January 2022: Sleep Disorders

Instructions

The January 2022 JFD training in mental health is focused on sleep as it relates to firefighters.

Read: Please read the attached lesson plan, article from Firehouse Magazine, and the journal article related to the Sleep Disorder Checklist-25 (SDS-25) self-survey prior to discussing them with your crew.

Discussion: Officers, please gather your firefighters and review the Sleep Disorder Symptom Checklist-25 (SDS-25) self-survey. This survey is a self-assessment tool used by professionals, especially primary care providers in the field of medical sleep study. It screens for a variety of sleep disorders and has been shown to be valid (Klingman et al., 2017a; 2017b).

Please discuss the content of the training in any way you feel appropriate. There is no wrong way to complete this straining besides not doing it. It is hoped that the article and survey will promote discussion. There are discussion questions in the lesson plan if they are needed to spur conversation. They are not required. If the firefighters voices problems or concerns, it is recommended that they speak to their primary care healthcare provider.

References

Czeisler, C., Barger, L., & O'Brien, C. (2019, February). Managing sleep, health, and safety. *Firehouse*, *44*(2), 44–48.

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Klingman, K. J., Jungquist, C. R., & Perlis, M. L. (2017b). Questionnaires that screen for multiple sleep disorders. *Sleep Medicine Reviews, 32*, 37–44. https://doi.org/10.1016/j.smrv.2016.02.004

JFD MENTAL HEALTH LESSON PLAN

Level: All	Subject: Mental Health	Month: January 2022

Topic: Sleep Disturbance: Cognitive/Affective Domains	Lesson: #22-01. Time: 20 minutes

Lesson Focus & Goals: To discuss sleep disturbance issues in the fire service and allow the firefighter to complete a self-assessment in order to gauge their sleep patterns and the potential need for evaluation.

Materials Needed: Firehouse Article, Sleep Disorder Symptom Checklist-25 Questionnaire

Learning Objectives:

1. Discuss common barriers to effective sleep in firefighters.
2. Assess individual sleep issues via the provided questionnaire.
3. Contact primary health provider if concerned about personal results.

Structure / Activity:

Read: Please read the attached article from Firehouse Magazine prior to the training session.

Discussion: Officers, please gather your firefighters and review the SDSC-25 sleep self-survey. This survey is a self-assessment tool used by many professionals including primary care physicians. It screens for a variety of sleep disorders and has been shown to be valid (Klingman et al., 2017a). It is hoped that the article and survey will promote discussion among the firefighters and help find potential problems in the firefighters sleep habits early that may require physician assessment.

THIS ASSESSMENT IS FOR THE FIREFIGHTER'S PERSONAL USE ONLY AND **IS NOT TO BE SUBMITTED** TO THE FIRE DEPARTMENT.

Assessment: Discussion Questions

In the event discussion does not take place due to non-participation, the following discussion questions may be asked of the crew.

1. What do you, as a firefighter, find to be the biggest challenge related to sleep?
2. Has this challenge changed over the course of your career?
3. Do you have any personal strategies for managing sleep issues that you would like to share to help your fellow firefighters?
4. Are there any recommendations you have for improving sleep-related issues on the Joliet Fire Department?

Resources: Czeisler, C., Barger, L., & O'Brien, C. (2019, February). Managing sleep, health, and safety. Firehouse, 44(2), 44–48.

Klingman, K. J., Jungquist, C. R., & Perlis, M. L. (2017a). Introducing the sleep disorders symptom checklist-25: A primary care friendly and comprehensive screener for sleep disorders. Sleep Medicine Research, 8(1), 17–25. https://doi.org/10.17241/smr.2017.00010

Klingman, K. J., Jungquist, C. R., & Perlis, M. L. (2017b). Questionnaires that screen for multiple sleep disorders. Sleep Medicine Reviews, 32, 37–44. https://doi.org/10.1016/j.smrv.2016.02.004

By Charles Czeisler, Laura Barger & Conor O'Brien,
in conjuction with Orange County, FL, Fire Rescue

Sleeping in shared or dormitory-style rooms can make restful sleep difficult to achieve.
Photo courtesy Orange County, FL, Fire Rescue

Managing Sleep, Health & Safety

What's the right approach for your department?

Heart attacks and motor vehicle crashes are the two leading causes of death in firefighters. Sleep deficiency—whether instigated by short sleep duration, circadian misalignment associated with working overnight shifts, or a sleep disorder—increases the risk of these two adverse health and safety outcomes.

These and other negative consequences of sleep loss are of major concern, with more than half of firefighters reporting sleep disturbances.

Sleep deficiencies: a national snapshot

There are several aspects of firefighting that make obtaining sufficient quantity and quality of sleep particularly challenging for firefighters. First, firefighting requires 24-hour coverage, 7 days per week, 365 days each year, and most firefighters work 24-hour shifts. The number of alarms sounded each shift and policies restricting on-duty daytime sleep may limit sleep duration on duty. Even when permitted, daytime sleep following night work is more difficult due to light streaming through windows, noise at the fire station, and the circadian clock's push for wakefulness during the day. Further, the circadian disruption inherent in shift work has been associated with an increased cancer risk. Finally, firefighters often live together while on duty at the fire station, often sleeping in the same room. Therefore, when one firefighter or paramedic is awakened for or returns from duty, makes noise or snores loudly, the sleep of others may be disturbed.

A nationwide survey of nearly 7,000 firefighters in 66 fire departments across the country found that 37 percent of firefighters were at high risk for a common sleep disorder. More than one out of four firefighters (28 percent) screened positive for obstructive sleep apnea (OSA), which is commonly associated with loud snoring. Nearly one in 10 (9 percent) screened positive for insomnia, with another 6 percent screening positive for shift work disorder and 3 percent for restless leg syndrome.

Those firefighters who screened positive for a sleep disorder had twice the risk of a motor vehicle crash, near-crash or falling asleep while driving. They were also more than twice as likely to have cardiovascular disease, almost twice as likely to have diabetes, and more than three times as likely to have depression or anxiety. Common sleep disorders are easily treated, but alarmingly, 83 percent of firefighters who screened positive for a sleep disorder were undiagnosed and untreated.

CHARLES A. CZEISLER, PhD, MD, is the director of the Sleep Matters Initiative, chief of the Division of Sleep and Circadian Disorders at Brigham and Women's Hospital, and the director of the Division of Sleep Medicine at Harvard Medical School.

