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## Reliability and validity of the Chinese version of the Nightmare disorder index in adolescents

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### Abstract

The Nightmare Disorder Index Questionnaire (NDI) was developed to measure the impact of nightmares. The purpose of this study was to investigate the psychometric properties of NDI among Chinese adolescents. This study investigated the validity and internal consistency of the Nightmare Disorder Index Chinese (NDI-CV) among 6014 Chinese adolescents who completed the NDI-CV, Nightmare Distress Questionnaire-Chinese Version (NDQ-CV), Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI), Chinese Adolescent Daytime Sleepiness Scale (CADSS), Generalized Anxiety Disorder-7 Questionnaire (GAD-7), and Patient Health Questionnaire-9 (PHQ-9). In addition, we investigated the test-retest reliability of the NDI-CV among 423 adolescents who completed a retest of the NDI-CV after a 2-week interval. Finally, NDI-CV demonstrated good psychometric properties in a sample of Chinese adolescents (Cronbach's  $\alpha$  coefficient of 0.876), and the 95% confidence interval for the 2-week retest correlation coefficient was 0.675–0.977 ( $p < 0.001$ ).

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#### AUTHOR CONTRIBUTIONS

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#### CONFLICT OF INTEREST STATEMENT

All authors declare no competing financial interest.

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethics Committee of Beijing HuiLongGuan Hospital approved the study.

#### SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

## Keywords

adolescents; nightmare; psychometrics; rating scale; sleep disorder

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## 1 | INTRODUCTION

Nightmares are disturbing, dysphoric, well-remembered dreams that can cause terror, despair, anxiety, extreme sadness, and other strong negative emotional reactions. According to the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) nightmare disorder was described as (1) repeated with extreme and extended dysphoric dreams that are well-remembered, (2) typically involving threatening scenarios (to physical integrity, security, or survival), (3) marked by rapid alertness and orientation upon waking, and (4) causing impaired function (which may include social and occupational functioning) resulting from clinically significant distress from the repeated experiences (American Psychiatric Association, 2013). Nightmares result in awakening, after which the individual quickly recovers orientation and alertness (Sateia, 2014).

The published prevalence estimates in different studies vary widely due to differences in methodology and study populations. In general, about 2%–5% of the general population experiences frequent nightmares (defined as at least once per week), and more women than men report frequent nightmares (Nils et al., 2013; Park et al., 2021; Schredl, 2010). Nightmares are also considered to be more frequent in adolescents than in adults, with 26.2% of Chinese adolescent students reporting nightmares by using a single item questionnaire (Liu, Yang, et al., 2021). The prevalence of nightmare is much higher among people with psychiatric disorders than among the general population (Akkaoui et al., 2020; Swart et al., 2013). Systematic reviews indicate that 9%–55% of patients with psychotic disorders have nightmares, and other studies investigating the prevalence of nightmares in mental disorders found an incidence of 37.3% in major depressive disorder, 31.1% in personality disorders, and 66.7% in posttraumatic stress disorder (Akkaoui et al., 2020; Swart et al., 2013; Waters et al., 2017). Moreover, anecdotal evidence suggests that some antidepressants, such as vilazodone and mirtazapine, may be a risk factor for nightmares (Wichniak et al., 2017). Exposure to stressful events can also increase the frequency of nightmares, especially for adolescents (Solomonova et al., 2021). A meta-analysis shows that exposure to childhood abuse is significantly associated with adolescent nightmares (OR = 3.15, 95% CI = 2.38–4.18) (Schonning et al., 2022).

Frequent nightmares have been linked to a variety of other sleep problems, poor mental health outcomes, and reduced quality of life (Akkaoui et al., 2020; Hermoso et al., 2020; Isabelle et al., 2013). Nightmares are associated with increased risk of suicidal behavior or suicidal ideation, which independently of insomnia, PTSD, anxiety and depression (Liu, Yang, et al., 2021; Russell et al., 2018). Specifically, nightmares are related to and predictive of increased severity of delusions, hallucinations and emotions problems (anxiety and depression) (Kammerer et al., 2020; Sheaves et al., 2015).

