Evaluation of the Psychometric Properties of the Malay Version of the Minnesota Nicotine Withdrawal Scale

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A B S T R A C T

Objectives: Assessment of nicotine withdrawal symptoms is an essential part of tobacco dependence treatment. This study aimed to evaluate the psychometric properties of a Malay translated version of the Minnesota Nicotine Withdrawal Scale (MNWS). **Methods:** The original scale was translated into Malay following the standard guidelines proposed for translation studies. The reliability and validity of the Malay version scale were evaluated on the basis of data collected from 133 participants. The Cronbach's alpha coefficient was calculated to assess the reliability. To validate the psychometric properties of the scale, factor analysis and construct validity were used. This study was conducted at the Quit Smoking Clinic at Penang General Hospital, Penang, Malaysia. **Results:** The translated scale has excellent reliability, with total Cronbach's alpha of 0.91. The test-retest reliability for the scale presented an excellent reliability and stability of the translated scale with Spearman's rank correlation coefficient ($r = 0.876$; $P < 0.001$). There was a significant positive correlation between the exhaled carbon monoxide level, Fagerstrom Test for Nicotine Dependence total score, and number of cigarettes smoked per day and the MNWS total score ($r = 0.72$, 0.68, and 0.68, respectively; $P < 0.001$). A principal-components analysis with orthogonal rotation yielded a unidimensional model that includes all the items of the MNWS. **Conclusions:** The Malay version of the MNWS is a reliable and valid measure of withdrawal symptoms as well as the smoking urge, and it is applicable to clinical practice and research study.

Keywords: Malay language, Minnesota Nicotine Withdrawal Scale, psychometric properties, translation, validation.

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Introduction

Tobacco, according to the World Health Organization, is one of the biggest public health threats the world has ever faced. Tobacco smoking is now a global epidemic of public health concern. Several reports conclude that cigarette smoking is the massive avoidable cause of premature death and disability worldwide [1,2]. Tobacco products are addictive in nature due to the nicotine contained in them. Nicotine dependence causes physical withdrawal as well as lifelong addiction. When tobacco use is stopped, nicotine withdrawal syndrome emerges because the body has developed a homeostatic response [2–5]. The nicotine withdrawal syndrome has been well described and can be a hallmark sign of dependence [6,7]. Typically, these symptoms appear within 2 hours after the last cigarette, peak between 1 and 2 days after cessation, and last up to a few weeks on average [7,8]. Other studies, however, have shown that there can be substantial variability in both the trajectory of symptoms and the time course of withdrawal [8].

Unfortunately, in many of the previous cases, the nicotine withdrawal syndrome was an important obstacle to successfully quitting and this may cause smoking relapse. Therefore, effective smoking cessation counseling has to emphasize how to cope with withdrawal symptoms and stress as well as provide social support as part of the treatment [5]. Several studies have concluded that craving hinders successful smoking cessation and that it correlates with relapse after periods of abstinence [9–18].

Several questionnaires have been developed with different coverage of symptoms, quantitative indices of nicotine withdrawal symptoms, and psychometric properties. The Minnesota Nicotine Withdrawal Scale (MNWS) is considered the briefest scale among the self-report measures of nicotine withdrawal symptoms currently available, and the psychometric properties of the scale have been reported to be as good as for other, longer ones [19]. The scale has been translated into many languages such as Chinese, Korean, and Japanese, but there is no Malay version of this scale [20–22]. The original scale was developed in 1986 to assess nicotine withdrawal symptoms [6]. In 1996, the nine-item scale was revised to reflect changes made in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* criteria for nicotine withdrawal [23]. The total score of the scale ranges from 0 to 36,

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depending on the participants' rating of the symptoms as not present (0), slight (1), mild (2), moderate (3), and severe (4).

The decision to develop the Malay version of the MNWS was based on the fact that there was only one scale available for the assessment of nicotine withdrawal symptoms in Malay [24] for use in clinical research and routine clinical practice in Malaysia or other Malay-speaking population. The available scale contains 28 items, while the MNWS has fewer items and is more practical. Thus, it will be the first briefest scale for the measurement of withdrawal symptoms available in Malaysia. In addition, this translated scale helps in the measurement of these withdrawal symptoms, which will help understand why some interventions may be more useful than others in quitting smoking.