LAURA K. BARGER, PhD, is an associate physiologist in the Division of Sleep and Circadian Disorders at Brigham and Women's Hospital and an assistant professor at Harvard Medical School.

CONOR O'BRIEN is a senior project manager in the Division of Sleep and Circadian Disorders at Brigham and Women's Hospital.

Sleep Matters Initiative

Fatigue education and awareness training programs are already required in commercial aviation, and similar programs have been instituted successfully for railroad workers, truck drivers and nurses. In an effort to improve the health and safety of firefighters, the Sleep Matters Initiative at Brigham Health in Boston, MA, offers a sleep health education and sleep disorders screening program tailored for firefighters. The program includes presentations on the basics of sleep and circadian rhythms, strategic use of caffeine, napping and other fatigue countermeasures, descriptions and screening for common sleep disorders, and sleep health monitoring.

In a randomized trial of a sleep health education and sleep disorders screening program in the Columbus, OH, Fire Department, firefighters assigned to stations that received such a program reported 46 percent fewer disability days than those assigned to control stations. Firefighters who received the education were also 24 percent less likely to report an injury than firefighters who did not receive the training. In a department of approximately 1,200 active firefighters, such a reduction in disability day usage translates into an estimated annual savings of $2.1 million, not including the medical costs and human suffering associated with injury and disability.

Further, considering the differences among fire departments—number of firefighters, the number of trainers, the experience in implementing wellness programs, and technology available in firehouses—we compared three different methods of administering the sleep health and education program using three different methods:

- Expert-led: The research team presented the sleep health education and sleep disorders screening program in-person.
- Train-the-Trainer: Fire department trainers attended a two-day course taught by the research team and then lead the program in their department.
- Online: The program was provided via website.

In each method, firefighters listened to the educational program and then were screened for common sleep disorders. Those who scored at risk for one or more sleep disorders were notified either by mail or online, and encouraged to seek additional evaluation from a board certified sleep specialist in their area (sleep education.org/find-a-facility).

Eight fire departments enrolled in this part of the study: two Expert-led departments, two Train-the-Trainer departments and four Online departments. Although all groups showed improvement in the knowledge of sleep-related topics following the education, the Expert-led group had the highest improvement rate. Firefighters in the Expert-led departments were also twice as likely to seek clinical evaluation if identified as at risk for a sleep disorder.

In all groups, the majority of firefighters rated the program as important, and indicated that the information was useful and that they would recommend the program to other fire departments. At the conclusion of the study, 42 percent of firefight-

ers participating in focus groups reported that they had positive changes in their sleep behavior, such as paying more attention to their fatigue level, improving their sleep environment and taking more naps.

In all methods, there are challenges associated with the use of such programs in operational fire departments. Scheduling all firefighters for additional training when they already have heavy training loads can be difficult. Confidentiality is required for sleep disorders screening, and this portion of the program may be more accepted by firefighters when it is done by a group outside the fire department administration.

The challenges, however, are vastly outweighed by the potential improvement in the health and safety of firefighters. The sleep health education and screening program is not "one size fits all"; rather the methods can be modified to meet the department's needs. Each fire department should select the method that is best suited for conducting a program in order to successfully improve the health and safety of their firefighters. Implementing sleep health education and sleep disorders screening in fire departments could lead to a decrease in crashes, accidents, injuries, lost work time and poor health outcomes in firefighters, and provide major cost savings for fire departments.

Implementation strategies

As a progressive, data-driven fire department, Orange County, FL, Fire Rescue (OCFR) regularly participates in high-level research efforts that impact the profession. Operation Stay Alert—developed by sleep scientists at Brigham Health and Harvard Medical School in Boston, and supported by a FEMA Assistance to Firefighters (AFG) grant—was poised to add a body of knowledge about an important topic that would benefit firefighters nationwide.

The department was selected to participate in the Train-the-Trainer model, in which the Brigham Health/Harvard team trained its firefighter safety staff members, who then taught classes to the rest of the firefighters in the department.

Training focused on educating OCFR participants about the risks of sleep deprivation and sleep disorders in firefighters, and how to manage them more effectively. This included topics ranging from sleep hygiene, post-shift recovery sleep, and in-station sleep patterns.

OCFR had a high degree of participation, driven by our assurance of strict confidentiality. Initially, firefighters were concerned that issues identified could impact their career if released to management. There was also concern as to whether findings would be a catalyst to alter the highly preferred 24-hour shift schedule. However, no identifiable personal information was given to the management team; only de-identified aggregate data was summarized in reports. This anonymity reinforced to participants the department's commitment to both their health and their privacy.

With the help of the Sleep Matters Initiative team at Brigham Health and Harvard Medical School, OCFRs peer fitness trainers have become subject-matter

experts, and having that asset moving forward proved to be a key benefit of using the Train-the-Trainer model.

Furthermore, the department unexpectedly found a study within the study that provided an additional benefit. The partnership with the Brigham Health/Harvard team provided a clearer understanding of the limitations and benefits of each available training delivery model. Following the study, OCFR adopted all three methods of training models, and regularly discusses the options when coordinating its own training efforts.

For example, Expert-led classes are provided for live-fire exercises and other critical, high-risk skills. In the Expert-led model, full-time training officers and credentialed adjunct instructors personally lead training evolutions. Crews attending Expert-led training are taken offline, where they can focus on the training material without interruption. Although this training model can be more costly, it is important to consider when clear, consistent messaging and trainer expertise is critical to life safety.

The Train-the-Trainer model is used for efforts such as instruction on the operation of new equipment and ongoing skill maintenance and reinforcement. In this method, a group of battalion chiefs, captains, or firefighters can be trained prior to delivering the training to crews at the station level. This model allows instructors to train in-service crews without taking units offline. Although crews are available to respond to emergency calls during Train-the-Trainer-delivered classes, these interruptions in drills can hamper training efforts.

For time-sensitive topics in which the department needs to reach all 1,300 employees rapidly, such as for notification of policy updates or prerequisite training required prior to expert-led efforts, Online training is often used. With this model, information can be quickly disseminated, and verification of training completion obtained through the department's Learning Management System. However, distractions can affect the retention of information provided during online training.

The High Price of Sleep Problems

Sleep disorders and sleepiness cost the United States approximately $411 billion annually. The National Safety Council and the Brigham Health Sleep Matters Initiative have launched a Fatigue Cost Calculator (nsc.org/tiredatwork) to enable individual employers to estimate the economic impact of sleep disorders and sleep deficiency among their employees. The calculator itemizes for individual employers the increased healthcare costs associated with undiagnosed and untreated obstructive sleep apnea and chronic insomnia. It also estimates the increased fatigue-related costs of accidents, motor vehicle crashes and injuries, and absenteeism.