An essential prerequisite to the accurate evaluation of nightmares is the availability of reliable and valid assessment tools. The structured clinical interview has good qualities as the gold standard for assessing nightmare disorder (Taylor et al., 2018). However, they are not always feasible in the context of scientific research and rarely do they include this disorder. Thus, self-report questionnaires are the most common method for assessing the severity of nightmare (Aurora et al., 2010). The Nightmare Distress Questionnaire (NDQ) is commonly used for nightmare assessment that has good reliability and validity (Belicki, 1992; Liu, Liu, et al., 2021). However, the scale only measures nightmare distress. The Disturbing Dream and Nightmare Severity Index is another widely used questionnaire for measuring nightmares, but it only assesses nightmare frequency and nightmare distress (Lee et al., 2021). Recently, Dietch et al. (2021) developed a brief 5-item validated self-report measure called the Nightmare Disorder Index (NDI) to briefly screen for nightmare disorder according to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) criteria. The NDI has five items assessing nightmare frequency, characteristics, distress, and impairment, and duration, with scores ranging from 0 to 4 for each item. One study showed that this scale has reliable internal consistency reliability and excellent validity for nurses (Dietch et al., 2021). However, it is a new instrument and has been little used to date, so there is limited information on the psychometric properties of this scale.

The NDI has not yet been investigated in the Chinese cultural background factors, and whether the NDI is an effective measurement of nightmare in China disorder is unclear. There are also few useful nightmare assessment tools available in China Chinese languages. This study introduced the NDI in a Chinese context and assessed the psychometric properties of the NDI-Chinese version (NDI-CV) in Chinese adolescents.

## 2 | METHODS

### 2.1 | Sample

We conducted this cross-sectional study through an online survey (Wenjuanxing platform) between March 17 and 14 May 2021. In total 7011 participants aged 12–18 years took part in the survey mainly from Shandong Province, some from Hebei Province, Tianjin and Beijing. All participants and their parents and guardians have read the informed consent in detail, and all voluntarily and consented to participate in this study. Parents or legal guardians gave written consent to the study. Electronic informed consent was obtained from parents or guardians, and all participants' information is anonymous. No reward was offered, and only one survey was allowed per IP address.

The inclusion criteria for participants were as follows: (1) middle and high school students, (2) can read and understand the Chinese questionnaire, (3) WeChat users or QQ users, (4) volunteer to participate in the survey, (5) submit only one survey using the same IP. Exclusion criteria are as follows: (1) the participants who have not completed the answers, (2) participants who answered the questions for too short a time (less than 5 min).

After removing incomplete responses, the results of 6014 completed questionnaires were included in the analysis. To inspect test-retest reliability, we randomly selected 423 participants to complete the Chinese version of the NDI (NDI-CV) again two weeks later

followed a simple random sampling method. Prior to the study, the Ethics Committee of Beijing Huilongguan Hospital approved the research protocol.

## 2.2 | Measures

**2.2.1 | Nightmare disorder index Chinese version**—The original NDI is a self-report measurement tool and contains five items with a total score from 0 to 20, and higher scores indicating more severe nightmare (Dietch et al., 2021). Categorical scoring is mainly based on the participants' responses (frequency) to the first four items, divided into *No Nightmare Disorder* (response to the first item is 0), *Subthreshold/Partial Nightmare Disorder Symptoms* (response to the first item is 1–4, and responses to items 2–4 are all 0 or 1), and *Probable Nightmare Disorder* (response to item 1 is 1–4, and the responses to items 2–4 = 2). Dr. Jessica Dietch, the first author of NDI validation publication (Dietch et al., 2021), gave us permission to use NDI. The English version of NDI was independently translated into Chinese by two researchers in psychology. Then, the final version of the NDI-CV was determined after discussion by two psychology professors who revised inconsistent and inaccurate items. Next, the final version was back-translated by a professional bilingual translator who had not read the original version of the NDI. Corrections were made iteratively until the same meaning as the original version was accurately expressed by NDI-CV. After initial testing, all authors determined that the NDI-CV adequately represented the NDI. The NDI-CV can be found in the Appendix.