Methods

Study Design

A cross-sectional study design was adopted to conduct the study. The study was conducted at the Quit Smoking Clinic in Penang General Hospital, Penang, Malaysia. The Penang General Hospital is the largest public tertiary hospital in Penang.

Participants

The study participants were smokers who attended the Quit Smoking Clinic at the Penang General Hospital. A convenience sampling method was used to recruit the study participants. To be included in the study, participants needed to be an adult smoker (man or woman) aged more than 18 years and able to read, understand, and complete the Malay language scale independently.

The subject was excluded if he or she had a past or present history of mental illness; used concomitant antidepressant or anti-anxiety medications or sedatives; indulged in alcohol or drug abuse; or was unlikely to commit to the study in the researchers' opinion. The data were collected from September 1, 2011, to January 31, 2012.

Sample Size

In general, it is highly recommended to use at least 10 subjects for each item of a questionnaire or an instrument scale for the evaluation of validity [25–27]. A target sample size of 100 patients, however, was estimated to give better precision to the reliability and validity of the study [28]. Others suggest that five subjects for each item are adequate in most cases [29].

In this study, it was decided to depend on the recommendation of at least 10 subjects for each item of a questionnaire or an instrument scale for the evaluation of validity [25–27]. The MNWS consisted of nine items, and it was estimated that 90 smokers were needed for the purpose of validation. An additional 30% as dropouts was considered to be necessary for the study to overcome the erroneous results and to increase the reliability of the conclusion. A convenience sample of 133 smokers who attended the Quit Smoking Clinic was collected. In addition, only 75 subjects agreed to participate in a test-retest reliability analysis. There is no evidence available to help in the selection of the time interval between questionnaire administrations for a study of test-retest reliability of health status instruments, and an interval ranging from 10 minutes to 1 month has been selected. Therefore, we chose a 1-month interval for the purpose of subjects' feasibility.

Ethical Approval

This study was conducted after it was approved by the Ethic Committee of the Institute of Public Health, the National Institutes of Health, and the Medical Research and Ethics Committee of the Ministry of Health, Malaysia. Before an expert counselor started the interviews, a written consent form was provided to all the participants. All the participants were assured that their personal information would be kept confidential. The counselor interview for each participant to explain the study aims and procedure took about 15 to 20 minutes.

Instruments

A structured questionnaire was used for the collection of data needed for the validation study and it consists of three sections: 1) participants' sociodemographic information, participants' smoking status history, and carbon monoxide (CO) concentration value; 2) Malay version of the Fagerstrom Test for Nicotine Dependence (FTND-M); and 3) Malay version of the nine-item MNWS. In addition, the average completion time was 10 minutes.

Linguistic Validation Process

Conceptual equivalence between the original instrument and the translated version is an extremely important aspect in the translation and cross cultural adaptation of patient-reported outcome measures [30–32]. In the current study, the conceptual equivalence occurs when the source language (English) of the MNWS is not different from the translated version (Malay) in meaning and content of the context [31]. This is achieved through a procedure called linguistic validation and cultural adaptation [32]. The process includes two complementary steps: a translation step to achieve linguistic validity of the questionnaire in the desired language and a psychometric evaluation. After taking permission from the developers of the original scale to translate it into Malay language (personal communication with John Hughes, May 23, 2011), all parts of the data collection forms were translated according to standard guidelines [32,33] as follows:

- A forward translation (one-way translation) of the original scale was carried out by translation from English to the target language (Malay) to create a version that was semantically and conceptually as close as possible to the original scale. The translation was done by two qualified independent linguistic translators who were lecturers at the School of Language, Literacies and Translation, Universiti Sains Malaysia. They were both native Malaysian speakers and proficient in English. Each translator formed a forward translation of the original questionnaire into the target (Malay) language without any mutual consultation. This process generated two translated Malay versions that contained words and sentences that cover both the medical and usual Malay-speaking language with its cultural nuance. Two of the researchers, who were Malaysians and spoke English fluently, reviewed the two primary versions and compared them with the original regarding ambiguities and discrepancies in words, sentences, and meanings. Thereafter, they reconciled by merging the two forward translations into a single preliminary initial translated version.
- Blind back-translation of the first reconciled translated Malay version was done by another professional translator who was a native Malay speaker and proficient in English. For this step, the third translator was completely blind to the original version of the instruments. This allowed for clarification of words and sentences used in the translations. Subsequently, back-translation review was done by comparison of the back-translated versions of the two instruments with the original to highlight and investigate discrepancies between the original and the reconciled translation, which was then reviewed in the process of resolving the issues. Inconsistencies were resolved in a consensus meeting, and a prefinal Malay version, ready for a pilot testing, was generated.
- The prefinal version of the instruments was distributed to 20 Malaysian smokers who were native speakers of Malay by a

counselor who was fluent in both Malay and English and was involved in the respondent testing or cognitive debriefing. The participants completed the questionnaire and commented on the questions. Then, a review of feedback from the participants of the respondent testing was discussed by the researchers.

- The final form of the Malaysian questionnaire was accomplished and prepared for the reliability and validity study. The scale takes approximately 10 minutes to complete.

Statistical Analysis

All statistical analyses were conducted by using SPSS, version 18.0 (SPSS, Inc., Chicago, IL). The significance level was set at a P value of less than 0.05. Descriptive statistics were used to describe demographic and smoking-related characteristics of the subjects in the MNWS sample separately. Descriptive analyses were performed for quantitative (continuous) variables by calculating mean ± SD, whereas percentages and frequencies were determined for qualitative (categorical) variables.

The Cronbach's alpha coefficient was used to measure the internal consistency and homogeneity of the items and the total score for the questionnaire. Intraclass correlation coefficient for each item and for the total score of the Malay version of the MNWS was estimated to evaluate test-retest reliability. The internal consistency and test-retest reliability were used to assess the reliability of the scale. To validate the psychometric properties of the scale, factor analysis and concurrent validity were used. To determine the factor structure of the translated scale, an exploratory principle-component analysis with orthogonal rotation was conducted on the items of the scale. To verify that the data set was suitable for factor analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy [34] and the Bartlett's Test of Sphericity [35] were applied. The criteria used to select the number of factors and the number of items within a factor of the principle-component analysis included eigenvalue greater than 1 and item-factor loading of at least 0.4 [36]. Concurrent validity was used to support the validation of the scale by administering the FTND-M with the translated MNWS to assess the association between these two tools. Construct validity is established when there is correlation between the results of the desired measure and the results of a gold standard that was obtained at approximately the same point in time [37,38]. In addition, scale validation was assessed through the association of scale total score with several variables by using the Spearman rank correlation coefficient test.

Results

Demographic and Smoking-Related Information

The mean age of our population was 47.7 ± 14.0 years, with the majority being men (99.2%) and only one woman (0.8%) in the whole sample (N = 133). The highest proportion in our population was of Chinese (39.1%) followed by Malays (37.6%) and Indians (23.3%). Most of the smokers in our cohort had finished their secondary high school education (46.6%). For smoking-related characteristics, the mean for the number of cigarettes smoked per day was 14.92 ± 9.1. Unfortunately, more than 77% of our population had not attempted quitting previously.

Out of the 133 smokers, 107 (80.5%), 20 (15.0%), 2 (1.5%), and 4 (3.0%) were in very low, low, medium, and high nicotine dependence level, respectively, according to FTND levels. There were significant differences in the number of cigarettes smoked per day ($P < 0.001$), number of previous quitting attempts ($P = 0.032$),

Table 1 – Sociodemographic and smoking-related information for MNWS validation's subjects (N = 133).