Another key implementation following the Brigham Health/Harvard study is within the department's Safety & Wellness Program. The program now incorporates the role of cardiac health and other sleep-related topics into its wellness educational programs. Beginning with recruit school, the department's wellness coordinator educates recruits about the importance of sleep and fatigue management. Ongoing education by the Safety & Wellness program promotes to all firefighters how to use their time off between shifts to recover effectively.

Following the study, Orange County Fire Rescue adopted many principles of fatigue risk management and expanded the fatigue policy in its standard operating procedures (SOPs) and collective bargaining agreement. Rules include limitations on overtime and mandatory rest periods before and after work shifts.

Lessons learned: practical application of the study

OCFR identified several actionable steps that could be implemented for the improved health of its members:

- It is the department's goal to effectively train, reinforce and support the principles of sleep hygiene.
- The department has implemented a state-of-the-art station alerting system so only responding crews are affected by station tones and lighting. Each bunk is programmed by unit responding. For example, if the rescue crew gets a call and the engine isn't required to respond, the engine crew is not disturbed by station tones.
- During extended operations, incident action plans (IAPs) are broken into operational periods of front-line crews, and incident commanders are rotated out for rest.
- Individual bunk rooms outfitted with blackout shades and sound-attenuating walls should be used instead of group sleeping areas. OCFR has created division walls between bunks as buffers in existing stations. All future fire station designs provide for individual sleep rooms.
- Compensatory daytime sleep is encouraged between calls for service at the fire department. NASA has demonstrated in commercial aviation that cockpit napping is one of the best ways to improve performance from top-of-descent to landing.
- Continuous positive airway pressure (CPAP) systems, a treatment that uses mild air pressure to keep airways open, are regularly used at the stations by those who suffer from sleep apnea to improve health and safety for affected firefighters, and to reduce snoring and thereby minimize sleep disruption to other firefighters.

Crews have been instructed in a CRM approach to vehicle operation in which all crewmembers assist the driver in staying alert and watching for unseen hazards while driving.

- Research showed low-dose caffeine over a longer period of time is the most effective manner of maintaining alertness during extended bouts of wakefulness. The department includes caffeine education, including instruction on the risks of the overuse of caffeine, during annual fitness assessments, multi-company drills and live-fire burn training. Vitals are taken prior to physical training, and firefighters who exceed the maximum blood pressure levels are ineligible to participate.
- The department continually promotes self-awareness and supervisory responsibility in recognizing indicators of fatigue. A formal rehab process and Rehab Unit are in place for field personnel. These include rotation of crews for fatigue as well as providing proper nutrition, hydration, vital checks and cooling mechanisms on fire scenes, during extreme heat and for extended operations.
- Crews have been instructed in a crew resource management (CRM) approach to vehicle operation in which all crewmembers assist the driver in staying alert and watching for unseen hazards while driving.

Final thoughts

Despite firefighters' expectations to the contrary, they are not superhuman and do require quality sleep to perform optimally. Chronic sleep deficiency can increase the risk of a variety of serious health disorders, making fatigue management every bit as critical to firefighter wellness as using breathing apparatus, eye protection and gloves.

In an industry that demands long work shifts in which firefighters provide service both day and night, interruption of normal sleep habits is inevitable. However, much can be done through sleep health education, screening for common sleep disorders, individual awareness, management philosophy and operational procedures to mitigate the effects of sleep deficiency. The end goal, after all, is to both survive and thrive for a 30-year career.

To learn more about the Sleep Matters Initiative, visit BrighamandWomens.org/SleepMatters. ■

References

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ORIGINAL ARTICLE

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Introducing the Sleep Disorders Symptom Checklist-25: A Primary Care Friendly and Comprehensive Screener for Sleep Disorders

Karen J. Klingman, PhD, RN[1], Carla R. Jungquist, PhD, FNP-BC[2], Michael L. Perlis, PhD[3,4]

[1]SUNY Upstate Medical University College of Nursing, Syracuse, NY, USA
[2]University at Buffalo (SUNY Buffalo) School of Nursing, Buffalo, NY, USA
[3]Department of Psychiatry, University of Pennsylvania, Behavioral Sleep Medicine Program, Philadelphia, PA, USA
[4]University of Pennsylvania School of Nursing, Philadelphia, PA, USA

Background and Objective With sleep disorders highly prevalent and associated with poor health outcomes, screening for sleep disorders in primary care could reduce the burden of chronic diseases and costs of health care. Currently, a brief comprehensive primary-care-friendly multiple-sleep-disorders screening instrument is not available. The Sleep Disorders Symptom Checklist (SDS-CL)-17, a single-page instrument, was developed to screen for six sleep disorders (insomnia, obstructive sleep apnea, restless legs syndrome/periodic limb movement disorder, circadian rhythm sleep-wake disorders, narcolepsy, and parasomnias) and evaluated psychometrically. SDS-CL-17 psychometrics are reported. The resulting development of a more comprehensive single-page 25-item instrument, the SDS-CL-25, based on validation study results is described. Approaches for clinical use of the SDS-CL-25 are recommended.

Methods A cross-sectional study using nested data from two previous research studies (n = 395 sleep clinic referrals and n = 299 community volunteers) was used. SDS-CL-17 subscale scores and physician diagnoses were analysed using receiver operator characteristic curves. Resulting cut-point scores determined sensitivities/specificities. Study subject interview data were used to assess patient-friendliness of the instrument.

Results Sensitivities/specificities for the diagnosed sleep disorders ranged from 0.64 to 0.88. Interviewees endorsed the instrument as user-friendly.

Conclusions While the SDS-CL-17 is useful, the SDS-CL-25 assesses for a much larger number of sleep disorders yet retains brevity and is therefore recommended for ongoing clinical use. Psychometric evaluation of the SDS-CL-25 continues.

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Key Words Sleep, Sleep wake disorders, Primary health care, Preventive health services, Diagnosis.