**2.2.2 | The NDQ-Chinese version**—The original NDQ was developed by Belicki et al., consisting of 13 items to assess nightmares waking distress (Belicki, 1992). The Chinese version (NDQ-CV) was revised by Liu et al., and the item of general distress of nightmare was added. The scale includes 14 items and uses a 5-point Likert scale, with a total score ranging from 14 to 70 points. The NDQ-CV has good reliability and validity in Chinese adolescents, and the Cronbach's  $\alpha$  is 0.88 (Liu, Liu, et al., 2021).

**2.2.3 | The pittsburgh sleep quality index**—The Pittsburgh Sleep Quality Index (PSQI) is a scale used to assess subjective sleep quality, which consisting of 19 items (Buysse et al., 1989). The PSQI has shown adequate psychometric properties in samples of adolescents with the Cronbach's  $\alpha$  0.73 (de la Vega et al., 2015; Raniti et al., 2018). The questionnaire contains seven components that assess various aspects of sleep. Higher scores on the PSQI indicate worse sleep quality. PSQI score  $\geq 5$  was used to distinguish poor sleepers from good sleepers (Kalamara et al., 2022). The Chinese version of the PSQI have been examined and performed a reliable and valid instrument for evaluating sleep quality (Liu et al., 1996).

**2.2.4 | The insomnia severity index**—The Insomnia Severity Index (ISI) is a self-rating questionnaire used to assess the characteristics and severity of insomnia and its impact on individuals. The scale includes seven items, and a Likert score 1–4 is adopted for each item, with a total score of 0–28 points. The Chinese version of ISI is also a reliable and effective tool with the Cronbach's  $\alpha$  0.83 (Chung et al., 2011).

**2.2.5 | Chinese adolescent daytime sleepiness scale**—The Chinese Adolescent Daytime Sleepiness Scale (CADSS) was used to evaluate the daytime sleepiness of subjects over the previous month. It consists of seven items determining daytime sleepiness and napping in different scenarios over the past month. The CADSS mainly consists of seven items, with an overall score range of 7–35 points. The scale has shown good validity and reliability in Chinese adolescents with the Cronbach's  $\alpha$  0.89 (Liu et al., 2017).

**2.2.6 | Patient health questionnaire-9**—The Patient Health Questionnaire-9 (PHQ-9) has been widely used to assess the severity of depressive symptoms, following the diagnostic items for major depressive disorder in the DSM-5 (Spitzer et al., 1999). The questionnaire was composed of nine items, with each item scoring 0–3 points, producing a total score of 0–27 points. The Chinese version of the PHQ-9 shows good reliability and validity with the Cronbach's  $\alpha$  0.86 (Wang et al., 2014).

**2.2.7 | Generalized anxiety disorder-7**—The Generalized Anxiety Disorder-7 (GAD-7) is a self-assessment tool with good reliability and validity (Spitzer et al., 2006). GAD-7 consists of seven items, and all items are scored on 0–4, with the total score ranging from 0 to 21. The higher the score, the more serious the anxiety symptoms. The reliability and validity of the Chinese version of GAD-7 have been confirmed by studies with the Cronbach's  $\alpha$  0.84 (Yga et al., 2020).

