Sleep Medicine 80 (2021) 204–209

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Validation of the Japanese version of the Sleep Hygiene Practice Scale

Shintaro Hara [a], Shunsuke Nonaka [b], Miho Ishii [c], Yuko Ogawa [d], Chien-Ming Yang [e], Isa Okajima [f, *]

[a] Advanced Research Center for Human Sciences, Waseda University, Saitama, Japan
[b] Department of Child Psychology, Tokyo Future University, Tokyo, Japan
[c] Senzoku Stress Coping Support Office, Tokyo, Japan
[d] National Cancer Center Hospital, Tokyo, Japan
[e] Department of Psychology/Research Center for Mind, Brain, & Learning, National Chengchi University, Taipei, Taiwan
[f] Department of Psychological Counseling, Faculty of Humanities, Tokyo Kasei University, Tokyo, Japan

ARTICLE INFO

Article history:
Received 21 September 2020
Received in revised form
9 December 2020
Accepted 26 January 2021
Available online 1 February 2021

Keywords:
Sleep hygiene practice scale
Sleep hygiene
Insomnia
Cognitive behavioral therapy for insomnia
Cross-sectional survey

ABSTRACT

Objective: This study sought to validate the Japanese version of the Sleep Hygiene Practices Scale (SHPS-J).
Patients/methods: A cross-sectional questionnaire-based study was conducted via the internet. In total, 854 participants (435 men, 419 women; mean age, 42.91 ± 11.54 years) were asked to complete all scales, and 283 of them were asked to complete the same scales two weeks later. The survey consisted of the SHPS-J, the Japanese version of the Insomnia Severity Index (ISI-J), and the Japanese version of the Pittsburgh Sleep Quality Index (PSQI-J). The SHPS-J was developed according to the International Society for Pharmacoeconomics and Outcomes Research Task Force for Translation and Cultural Adaption. For the analysis, participants were divided into three groups: insomnia syndrome, insomnia symptoms, and good sleep groups.
Results: The SHPS-J had good test-retest reliability (ICC: 0.55–0.76) and adequate internal consistency ($\alpha = 0.54$–0.74), except with regard to eating/drinking behaviors. The factorial validity of the four-factor structure was confirmed through a confirmatory factor analysis; however, one item related to eating/drinking behaviors had no significant factor loading. The construct validity was confirmed through a correlation analysis between each domain of the SHPS-J and ISI-J ($r = 0.19$–0.60, $p < 0.01$). The results of clinical validation confirmed that all domains of the SHPS-J were significantly higher for individuals with insomnia than for good sleepers.
Conclusions: This study confirmed both the reliability and validity of the SHPS-J.

1. Introduction

Insomnia is defined as nocturnal sleep problems such as difficulty initiating and maintaining sleep with consequent daytime dysfunction at least three times a week, along with symptoms present for at least three months [1]. Epidemiological studies regarding insomnia have reported prevalence rates of approximately 10%–16% for insomnia syndrome (nocturnal sleep problem with daytime dysfunction) and between 13% and 32% for insomnia symptoms (nocturnal sleep problem alone) [2–4]. An epidemiological study in Japan reported the prevalence of insomnia symptoms to be around 20% [5]. In addition, insomnia syndrome and insomnia symptoms contribute to emotional disorders and economic burden [3,4]. Therefore, it is important to treat insomnia.

Sleep hygiene education is one of nonpharmacological intervention of insomnia, and refers to the behaviors and environment that promote good sleep [6,7]. According to Hauri (1992), some examples of adaptive sleep hygiene are restricting time in bed, never trying to sleep, eliminating the bedroom clock, exercise in the late afternoon or early evening, avoiding coffee, alcohol, and nicotine, regularizing the bedtime routine, eating a light bedtime snack,

Abbreviations: ANOVA, analysis of variance; CBT-I, cognitive behavioral therapy for insomnia; CI, confidence interval; ICC, intraclass correlation coefficient; ISI, Insomnia Severity Index; ISI-J, Japanese version of ISI; PSQI-J, Pittsburgh Sleep Quality Index; SHPS, Sleep Hygiene Practices Scale; SHPS-J, Japanese version of the SHPS.