INTRODUCTION

Sleep disorders, if untreated, increase the risk for the development of obesity, diabetes, cardiovascular disease, and depression and negatively impact the course and treatment of these chronic conditions once developed.[1-4] With the prevalence of sleep disorders at 10–40% in the general population,[5] the detection and treatment of sleep disorders is important for the maintenance of wellness and may serve as a means to reduce the onset and burden of chronic diseases and the overall cost of health care. As important as this opportunity for prophylaxis may be, most medical providers do not inquire about their patients' sleep quality or quantity. This may be due, in part, to a lack of training and expertise regarding the assessment and treatment of sleep disorders. This may also be due to the understandable constraints on providers' time in primary care settings. Time constraints could be overcome, however, if a brief, comprehensive and psychometrically sound sleep disorders screening questionnaire were available. If this were the case, then it might be possible to put the assessment of sleep disorders into regular practice in a manner that is akin to what has occurred with depression in the last decade. That is, with the advent of brief screeners for depression, e.g., the nine-item Patient Health Questionnaire (PHQ-9),[6,7] it became possible to assess for depression in the primary care setting. In the case of sleep disorders, the screening process is complicated by the fact that not one,

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Correspondence
Karen J. Klingman, PhD, RN
SUNY Upstate Medical University,
College of Nursing, 750 East Adams Street,
Syracuse, NY 13210, USA
Tel +1-585-208-5336
Fax +1-315-464-5168
E-mail klingmak@upstate.edu

but multiple disorders need to be evaluated.

To date, several attempts have been made to create a comprehensive self-report sleep disorders assessment tool. In a recent review of these instruments,[8] seven were identified as comprehensive screeners but only one was found to be relatively comprehensive, brief and psychometrically sound: the Global Sleep Assessment Questionnaire (GSAQ).[9] This instrument assesses for four sleep disorders, excessive daytime sleepiness (EDS) and impaired daytime function and is especially user-friendly for primary care settings because of its single-page layout and grid format with a header design that captures patient characteristics such as work schedule. The GSAQ, however, is not truly comprehensive as it does not assess for circadian rhythm disorders, narcolepsy, nightmare disorder, night terror disorder, rapid eye movement (REM) sleep behavior disorder, or sleep-related temporomandibular joint disorder (TMJ). Further, it does not provide for an evaluation of initial, middle, or late insomnia. During the early 2000s, and in parallel with the development of the GSAQ, a research screener called the Sleep Disorders Symptom Checklist (SDS-CL)-17 was developed. This instrument covered six categories of sleep disorders in a single-page grid layout. Recently, this instrument underwent psychometric evaluation to assess its degree of concordance with polysomnography and physician diagnoses. The purpose of the present report is to 1) summarize the findings from this evaluation, 2) describe how these findings led to the development of the SDS-CL-25, and 3) explain the plan for the ongoing validation of the SDS-CL-25.

METHODS

Study Design and Participants

This cross-sectional study used nested data of samples from two previous research studies: 1) Who had been referred by primary care providers to a sleep clinic for confirmatory sleep disorder diagnoses (n = 395)[10] and 2) Community volunteer participants in a study that included diagnosing for obstructive sleep apnea (OSA) and insomnia as part of its protocol (n = 299).[11] Data for the sleep clinic patients was obtained in New York State and Illinois between 2009–2011 as part of the regular intake procedure for several clinical practices; data were collected in sequence for all incoming patients with no inclusion/exclusion criteria. Data for the community sample were collected in New York State between 2012–2014. The community volunteer study utilized actigraphy, home respiratory sleep tests, questionnaires, and sleep diaries; exclusion criteria were previous sleep disorder diagnosis, or use of continuous positive airway pressure or supplementary oxygen while sleeping.

The use of these data for a validation study was approved by the Institutional Review Board at the State University of New York at Buffalo.

Measures

Subject characteristics

Measures collected in both samples (n = 694 total) were age, sex, height and weight; body mass index (BMI) was calculated from height and weight. For the community sample only, race, ethnicity, and educational level were also collected. All subjects completed the SDS-CL-17 (see below), and were characterized for daytime sleepiness using the Epworth Sleepiness Scale (ESS).[12] The community volunteers were evaluated for insomnia symptoms using the Insomnia Severity Index (ISI).[13] Study participants were interviewed about the content and ease-of-use of the SDS-CL-17. The major outcome variables for the study were 1) SDS-CL-17 subscale scores (see below), 2) expert diagnostic assessments for each disorder, 3) receiver operator characteristics (ROC) curve determined thresholds for the six SDS-CL-17 subscale scores, and 4) patient assessments regarding the ease-of-use of the SDS-CL-17.

The Sleep Disorders Symptom Checklist-17

The SDS-CL-17 was developed as a paper instrument to screen potential research study participants for six categories of sleep disorders: insomnia, OSA, restless legs syndrome/periodic limb movement disorder (RLS/PLMD), circadian rhythm sleep-wake disorders, narcolepsy, and parasomnias. The instrument text is laid out as a grid on an 8.5 × 11 single sided page and requires about 1–3 minutes for completion. Questions and response options were based on international classification of sleep disorders (ICSD)-2 and DSM-IV diagnostic criteria[14] and expert opinion. Symptoms are framed as simple statements, e.g., "I am awake 30 or more minutes during the night", with subjects asked to rate how frequently the statement is of relevance for them. The time frame for responses is "over the course of the last year" and the rating scale (response options) ranges from "never" to "frequently (> 3 x/week)". The symptom items and response options are arrayed so that completed questionnaires form a grid of "X" mark patterns depending on the participants' sleep disorder diagnoses. Each of the 17 statements are clustered by disorder (Fig. 1) with 4 items dedicated to insomnia disorder, 4 for OSA, 3 for RLS/PLMD, 2 for circadian rhythm sleep-wake disorders, 2 for narcolepsy, and 3 for parasomnias. Summing the items per subscale adds to 18 (vs. 17) because one of the 17 items is used for both OSA and insomnia. The subscale scores are determined by summing responses in each subscale (Fig. 1, lower portion).

Expert diagnoses

Sleep disorder diagnoses were obtained for both samples. The sleep clinic diagnoses were determined by a board certified sleep medicine physician based on in-lab polysomnography, questionnaires, and interviews. The community sample diagnoses were provided by a board certified sleep medicine physician

	Over the past year: (place an X in the box)	Never	Seldom (1 × yr)	Sometimes (1–3 × mo)	Often (1–3 × wk)	Frequently (> 3 × wk)
1	In takes me 30 minutes or more to fall asleep.					
2	I am awake 30 minutes or more during the night.					
3	I am awake 30 minutes or more prior to my scheduled wake time or alarm.					
4	I am tired, fatigued or sleepy during the day.					
5	I sleep better if I go to bed before 9:00 pm and wake up before 5:30 am.					
6	I sleep better if I go to bed late (after 1:00 am) and wake up late (after 9:00 am).					
7	I fall asleep at inappropriate times or places.					
8	I have been told that I snore.					
9	I wake up during the night choking or gasping.					
10	I have been told I stop breathing when I sleep.					
11	I feel uncomfortable sensations in my legs, especially when sitting or lying down that are relieved by moving them.					
12	I have an urge to move my legs that is worse in the evenings and nights.					
13	I wake up frequently during the night for no reason.					
14	I have experienced sudden muscle weakness when laughing, joking, angry or during other intense emotions.					
15	I have been told that I walk, talk, eat or act strange or violent while sleeping.					
16	I have nightmares.					
17	For no reason, I awaken suddenly, startled, and feeling afraid.					