### 2.3 | Data analysis

The internal consistency reliability of the NDI-CV scale was examined using Cronbach's  $\alpha$  as a measurement index, defined as follows: excellent:  $>0.90$ , good: 0.8–0.9, acceptable: 0.7–0.8, problematic: 0.6–0.7, poor: 0.5–0.6, unacceptable:  $<0.5$  (Chen et al., 2021). We also calculated the intra-class correlation coefficient (ICC) with a 95% confidence interval to test the internal and inter-rater reliability. In addition, we used Pearson's correlation coefficient to inspect the degree of correlation between the scores of NDI-CV and NDQ-CV, PSQI, ISI, CADSS, PHQ-9, and GAD-7 scores. Moreover, to investigate the internal structure and basic dimensions of NDI-CV, factor analysis was conducted with varimax factor rotations. We used one-way ANOVA followed by post-hoc Scheffé tests to compare the distribution of psychological parameters in possible nightmare disorder, subthreshold nightmare symptoms, and no nightmares disorder. All statistical tests were two-tailed tests. The threshold for statistical significance was set to  $p < 0.05$ . We used SPSS statistical software package (version 20.0) to analyze the data.

## 3 | RESULTS

Deleting questionnaires with incomplete answers, a total of 6014 adolescents completed the assessment, with a response rate of 85.8%. In the sample, the mean age was 16.12 (SD = 1.44) years; 49.0% of respondents were male, and 51.0% were female. Junior and senior high school students were 37.9% and 62.1% of respondents, respectively. Over the previous month, nightmares were reported by 32.8%, 24.7% reported less than one night per week, 7.0% reported 1–3 nights per week, 0.8% reported 4–6 nights per week, and 0.5% reported seven nights per week (Table 1).

Table 2 shows excellent internal consistency reliability for NDI-CV, with a Cronbach's  $\alpha$  coefficient of 0.876. After one item was deleted, the Cronbach's  $\alpha$  of the remaining items ranging from 0.539 to 0.824, indicating that the internal consistency of the scale was acceptable (Intra-Rater Reliability of NDI-CV see Supplementary Table S1).

The test-retest reliability of 423 was analyzed at two-week intervals. The ICC was 0.926 for the total score (95% CI: 0.881–0.964). The ICC for awakening was 0.950 (95% CI: 0.919–0.977), higher than other factors. The ICC for frequency was 0.907 (95% CI: 0.855–0.950); the ICC for distress was 0.916 (95% CI: 0.865–0.960); the ICC for impairment was 0.809 (95% CI: 0.675–0.921); the ICC for duration was 0.836 (95% CI: 0.713–0.911) (Table 3).

Figure 1 shows the Pearson's correlation coefficients between the NDI-CV score and the NDQ-CV, PSQI, ISI, CADSS, PHQ-9, and GAD-7 scores. The NDI-CV scores were positively associated with the NDQ-CV scores ( $r = 0.732$ ,  $p < 0.01$ ), PSQI scores ( $r = 0.528$ ,  $p < 0.01$ ), ISI scores ( $r = 0.512$ ,  $p < 0.01$ ), CDSS ( $r = 0.411$ ,  $p < 0.01$ ), PHQ-9 ( $r = 0.512$ ,  $p < 0.01$ ), and GAD-7 ( $r = 0.496$ ,  $p < 0.01$ ). Further statistical analysis revealed that there was also a significant positive correlation between the score of each item of NDQ-CV and other scales ( $r_s = 0.239$ – $0.894$ , all  $p < 0.01$ ).

Exploratory factor analysis showed that the Kaiser-Meyer-Olkin value was 0.842, which is considered acceptable. The Bartlett test of sphericity exceeded the level of significance ( $\chi^2 = 17124.231$ ,  $p < 0.001$ ). These results indicated that our data were suitable for factor analysis. Using principal component analysis and the orthogonal rotating axis method, according to the gravel map and analysis results, one factor with a characteristic root greater than 1 was finally extracted. The characteristic root value was 3.413, and the total contribution rate of cumulative variance was 49.98%. We called this common factor NDI-CV. In addition, all items had medium to high range pattern coefficients, indicating that they all items had a strong correlation with common factors (Table 4).

