ORIGINAL ARTICLE

Cross-Cultural Adaptation and First Validation of the Chinese Version of the Medical Students' Stressor Questionnaire among Undergraduate Medical Students

[1,2]Shiyue Wang ID, [1]Garry Kuan ID*, [1,2]Le Li ID, [3]Rajesh Kumar ID, [4]Yee Cheng Kueh ID

[1]Exercise and Sports Science Programme, School of Health Sciences, Universiti Sains Malaysia, Kubang Kerian 16150, Kelantan, Malaysia.
[2]School of Rehabilitation Medicine, Jiangsu Medical College, Yancheng, Jiangsu, China.
[3]Department of Physical Education, Osmania University, Hyderabad, India.
[4]Biostatistics and Research Methodology Unit, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian 16150, Kelantan, Malaysia.
*. Corresponding Author: Garry Kuan; E-mail: garry@usm.my

ABSTRACT
Background. Medical students often face more stress than college students in other majors. The Medical Students' Stressor Questionnaire (MSSQ) is a tool commonly used to assess the stress levels and stressors experienced by medical students. However, no Chinese version has been validated to date. **Objectives.** This study represents the first cross-cultural adaptation and validation of the MSSQ in Chinese medical students, filling an important gap in stress assessment tools. **Methods.** Participants were 811 undergraduate medical students from a university in Yancheng, China, with a mean age of 20.96 years (SD = 1.98). The majority of the sample (66.6%) were female. Perceived stressors were measured using the 40-item Medical Students' Stressor Questionnaire (MSSQ), which assesses six domains of stressor (academic-related, intrapersonal and Interpersonal, teaching and learning, social, drive and desire, and group activities-related). The MSSQ was translated into Chinese following standard forward and backward translation procedures to ensure linguistic and conceptual equivalence. Participants completed the Chinese version of the MSSQ (MSSQ-C), and confirmatory factor analysis (CFA) was conducted using Mplus 8.3 to examine the factorial structure of the six-domain model. **Results.** The CFA supported the six-factor structure of the MSSQ-C. The initial model showed poor fit, but after model re-specification with four residual correlations, the final model demonstrated good fit (RMSEA = 0.040, CFI = 0.956, TFI = 0.952, SRMR = 0.053). Construct reliability for the six factors ranged from 0.824 to 0.938, indicating satisfactory internal consistency. **Conclusion.** The Chinese version of MSSQ is concise and has good reliability and validity, making it suitable for screening stress sources among Chinese medical students. Its strong psychometric properties make it a practical instrument for identifying stressors and guiding stress-management strategies in Chinese medical education.

INTRODUCTION

College students experience significant pressure due to the demanding nature of their academic studies, personal expectations, and the challenges of transitioning into adulthood (1). Medical students face even greater stress than peers in other majors, driven by a rigorous curriculum, long study hours, clinical responsibilities, and the constant need to keep pace with medical advances (2–5). Furthermore, the competitive nature of medical school admissions and the high standards of performance expected in the medical profession add to the pressure experienced by medical students. Balancing academic requirements, clinical rotations, and personal well-being becomes challenging (6, 7).

Stress refers to an individual's subjective response arising from dynamic and multifaceted interactions with their surrounding environment (8). Among Chinese medical students, stress originates from multiple sources, including an intensive academic workload, stringent clinical training and internship requirements, prolonged duty hours, separation from family, and a highly demanding examination system (9, 10). Recent studies further indicate that stress patterns are evolving: academic stressors remain central, but psychosocial issues—such as loneliness, sleep disturbances, and strained interpersonal relationships—have become increasingly salient (11-13). Unique systemic pressures, such as competition for the National Medical Licensing Examination, uncertainty about postgraduate entrance examinations or standardized residency training, and employment challenges, further differentiate the Chinese context (14, 15). This centralized and highly competitive system has been linked to elevated stress and burnout, particularly in the later years of medical education (16). Therefore, identifying stressors among Chinese medical students is essential for developing effective prevention and intervention strategies.

