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Original Article

The structured Diagnostic Interview for Sleep Patterns and Disorders: rationale and initial evaluation

K.R. Merikangas [a,*], J. Zhang [a,1], H. Emsellem [b], S.A. Swanson [c], A. Vgontzas [d], F. Belouad [a], M.M. Blank [a], W. Chen [e], M. Einen [e], J.P. He [a], L. Heaton [a], E. Nakamura [a], S. Rooholamini [e], E. Mignot [e]

[a] Genetic Epidemiology Branch, Intramural Research Program, National Institute of Mental Health, National Institutes of Health, Department of Health and Human Services, Bethesda, MD, United States
[b] The Center for Sleep and Wake Disorders, Chevy Chase, MD, United States
[c] Department of Epidemiology, Harvard School of Public Health, Boston, MA, United States
[d] Pennsylvania State College of Medicine, Hershey, PA, United States
[e] Department of Psychiatry and Behavioral Sciences, Stanford University, Palo Alto, CA, United States

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ABSTRACT

Objectives: We aimed to describe and report the initial validity of a newly developed structured interview for sleep disorders (Diagnostic Interview for Sleep Patterns and Disorders [DISP]) administered by trained lay interviewers.
Methods: A total of 225 patients with various sleep disorders were recruited from two nationally recognized sleep centers in the United States. The *International Classification of Sleep Disorders*, second edition (ICSD-2) criteria, were used to classify sleep disorders (e.g., delayed sleep phase disorder, hypersomnia, narcolepsy with cataplexy [NC], restless legs syndrome [RLS], periodic limb movement disorder [PLMD], insomnia, rapid eye movement sleep behavior disorder [RBD], and obstructive sleep apnea [OSA]). Interview diagnoses were compared with final diagnoses by sleep specialists (reference diagnosis based on clinical history, examination, and polysomnography [PSG] when indicated).
Results: DISP diagnoses had fair to substantial concordance with clinician diagnoses for various sleep disorders, with area under the receiver operator characteristic curves (AUC) ranging from 0.65 to 0.84. Participants classified by the clinician as having a sleep disorder were moderately well-detected (sensitivity ranging from 0.50 for RBD disorder to 0.87 for insomnia). Substantial specificity (>0.8) also was seen for five of the eight sleep disorders (i.e., delayed sleep phase, hypersomnia, NC, PLMD, and RBD). Interviews were more likely than clinicians to detect disorders secondary to the primary sleep problem.
Conclusions: The DISP provides an important tool for the detection of a wide range of sleep disorders in clinical settings and is particularly valuable in the detection of secondary disorders that were not the primary referral diagnosis.

1. Introduction

There has been increasing attention to the public health implications of sleep disorders. Insomnia [1–3], restless legs syndrome (RLS) [4,5] and obstructive sleep apnea (OSA) [6,7] are the most prevalent sleep disorders in the community and are associated with considerable daytime consequences [8] and negative health outcomes [9–11]. Because laboratory evaluation is required to establish a clinical diagnosis of several specific sleep disorders, including narcolepsy with cataplexy (NC), OSA, and rapid eye movement sleep behavior disorder (RBD) [12], it has been difficult to obtain accurate estimates of the magnitude of these disorders in the general population and their public health consequences. Some studies of community samples have utilized polysomnography (PSG) to determine the prevalence and mortality of specific disorders such as OSA [11,13], but the prohibitive cost and effort involved in administration of PSG is not feasible in large-scale community studies. Other population-based studies have solely focused on disorders that do not require PSG for a diagnosis such as insomnia or RLS [4,10,14–17]. Numerous questionnaires have been developed to collect information about specific sleep

* Corresponding author. Address: Intramural Research Program, National Institute of Mental Health, Genetic Epidemiology Research Branch, 35 Convent Dr, MSC# 3720, Bethesda, MD 20892, United States. Tel.: +1 301 496 1172; fax: +1 301 480 2915.
E-mail address: Kathleen.merikangas@nih.gov (K.R. Merikangas).
[1] Present address: Department of Psychiatry, Faculty of Medicine, The Chinese University of Hong Kong, China.

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disorders, including insomnia [18,19], RLS [20–22], OSA [23,24], and general sleep quality [25]. However, most of these self-administered questionnaires do not assess the full criteria for these disorders. A third approach to estimate sleep morbidity statistics relies on identification of individuals in the general population who have received a diagnosis from a physician based either on laboratory or clinical evaluations. This approach can provide estimates of the full range of sleep disorders, but it is likely to yield underestimates, as only 33% of those with RLS in the general population have received a physician diagnosis [4].

Studies using one or more of these approaches have provided estimates of the magnitude of sleep disorders in community samples in specific regions of the United States and in international settings [13,14,26–40]. These studies estimate that approximately 30–48% of nonclinical samples report periodic insomnia [30], whereas approximately 10% report chronic insomnia (i.e., insomnia symptoms occurring at least three nights per week for 1 month) [30]. Population-based studies of RLS that have applied the *International Classification of Sleep Disorders*, second edition (ICSD-2), criteria have yielded prevalence estimates ranging from 5% to 12% [4,10,36], and those of OSA consistently yield prevalence estimates ranging between 2% and 7% of US adults based on either the apnea–hypopnea index or self-reports [6,41].

