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Original Article

Psychometric properties of the Sleep Condition Indicator and Insomnia Severity Index in the evaluation of insomnia disorder

Mark Lawrence Wong [a], Kristy Nga Ting Lau [b], Colin A. Espie [c], Annemarie I. Luik [c], Simon D. Kyle [c], Esther Yuet Ying Lau [d, e, f, *]

[a] Department of Clinical Psychology, Pamela Youde Nethersole Eastern Hospital, Hospital Authority, Hong Kong
[b] Department of Psychology, The University of Hong Kong, Hong Kong
[c] Nuffield Department of Clinical Neurosciences, University of Oxford, UK
[d] Department of Psychological Studies, The Education University of Hong Kong, Hong Kong
[e] Centre for Psychosocial Health, The Education University of Hong Kong, Hong Kong
[f] Department of Psychiatry, The University of Hong Kong, Hong Kong

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ABSTRACT

Objective: The Sleep Condition Indicator (SCI) and Insomnia Severity Index (ISI) are commonly used instruments to assess insomnia. We evaluated their psychometric properties, particularly their discriminant validity against structured clinical interview (according to DSM-5 and ICSD-3), and their concurrent validity with measures of sleep and daytime functioning.
Methods: A total of 158 young adults, 16% of whom were diagnosed with DSM-5 insomnia disorder and 13% with ICSD-3 Chronic Insomnia by structured interview, completed the ISI and SCI twice in 7–14 days, in addition to measures of sleep and daytime function.
Results: The Chinese version of the SCI was validated with good psychometric properties (ICC = 0.882). A cutoff of ≥8 on the ISI, ≤5 on the SCI short form, and ≤21 on the SCI achieved high discriminant validity (AUC > 0.85) in identifying individuals with insomnia based on both DSM-5 and ICSD-3 criteria. The SCI and ISI had comparable associations with subjective ($0.18 < r < 0.51$) and actigraphic sleep ($0.31 < r < 0.43$) and daytime functioning ($0.34 < r < 0.53$).
Conclusion: The SCI, SCI short form, and ISI were found to correctly identify individuals with DSM-5- and ICSD-3-defined insomnia disorder. Moreover, they showed good concordance with measures of daytime dysfunction, as well as subjective and objective sleep. The SCI and ISI are recommended for use in clinical and research settings.

1. Introduction

Insomnia is one of the most common mental disorders, with a prevalence estimated to be around 10% [1]. Preferably, assessment of insomnia should include a structured clinical interview, prospective sleep diary and actigraphy [2]. Yet in practice, resources—especially time and expertise—are scarce; thus, self-report questionnaires are more frequently used than other forms of appraisal [3]. The concordance of such scales with other insomnia measures therefore warrants specific investigation.

The Sleep Condition Indicator (SCI) is a self-reported measure of insomnia symptoms, recently developed and based on DSM-5 criteria [4]. Items assess both sleep disturbances at night, such as difficulty initiating sleep, as well as daytime functions, such as productivity/ability to concentrate and energy/mood. Several recent reports have provided initial data suggesting the SCI has good reliability, is internally consistent, and is sensitive to treatment outcome [4–6]. The SCI has also been found to be sensitive in differentiating patients with insomnia from healthy controls in an Italian study [7]. However, the discriminant validity of the SCI compared with a structured clinical interview, the gold standard of insomnia assessment [2], remains unknown.

The Insomnia Severity Index (ISI) has been one of the most widely used self-reported assessment tools for insomnia [3]; this

* Corresponding author. Department of Psychological Studies, The Education University of Hong Kong, 10 Lo Ping Road, Tai Po, N. T., Hong Kong.
E-mail addresses: estheryylau@gmail.com, laueyy@eduhk.hk (E.Y.Y. Lau).

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tool was developed based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [8], and is a sensitive screening and treatment outcome measure [3,9]. There are established cutoff scores to identify individuals with different degree of insomnia [3,9]. However, the measurement properties of the ISI on insomnia based on the updated diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) and International Classification of Sleep Disorders, third edition (ICSD-3) have not been comprehensively assessed.

Compared with the ISI, there are more items assessing daytime functioning in the SCI. The SCI also has a validated short version, SCI-SF, consisting of only two items, which may be helpful as a quick screening tool or for use in large-scale survey studies which may only allow for a limited number of sleep items.

The current study primarily aimed to assess the measurement properties of the SCI and ISI against insomnia disorder diagnosed from a structured clinical interview and insomnia symptoms assessed by sleep diary and actigraphy. In addition, as the DSM-5 and ICSD-3 both emphasize daytime functioning, we aimed to assess the concurrent validity of the SCI and ISI with measures of daytime functioning, specifically negative mood and well-being. Furthermore, the psychometric properties of the Chinese version of the SCI were assessed, as these have not been studied to date.