In prior research, various scales have been applied to assess stress in medical students, including the Depression, Anxiety, Stress Scale, the Perceived Stress Questionnaire, and the Copenhagen Burnout Inventory. While these instruments demonstrate good psychometric properties (17-19), they were not explicitly designed for medical students and fail to capture the distinct stressors embedded in medical education. For instance, non-specific measures such as the DASS focus on general psychological distress and may overlook medical education–related stressors such as clinical workload, professional identity formation, and licensing examination pressure. Moreover, applying non-culturally adapted tools risks measurement bias and threatens validity, as shown in cross-cultural psychometric studies (20, 21).

The Medical Students' Stressor Questionnaire (MSSQ) is a validated tool to measure stressors associated with medical education, clinical rotations, academic performance, and career concerns (22). It demonstrates robust psychometric properties, including strong factorial structure and high internal consistency (23). The MSSQ categorizes stressors into six domains: Academic Related Stressors (ARS), Intrapersonal and Interpersonal Related Stressors (IRS), Teaching and Learning-Related Stressors (TLRS), Social Related Stressors (SRS), Drive and Desire Related Stressors (DRS), and Group Activities Related Stressors (GARS). It has been translated and validated in several countries—Malaysia, Sri Lanka, India, Bangladesh, Italy, and Romania—demonstrating cross-cultural applicability (22–27).

Nevertheless, no validated Chinese version is currently available. Given that stress among Chinese medical students is increasingly recognized as multifaceted and strongly shaped by cultural and systemic factors, reliance on non-adapted measures risks construct bias and incomplete assessment. The novelty of this study lies in providing the first validated MSSQ for Chinese medical students. This work fills an important methodological and practical gap, as reliable identification of stressors is a prerequisite for evidence-based stress management in Chinese medical education. In particular, Chinese students' stress experiences are shaped by Confucian traditions that emphasize academic excellence, filial piety, and collective expectations, which create unique cultural pressures distinct from those typically reported in Western contexts. Beyond offering a culturally valid tool, the study contributes to the broader field of cross-cultural psychometrics by demonstrating how stress measurement must be adapted to specific cultural and educational contexts. In doing so, this validation advances theory and provides medical educators and policymakers with a practical instrument for identifying stress sources and informing targeted interventions. Moreover, by

enabling early recognition of medical education–specific stressors, the study supports the development of targeted strategies to prevent burnout and promote long-term well-being among medical students.

MATERIALS AND METHODS

Study Design. This study utilized a cross-sectional design and was conducted between November 2021 and January 2022 at Jiangsu Medical College in Yancheng, China. This design was selected as it aligns with the study's primary objective of examining the measure's initial factorial structure and internal consistency. Although a cross-sectional approach does not allow for assessing longitudinal stability or test–retest reliability, it represents a methodologically appropriate and efficient strategy to address the core research aim. Future studies should evaluate these additional psychometric properties to validate the measure further.

Participants. Students from the first to third academic years were invited to participate through official course announcements and online notices. Eligible participants were undergraduate students enrolled in clinical medicine, nursing, rehabilitation therapy, and stomatology majors. Inclusion criteria were current enrollment as a full-time student, ability to read Chinese, and consent to participate. Exclusion criteria were self-reported history of major psychiatric disorders or incomplete responses. 811 students consented and completed the survey (mean age = 20.96 years, SD = 1.98). The sample included 66.6% females, reflecting the gender distribution of medical majors in China

Measures. The Medical Students' Stressor Questionnaire (MSSQ) consists of 40 items representing common stressors encountered by medical students. Responses are recorded on a five-point Likert scale: 0 = "causing no stress at all," 1 = "causing mild stress," 2 = "causing moderate stress," 3 = "causing high stress," and 4 = "causing severe stress."