This is the SDS-CL-17 instrument that is printed on an 8.5 × 11" sheet of paper. The text below shows how to score each item, and the subscale score above which a positive screen is indicated. Cut-point score determination is described in the methods and results sections, but are included here for completeness.

Item choice	Item score	Subscale	Items to sum for subscale score	Subscale score range	Cut-point score
Never	0	Insomnia	1, 2, 3, 4	0–12	5
Seldom	0	Circadian rhythm	5, 6	0–6	-
Sometimes	1	Narcolepsy	7, 14	0–6	1
Often	2	Obstructive sleep apnea	4, 8, 9, 10	0–12	3
Frequently	3	Restless legs syndrome	11, 12, 13	0–9	3
		Parasomnias	15, 16, 17	0–9	-

Fig. 1. The Sleep Disorders Symptom Checklist (SDS-CL)-17 instrument and scoring guide.

based on actigraphy, home respiratory sleep tests, questionnaires, and sleep diaries. For the community volunteers, a diagnosis of OSA, in general, corresponded to an apnea hypopnea index of 5 or greater, and a diagnosis of insomnia, in general, corresponded to an ISI score of 10 or greater; however, the physician also utilized clinical judgement which may have been informed by actigraphy data, diaries, and questionnaire responses.

Receiver operator characteristic curve determined cut-points

Cut-point scores for each SDS-CL-17 subscale were determined using ROC curve analyses,[15,16] with cut-points based on the ROC curve inflection. The ROC curve analyses were performed with sleep disorder diagnosis as the state variable and SDS-CL-17 subscale score as the test variable. For each ROC curve, area under the curve (AUC) with 95% confidence intervals was also obtained. Sensitivity and specificity for each subscale were determined using ROC-determined cut-point scores.

Participants' assessments

A subset (n = 8) of the community participants had been queried in one-on-one interviews about the SDS-CL-17. Interviewees ranged from 33–73 years old, were 50% female, 75% Caucasian, with educations from high school through post-bachelor's degree; half of the interviewees were diagnosed with OSA and half with insomnia during the community volunteer study. A pre-set list of questions was asked about the SDS-CL-17 regarding impressions of response options, item wording, and ease of completion. Interview notes of participants' responses were explored for key findings.

Data management and statistics

All data were provided for use in this study as SPSS data files. The data files as received included no personally identifiable information and were stored on a secure server at SUNY Buffalo. SPSS version 22 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses.

RESULTS

Sample Characteristics

The total number of subjects used for this validation study was n = 694 (Table 1). The overall sample was 56% female averaging 45 years old with average BMI of 31.7. The sleep clinic pa-

Table 1. Subject demographics, SDS-CL-17 subscale scores, and sleep disorder diagnoses

Characteristic	Community volunteers (n = 299)	Sleep clinic patients (n = 395)	Total (n = 694)
Age, mean (SD)	40 (17)	48 (13)	45 (16)
Sex (proportion female)	68%	48%	56%
Body mass index, mean (SD)	27 (6.0)	35 (8.5)	31.7 (8.5)
Epworth Sleepiness Scale, mean (SD)	6.9 (4.8)	11.2 (5.3)	9.3 (5.5)
SDS-CL subscale scores, mean (SD)			
Obstructive sleep apnea	5.5 (2.6)	9.3 (3.5)	7.8 (3.7)
Insomnia	7.5 (3.1)	9.3 (3.5)	8.5 (3.5)
Circadian rhythm disorder	2.2 (1.6)	2.3 (1.7)	2.2 (1.6)
Restless legs syndrome	3.3 (2.3)	4.9 (3.3)	4.2 (3.0)
Narcolepsy	0.9 (1.3)	2.0 (1.7)	1.5 (1.6)
Parasomnias	2.0 (2.0)	2.8 (2.6)	2.5 (2.4)
Diagnosed with obstructive sleep apnea, proportion (numbers)	27% (n = 77 dx, 283 valid)	85% (n = 334 dx, 395 valid)	61%
Diagnosed with chronic insomnia disorder, proportion (numbers)	24% (n = 163 dx, 298 valid)	55% (n = 299 dx, 395 valid)	37%
Dual dx obstructive sleep apnea and insomnia, proportion (numbers)	14% (n = 39 dx, 283 valid)	14% (n = 56 dx, 395 valid)	14%
Diagnosed with circadian rhythm sleep-wake disorder, proportion (numbers)	N/A	0%	-
Diagnosed with restless legs syndrome, proportion (numbers)	N/A	7% (n = 28, 395 valid)	-
Diagnosed with narcolepsy, proportion (numbers)	N/A	2% (n = 8, 395 valid)	-
Diagnosed with parasomnias, proportion (numbers)	N/A	0%	-

dx: diagnosed, N/A: not available or not assessed, SD: standard deviation, SDS-CL-17: Sleep Disorders Symptom Checklist-17.

tients were significantly heavier (BMI of 35 vs. 27, $p < 0.001$) and reported more daytime sleepiness (ESS of 11.2 vs. 6.9, $p < 0.001$) in comparison to the community volunteers. This is not unexpected, as the sleep clinic patients had been referred to the sleep clinic for confirmatory diagnosis of sleep disorder(s), some of which (e.g., OSA) tend to be more prevalent as BMI increases. Similarly, patients referred to sleep clinics would be expected to report higher levels of daytime sleepiness, on average, in comparison to a sample from the community at large.

SDS-CL-17 Scores

As can be seen in Table 1, the SDS-CL-17 subscale scores indicate what might be expected for the two samples: the sleep clinic patients, on average, scored higher on all six sleep disorder subscales than the community sample.

