

# *Validity and Reliability of the Chinese Bedtime Procrastination Scale Among College Students*

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**Abstract— Objective:** The research on bedtime procrastination is getting more and more attention, but the assessment tools are rare. The purpose of this study was to translate the English version of the Bedtime Procrastination Scale ( BPS ) into Chinese and test its reliability and validity among college students. **Methods:** The Chinese version of BPS was developed by translation, back-translation, and cultural adjustment from December 2019 to January 2020, a total of 220 students were selected from a college in Guangzhou by convenient sampling method, and 200 questionnaires were collected available. The rate of effective response was 90.1%, and 14 out of the 200 were retested two weeks later. Using critical ratio method and correlation analysis to evaluate the scale. Using internal consistency Cronbach's  $\alpha$  coefficient and retest reliability to measure the reliability of the scale. Using content validity and confirmatory factor analysis to test the validity of the scale. **Results:** The internal consistency and retest reliability of the scale were analyzed in this study, the results showed that Cronbach's  $\alpha$  was 0.887, and met the standard of  $>0.8$ . It was shown that the scale had a good consistency. The students were retested 2 weeks later, and the retest reliability was 0.825. It was suggested that the model fitting was good, indicating that the Chinese version of BPS had good construct validity. **Conclusions:** The Chinese version of BPS has good reliability and validity, it can be used to evaluate the status of bedtime procrastination in college students.

**Keywords—** Bedtime Procrastination Scale; Reliability; Validity.

## I. INTRODUCTION

As the stress of life increases, diversified ways of entertainment, and personality consciousness enhancement, more and more young people are developing the bad lifestyle of staying up late at night<sup>1-2</sup>. The study of White Paper on Chinese Young people sleeping late 2019 indicated that nearly 33.7% of young people aged 15 to 35 usually go to bed between 23:00 and

24:00, the characteristics of long-term irregular sleep and going to bed after 24:00 are more obvious in the age of 15~25. More than 30% of young people who stay up late get less than six hours of sleep<sup>3</sup>. The phenomenon of insufficient sleep among college students is common<sup>4-6</sup>. Insufficient sleep will directly do harm to the physical and mental health of individuals<sup>7-11</sup>, and bedtime procrastination is an important cause<sup>12-13</sup>. It has caused serious health problems in college students which can not be ignored. Bedtime procrastination is defined as failing to go to bed at the intended time, while no external circumstances prevent a person from doing so. Floor M. Kroese from Holland was the first to introduce the concept into the sleep domain in 2014 and developed the Bedtime Procrastination Scale. The scale is single-dimensional with 9 items and is used to measure bedtime procrastination in adults. The study confirmed that the scale has good reliability and validity, and the scale has been translated into Spanish, Polish, and other versions<sup>14-15</sup>, all of which are single-dimensional. The research was based on bedtime procrastination is getting more and more attention in China, Zhang Lu and other scholars translated the scale, exploratory factor analysis confirmed that all the scales are a single-dimensional structure. However, all these scales have problems in translation, the definition of bedtime procrastination was mistranslated, "go to bed" was translated into "sleep", however, "sleep" includes "go to bed" in Chinese. Obviously, it could beyond the scope of original research, and sleep procrastination should be divided into Bedtime procrastination and While-in-Bed procrastination<sup>18</sup>, so the translation of the scale in Chinese version needs further revision. The purpose of this study is to localize the Bedtime Procrastination Scale and test it by standardized measurement. In order to provide an accurate and effective research tool for studying the phenomenon of college students going to bed late.

## II. METHODOLOGY

### 2.1 Participants

A total of 220 students were selected from 5 medical classes and 1 non-medical class in a credit college in Guangzhou from December 2019 to January 2020 by means of the convenience sampling method. Inclusion criteria : (1) Students who live on campus; (2) Volunteer to be a participant. Exclusion criteria: (1) Interns; (2) Short-term communication learners in college. According to the sample size calculation method of factor analysis<sup>19</sup>, The sample size was 5~10 times the number of items in the scale, but half of the data was extracted for confirmatory factor analysis, so the sample size was 10~20 times the number of items. Besides 10% sample loss rate was considered, so the final sample size was 200.

### 2.2 Questionnaires

#### 2.2.1 Demographics

Demographics included gender, age, grade, and major.

#### 2.2.2 Bedtime Procrastination

The Bedtime Procrastination was assessed with the 9-item Bedtime Procrastination scale which was developed by Floor M. Kroese<sup>12</sup> (Cronbach's  $\alpha = 0.92$ ). Items were answered on 5-point scales ranging from 1 (never) to 5 (always). Items 2, 3, 7, and 9 were scored in reverse order. The higher the score, the more likely it was to delay bedtime.