* Corresponding author. 1-18-1 Kaga, Itabashi-ku, Tokyo, 173-0031, Japan. Fax: +81 3 3961 5276.
E-mail address: okajima-i@tokyo-kasei.ac.jp (I. Okajima).

https://doi.org/10.1016/j.sleep.2021.01.047
1389-9457/

and exploring napping [8]. Overall, sleep hygiene practices were related to sleep quality [9]. However, evidence has been insufficient to prove the effectiveness of sleep hygiene education as a treatment for insomnia when conducted alone [10]. As a reason, sleep hygiene education focuses on many elements (eg, caffeine, bright-light, exercise, and regular sleep), but the maladaptive practice may vary widely among individuals [7,11]. In a previous study that evaluated each sleep hygiene element in older adults, the elements were not related to sleep complaints, except for napping [12]. Therefore, a measure that can categorize sleep hygiene practices into domains could help assess sleep hygiene in both research and clinical settings.

One subjective rating scale, the Sleep Hygiene Practices Scale (SHPS), was designed to assess sleep hygiene practice in different categories [11]. The SHPS consists of 30 items that were derived from the sleep hygiene guidelines of the National Sleep Foundation and the Taiwan Society of Sleep Medicine as well as items of previously published scales, such as the Sleep Hygiene Awareness and Practice Scale [13], the Sleep Hygiene Self-Test [14], and the Sleep Hygiene Index [15]. These 30 items were categorized by two sleep medicine specialists into four domains: arousal-related behaviors, sleep scheduling and timing, eating/drinking behaviors, and sleep environment.

Yang et al. (2010) reported that the original SHPS has adequate reliability and validity [11]. The scale was administered to individuals with insomnia and good sleepers. Cronbach's α coefficients for the four domains in the two groups ranged from 0.58 to 0.82, indicating acceptable internal consistency. In addition, a confirmatory factor analysis indicated an acceptable fit for both insomniacs ($\chi^2 = 17.95$, NNFI = 0.96, CFI = 0.98, RMSEA = 0.047, SRMR = 0.048) and good sleepers ($\chi^2 = 24.57$, NNFI = 0.95, CFI = 0.98, RMSEA = 0.083, SRMR = 0.043). Furthermore, for insomniacs, a significant positive correlation ($r = 0.33$) was found between the Insomnia Severity Index (ISI) [16,17] and arousal-related behaviors. For the good sleepers, significant positive correlations were found between ISI and arousal-related behaviors ($r = 0.61$), sleep scheduling and timing ($r = 0.38$), eating/drinking behaviors ($r = 0.32$), and sleep environment ($r = 0.51$). Moreover, the correlation coefficients between ISI and each domain were higher for good sleepers than for insomniacs. In addition, the score for arousal-related behavior was significantly different between the insomniacs and good sleepers. Thus, the SHPS could be used to assist sleep hygiene education by assessing categories of sleep hygiene. Since there is no scale for assessing sleep hygiene categories in Japan, this study sought to develop and validate a Japanese version of the SHPS (SHPS-J).

2. Material and methods

2.1. Procedure

From November to December 2017, a survey was conducted at two time points by an online survey company. The survey at Time 2 was conducted 20 days after the survey at Time 1. The survey consisted of questionnaires regarding demographic characteristics, physical and mental health, other sleep-wake disorders, and insomnia, as well as three scales: the SHPS-J, Japanese version of ISI (ISI-J) [18], and the Japanese version of the Pittsburgh Sleep Quality Index (PSQI-J) [19].

2.2. Participants

The data analyzed in this study, known as the Japan Validation of Insomnia-related scales Project [20], were collected on September 21, 2017 (Time 1), and October 11, 2017 (Time 2). Participants were recruited by Rakuten Research Inc., an online marketing research company that has the contact details of approximately 2.3 million Japanese survey respondents. We identified random individuals across Japan, stratified them by sex and age, and sent an e-mail with a link to an online questionnaire. The study participants ranged in age from 20 to 65 years. A total of 900 survey panel members consented to participate in Time 1. Of these, 46 participants indicating they had physical or mental illnesses or other sleep-wake disorders were excluded. The remaining 854 participants consisted of 435 men and 419 women of a mean age of 42.91 ± 11.54 years. These participants were divided into three groups: insomnia syndrome (ISD; nighttime symptoms with consequent daytime dysfunction: $n = 113$, 61 men, 52 women; mean age, 40.07 ± 11.01 years); insomnia symptoms (ISP; nighttime symptoms alone: $n = 126$, 57 men, 69 women; mean age, 42.83 ± 11.76 years); and good sleepers (GS; no insomnia symptoms: $n = 615$, 317 men, 298 women; mean age, 43.5 ± 11.54 years).