		Minimum–Maximum
Age (y), mean ± SD	47.7 ± 14.0	18–76
Sex, n (%)		
Male	132 (99.2)	
Female	1 (0.8)	
Race, n (%)		
Malay	50 (37.6)	
Chinese	52 (39.1)	
Indian	31 (23.3)	
Educational status, n (%)		
No formal education	4 (3.0)	
Primary	59 (44.4)	
Secondary	62 (46.6)	
College/university	8 (6.0)	
Marital status, n (%)		
Single	19 (14.3)	
Married	114 (85.7)	
Age started smoking (y), mean ± SD	18.43 ± 5.4	8–54
Number of cigarettes smoked per day, mean ± SD	14.92 ± 9.1	2–40
Duration of smoking (y), mean ± SD	29.26 ± 13.2	2–60
Previous quit attempts, n (%)		
Yes	30 (22.6)	
No	103 (77.4)	
FTND total score, mean ± SD	1.97 ± 1.33	0–7
Exhaled CO level, mean ± SD	13.83 ± 5.26	4–28

Note. Data were presented as mean ± SD with minimum to maximum values unless otherwise indicated.
CO, carbon monoxide; FTND, Fagerstrom Test for Nicotine Dependence; MNWS, Minnesota Nicotine Withdrawal Scale.

CO level ($P < 0.001$), and MNWS total score ($P = 0.003$) among these participants with different types of dependence levels. There were no significant differences among age, sex, race, education status, marital status, duration of smoking, and chances for quitting (Table 1).

Evaluation of Reliability

The internal consistency for the MNWS was measured by using the Cronbach's alpha test and it was 0.91, which was considered as having excellent internal consistency [39,40]. Table 2 shows the reliability and internal consistency for the scale. The mean of interitem correlation was 0.52, with values ranging from 0.37 to 0.75. The test-retest reliability (n = 75) for the nine-item MNWS presented an excellent reliability and stability of the translated scale with Spearman's rank correlation coefficient ($r = 0.876$; $P < 0.001$).

Evaluation of Validity

A principal-components analysis with orthogonal rotation was used to examine the structure of the MNWS. The Barlett's test of sphericity was significant ($P < 0.001$), and the Kaiser-Meyer-Olkin measure of sampling adequacy for the FTND-M was above 0.6 (0.899). Depending on the scree plot test, the rule of eigenvalue more than 1 suggested that the MNWS contained one factor only. This unidimensional model, which included all the items of the

Table 2 – Reliability test for the Malay version of the nine-item MNWS.

	Corrected item-total correlation	Cronbach's α if item deleted	ICC	95% confidence interval		P value
				Lower	Upper	
Question 1	0.67	0.89	0.93	0.89	0.96	<0.001
Question 2	0.78	0.88	0.96	0.94	0.97	<0.001
Question 3	0.69	0.89	0.98	0.97	0.98	<0.001
Question 4	0.54	0.90	0.91	0.86	0.94	<0.001
Question 5	0.79	0.88	0.97	0.96	0.98	<0.001
Question 6	0.74	0.89	0.95	0.93	0.97	<0.001
Question 7	0.55	0.90	0.88	0.82	0.92	<0.001
Question 8	0.64	0.89	0.84	0.74	0.89	<0.001
Question 9	0.69	0.89	0.91	0.86	0.94	<0.001
Total	–	–	0.97	0.96	0.98	<0.001

Note. The Cronbach's α for the scale was 0.91.
ICC, intraclass correlation coefficient; MNWS, Minnesota Nicotine Withdrawal Scale.

Table 3 – Principle-component analysis for the Minnesota Nicotine Withdrawal Scale (N = 133).

Withdrawal symptom		Unrotated factor loading
Original items	Translated items	
1. Urge to smoke/ craving for cigarettes	1. Gian/ingin untuk merokok	0.75
2. Depressed mood	2. Perasaan tertekan	0.84
3. Irritability, frustration, or anger	3. Cepat meradang, rasa kecewa, atau marah	0.77
4. Anxiety	4. Rasa takut atau bimbang	0.63
5. Difficulty concentrating	5. Sukar memberi tumpuan/ perhatian	0.85
6. Restlessness	6. Gelisah	0.81
7. Increased appetite	7. Selera makan bertambah	0.63
8. Difficulty going to sleep	8. Susah tidur	0.72
9. Impatience	9. ketidaksabaran	0.77
% of total variance		57.4

MNWS, accounted for 57.4% of the explained total variance (as shown in Table 3).