### 2.3 Procedure

#### 2.3.1 Localization and Cross-cultural Adaptation

After permission, the Brislin translation model was used to translate and revise the scale. (1) translation: two nursing teachers and a teacher with overseas education background were invited to complete the translation, Then, invited a Chinese professor of nursing and psychology adjusted the expression of relevant items according to Chinese culture. (2) Back-translation: Invited 2 English lecturers to translate the first Chinese version into English. (3) Culture adaptation: Invited a team of experts to interpret the consistency between the original version and the translated version.

#### 2.3.2 Pilot Survey

There were 10 nursing students selected by means of convenience sampling, to test the students' understanding of items, and then revise again.

### 2.3.3 Investigation

The survey was posted on the WJX platform, participants were required to finish the questionnaire during their free time between classes, and it was only allowed to be answered one time by WeChat within 5 min. Before that, informed participants of the purpose of this research, the way to fill in, and the attention. The study was conducted in an anonymous way, participants had the right to reject it. Finally, a total of 220 questionnaires were recovered, 20 invalid questionnaires were eliminated, and the effective recovery rate was 90.9%. 14 cases were randomly selected from the participants and retested 2 weeks later.

### 2.3.4 Statistical Methods

The SPSS21.0 and AMOS21.0 software was used for descriptive analysis, correlation analysis, reliability analysis, and confirmatory factor analysis. Using two independent sample t-test and correlation analyses were used for item analysis. Using internal consistency Cronbach's  $\alpha$  coefficient and retest reliability to measure the reliability of the scale. Using content validity and confirmatory factor analysis to test the construct validity of the scale.

## III. RESULTS

### 3.1 Descriptives

The Table 1 presents the descriptive statistics of the demographics outcome of 200 participants. Including: male 33 cases (16.5%), female 167 cases (83.5%). Age from 17 to 24, the average age was (19.40±0.55). Freshman 79 cases (39.5%), sophomore 83 cases (41.5%), junior 30 cases (15.0%), senior 8 cases (4.0%). Medical 155 cases (77.5%), literature 11 cases (5.5%), science 11 cases (5.5%), economics 6 cases (3.0%), management 7 cases (3.5%), engineering 10 cases (5.0%). As seen in table 1.

### 3.2 Item analysis of the scale

The critical ratio method and correlation analysis outcome indicated that the CR value of each item was 8.824~18.649 ( $P < 0.05$ ), the correlation coefficient between items and the scale was 0.583~0.813 ( $P < 0.05$ ). All 9 items of the scale passed the test, and all items were retained. As seen in table 2.

### 3.3 Validity Analysis

#### 3.3.1 Content Validity

There are three nursing experts who were invited to evaluate the content validity of The Chinese version of BPS, A four-level scoring method (1=irrelevant, 2=weak correlation, 3=strong correlation, 4= strong correlation) was used to evaluate item relevance. The results indicated that the content validity index (I-CVI) of each item was 1.00, S-CVI/UA was 1.0.

#### 3.3.2 Construct Validity

Confirmatory factor analysis was used to examine its possible factor structure. The results indicated that  $\chi^2/df$  was 2.340, RMSEA was 0.082, GFI was 0.934, SRMR was 0.0431, CFI was 0.956, IFI was 0.956, TLI was 0.941. As shown in table 3 and figure 1.

#### 3.3.3 Reliability Analysis

The Cronbach's  $\alpha$  coefficient of the Chinese version of BPS was 0.887, and the retest reliability was 0.82 ( $P < 0.01$ ). As seen in Table 4.

## IV. DISCUSSION

### 4.1 Item analysis of the Chinese version of BPS

The Chinese version of BPS contains 9 items. According to the item analysis results. The CR value of each item ranged from 8.824 to 18.649 ( $P < 0.05$  and was all greater than 3.00. This indicated that the scale had a good discriminability, which reflected that the scale can be evaluated from different aspects of bedtime procrastination. The correlation coefficient between each item and the scale was 0.583~0.813 ( $P < 0.05$ ). This indicated that items were consistent with the scale, which can reflect the extent of bedtime procrastination among college students.

### 4.2 Validity evaluation of the Chinese version of BPS

The results of this study showed that the I-CVI and S-CVI were both 1.00, which met the standards of I-CVI>0.78 and S-CVI >0.9020. This indicated that the content validity of the scale was relatively ideal, which could reflect the bedtime procrastination situation of college students. Confirmatory factor analysis was carried out for the scale, and the results showed that  $\chi^2/df$  was 2.340 and all other indexes reached the reference value as well. It was suggested that the model fitting was good, indicating that the Chinese version of BPS had good construct validity.

### 4.3 Reliability evaluation of the Chinese version of BPS

The internal consistency and retest reliability of the scale was analyzed in this study, the results showed that Cronbach's  $\alpha$  was 0.887, met the standard of >0.8. It was said that the scale had a good consistency. The students were retested 2 weeks later, and the retest reliability was 0.825. It indicated that the Chinese version of BPS had good stability.