Of the 900 participants at Time 1, 300 consented to participate at Time 2. Seventeen participants indicated at Time 1 that they had physical or mental illnesses or other sleep-wake disorders and were excluded. The remaining 283 participants consisted of 142 men and 141 women of a mean age of 42.84 ± 11.11 years.

2.3. Measures

2.3.1. Demographic characteristics, physical health, mental health, sleep-wake disorders, and insomnia

The demographic items assessed age, gender, occupation, and prefecture of residence. The physical health items assessed whether participants had a history of high blood pressure, diabetes dyslipidemia, hyperlipidemia, stroke, irregular heartbeat, heart disease, respiratory disease, thyroid disease, physical trauma, or a gastrointestinal disorder. The mental health items assessed whether they had a history of major depressive disorder, bipolar disorder, anxiety disorder, schizophrenia, eating disorder, attention deficit/hyperactivity disorder, or autism spectrum disorder. The other sleep-wake disorders items asked if they had sleep apnea syndrome, hypersomnia, parasomnia, restless legs syndrome, or a periodic limb movement disorder. The insomnia-related items asked about the presence and frequency of insomnia-related symptoms persisting for three or more months, such as difficulty in initiating sleep (unable to fall sleep within 30 min after going to bed for at least three days/week), difficulty maintaining sleep (waking during the night and being unable to fall asleep within 30 min at least three times/week), waking up too early (waking up 2 h earlier than planned at least three days/week), and consequent daytime dysfunction (daily living activities being impaired owing to nighttime insomnia symptoms).

2.3.2. SHPS-J

The SHPS-J is a self-rating scale that assesses sleep hygiene. The SHPS-J is a 30-item scale that measures four domains of sleep hygiene: D1, arousal-related behaviors; D2, sleep scheduling and timing; D3, eating/drinking behaviors; and D4, sleep environment. Respondents rated each item on a six-point Likert scale, from 1 = never to 6 = always. Higher total scores for each domain signify greater maladaptive sleep hygiene.

Following the International Society for Pharmacoeconomics and Outcomes Research task force translation and cultural adaption [21], we obtained the permission to develop and validate the Japanese version from Yang, the corresponding author of the original scale, and the fifth author of this study. After having the SHPS independently translated into Japanese by the second and third authors of the present study (both graduate students in clinical psychology), the rest of the research team (first author, a graduate

student in clinical psychology; fourth author, a graduate student proficient in English; sixth author, a clinical psychologist with extensive experience in sleep research and clinical practice) consolidated the translations into a preliminary Japanese version. This Japanese version was independently back-translated into English by two native English speakers. These back-translations were reviewed by Yang, and were revised by the research team based on the review. Consequently, the research team and Yang came to an agreement on the final version of the SHPS-J.

2.3.3. ISI-J [18]

The ISI-J is a seven-item self-rated scale used to assess insomnia severity. Respondents rated each item on a five-point Likert scale from 0 (no problem) to 4 (very severe problem); a higher score indicated more severe insomnia. Scores of 8–14 are interpreted as indicative of sub-threshold insomnia, 15–21 of moderate insomnia, and 22 or more of severe insomnia.

2.3.4. PSQI-J [19]

The PSQI-J is a self-rated scale that assesses overall sleep quality and consists of seven components: C1, subjective sleep quality; C2, sleep latency; C3, sleep duration; C4, habitual sleep efficiency; C5, sleep disturbances; C6, use of sleep medication; and C7, daytime dysfunction. Respondents answered 4 of the 18 items with a time of day or a number of minutes or hours (for bedtime, sleep latency, rising time, and sleep duration) and then rated the other 14 items on a four-point Likert scale indicating weekly frequency from 0 = never to 3 = three or more times a week. Higher global PSQI scores indicate poorer sleep quality.