Construct validity was used to show the correlation between the MNWS total score and several clinical variables. Most of the theorized variables showed good to excellent correlations with the MNWS total score. As hypothesized, there was a significant positive correlation between the CO level ($r = 0.72$), the FTND-M total score ($r = 0.68$), and the number of cigarettes smoked per day ($r = 0.68$) and the MNWS total score ($P < 0.001$). Similarly, there was an inverse fair relationship between the MNWS total score and self-rated chances to quit ($r = -0.38$; $P < 0.001$). Unfortunately, there was an insignificant correlation between the MNWS total score and each of duration of smoking and previous quit attempts.

Discussion

In the present study, the MNWS was translated from the original English into the Malay language through a rigorous extensive approach; in this, cultural and language equivalence, as well as psychometric properties, are checked. This is to ensure optimal transfer of the original message and measuring what is intended to be measured. These standard procedures were suggested by standard guidelines [32,33]. The Malay version of the MNWS showed satisfactory reliability and validity, and it is ready for either practical or research purposes.

In terms of checking its reliability, the scale presented an excellent total internal consistency (above the standard accepted value of 0.7) with satisfactory corrected item-total correlation. These findings suggest that the translated version of the MNWS is reliable. Our findings were consistent with the original English scale (Cronbach's $\alpha = 0.85$) [19]. In addition, other translated versions of this scale such as the Korean and Chinese versions had similar findings (Korean version, Cronbach's $\alpha = 0.88$; Chinese version, Cronbach's $\alpha = 0.90$).

The factor analysis was conducted for the MNWS, yielding a single-factor structure. This result supports the concept that the MNWS must be represented as a single withdrawal factor. In 2006, Etter and Hughes [19] carried out a study with 794 ex-smokers who had quit 0 to 31 days before the administration of the MNWS. They conducted exploratory and confirmatory factor analyses resulting in one factor. In the same manner, Toll et al. [41] examined the structure of the MNWS through confirmatory factor analysis, based on previous research in three research samples of smokers trying to quit (N = 723) at multiple points of time. Their results also showed that the MNWS contained one component that included all items of the scale, which was found to be the best explanation of the data [41].

There are discrepant findings, however, regarding the factor structure of the MNWS; multiple-factor solutions were documented by other studies in which researchers assessed the structure of the MNWS by using exploratory factor analysis. A study was conducted by using 105 smokers who were studied for 1 to 2 weeks after quitting. The researchers reported a factor analysis that represented four factors: mood, somatic complaints, craving, and other symptoms (hunger and insomnia) [42]. Although the researchers showed these results, Hughes [43] carried out another study with 178 smokers who quit. He applied a factor analysis 7 days after they quit, which yielded three factors: mood, increased appetite, and insomnia.

In terms of providing more support for the validation, the relationships of proposed related variables with the MNWS scale have been investigated by using Spearman correlation. As expected, there was a good significant correlation between the translated scale and the FTND-M score and the number of cigarettes smoked per day ($r = 0.68$ 0.68, respectively; $P < 0.001$).

These results were consistent with Littel et al.'s [44] study findings, where they found significant relationships (FTND-M score, $r = 0.14$, $P < 0.05$, and the number of cigarettes smoked per day, $r = 0.25$, $P < 0.01$) among these variables.

In the same manner, our finding regarding the negative relationship observed between the MNWS and self-efficacy is consistent with Bandura's theory positing that physiological states and emotional arousals associated with nicotine withdrawal decrease self-efficacy appraisal [45]. In addition, the Korean translated version of the MNWS demonstrates this negative relationship ($r = -0.23$, $P < 0.05$).

Nevertheless, there were a few limitations to the study. Most notably, there was only one woman in our cohort. Another limitation is that about 80% of the recruited participants were classified as having a very low level of nicotine dependence on the basis of the FTND-M score. Therefore, the generalizability of our results to other Malay-speaking females or those with higher nicotine dependence levels might be compromised.

Conclusions

In summary, the careful translation process that was applied to the English version of the MNWS was successful to ensure the equivalence of the Malay version of this scale before its use for academic and clinical practice purposes in smoking cessation. The findings from the current validation study revealed that the Malay version of the MNWS is a reliable and valid measure for withdrawal symptoms as well as smoking urges and ready for use in clinical practice and research study.

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