A major challenge to estimation of the magnitude of sleep problems and disorders in the general population is variation in the methods of assessing the diagnostic criteria for sleep disorders. Aside from the well-established self-report questionnaires for sleep difficulties, sleep patterns, and self-report assessments of specific sleep disorders including insomnia, OSA, RLS and NC, there is a lack of validated instruments for assessing ICSD-2 criteria for the full range of sleep disorders that can be administered by non-experts in the general population.

To address the lack of structured interviews for ICSD-2 sleep disorders, the National Institutes of Mental Health Intramural Research Program in collaboration with two sleep specialty clinics, the Stanford Center for Sleep Science and Medicine (Mignot E) and the Center for Sleep and Wake Disorders (Emsellem H) have developed a diagnostic interview called the Diagnostic Interview for Sleep Patterns and Disorders (DISP) to ascertain diagnostic criteria for the full range of sleep disorders. The interview covers sleep patterns, difficulties, and routines, as well as screens for most of the major sleep disorders. Respondents who screen into the key symptoms of a sleep disorder are then queried about the symptoms, course, impairment, severity, and treatment of each condition into which they positively screened. The DISP can be administered by lay interviewers either in person or by telephone. Computerized diagnostic algorithms have been developed to score the disorders according to ICSD-2 criteria. This interview is now included in the PHENX project of the National Institutes of Health (NIH) (https://www.phenx.org/). The goal of our report was to assess the concordance of the DISP with expert sleep clinician diagnoses for a range of sleep disorders in a clinical sample recruited from two US sleep centers.

2. Methods

2.1. Sample

The sample characteristics are presented in Table 1. A total of 225 subjects were recruited over a 2-year period from the Center for Sleep and Wake Disorders in Chevy Chase, Maryland (82.7%) and the Stanford Center for Sleep Science and Medicine in California (17.3%) for the interview validation study. The diagnoses included eight sleep disorders: delayed sleep phase disorder, hypersomnia, insomnia, NC, periodic limb movement disorder (PLMD), RLS, RBD, and OSA. The sample consisted of 57.3% women, with a mean age of 52.9 years (median, 54 years; range, 19–90 years). A majority of participants were non-Hispanic white, one-half married or cohabiting, and three-quarters with a college or higher-level education. Participants from Stanford Center were younger, more likely to be single and had lower education levels than those at the Chevy Chase Center. On average, administration of the interview was approximately 30 min.

2.2. Disorder assessment

2.2.1. The DISP

The DISP was developed by KRM and EM to assess both Sleep Patterns and Disorders in a structured format and it is to be used in the general population and clinical samples in nonsleep specialty settings. The interview is administered by trained lay interviewers with some medical background and experience in the administration of structured interviews. All interviewers received training from a clinical neurologist on the symptoms and diagnostic criteria of targeted sleep disorders, followed by clinical review of the interviews with feedback to establish common procedures, and joint blind ratings of interviews.

The first section of the interview includes questions regarding sleep patterns (i.e., routine sleep schedule, naps, sleep regularity, circadian preference). This section of the interview provides context regarding the general sleep-wake patterns and circadian preferences of the participants and a screen for potential delayed sleep phase disorder. The second section collects detailed information on the eight specific sleep disorders including 1–4 initial screening questions for each disorder followed by a more comprehensive evaluation of symptoms, signs, duration, course, and episodes (onset and offset history); impairment and severity; clinical examination; and help seeking and treatment histories if entry probes are endorsed. A module for advanced sleep phase disorder also has recently been added to the DISP. To avoid potential bias from using a clinical sample, the information about clinical examination, help seeking and treatment history was not included in the validation study. All diagnoses were based on lifetime symptoms and disorders.

The sleep disorders assessed in different sections of the DISP are the aforementioned eight sleep disorders. Computer algorithms were developed to assess criteria for these eight sleep disorders based on ICSD-2 criteria with minor modifications. For example, the classification for subtypes of insomnia was not further divided based on its assumed associated factors. For sleep disorders that require PSG examination or clinical examination in the ICSD-2 (NC and PLMD), the minimal criteria listed in ICSD, first edition, were used to determine the diagnoses [32]. For example, minimal criteria for NC (criterion B [recurrent excessive daytime sleepiness and naps] and criterion C [cataplexy]) were used to diagnose NC. Hypersomnia was defined as complaints of excessive daytime sleepiness symptoms occurring almost daily for at least 3 months. Multiple sleep latency test (MSLT) results (if any) were not used to diagnose hypersomnia in the computerized algorithms. The clinical interview and detailed algorithms for each disorder are available by request from the study author. The DISP is included on the NIH PHENX Toolkit for phenotype measures in genetic studies (https://www.phenx.org/) [42]. In addition, the key components of the diagnostic criteria for each sleep disorder in the DISP are presented in Table 2.

2.2.2. Clinician diagnoses

The patients in our study were adults referred to one of the two sleep centers. In suspected cases of hypersomnia or narcolepsy, patients underwent at least one night of standard PSG assessment and an additional MSLT. The clinician diagnosis was based on the disease history, clinical examination, PSG, and MSLT for all