2.4. Statistical analyses

2.4.1. Reliability

For the internal consistency analysis, 854 valid responses from Time 1 were analyzed. For the test-retest reliability analysis, 283 valid responses from Time 1 and Time 2 were analyzed. To test the internal consistency of the SHPS-J, Cronbach's α coefficients were calculated for each of the domains. To test for the test-retest reliability of the SHPS-J, the intraclass correlation coefficient (ICC) (1, 1) was calculated for each domain.

2.4.2. Validity

For the validity analysis, 854 valid responses from Time 1 were analyzed. Factorial validity: The SHPS categorizes sleep hygiene practices into four domains, which are arousal-related behaviors, sleep scheduling and timing, eating/drinking behaviors, and sleep environment [11]. A confirmatory factor analysis was performed to verify that the four domains constitute the underlying factors for the SHPS-J. Construct validity: A correlational analysis was performed between each domain and the ISI-J. As regarding to clinical validity, a one-way analysis of variance (ANOVA) was performed along with multiple comparisons by the Bonferroni method to test for between-group differences in each domain.

Statistical analyses were performed using IBM SPSS Statistics 25 (IBM Corp., Armonk, NY).

2.5. Ethical considerations

Before responding to the survey, participants were informed about the study's purpose, voluntary participation, and privacy rights, and consented to participate in the survey. This study was approved by the Waseda University's Ethics Review Committee on Research with Human Subjects (approval no. 2017-192, September 17, 2017).

3. Results

Table 1 shows participants' attributions in Time 1 and 2.

3.1. Reliability

3.1.1. Internal consistency

Cronbach's α coefficients were 0.73 for arousal-related behaviors, 0.70 for sleep scheduling and timing, 0.54 for eating/drinking behaviors, and 0.74 for sleep environment.

3.1.2. Test-retest reliability

Results of ICC (1, 1) calculations were 0.69 for arousal-related behaviors [95% confidence interval (CI): 0.62–0.75, $p < 0.01$], 0.76 for sleep scheduling and timing (95% CI: 0.71–0.81, $p < 0.01$), 0.76 for eating/drinking behaviors (95% CI: 0.71–0.81, $p < 0.01$), and 0.55 for sleep environment (95% CI: 0.46–0.63, $p < 0.01$).

3.2. Validity

3.2.1. Factorial validity

A confirmatory factor analysis for the SHPS-J yielded model fit indicators of $\chi^2(399) = 1937.63$ ($p < 0.01$), NNFI = 0.74, CFI = 0.76, RMSEA = 0.067, and SRMR = 0.075. In addition, the factor loadings for 29 of its 30 items were significant ($\beta = 0.16–0.79$, $p < 0.01$). Only the factor loading for the sixth item in the eating/drinking behaviors was not found to be significant ($\beta = 0.07$, $p = 1.11$).

3.2.2. Construct validity

The results of the Pearson correlation coefficients among variables are shown in Table 2. For the overall participants, significant positive correlations were found with the ISI-J for each domain: arousal-related behaviors ($r = 0.60$, 95% CI: 0.56–0.64, $p < 0.01$), sleep scheduling and timing ($r = 0.39$, 95% CI: 0.33–0.45, $p < 0.01$), eating/drinking behaviors ($r = 0.16$, 95% CI: 0.09–0.22, $p < 0.01$), and sleep environment ($r = 0.39$, 95% CI: 0.33–0.45, $p < 0.01$).

For the ISD group, significantly positive correlations with the ISI were found for both arousal-related behaviors ($r = 0.46$, 95% CI: 0.30–0.59, $p < 0.01$) and sleep scheduling and timing ($r = 0.34$, 95% CI: 0.17–0.49, $p < 0.01$), but not for eating/drinking behaviors ($r = -0.02$, 95% CI: −0.20–0.17, $p = 0.83$) or sleep environment ($r = 0.16$, 95% CI: −0.03–0.33, $p = 0.10$).

For the ISP group, significantly positive correlations were found with ISI for arousal-related behaviors ($r = 0.33$, 95% CI: 0.16–0.48, $p < 0.01$) and sleep environment ($r = 0.29$, 95% CI: 0.12–0.44, $p < 0.01$), but not for sleep scheduling and timing ($r = 0.11$, 95% CI: −0.07–0.28, $p = 0.20$) or eating/drinking behaviors ($r = 0.05$, 95% CI: − −0.13–0.22, $p = 0.59$).