Expert Diagnoses

Among all study participants, none were diagnosed with either circadian rhythm sleep-wake disorders or parasomnias. OSA was the most prevalent sleep disorder in the total sample (61%) as well as for the community volunteers (27%) and sleep clinic referrals (85%). The next most prevalent diagnosis was insomnia (37% overall, 24% of community volunteers, 55% of sleep clinic patients). Interestingly, 14% of all study subjects received dual diagnoses of both OSA and insomnia. Among the sleep clinic participants, 7% were diagnosed with RLS and 2% with narcolepsy.

Receiver Operator Characteristic Curve Determined Cut-Points

Cut-point scores (above which a positive screen is indicated) were: 5 for insomnia disorder, 3 for OSA, 3 for RLS/PLMD, and 1 for narcolepsy. Using these cut-point scores, sensitivity/specificity/AUC (95% confidence intervals) for each subscale were: 1) 0.70/0.64/0.72 (0.69–0.76) for insomnia disorder, 2) 0.74/0.67/0.76 (0.72–0.80) for OSA, 3) 0.75/0.80/0.88 (0.83–0.93) for RLS/PLMD, and 4) 0.88/0.68/0.79 (0.65–0.93) for narcolepsy.

Participants' Assessments

Overall, study participants endorsed use of the SDS-CL-17. Instructions were reported to be easily understood and read-

able. Although only community volunteers participated in interviews, they were diagnosed with either insomnia or OSA, therefore their collective viewpoints are expected to be no different than those of the sleep clinic group. About three-fourths of the interviewees commented that remembering the past year was difficult, while others liked the idea of reporting symptoms over the last year because it was "a leveler" and allowed them to report how they usually were, without having to worry about a recent week or month being abnormal. In addition, those who reported the last year was difficult to remember indicated that their SDS-CL-17 responses represented "Whatever I'm usually like."

All the interviewed subjects stated they liked having frequencies or timeframes along with the descriptive words for response options, and that the choices seemed clear. All stated that the frequencies helped them choose how to answer. One person commented on the once a year option, "Why bother, it's so close to never is it worth mentioning?"

DISCUSSION

Given the strength of the SDS-CL-17 validation study, the 17-item instrument could be used in practice with the cut-points and scoring algorithms as described above. Patients who complete the SDS-CL-17 and yield any sleep disorder subscale score above its respective cut-point (i.e., 5 for insomnia disorder, 3 for OSA, 3 for RLS/PLMD, and 1 for narcolepsy) would warrant follow-up as described in the "Follow-up to Screening Results" section below. However, while the SDS-CL-17 is a useful instrument, continued experience with this version indicated that several changes were required to make the questionnaire more comprehensive, more clinically relevant, and more informative.

First, a document header was created to gather patient characteristics. The header requests the patient's age, sex, height, and weight. Such data provide convergent evidence with respect to some of the diagnoses (e.g., OSA is more likely to occur in males who are older adults and overweight). The header also queries about work shift, number of hours worked per week, whether the respondent has a bed partner, what the typical sleep period is (from what time to what time), how many hours of sleep the patient typically gets per night, and how many hours the patient typically spends in bed each night. The question regarding shift work is to determine if the sleep complaints (as endorsed in items 1–6 and 25) may be, in part or in total, related to "shift work sleep disorder."

Information about weekly work hours allows a means to assess "sleep opportunity." Knowing whether the patient co-sleeps identifies a potential corroborator regarding the data provided and the possibility that a bed partner may be a contributory factor. Typical sleep period is used to assess the subject's preferred sleep phase, and total sleep time has a variety of purposes including evaluation of sleep duration (whether this is within normal limits or represents a problem in and of itself) and indirect evidence for the phenomenon of sleep state misperception. Time in bed, in combination with sleep duration, provides a rough estimation of sleep efficiency and the potential need to assess further for insomnia symptoms and/or the subject's appropriateness for cognitive behavior therapy for insomnia.

Second, the response time frame was altered from "the past year" to the "last 3 months." This is not only consistent with contemporary classifications of chronic sleep disorders, but may also allow for easier, and potentially more accurate, patient responses.

Third, the rating scale was changed to be more sensitive to diagnostically relevant symptom frequencies. Specifically, the scale was shifted to refine ratings on a per-week basis and limit the per-month options; response options of "1–3 times per week", "3–5 times per week", and "> 5 times per week" were added, while "monthly" and "never" were retained. The three weekly frequencies allow differentiation between mild, moderate, and severe levels of symptomatology and the latter two frequencies represent the threshold for what is likely of clinical relevance.

Fourth, several questions were simplified. For example, one of the questions pertaining to narcolepsy was changed from "I have experienced sudden muscle weakness when laughing, joking, angry or during other intense emotions" to "When angered, humored, frightened, I experience sudden muscle weakness."

Lastly, eight questions were added, thus the SDS-CL-25 designation. Three of these questions, while not specific to any one diagnosis, provide information about sleep insufficiency, night-to-night variability sleep timing, and whether the endorsed sleep disturbance items are perceived as being related to daytime dysfunction. Two questions were added to enhance sensitivity to OSA, two to assess for narcolepsy disorder, and one to assay for bruxism.

The SDS-CL-25 Instrument

The SDS-CL-25 can be administered (by paper or online) as a single standard page instrument (8.5 × 11, one side only) and forms a grid of responses. Table 2 summarizes the SDS-CL-25 item and header content. The header captures patient data as described above. Below the header is a list of 25 symptom statements (at the fifth-grade Flesh-Kincaid reading level). Five response options are laid out as columns, so that patients can quickly scan and endorse with a "check mark" the relevant response ("never", "once a month", "1–3 times a week", "3–5 times a week", and "> 5 times a week"). Each row contains a single query and rows are clustered together to represent sleep disorders. Table 3 shows how the items are associated with the sleep disorders and functional outcomes being assessed instructions

Table 2. Item content of the SDS-CL-25

Item	Content
Header	Age, sex, height, weight
	H1: work shift
	H2: hours worked per week
	H3: presence of bed partner
	H4: amount of sleep each night
	H5: amount of time in bed each night
Q1	Work/activity interferes w/sufficient sleep
Q2	Bed or wake time variability
Q3	Time to fall asleep
Q4	Time awake during sleep period
Q5	Early awakening
Q6	Daytime sleepiness or fatigue
Q7	Prefers early bed & wake times
Q8	Prefers late bed & wake times
Q9	Inappropriately falling asleep
Q10	Snores
Q11	Morning dry mouth
Q12	Snoring interferes w/others' sleep
Q13	Stops breathing while asleep
Q14	Gasps while asleep
Q15	Leg sensations
Q16	Urge to move legs at night
Q17	Frequent nighttime awakenings for unknown reason
Q18	Muscle weakness w/strong emotions
Q19	Frightening images as awakens
Q20	Can't move as awakens
Q21	Nightmares
Q22	Wake up afraid for no reason
Q23	Strange behaviors while sleeping
Q24	Grind teeth while sleep
Q25	Sleep problems interfere with daytime function

SDS-CL-25: Sleep Disorders Symptom Checklist-25.

are to respond regarding how frequently the statements apply over the past three months.

