior to allowing the patient to go to sleep. This recording can determine sleep stages, the total time in each sleep stage, total sleep time, sleep efficiency, sleep latency, REM sleep latency, wake after sleep onset, and arousals. In-laboratory PSG studies are used for the diagnosis of sleep disordered breathing disorders, narcolepsy, parasomnias, and sleep related seizure disorder. PSGs are not indicated in the routine diagnosis or management of transient or chronic insomnia. In-laboratory sleep studies are recommended for patients with congestive heart failure, history of stroke, or cardiac arrhythmias.

In-home sleep testing

In-home sleep testing is a less expensive and convenient alternative to in-laboratory PSG for patients with a high probability of moderate to severe OSA³⁴. In-home sleep testing enables diagnosis of OSA in patients’ home environment using unattended, portable monitors which must record airflow, respiratory effort, and blood oxygenation. Application of the portable monitor sensors can be done by a sleep technician or the patient after training. In-home sleep testing should be used in conjunction with a comprehensive sleep evaluation and interpreted by a sleep specialist³⁴. In-home sleep testing is not appropriate patients with significant comorbid conditions, such as congestive heart failure, neuromuscular disease and severe

pulmonary disease, or other sleep disorders, but can be useful for patients who cannot attend an in-laboratory PSG due to immobility³⁴.

Multiple Sleep Latency Test

The MSLT is used to objectively evaluate physiological disorders of excessive sleepiness³⁵ such as narcolepsy or idiopathic hypersomnia. An MSLT is an in-laboratory PSG that consists of a series of at least four daytime nap opportunities spaced every two hours to determine the average amount of time it takes until the patient falls asleep. Frequently, there is an overnight PSG prior to the MSLT to objectively determine whether a sleep disorder or inadequate sleep duration is responsible for the excessive sleepiness. The MSLT starts approximately 2 hours after the time the patient awakes in the morning and takes place in a bedroom that is quiet and dark. At the beginning of each nap opportunity the polysomnographic technologist instructs the patient to “lie quietly, close your eyes, and *allow yourself to fall asleep*.” Sleep is evaluated with the standard PSG recording montage used for overnight studies; the study is usually evaluated in 30 second epochs. Each nap opportunity is terminated if the patient does not fall asleep within 20 minutes or after 3 consecutive epochs scores as “sleep.” Sleep onset is calculated for each nap as the time from “lights out” to the first epoch of sleep. Sleep-onset REM is documented, which is used as part of the determination of whether the patient has narcolepsy. A mean MSLT score of 10 to 20 minutes is usually considered normal, and a mean MSLT of < 5 minutes is excessively sleepy³⁵.

Discussion

Sleep is an essential requisite for healthy aging; unfortunately nurse clinicians and nurse researchers too frequently fail to evaluate sleep in older adults. Misinformation that poor sleep and excessive daytime sleepiness are an integral part of the aging process act as a barrier to the provision of optimal care. Nurses are in a pivotal position to identify patients with sleep disorders, provide an environment that is conducive to sleep, and investigate interventions to help improve sleep in older adults. Nurse researchers need to include an assessment of sleep in studies in older adults that focus on health promotion, disease prevention, caregiving, symptom management, self-management of chronic illness, and palliative/ end-of-life care.

Choosing the correct instrument is a critical component in the assessment of sleep disturbances in older adults for researchers and clinicians. While the use of a self-report measure such as the ESS may be the most appropriate instrument to measure this patient symptom, determination of the risk for a potential mechanism for the excessive sleepiness, such as OSA, is also important. Furthermore, while risk of OSA can be evaluated with a Berlin or OSA50 questionnaire, the diagnosis and treatment of OSA requires use of objective tests such as PSG. Likewise, insomnia symptoms and evaluation of response to an intervention such as cognitive behavioral therapy may be evaluated with the ISI or the PSQI; however, the addition of objective measures such as actigraphy can also be beneficial. In conclusion, there are reliable and valid instruments that are available for the evaluation of sleep. Use of these instruments, as appropriate, can improve the assessment of older adults.