For the GS group, significantly positive correlations with ISI were found for each domain: arousal-related behaviors ($r = 0.49$, 95% CI: 0.43–0.55, $p < 0.01$), sleep scheduling and timing ($r = 0.32$, 95% CI: 0.25–0.39, $p < 0.01$), eating/drinking behaviors ($r = 0.19$, 95% CI: 0.11–0.27, $p < 0.01$), and sleep environment ($r = 0.39$, 95% CI: 0.32–0.46, $p < 0.01$).

In addition, significant differences between the ISD and GS were found in the correlation coefficients with ISI for eating/drinking behaviors ($Z = 2.05$, $p < 0.05$) and sleep environment ($Z = 2.41$, $p < 0.05$). Between the ISP and GS, a significant difference was found in the correlation coefficients with ISI only for sleep scheduling and timing ($Z = 2.24$, $p < 0.05$).

3.2.3. Clinical validity

Table 3 shows the comparison of the SHPS-J between groups. Significant between-group differences were found in each domain:

Table 1
Participants' attributions.

Variables	Time 1 ($n = 854$)		Time 2 ($n = 283$)	
	Mean (95% CI)	*SD*	*Mean* (95% CI)	*SD*
SHPS				
D1: Arousal-related behaviors	21.36 (20.94, 21.79)	6.37	22.15 (21.44, 22.86)	6.11
D2: Sleep scheduling and timing	21.44 (21.04, 21.85)	5.98	21.83 (21.19, 22.48)	5.57
D3: Eating/drinking behaviors	14.79 (14.47, 15.12)	4.79	14.81 (14.25, 15.37)	4.79
D4: Sleep environment	18.02 (17.63, 18.41)	5.81	18.48 (17.80, 19.16)	5.85
ISI				
Total: Insomnia severity	6.96 (6.62, 7.30)	5.60	7.71 (7.12, 8.31)	5.12
PSQI				
Bedtime (hour: min.)	23:45 (23:39, 23:52)	1:31	23:48 (23:38, 23:59)	1:32
Sleep latency (min.)	25.95 (25.10, 26.79)	24.69	32.01 (28.53, 35.50)	29.88
Rise time (hour: min.)	6:43 (6:38, 6:49)	1:23	6:45 (6:35, 6:55)	1:24
Sleep duration (min.)	388.98 (384.39, 393.56)	68.37	387.23 (379.50, 394.95)	66.33
C1: Subjective sleep quality	1.38 (1.34, 1.43)	0.65	1.45 (1.37, 1.52)	0.65
C2: Sleep latency	1.09 (1.03, 1.16)	0.97	1.34 (1.22, 1.46)	1.02
C3: Sleep duration	1.26 (1.21, 1.32)	0.87	1.27 (1.16, 1.37)	0.89
C4: Habitual sleep efficiency	0.25 (0.21, 0.30)	0.64	0.30 (0.22, 0.38)	0.69
C5: Sleep disturbances	0.98 (0.95, 1.01)	0.45	1.01 (0.96, 1.06)	0.43
C6: Use of sleeping medication	0.12 (0.08, 0.15)	0.53	0.13 (0.06, 0.19)	0.54
C7: Daytime function	0.61 (0.56, 0.65)	0.70	0.65 (0.57, 0.73)	0.71
Global: Sleep quality	4.11 (3.96, 4.26)	2.26	4.48 (4.21, 4.75)	2.33

CI: Confidence interval SHPS: Sleep Hygiene Practice Scale ISI: Insomnia Severity Index PSQI: Pittsburgh Sleep Quality Index.

Table 2
Pearson correlation coefficients among variables.