The psychosocial characteristics of participants with different nightmare disorder index levels are shown in Figure 2 (See Supplementary Table S2. for more detail). The mean age for without nightmare disorder, subthreshold nightmare symptoms and possible nightmare disorder respectively were 16.08 (SD = 1.46), 16.22 (SD = 1.39), 16.05 (SD = 1.43) years. Female students have higher proportion of subthreshold nightmares and possible nightmare disorder. Junior high school students have a higher proportion of subthreshold nightmare symptoms, but junior high school students have a higher proportion of possible nightmare disorder (See Supplementary Table S3. for more detail). The possible nightmare disorder group had significant differences in the dimensions of nightmare disturbance, insomnia, daytime sleepiness, and depression/anxiety symptoms, when compared with subthreshold nightmare symptoms and no nightmare disorder. Regarding psychosocial characteristics, participants who reported no nightmare disorder had the lowest average, followed by participants with subthreshold nightmare symptoms, and then participants with possible probable nightmare disorder.

## 4 | DISCUSSION

In our study, we introduced a Chinese version of the NDI and examined the psychometric properties of this questionnaire, created to assess the severity of nightmare disorder in a Chinese adolescent population. We also tested the psychometric properties in a Chinese sample of more than 6000 adolescents. The Cronbach's alpha value suggests that the tool had good internal consistency ( $\alpha = 0.876$ ), which is consistent with the initial research in the American social and cultural context ( $\alpha = 0.80$ ) (Dietch et al., 2021). Therefore, our results suggest that NDI-CV is an effective and reliable tool for screening for DSM-5 nightmare disorder in Chinese adolescents. In this study, the test-retest reliability of the total NDI-CV score was excellent, with an ICC of 0.926 (95% CI: 0.881–0.964). Likewise, the test-retest reliability for each item was good or excellent, with the Cronbach's alpha ranging from 0.836 to 0.950. Therefore, the NDI-CV was reliable based on test-retest reliability, in that it consistently yielded similar results over time. Exploratory factor analysis was also conducted to investigate the factor structure of the NDI-CV, and the results indicated that the one factor can be recommended as the best model for Chinese adolescents, which was consistent with the initial validation (Dietch et al., 2021).

Prior findings suggested that nightmares were associated with psychological and sleep disturbances (Horie et al., 2021; Liu, Liu, et al., 2021; Stefani & Hogl, 2021; Wan et al., 2020). We calculated the Pearson correlation coefficient with multiple related validated questionnaires (NDQ-CV, PSQI, ISI, CADSS, PHQ-9, and GAD-7) to examine concurrent validity of the NDI-CV. As expected, the total score of NDI-CV had significant positive correlations with the quality of sleep, insomnia, daytime sleepiness, anxiety symptoms, and depressive symptoms. A similar positive correlation was also observed between each item of NDI-CV (frequency, awakenings, distress, impairment, and duration) and the questionnaires. As expected, the highest correlations were seen with the nightmare domain-specific measure, then the sleep domain measures, and then the psychological symptom measures. Taken together, these results provide evidence that the NDI-CV has acceptable validity in assessing the severity of nightmare disorder in Chinese adolescents.

In addition, although several reports on nightmares have emerged in recent years, individual item measures, such as frequency or distress, examine only a single dimension of the nightmare experience (Kammerer et al., 2020; Liu, Liu, et al., 2021; Schredl et al., 2017; Schredl et al., 2019). In this study, we also analyzed the frequency of nightmares over the previous month and found a much lower frequency than in previous studies of general adolescent populations (Liu, Liu, et al., 2021; Liu, Yang, et al., 2021). Different assessment tools and criteria were selected, as factors to be considered. In our study, strict criteria were used to assess the incidence of nightmares. However, so far as we know, no studies have focused on the frequency of probable nightmare disorder in adolescents with the use of NDI until now. In future studies, uniform tools and strict evaluation criteria should be used to obtain consistent and accurate evaluation results. In the current sample, the rate of probable nightmare disorder was 1.7%, and the rate of subthreshold nightmare symptoms was 31.1%, lower values than those previously reported among American nurses (Dietch et al., 2021). This may be related to the fact that nurses engage in overnight or rotating shift work, face difficult work tasks, and experience stress every day compared to teenagers.