### 4.4 Significance of the Chinese Version of BPS

Sleep is closely related to health, lack of sleep can cause a variety of sub-health symptoms<sup>21-24</sup>, and even lead to physical and mental diseases<sup>25-26</sup>. Studies have shown that 69.48% of college students who often stay up late are in a sub-health state<sup>27</sup>, the behavior of staying up late is common among college students<sup>28-29</sup>, and this problem can not be ignored. Domestic studies on sleep problems focus on sleep status, sleep disorder, sleep quality, and its influencing factors<sup>30-33</sup>, little attention has been paid to bedtime procrastination, and there is a lack of accurate assessment tools<sup>34</sup>. Xu Yanjing<sup>35</sup> translated and adapted the scale, but no detailed validity analysis was found, and the accuracy of its translation also needs to be improved.

### 4.5 Limitation of this Study

This study is based on strict cultural adaptation and standardized reliability and validity tests, and all indexes of the scale are up to the requirements of measurement. It can provide a scientific and effective measuring tool for evaluating bedtime procrastination. It also can help health practitioners to understand the status of staying up late in college students and to develop intervention measures, so as to promote physical and mental health.

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## V. CONCLUSION

To sum up, the Chinese Version of BPS in this study has good reliability and validity, it can provide an effective and far-reaching research tool for evaluating the bedtime procrastination of college students in China. However, most of the subjects of this study were enrolled in one college, and the sample source was single. A larger sample size could be contained to verify the measurement indexes of the scale in further study.

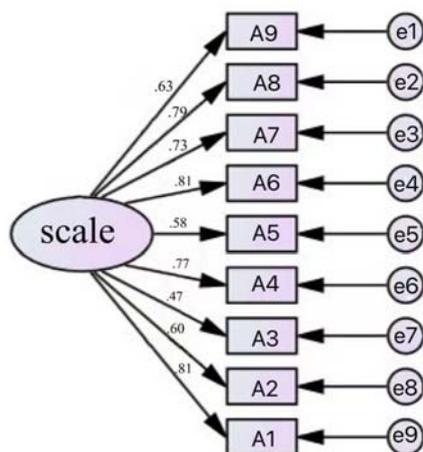


Figure1. Confirmatory factor analysis path

Table1 Demographics outcome of participants (n =200)

Items		Cases (n)	Constituent Ratio (%)
Gender	Male	33	16.5
	Female	167	83.5
Grade	Freshman	79	39.5
	Sophomore	83	41.5
	Junior	30	15.0
	Senior	8	4.0
Major	Medical	155	77.5
	Literature	11	5.5
	Science	11	5.5
	Economics	6	3.0
	Management	7	3.5
	Engineering	10	5.0

Table 2 Item analysis results

Item	Critical Ratio Method	Correlation Analysis	Results
	CR value	correlation coefficient	
1. My bedtime is later than I plan.	14.4**	.813**	Retain
2. If I have to get up early the next day, I'll go to bed ahead of time. R	10.487**	.665**	Retain
3. when it's time to turn the lights off at night, I'll immediately turn them off. R	8.524**	.583**	Retain
4. when it's time to go to bed, I'm often engaged in other things.	15.074**	.802**	Retain
5. when I really want to go to bed, I can be easily distracted by other things.	11.137**	.646**	Retain
6. I don't go to bed on time.	15.285**	.813**	Retain
7. I have a regular bedtime. R	15.094**	.771**	Retain
8. I want to go to bed on time, but I just couldn't make it.	18.649**	.794**	Retain
9. When it's time to go to bed, I'll immediately stop the activity at hand. R	10.21**	.668**	Retain

\*\* $P < 0.01$

Table 3 Confirmatory factor analysis fitting results

Index	$\chi^2/df$	RMSEA	GFI	SRMR	CFI	IFI	TLI
Factor Model	2.340	0.082	0.934	0.0431	0.956	0.956	0.941
Reference Value	$\leq 3.0$	$\leq 0.08$	$> 0.9$	$< 0.05$	$> 0.9$	$> 0.9$	$> 0.9$

Table 4 Reliability analysis results

Item	Corrected Total Item Correlation Index	Cronbach's Alpha	Retest Reliability Index
1. My bedtime is later than I plan.	.753		
2. If I have to get up early the next day, I'll go to bed ahead of time.	.573		
3. When it's time to turn the lights off at night, I'll immediately turn them off.	.451		
4. When it's time to go to bed, I'm often engaged in other things.	.740	.887	.825
5. When I really want to go to bed, I can be easily distracted by other things.	.532		
6. I don't go to bed on time.	.747		
7. I have a regular bedtime.	.699		
8. I want to go to bed on time, but I just couldn't make it.	.722		
9. When it's time to go to bed, I'll immediately stop the activity immediately.	.581		

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