	ISI total score				Difference[a] (Z score)
	All ($n = 854$)	ISD ($n = 113$)	ISP ($n = 126$)	GS ($n = 615$)	
SHPS					
D1	0.60** (0.56, 0.64)	0.46** (0.30, 0.59)	0.33** (0.16, 0.48)	0.49** (0.43, 0.55)	–
D2	0.39** (0.33, 0.45)	0.34** (0.17, 0.49)	0.11 (-0.07, 0.28)	0.32** (0.25, 0.39)	ISP<GS (2.24)
D3	0.16** (0.09, 0.22)	−0.02 (-0.20, 0.17)	0.05 (-0.13, 0.22)	0.19** (0.11, 0.27)	ISD<GS (2.05)
D4	0.39** (0.33, 0.45)	0.16 (-0.03, 0.33)	0.29** (0.12,0.44)	0.39** (0.32, 0.46)	ISD<GS (2.41)

[a] The pearson correlation coefficients among groups is significant at the 5% level among groups **: $p < 0.01$ *: $p < 0.05$ CI: Confidence interval ISD: Insomnia syndrome ISP: Insomnia symptoms GS: Good sleep SHPS: Sleep Hygiene Practice Scale ISI: Insomnia Severity Index D1: Arousal-related behaviors D2: Sleep scheduling and timing D3: Eating/drinking behaviors D4: Sleep environment.

arousal-related behaviors [$F(2) = 118.60$, $p < 0.01$, $\eta^2 = 0.22$], sleep scheduling and timing [$F(2) = 33.16$, $p < 0.01$, $\eta^2 = 0.07$], eating/drinking behaviors [$F(2) = 4.70$, $p < 0.01$, $\eta^2 = 0.01$], and sleep environment [$F(2) = 20.53$, $p < 0.01$, $\eta^2 = 0.05$]. In addition, the ISD had a significantly higher score for each domain compared with the other groups ($p < 0.01$). In the ISP group, the score for arousal-related behaviors was significantly higher than that for GS ($p < 0.01$).

4. Discussion

The purpose of this study was to develop and validate the SHPS-J. Results indicated that the SHPS-J had adequate reliability and validity. To the best of our knowledge, this is the first study to develop and test a scale for assessing sleep hygiene in Japan.

4.1. Reliability

In addition to the original SHPS [11], all domains of the SHPS-J indicated acceptable internal consistency as measures of individual behaviors and environments, except for “eating/drinking behaviors”. This domain consists of items related to going to bed hungry, drinking caffeinated drinks, drinking alcohol, consuming stimulating substances, or drinking/eating too much before bedtime. This result could be explained by the insufficient differentiation among individual maladaptive eating and drinking. For

Table 3
Comparison of Sleep Hygiene Practice Scale among participants' groups.

	ISD ($n = 113$)	ISP ($n = 126$)	GS ($n = 615$)	One-way analysis of variance			
	Mean (SD) (95% CI)	*Mean (SD)* (95% CI)	*Mean (SD)* (95% CI)	*F (df)*	*p* value	η^2	Bonferroni[a]
SHPS							
D1	27.91 (6.72) (26.67, 29.15)	23.98 (5.74) (26.67, 29.15)	19.62 (5.40) (19.20, 20.05)	118.92 (2)	0.00	0.22	ISD>ISP, GS ISP>GS
D2	25.38 (6.43) (24.20, 26.57)	21.96 (5.73) (20.96, 22.96)	20.62 (5.65) (20.17, 21.06)	33.16 (2)	0.00	0.07	ISD>ISP, GS
D3	16.06 (5.40) (15.07, 17.06)	14.44 (5.13) (13.54, 15.33)	14.63 (4.57) (14.27, 15.00)	4.70 (2)	0.00	0.01	ISD>ISP, GS
D4	21.04 (6.27) (19.88, 22.19)	18.53 (5.48) (17.58, 19.49)	17.36 (5.61) (16.92, 17.81)	20.53 (2)	0.00	0.05	ISD>ISP, GS

CI: Confidence interval ISD: Insomnia syndrome ISP: Insomnia symptoms GS: Good sleep SHPS: Sleep Hygiene Practice Scale D1: Arousal-related behaviors D2: Sleep scheduling and timing D3: Eating/drinking behaviors D4: Sleep environment.
[a] The average difference among groups is significant at the 5% level.

example, it is unlikely that individuals who often drink caffeinated drinks before going to bed would frequently drink alcohol at the same time. Thus, in the future, similar maladaptive eating/drinking behaviors that individuals engage in should be divided into different categories.

In addition, all domains of the scale showed good test-retest reliability. Given that the original SHPS study did not confirm test-retest reliability, this finding for the SHPS-J is a significant outcome.