2. Methods

2.1. Participants and design

Our sample was drawn from two existing studies on sleep, napping, and daytime functioning ($n = 200$) and on insomnia and emotional processing ($n = 70$). Participants from both studies were recruited on campus using mass e-mail messages, flyers, and posters. Inclusion criteria were full-time students with normal or corrected to normal vision and the absence of medical conditions or medication use affecting sleep in the preceding two weeks. Data on 51 participants was excluded due to missing/invalid information on the structured clinical interview on insomnia (n = 20) or a missing SCI at one of the two assessment points (n = 31), and 61 individuals were excluded because they reported inadequate sleep opportunity in the structured interview for insomnia (detailed in Measures section). The final sample included 158 participants; 36 (23%) had DSM-5 insomnia disorder, and 29 (13%) had ICSD-3 chronic insomnia. Individuals excluded and those remaining in the final sample were not significantly different on demographic, sleep, and mood measures ($p > 0.05$).

Participants were first approached by telephone and were provided with information on the study background and aims. Those interested in participating were invited to the laboratory for the assessment procedures, informed consent, screening interview, structured clinical interview for insomnia, questionnaires, and instruction on the use of actigraphy and sleep diary for the following 7–14 days. Participants received $200 Hong Kong dollars upon completion of the study. The assessment procedures were conducted by extensively trained research staff following a standardized assessment protocol developed by the first and corresponding author (registered clinical psychologist trained in sleep medicine). Data of the SCI and ISI were scored and managed by research staff blinded to the same participants' data on structured clinical interview, sleep diary, and actigraphy.

Ethics approval was obtained from the Human Research Ethics Committee for Non-Clinical Faculties of the University of Hong Kong before the commencement of data collection. The study was conducted in compliance with the tenets of the Declaration of Helsinki.

2.2. Measures

2.2.1. Sleep assessment

The SCI consists of eight items (rated on five-point scales of zero to four; range 0–32). Participants rate their sleep characteristics and related impact on daytime functioning over the previous month. A higher SCI indicates that sleep is of better quality, and a lower score indicates greater symptom severity. The short version of the SCI consists of two items (SCI-SF). The SCI was administered on two occasions, separated by 7–14 days. The SCI data in the second assessment occasion was used for psychometric analysis, as the ISI, mood, and quality of life measures were conducted at the same time.

The Chinese version of the SCI and SCI-SF were developed following linguistic validation processes used in other studies [10,11]. After obtaining the consent of the author of the original version of the SCI (co-author, C.E.), we first performed two independent forward translations and one back translation by bilingual English–Chinese speakers, and then field tested the tool before finalizing it. Each procedure and related amendment of the Chinese SCI took place after a panel meeting, and the panel was supervised by the corresponding author.

The ISI [9] comprises seven items, and assesses the individual's insomnia over the previous two weeks symptoms on a five-point Likert scale. The total score ranges from zero to 28, in which a higher score indicates greater symptom severity. The Chinese version of ISI has been validated with good psychometric properties [12]. We also observed very good internal consistency ($\alpha = 0.832$) among our sample.

The Brief Insomnia Questionnaire (BIQ) is a structured clinical interview protocol developed based on several insomnia diagnostic systems, for example, the DSM and ICSD [13]. The BIQ has been reported to have good test–retest reliability, and concordance with diagnoses made by sleep medicine experts conducting clinical interviews. Chung et al. [14,15] recently added two items and published a scoring algorithm so that the BIQ could detect DSM-5 insomnia disorder and ICSD-3 chronic insomnia. Apart from insomnia symptoms, the BIQ also assesses whether individuals' sleep problems are explained by environmental circumstances, such as noise, or inadequate sleep opportunity, such as early wake-up or late bedtime. As mentioned before, the BIQ was administered by trained research staff, and all completed BIQ protocols were cross-checked by the first author.

Participants wore an actigraph-watch (Micro Motion Logger Sleep Watch, AMI of USA) and completed a sleep diary for 7–14 days (mean = 8.1 days, standard deviation = 2.5 days), depending on the availability of testing equipment, facilities, and participants' availability. The actigraph was worn on participants' nondominant hand, set at zero crossing mode with 1-min bins, and analyzed with a previously validated algorithm [16]. The sleep diary was developed based on the Consensus Sleep Diary [17]. In both the sleep diary and actigraphy, actual sleep time was computed by subtracting sleep onset latency (SOL) and duration of wake after sleep onset (WASO) from the time in bed (TIB). TIB was the difference between the time that participants went to and left their bed. Sleep efficiency (%) was calculated by dividing actual sleep time by TIB ($\times 100$). The sleep diary additionally measured the number of WASO per night as well as duration of early morning awakenings (EMA) per day, and number of days with EMA per week.

2.2.2. Negative mood and well-being assessment

The Depression Anxiety Stress Scale 21-item (DASS) [18] and the World Health Organization Quality of Life Scale–Brief Version (WHOQOL) [19] were used to assess participant mood and well-being. Both WHOQOL and DASS have been used among Chinese