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Table 1
Subjective Assessment Measures for Sleep Quality, Daytime Sleepiness, and Functional Outcomes

Measure	Purpose	Number of items	Score Interpretation & Psychometrics	Additional Information
Pittsburgh Sleep Quality Index ²⁰	<ul style="list-style-type: none"> Assess subjective sleep quality and sleep habits during the last month 	<ul style="list-style-type: none"> 19 items and 5 additional items that are completed by bedpartner 	<ul style="list-style-type: none"> Global PSQI calculated by summing seven domain scores PSQI > 5 has sensitivity (89%) and specificity (86.5%) for differentiating “poor” from “good” sleepers Internal consistency: Cronbach $\alpha = 0.73$. Test-retest reliability = 0.85 	<ul style="list-style-type: none"> Translated into 56 languages Time to complete: 5–10 minutes Detailed information at: http://www.sleep.pitt.edu/content.asp?id=1484&subid=2316
PROMIS Sleep Disturbance ²¹	<ul style="list-style-type: none"> Evaluates self-reported sleep quality, sleep depth, and satisfaction with sleep 	<ul style="list-style-type: none"> Pool of 27 items. Short form options: 4, 6, or 8 items Computerized adaptive test option 	<ul style="list-style-type: none"> T-score ranges from approximately 29 to 78 (depending on the version used) Average score is 50, with higher scores indicating more sleep disturbance Internal consistency: Cronbach $\alpha = 0.91$ 	<ul style="list-style-type: none"> More information at: http://www.nihpromis.org/
Epworth Sleepiness Scale ²²	<ul style="list-style-type: none"> Assesses subjective daytime sleepiness 	<ul style="list-style-type: none"> 8 items 	<ul style="list-style-type: none"> Total score >10 = excessive daytime sleepiness; 17 indicates pathological sleepiness Internal consistency: Cronbach's α ranged from 0.73 to 0.86 	<ul style="list-style-type: none"> Time to complete: 5 minutes Information at: http://epworthsleepinessscale.com/1997-version-ess/
Functional Outcomes of Sleep Questionnaire ²³	<ul style="list-style-type: none"> To assess the impact of excessive sleepiness on daily activities and quality of life 	<ul style="list-style-type: none"> 30-items self-rated Likert 	<ul style="list-style-type: none"> Total score calculated from five domain scores Scores range from 0 to 24, with higher scores indicating less functional impact Internal consistency: Cronbach $\alpha = 0.95$ 	<ul style="list-style-type: none"> Written at a fifth grade reading level Time to complete: 15 minutes FOSQ-10 is a shortened 10-item version; total score only should be used (not domain scores)²⁴ Use with permission T. Weaver, PhD teweaver@uic.edu

Measure	Purpose	Number of items	Score Interpretation & Psychometrics	Additional Information
			• Test-retest reliability = 0.90	

Note: PSQI, Pittsburgh Sleep Quality Index; FOSQ, Functional Outcomes of Sleep Questionnaire

Table 2

Subjective Assessment Measures for Insomnia

Measure	Purpose	Number of items	Score Interpretation & Psychometrics	Additional Information
Consensus Sleep Diary ³³	<ul style="list-style-type: none"> To gather information about sleep patterns: sleep onset latency, wakefulness after initial sleep onset, total sleep time, total time spent in bed, sleep efficiency, and sleep quality or satisfaction 	<ul style="list-style-type: none"> Eight core questions with space for open-ended comments from the respondent 	<ul style="list-style-type: none"> Still needs to be tested, refined, and validated 	<ul style="list-style-type: none"> Two optional versions exist with seven additional questions: 1. completed entirely in the morning and 2. completed in the morning and before bed Available in the original publication³³
Insomnia Severity Index ^{34,35}	<ul style="list-style-type: none"> Assess the severity and impact of insomnia 	<ul style="list-style-type: none"> 7 items self-rated on 5 point Likert scale Scale scores range from 0 = no difficulty to 4 = very difficult 	<ul style="list-style-type: none"> Total scores can be categorized into 0–7 = no clinically significant insomnia, 8–14 = subthreshold insomnia, 15–21 = moderate clinical insomnia, and 22–28 = severe clinical insomnia Scores of 10 have a sensitivity of 86.1% and specificity of 87.7% for detecting insomnia cases Internal consistency: Cronbach $\alpha = 0.90$ 	<ul style="list-style-type: none"> Available in English, Spanish, French, and Arabic Time to complete: 5 minutes Use with permission: Charles M. Morin, PhD cmorin@psy.ualaval.ca

Table 3
Subjective Assessment Measures for Obstructive Sleep Apnea and Restless Leg Syndrome