In this study, we explored the psychosocial characteristics of participants with nightmares. We found that possible nightmare disorder is significantly related to severe psychosocial burden. Our results indicated that the severity of nightmares is related to severity of the social psychological burden, such that adolescents who had probable nightmare disorder based on the NDI had significantly greater chance of symptoms of insomnia, sleepiness, depression, and anxiety than adolescents with subthreshold or no nightmares. Moreover, this study found that adolescents with subthreshold nightmare disorder had poorer subjective sleep quality and more severe symptoms of insomnia, sleepiness, depression, and anxiety compared to those with no nightmares. In addition, nearly one-third of the adolescents in our study had subthreshold nightmare symptoms, and we should examine the psychological problems and sleep problems of these adolescents as well.

Of course, there are some limitations to consider in our study. First, we did not compare the measure against a gold standard of nightmare disorder diagnosis, such as a clinical interview. In future studies, online surveys could be combined with clinical interview to provide additional validity evidence for the measure. Second, the scales produce subjective reports from participants, without an objective standard. Future research could be combined with polysomnography to analyze this research. Although this is not within the scope of the current study, it is an important future direction to consider that some adolescents with nightmare disorders have increased sleep abnormalities. Third, since our online survey targeted all adolescents, and did not completely exclude nightmare disorder caused by the effects of a drug of abuse or medication or attributed to another mental disorder (i.e., posttraumatic stress disorder, delirium) or medical condition, it may lead to an increase in the incidence of nightmare disorder among adolescents. Finally, the participants we surveyed were 12–18 years old. It is unclear whether the results can be generalized to other age groups in China. It is necessary to further expand the investigation group in future studies. Of course, because our participants were not clinical sample of patients with nightmare disorders, future studies also could be conducted in clinical sample of patients to verify the clinical validity of this questionnaire.

## 5 | CONCLUSIONS

In conclusion, our study suggests that NDI-CV has good reliability and validity in Chinese adolescents, and adolescents suffering from nightmares have more severe sleep and mood problems. Increased screening for nightmare disorder among adolescents using a brief questionnaire like the NDI-CV would allow for detection of potential cases of nightmare disorder and referral for intervention.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## DATA AVAILABILITY STATEMENTS