In evolving to its current 25-item version, the instrument's depth and breadth grew beyond what might be expected by adding a short header and eight items. The SDS-CL-25 assesses for thirteen sleep disorders and four functional outcomes of sleep. The thirteen sleep disorders include insomnia (initial, middle, and late), advanced sleep phase syndrome (ASPS), delayed sleep phase syndrome (DSPS), OSA, RLS/PLMD, narcolepsy, nightmare disorder, night terror disorder, REM sleep behavior disorder, sleep-related TMJ, sleep insufficiency disorder, shiftwork sleep disorder, EDS not otherwise specified. The four functional outcomes of sleep include night-to-night variability of sleep, daytime dysfunction, and fatigue.

SDS-CL-25 Interpretation

At present the SDS-CL-25 does not have a validated scoring algorithm, this work is in progress (see future directions). This said, the interpretation method delineated in Table 3 represents a common sense approach to determining: 1) the likelihood of an individual having one or more of the 13 assessed sleep disorders, 2) the severity of presenting complaint by category, and 3) a method for assessing cumulative morbidity. With respect to the identification of one or more individual sleep disorders, any symptom grouping with at least one clinically relevant symptom (i.e., occurring 3 or more times a week) can be interpreted as a positive screen requiring follow up. With respect to relative severity of the individual sleep disorders, one may simply sum the individual item scores for each category and divide by the number of items to yield an average score per disorder. With respect to cumulative morbidity, one may simply sum all of the endorsements across the 25 items, with a resulting range of 0 to 100. It is anticipated that the ongoing validation studies will yield a similar strategy but it is likely that individual items will not be equally weighted.

This approach is very sensitive and likely much more liberal in terms of screen positives than the SDS-CL-17. For example, an endorsement of snoring on 3 or more days per week is suggestive and consistent with the diagnosis of OSA but may nevertheless result in a false positive. This is consistent with the use of the SDS-CL-25 as a screening instrument and underscores the need for additional assessment. This said, endorsement of more than one symptom per category may increase the clinician's confidence that the patient may have one or more of the core sleep disorders. Header information can also be used to aid interpretation of the responses. For example, if the SDS-CL-25 score for OSA is just below the suggested threshold, but the patient is an overweight male, the provider may decide that follow-up is warranted.

Deconstructing the parasomnias subscale is also recommended, with further exploration of these symptoms, perhaps by discussion or referral, for patients who endorse any one of the individual items 20–24. Nightmare disorder is represented by item 21, night terrors by item 22, REM sleep-behavior disorder by items 20 and 23, and sleep-related TMJ by item 24.

For all patients, sleep duration (header), interference of activities with achieving sufficient sleep (item 1), night-to-night variability of sleep (item 2), daytime dysfunction (item 25), and EDS and/or fatigue (item 6) warrant exploration for potential follow-up. Simple assessment of sleep duration (header) determines whether amount of sleep might be an issue. For example, those who indicate typical sleep durations of 5.5 hours but claim to have no daytime consequences (items 6 and 25) may be naturally short sleepers. Information regarding presence of a bed partner (header data) or activities that interfere with sleep

Table 3. SDS-CL-25 interpretation approach

Assessment	Items to consider*
Insomnia disorder	(Q3 or Q4 or Q5) + (Q6 or Q9 or Q25) Q17 may also be highly endorsed
Advanced sleep phase syndrome	Q7 + Q5 + (Q6 or Q9 or Q25)
Delayed sleep phase syndrome	Q8 + Q3 + (Q6 or Q9 or Q25)
Obstructive sleep apnea	Q10 – Q14 + (Q6 or Q9 or Q25)
Restless legs syndrome/periodic limb movement disorder	Q15 – Q17 + (Q6 or Q9 or Q25)
Narcolepsy	Q18 – Q20 + Q9 (also Q6 or Q25)
Nightmare disorder	Q21 + Q25
Night terror disorder	Q22
REM sleep behavior disorder	Q23
Sleep-related TMJ	Q24
Sleep insufficiency disorder	H4 and H5 + Q1 + (Q6 or Q9 or Q25)
Shiftwork sleep disorder	H1 + (Q1 or Q2 or Q3) or (H4 and/or Q1) + (Q6 or Q9 or Q25)
Excessive daytime sleepiness non-specific	Q9
Fatigue	Q6
Total sleep time (TST)	H4
Time in bed (TIB)	H5
Sleep efficiency (%)	100 × TST / TIB = 100 × H4 / H5
Shift worked	H1
Informant	H3-can verify Q10, Q12–15, Q23
Normal short sleep variant	H4 without (Q6 or Q9 or Q25)
General concern	(Q6 or Q9 or Q25) without other Q's endorsed

*Interpretation strategy: each Q is scored as follows: 0 points for a response of "never", 1 point for a response of "once a month", 2 points for a response of "1–3 times a week", 3 points for a response of "3–5 times a week", 4 points for a response of "> 5 times a week". Identification of individual sleep disorders: disorder may be deemed appropriate for follow-up if one or more endorsements within the category has response option 3 or 4 checked. Severity of the individual sleep disorders: sum the individual item scores for each category and divide by the number of items to yield an average score per disorder. Cumulative morbidity: sum all of the endorsements across the 25 items.
TMJ: temporomandibular joint disorder, SDS-CL-25: Sleep Disorders Symptom Checklist-25.

(item 1) can help determine if patients might achieve more sleep by managing lifestyle choices. Individuals whose work/life activities interfere with sufficient sleep (item 1) may need more frequent and/or vigilant consultations to follow how short sleep may be impacting their overall cardiovascular or mental health.

Follow-Up to Screening Results

For patients who screen positive for one or more sleep disorder, follow-up could include treatment in-house by the primary care provider, referral to a specialist and/or follow-up with validated single-disorder questionnaires such as the ISI for insomnia disorder (7 items),[13] the STOP for OSA (4 items),[17] the Ullanlinna Narcolepsy Scale (11 items) for narcolepsy disorder[18] and the Munich parasomnias questionnaire (21 items) for parasomnia disorders.[19] Positive screens from these single-disorder questionnaires can be used to bolster the SDS-CL-25's suggestion for follow-up.