Measure	Purpose	Number of items	Score Interpretation & Psychometrics	Additional Information
<i>Obstructive sleep apnea</i>				
Berlin Questionnaire ³⁸	<ul style="list-style-type: none"> To screen patients for OSA 	<ul style="list-style-type: none"> 10-items in addition to BMI and history of hypertension 	<ul style="list-style-type: none"> Items fall into three categories: snoring and witnessed apnea, daytime fatigue and sleepiness, and history of hypertension and/or obesity High risk for OSA if two or more categories are considered high risk Being at high risk predicted an AHI > 5 with a sensitivity of 86% and specificity of 77% Internal consistency: Cronbach α ranges from 0.86 to 0.92 	<ul style="list-style-type: none"> Time to complete: 5 minutes Use with permission from the American College of Physicians
OSA50 ³⁹	<ul style="list-style-type: none"> To screen patients for OSA 	<ul style="list-style-type: none"> 4 items: waist circumference, snoring, witnessed apneas, and age 	<ul style="list-style-type: none"> Score of 5 predicts the probability of OSA Score of 5 has a sensitivity of 88% and specificity of 61% for predicting OSA 	<ul style="list-style-type: none"> Time to complete: 5 minutes Use with permission: C.L. Chai-Coetzer, MD chingli.chai@health.sa.gov.au
<i>Restless legs syndrome</i>				
International Restless Legs Syndrome Scale ⁴²	<ul style="list-style-type: none"> Evaluate the severity of RLS related symptoms and their impact on sleep quality, daily affairs, and mood 	<ul style="list-style-type: none"> 10-item self-rated on Likert scale Scale score range from 0 = no symptoms to 4 = very severe symptoms 	<ul style="list-style-type: none"> Higher total scores indicate worse severity and impact of RLS symptoms Internal consistency: Cronbach α ranges from 0.93 to 0.95 	<ul style="list-style-type: none"> Use with permission: Mapi Research Trust http://www.mapi-trust.org/

Note: OSA, obstructive sleep apnea; RLS, restless legs syndrome

Table 4

Objective Sleep Measures

Measure	Description	Purpose	Advantages	Disadvantages
Actigraphy ⁴³	<ul style="list-style-type: none"> About the size of a wristwatch, usually worn on the non-dominant wrist Records the presence and/or amplitude of movement Used with a sleep diary to help score sleep onset and awakening 	<ul style="list-style-type: none"> To study sleep-wake patterns and circadian rhythms by assessing movement 	<ul style="list-style-type: none"> May provide a measure of a patient's sleep that more closely approximate habitual sleep patterns Can monitor for multiple days and nights High concordance in total sleep time between actigraphy and PSG May detect periodic limb movements in sleep if placed on the ankle or great toe 	<ul style="list-style-type: none"> Less reliable estimates of sleep onset latency than PSG Cannot be used to stage sleep Cannot determine sleep related breathing disorders
In-laboratory PSG ⁴⁴	<ul style="list-style-type: none"> Overnight sleep study using standard PSG recording montage monitors 	<ul style="list-style-type: none"> To assess sleep architecture and characteristics Used to diagnosis sleep disorders and titrate treatment of positive airway pressure Used to diagnose narcolepsy, parasomnias such as REM sleep behavior disorder, and sleep related seizure disorder 	<ul style="list-style-type: none"> "Gold standard" for the diagnosis of OSA according to the American Association of Sleep Medicine⁴⁴ 	<ul style="list-style-type: none"> Expensive Setting not representative of home environment
In-home sleep testing ⁴⁶	<ul style="list-style-type: none"> Alternative PSG using portable, unattended monitors in patients' home environment 	<ul style="list-style-type: none"> Used to diagnose OSA in a limited group of patients with a high probability of moderate to severe OSA 	<ul style="list-style-type: none"> An alternative diagnostic test for OSA involving less clinician resources and expenses Useful for diagnosing OSA in patients for whom in-laboratory PSG is not feasible 	<ul style="list-style-type: none"> Not recommended for persons with significant comorbid conditions or other suspected sleep disorders
Multiple Sleep Latency Test ⁴⁸	<ul style="list-style-type: none"> Measure of the ability or tendency to fall asleep using in-laboratory PSG 	<ul style="list-style-type: none"> Used to diagnose narcolepsy and idiopathic hypersomnia 	<ul style="list-style-type: none"> Validated objective measure of excessive sleepiness 	<ul style="list-style-type: none"> Not routinely used for diagnosis of OSA or assessment of response to CPAP treatment Not routinely used for evaluation of sleepiness in medical and neurological disorders or insomnia

Note: PSG, polysomnography; REM, rapid eye movement; CPAP, continuous positive airway pressure

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