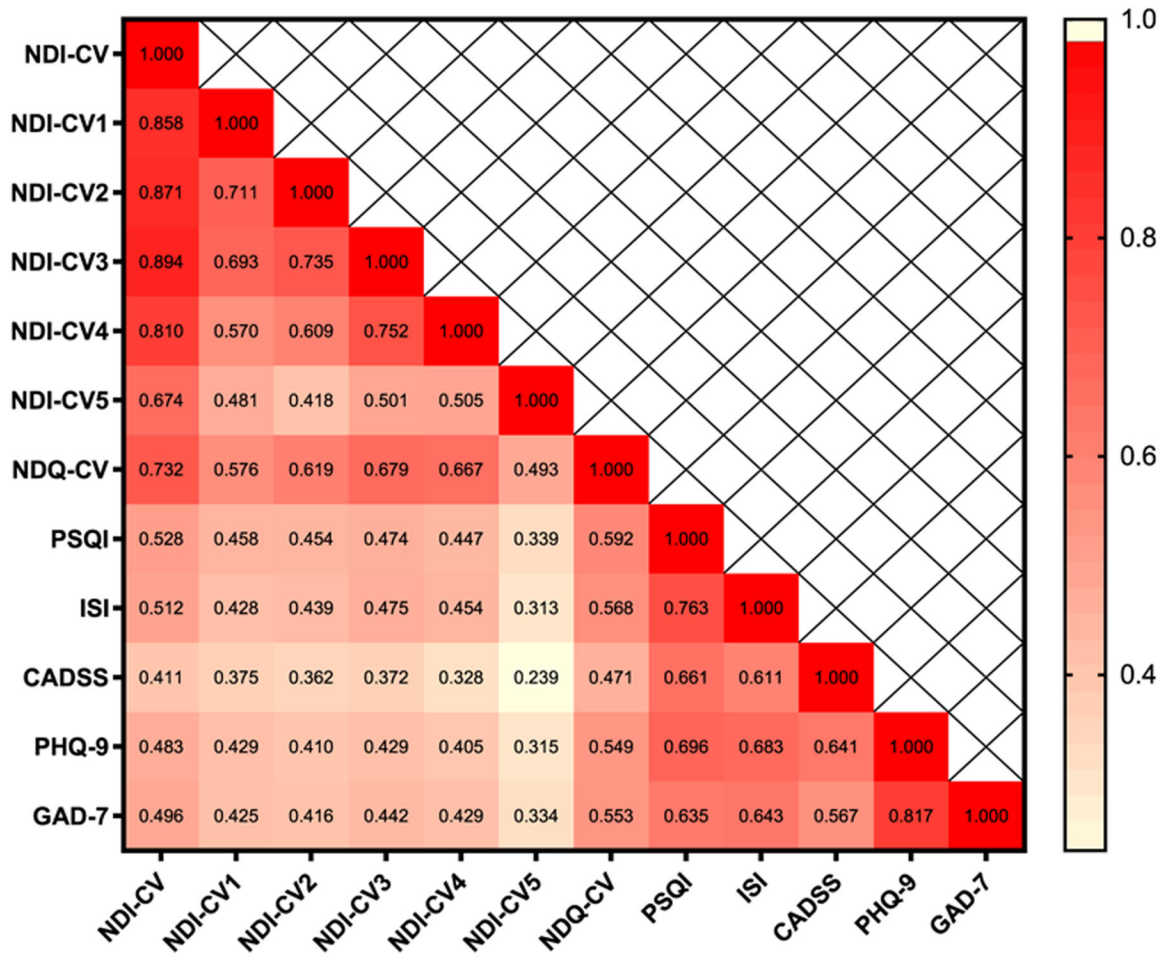
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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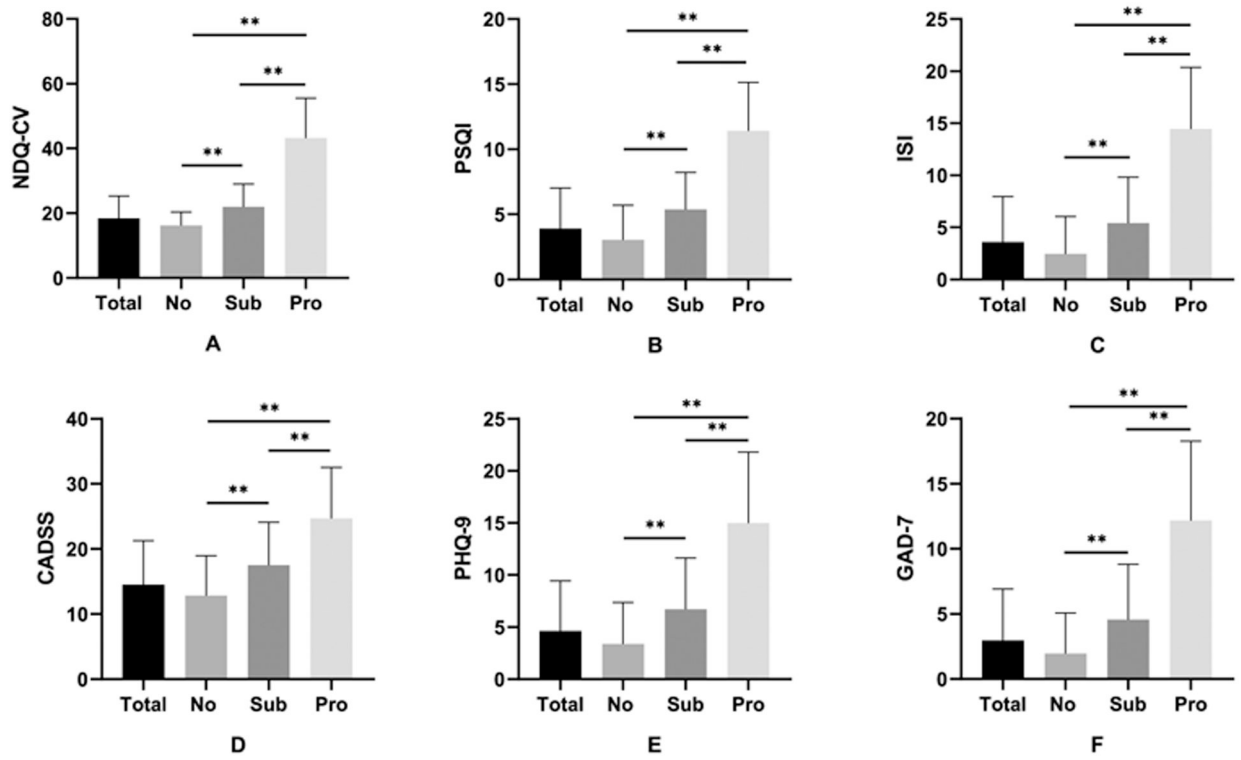
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**FIGURE 1.**  
Correlations Between the Total Scores of the NDI-CV and other scales.