Unfortunately, no single or multi disorder questionnaire exists that covers ASPS, DSPS, and/or shift work related sleep disorder. For DSPS, the best possible follow-up inquiry is to determine whether the individual's sleep schedule varies significantly from weekdays to weekends (or from work/school nights to days-off). Patients' responses to items 1 and 2 of the SDS-CL-25 can inform this determination. Yet, there is no hard-and-fast rule about what constitutes a significant deviation. The best rule-of-thumb is that schedules discordant by 3 or more hours suggest DSPS. In contrast, ASPS while often occurs as a stable invariant shift towards early time-to-bed and early morning awakenings. Here again, there is not a standard metric, but a shift of 3 or more hours (SDS-CL-25 item 7) suggests ASPS. It is possible to assess preferred sleep phases although not specific circadian rhythm sleep-wake disorders using the Morningness Eveningness Questionnaire[20] or the Munich Chronotype Questionnaire,[21] which provide self-report measures of patients' chronotypes.

Finally, the International Restless Legs Scale[22] assesses for RLS, this instrument is solely a metric for illness severity and pre-

sumes that the patient knows they have this particular disorder. Further, there is not a subscale for the signs and symptoms of PLMD. This may be the case because RLS is virtually pathognomonic for PLMD. This said, PLMD frequently can and does occur in the absence of RLS and thus likely warrants separate or independent assessment. Self-report assessment of PLMD, however, is nearly impossible and usually requires polysomnographic assessment for detection. The clinician may suspect PLMD when the patient reports pathological daytime sleepiness (e.g., strong endorsement of SDS-CL-25 item 9 regarding falling asleep at inappropriate times or places) in the absence of other sleep fragmentation related complaints.

Treating in-house may depend on providers' knowledge and comfort level with the individual sleep disorders. Referrals to specialists for further assessment and/or treatment may occur by collaborating with local sleep disorders centers and sleep medicine specialists, by collaborating with behavioral sleep medicine specialists who specialize in the behavioral treatment of sleep disorders, using treatments such as cognitive behavioral therapy for insomnia or positional therapy for sleep apnea. In the event that local resources are unknown, several provider directories are available: http://www.sleepeducation.org/find-a-facility, http://www.behavioralsleep.org/ (select "provider search"), and http://www.med.upenn.edu/cbti/provder_directory.html.

Future Directions

Presently, SDS-CL-25 data are being collected as part of a study to establish a database comprising polysomnography, physician diagnoses, and sleep-related questionnaire responses. The study is expected to include over n = 1000 adult subjects representative of primary care patients. Analysis of these data will enable: 1) validation of the SDS-CL-25 as a sleep disorders screener against gold standard physician and polysomnographic diagnoses, 2) convergent validity of the SDS-CL-25 with validated single disorder instruments, 3) convergent validity of the SDS-CL-25 with the one other brief global screener (the GSAQ), 4) verification that the SDS-CL-25 can be used to characterize cumulative sleep disorders morbidity, and 5) evaluation of whether the SDS-CL-25 is sensitive to treatment-related change. This data set will allow for convergent validity analysis, assessment of stability over time, and additional psychometric assessments of the new instrument.

Concluding Remarks

A notable advantage of the SDS-CL-25 is that visually scanning a single sheet of paper affords a quick and thorough assessment of the likely presence or absence of each of the assessed sleep disorders. Response patterns with marks to the right side of the grid, i.e., symptom endorsements for 3 or more days per week, indicate likely presence of sleep disorder(s) and/or need for follow-up.

In closing, the SDS-CL-25 is available on line at https://redcap.upstate.edu/surveys/?s=DNT8PL7PNA (at time of manuscript submission, the website is a functional beta-test version). The on-line version, upon completion, may be printed. Alternatively, a PDF version of the instrument may be downloaded from the same site. Clinical practice use of the instrument does not require permission. Research use of the instrument requires permission from the development team and may be arranged by contacting the first author of this report. Updated versions of the SDS-CL-25, use information, and newly available data regarding the psychometric properties of the instrument will also be available at the instrument website noted above.

Conflicts of Interest

The authors have no financial conflicts of interest.

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Sleep Disorders Checklist-25 (SDC-25)

	Over the past year: (place an X in the box)	Never	Seldom (1 × yr)	Sometimes (1–3 × mo)	Often (1–3 × wk)	Frequently (> 3 × wk)
1	In takes me 30 minutes or more to fall asleep.					
2	I am awake 30 minutes or more during the night.					
3	I am awake 30 minutes or more prior to my scheduled wake time or alarm.					
4	I am tired, fatigued or sleepy during the day.					
5	I sleep better if I go to bed before 9:00 pm and wake up before 5:30 am.					
6	I sleep better if I go to bed late (after 1:00 am) and wake up late (after 9:00 am).					
7	I fall asleep at inappropriate times or places.					
8	I have been told that I snore.					
9	I wake up during the night choking or gasping.					
10	I have been told I stop breathing when I sleep.					
11	I feel uncomfortable sensations in my legs, especially when sitting or lying down that are relieved by moving them.					
12	I have an urge to move my legs that is worse in the evenings and nights.					
13	I wake up frequently during the night for no reason.					
14	I have experienced sudden muscle weakness when laughing, joking, angry or during other intense emotions.					
15	I have been told that I walk, talk, eat or act strange or violent while sleeping.					
16	I have nightmares.					
17	For no reason, I awaken suddenly, startled, and feeling afraid.					

This is the SDS-CL-17 instrument that is printed on an 8.5 × 11" sheet of paper. The text below shows how to score each item, and the subscale score above which a positive screen is indicated. Cut-point score determination is described in the methods and results sections, but are included here for completeness.

Item choice	Item score	Subscale	Items to sum for subscale score	Subscale score range	Cut-point score
Never	0	Insomnia	1, 2, 3, 4	0–12	5
Seldom	0	Circadian rhythm	5, 6	0–6	-
Sometimes	1	Narcolepsy	7, 14	0–6	1
Often	2	Obstructive sleep apnea	4, 8, 9, 10	0–12	3
Frequently	3	Restless legs syndrome	11, 12, 13	0–9	3
		Parasomnias	15, 16, 17	0–9	-