Firstly, the authors of the original MSSQ were contacted to obtain the English version of the questionnaire. The original English language version of MSSQ was translated into Chinese using the standard forward and backward translation procedure recommended by Beaton (28). The two translations were done independently by two English teachers who had worked abroad. These translations are compared to form a comprehensive version. Second, the combined Chinese version is translated back to English by a native English translator without referencing the original. Third, psychologists and medical experts read the Chinese version, paying special attention to semantic equivalence and understanding of terms, concepts, and psychological meanings. Since then, minor modifications have been made to certain words or expressions to include more commonly used terms. (For example, "quota system in examinations" in item 8 was initially translated as "supportive policies for remote areas and ethnic minorities") to adapt to local conditions.

Ethics and Procedures. Ethical approval was obtained from the Human Research Ethics Committee of the Universiti Sains Malaysia (USM/JEPeM/22050283). In addition, the study protocol was reviewed to ensure compliance with institutional regulations at Jiangsu Medical College. Formal permission to adapt and use the MSSQ was secured via email from the original authors. All participants received an explanation of the study's aims and procedures and provided electronic informed consent before participating. Data collection procedures were designed to ensure complete anonymity and confidentiality.

Data Collection. The online survey was conducted by WJX (https://www.wjx.cn/). WJX is an open-source online survey application allowing for anonymous data collection. The software automatically sends a link to all participants to access the survey. Once the participant completes the survey, any links between them and their survey answers are removed. Therefore, only de-identified data is provided to investigators to protect the anonymity of participants.

Data Analysis. Statistical analyses were performed using Mplus version 8.3. Descriptive frequency checks were conducted to detect any missing data across variables. All questionnaires were found to be fully completed, with no instances of missing responses. The assumption of multivariate normality was assessed, and results from Mardia's tests for multivariate skewness and kurtosis (both p<0.001) indicated significant deviation from normality. Consequently, the robust maximum likelihood estimator (MLR) was employed in the confirmatory factor analysis (CFA), as it accommodates violations of normality (29).

Standardized factor loadings greater than 0.40 generally indicate acceptable psychometric quality

(30). However, when making such a decision, it is recommended that a combination of methods (e.g., MI analysis, theoretical analyses, statistical significance tests) is used to ensure that model revisions are based on sound foundations and can enhance the overall quality and confidence of the study. The present study evaluated model fit based on a six-factor structure comprising 40 items. The following fit indices and their recommended thresholds were used: the Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI), both expected to exceed 0.90; the Root Mean Square Error of Approximation (RMSEA), with acceptable values below 0.08; the RMSEA probability, ideally greater than 0.05; and the Standardized Root Mean Square Residual (SRMR), which should also fall below 0.08 (31). Construct reliability (CR) for each latent factor in the MSSQ-C was calculated using the formula provided by Raykov and Marcoulides (32), with a threshold of 0.70 indicating acceptable internal consistency (31). Discriminant validity was assessed by examining inter-factor correlations, where values below 0.85 were interpreted as evidence of adequate discriminant validity.

RESULTS

Characteristics of Participants. A total of 811 valid samples were obtained from this questionnaire survey, in which the average age of the subjects was 20.96 ± 1.98 years old, and their majors were mainly concentrated in clinical medicine, accounting for 22.3% of the total, while the number of medical imaging subjects was the least, accounting for about 12% of the total. There were 540 female subjects, accounting for 66.6%, and 271 males, accounting for 33.4%, with a higher proportion of females than males. The statistical results of the background data of each subject are shown in Table 1.

Table 1. Demographic characteristics of participants (*n*=811).

Characteristics	Category	*n*	%
Major	Nursing	179	22.1
	Clinical Medicine	181	22.3
	Stomatology	128	15.8
	Rehabilitation therapy	121	14.9
	Pharmacy	105	12.9
	Medical Imaging	97	12
Gender	Male	271	33.4
	Female	540	66.6
Grade	1	221	27.3
	2	156	19.2
	3	113	13.9
	4	168	20.7
	5	153	18.9

Descriptive Statistics of the MSSQ. The scores for each item of the MSSQ are shown in Table 2. The overall mean score for the stressor factor was 1.99 ± 0.53, with the ARS factor scoring the highest at 2.25 ± 0.71, while the DRS factor scored a mean of 1.42 ± 0.83, which is relatively the lowest score among all six factors. The remaining four factors scored around 1.90.