**FIGURE 2.**

Psychosocial characteristics by nightmare status on NDI-CV. Total represents the total sample; No represents the no nightmares; Sub represents the subthreshold nightmare symptoms; Pro represents the probable nightmare disorder. \*\* $p < 0.001$ .

**TABLE 1**Sociodemographic and clinical characteristics of the participants ( $N=6014$ ).

<b>Variables</b>	<b>Values</b>
Gender ( <i>n, %</i> )	
Male	2949 (49.0%)
Female	3065 (51.0%)
Age (years, mean $\pm$ SD)	16.1 $\pm$ 1.4
Educational level ( <i>n, %</i> )	
Junior high school	2279 (37.9%)
Senior high school	3735 (62.1%)
Nightmare frequency ( <i>n, %</i> )	
None	4040 (67.2%)
Yes	1974 (32.8%)
<1 night per week	1471 (24.5%)
1–3 night per week	420 (7.0%)
4–6 night per week	50 (0.8%)
7 night per week	33 (0.5%)

Abbreviation: SD, standard deviation.

**TABLE 2**

Internal consistency features of the NDI-CV.

Item	Mean value if item deleted	SD value if item deleted	Item-total correlation	Cronbach's $\alpha$ if item deleted
1	0.904	2.014	0.858	0.752
2	0.962	1.950	0.871	0.758
3	1.066	2.043	0.894	0.824
4	1.180	2.22	0.810	0.728
5	1.229	2.272	0.674	0.539
				Cronbach's $\alpha$
NDI-C				0.876

Abbreviations: NDI-CV, Nightmare Disorder Index-Chinese Version; SD, standard deviation.

**TABLE 3**Intra-rater reliability of NDI-CV ( $n = 423$ ).

	<b>ICC</b>	<b>95% CI</b>	<b><i>p</i></b>
1. Frequency	0.907	0.855–0.950	<0.001
2. Awakenings	0.950	0.919–0.977	<0.001
3. Distress	0.916	0.865–0.960	<0.001
4. Impairment	0.809	0.675–0.921	<0.001
5. Duration	0.836	0.713–0.911	<0.001
NDI-CV	0.926	0.881–0.964	<0.001

Abbreviation: NDI-CV, Nightmare Disorder Index-Chinese version.

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**TABLE 4**

Pattern/structure coefficients and extracted communalities for NDI-CV.

<b>Item</b>	<b>Factor 1: NDI-CV</b>	<b><math>h^2</math></b>
1. Frequency	0.843	0.711
2. Awakenings	0.852	0.726
3. Distress	0.903	0.815
4. Impairment	0.837	0.701
5. Duration	0.678	0.460

Abbreviation: NDI-CV, Nightmare Disorder Index-Chinese Version.

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