4.2. Validity

The confirmatory factor analysis demonstrated that the SHPS-J has a four-factor structure, which is consistent with that of the original SHPS [11]. However, the NNFI (0.74) and CFI (0.76) were slightly poorer than those for the original scale (NNFI = 0.95.0.96, CFI = 0.98). In addition, the factor loading for the sixth item (going to bed hungry) of the "eating/drinking behaviors" domain was not significant. As previously mentioned, the eating/drinking behaviors vary among individuals. In particular, the internal consistency for the sixth item (going to bed hungry) may be problematic given that it conflicts with the 22nd item (eating too much food during the hour prior to sleep). Future research is needed to divide eating/drinking behaviors into categories based on the degree of hunger and fullness.

The construct validity analysis revealed significantly positive correlations between each domain of the SHPS-J and insomnia severity for the overall participants. These results were consistent with the concept that insomnia develops from and is perpetuated by maladaptive sleep hygiene practices [11]. In each group, the arousal-related behavior domain only had a significant correlation with insomnia severity. Although the other three domains were also significantly related to insomnia severity in the GS group, "sleep scheduling and timing" was not significantly related to insomnia severity in the ISP group, "eating/drinking behaviors" was not in either of the ISD and ISP groups, and the sleep environment was not in the ISD group. The original SHPS showed a significant correlation between arousal-related behaviors and insomnia severity in both the insomniacs and good sleepers, and that between the other domains and insomnia severity only for the good sleepers. Yang et al. [11] discussed these results on how insomnia develops and becomes perpetuated by using the 3P model of insomnia [22,23] and a cognitive model of the maintenance of insomnia [24,25]. In the 3P model, the interaction between the predisposing factor and the precipitating factor is a major contributor to the onset of insomnia. Based on these perspectives, arousal-related behaviors may contribute to both the onset and persistence of insomnia. On the other hand, sleep scheduling and timing were related to insomnia severity in both the GS and ISD groups, and the sleep environment was related to insomnia severity in both the GS and ISP groups. These results suggest that irregular sleep leads to an insomnia disorder with nocturnal symptoms and daytime dysfunction, and that a maladaptive sleep environment causes nocturnal sleep problems. Stimulus control and sleep restriction are especially effective in CBT-I; these findings are remarkable. Thus, our results demonstrated the adequate construct validity for the SHPS-J as well.

The clinical validity analysis showed that each domain was significantly higher for the insomnia syndrome than for either the insomnia symptom or good sleep. However, the effect size of the eating/drinking behaviors domain was small. In the original SHPS, only arousal-related behaviors were markedly higher in the insomniacs than in the good sleepers. Our results suggested that the ISD group was conducting more maladaptive sleep hygiene across the board [6,7]. However, the domains of the SHPS-J, except for arousal-related behaviors, were not significantly different between the ISP and GS groups. Since the original SHPS did not separate insomnia into two groups (ISP and ISD), these findings are useful in clinical settings with many patients with ISD. Thus, the SHPS-J is considered to have acceptable clinical validity. However, as mentioned above, the eating/drinking behaviors domain should be discussed in the future.

4.3. Limitations and future directions

This study has some limitations. First, the study participants might not be representative of the general population in Japan because the study was conducted as an internet-based survey. Second, it is not clear whether the participants in the insomniac group would have been diagnosed with chronic insomnia disorder by a physician, although they were classified based on a criterion for insomnia on Diagnostic and Statistical Manual of Mental Disorders fifth edition [1]. Therefore, it is necessary to analyze whether the same results would be obtained from a general population sample that includes insomniac patients from all age groups.

With regard to the study limitations and future directions for investigation, our results suggest that issues remain regarding the internal consistency and factorial validity of the eating/drinking behaviors domain of the SHPS-J. This issue stems from the fact that, as previously mentioned, eating and drinking behaviors vary among individuals. Future studies need to explore similarities in eating/drinking behaviors and restructure this category appropriately.

5. Conclusions

This study confirmed the reliability and validity of the SHPS-J. The SHPS-J could be used to assess different domains of sleep hygiene practice in order to facilitate the implementation of sleep hygiene education.

Funding

This work was partially supported by JSPS KAKENHI grant numbers 16K04388 and 19K03348.

Conflict of interest

SH, NS, MI, YO, and CMY declare no conflicts of interest. IO has received grants from NEC Solution Innovators and personal fees from Otsuka Pharmaceutical, Merck Sharp & Dohme, and Takeda Pharmaceuticals for projects unrelated to the submitted work.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleep.2021.01.047.

References

[1] American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington DC: American Psychiatric Association Publishing; 2013.
[2] Morin CM, LeBlanc M, Daley M, et al. Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. Sleep Med 2006;7:123–30.
[3] LeBlanc M, Beaulieu-Bonneau S, Merette C, et al. Psychological and health-related quality of life factors associated with insomnia in a population-based sample. J Psychosom Res 2007;63:157–66.
[4] Daley M, Morin CM, LeBlanc M, et al. The economic burden of insomnia: direct and indirect costs for individuals with insomnia syndrome, insomnia symptoms, and good sleepers. Sleep 2009;32:55–64.
[5] Kim K, Uchiyama M, Okawa M, et al. An epidemiological study of insomnia among the Japanese general population. Sleep 2000;23:41–7.
[6] Hauri PJ. Sleep hygiene. Kalamazoo: The Upjohn Company; 1977.
[7] Irish LA, Kline CE, Gunnm HE, et al. The role of sleep hygiene in promoting public health: a review of empirical evidence. Sleep Med Rev 2015;22:23–36.
[8] Hauri PJ. Sleep hygiene, relaxation therapy, and cognitive interventions. In: Hauri P, editor. Case studies in insomnia. Critical issues in Psychiatry (An educational series for residents and clinicians). Boston, MA: Springer; 1991. https://doi.org/10.1007/978-1-4757-9586-8_5.
[9] Brown FC, Buboltz Jr WC, Soper B. Relationship of sleep hygiene awareness, sleep hygiene practices, and sleep quality in universal students. Behav Med 2002;28:33–8.
[10] Morgenthaler T, Karmer M, Alessi C, et al. Practice parameters for the psychological and behavioral treatment of insomnia: an update. an American Academy of Sleep Medicine report. Sleep 2006;29:1415–9.
[11] Yang C, Lin S, Hsu S, et al. Maladaptive sleep hygiene practices in good sleepers and patients with insomnia. J Health Psychol 2010;15:147–55.
[12] McCrae CS, Rowe MA, Dautovich ND, et al. Sleep hygiene practices in two community dwelling samples of older adults. Sleep 2006;29:1551–60.
[13] Lacks P, Rotert M. Knowledge and practice of sleep hygiene techniques in insomniacs and good sleepers. Behav Res Ther 1986;24:365–8.
[14] Blake DD, Gomez MH. A scale for assessing sleep hygiene preliminary data. Psychol Rep 1998;83:1175–8.
[15] Mastin DF, Bryson J, Corwyn R. Assessment of sleep hygiene using the sleep hygiene index. J Behav Med 2006;29:223–7.
[16] Morin CM. Insomnia: psychological assessment and management. New York: Guilford Press; 1993.
[17] Bastien CH, Vallieres A, Morin CM. Validation of the insomnia severity index as an outcome measure for insomnia research. Sleep Med 2001;2:297–307.
[18] Munezawa T, Morin CM, Inoue Y, et al. Development of the Japanese version of the insomnia severity index (ISI-J). Jpn J Psychiatr Treat 2009;24:219–25 [in Japanese].
[19] Doi Y, Minowa M, Uchiyama M, et al. Psychometric assessment subjective sleep quality using Japanese version of the Pittsburgh Sleep Quality Index (PSQI-J) in psychiatric disordered and control subjects. Psychiatr Res 2000;97:165–72.
[20] Okajima I, Ishii M, Ochi M, et al. Psychometric properties of the Japanese version of the pre-sleep arousal scale. Tohoku J Exp Med 2020;252:169–76.
[21] Wild D, Grove A, Martin M, et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. Value Health 2005;8:94–104.
[22] Spielman AJ. Assessment of insomnia. Clin Psychol Rev 1986;6:11–25.
[23] Spielman AJ, Caruso LS, Glovinsky PB. A behavioral perspective on insomnia treatment. Psychiatr Clin North Am 1987;10:541–53.
[24] Harvey AG. A cognitive model of insomnia. Behav Res Ther 2002;40:869–93.
[25] Harvey AG. A cognitive theory and therapy for chronic insomnia. J Cognit Psychol 2005;19:41–59.