Table 2. Distribution of the items' scores for MSSQ.

Factor	Mean	SD
ARS	2.25	0.71
IRS	1.98	0.73
TLRS	1.91	0.70
SRS	1.98	0.60
DRS	1.42	0.83
GARS	1.86	0.58

ARS: Academic Related Stressors; IRS: Intrapersonal and Interpersonal Related Stressors; TLRS: Teaching and Learning-Related Stressors; SRS: Social Related Stressors; DRS: Drive and Desire Related Stressors; GARS: Group Activities Related Stressors.

Measurement Models of MSSQ. In this study, the measurement model of the theory of MSSQ was composed of 6 factors and 40 question items. The initial model (Model 1) did not fit the data well; some fit indices did not reach acceptable threshold values. To improve the fit indices of the model, a 4-item residual correlation was added to Model 1 (ARS10 with ARS6, SRS6 with SRS4, GARS3 with GARS1, GARS4 with GARS2). Model re-specification was carried out to enhance its theoretical coherence and statistical adequacy. The final model fit indices reached the desired threshold. The specific fit indices for each model are shown in Table 3, and the factor loadings for each model are in Table 4. The CR values support this finding, with CR values of 0.938, 0.908, 0.936, 0.925, 0.824, and 0.856 for the six factors exceeding the recommended threshold of 0.70. The final model of the MSSQ is represented by six factors, as shown in Figure 1.

Table 3. A summary of fit indices for MSSQ with six factors.

	χ^2	df	RMSEA	CFI	TLI	SRMR
Model 1	3407.906	725	0.068	0.872	0.862	0.060
Model 2	1647.039	721	0.040	0.956	0.952	0.053

χ^2: chi-square goodness of fit; df: degrees of freedom; CFI: comparative fit index; TLI: Tucker–Lewis index; RMSEA: root mean square error of approximation; SRMR: Standardised Root Mean Square Residual.

Table 4. Standardised factor loadings for Model 1 and Model 2 of the MSSQ.

Factors	Items	Factor Loadings	
		Model 1	Model 2
	ARS1	0.609	0.613
	ARS2	0.704	0.718
	ARS3	0.760	0.773
	ARS4	0.716	0.727
	ARS5	0.739	0.735
	ARS6	0.787	0.722
ARS	ARS7	0.715	0.725
	ARS8	0.719	0.730
	ARS9	0.788	0.789
	ARS10	0.820	0.765
	ARS11	0.751	0.759
	ARS12	0.770	0.778
	ARS13	0.679	0.684
	IRS1	0.839	0.840
	IRS2	0.854	0.854
	IRS3	0.843	0.843
IRS	IRS4	0.751	0.750
	IRS5	0.782	0.781
	IRS6	0.455	0.455
	IRS7	0.787	0.787
	TLRS1	0.738	0.738
	TLRS2	0.784	0.784
	TLRS3	0.787	0.787
TLRS	TLRS4	0.850	0.850
	TLRS5	0.890	0.890
	TLRS6	0.879	0.879
	TLRS7	0.828	0.828
	SRS1	0.973	0.972
	SRS2	0.985	0.987
SRS	SRS3	0.752	0.751
	SRS4	0.721	0.713
	SRS5	0.833	0.832
	SRS6	0.633	0.621
	DRS1	0.761	0.759
DRS	DRS2	0.808	0.809
	DRS3	0.774	0.775
GARS	GARS1	0.666	0.715

Factors	Items	Factor Loadings	
		Model 1	**Model 2**
	GARS2	0.896	0.758
	GARS3	0.748	0.807
	GARS4	0.924	0.812

ARS: Academic Related Stressors; IRS: Intrapersonal and Interpersonal Related Stressors; TLRS: Teaching and Learning-Related Stressors; SRS: Social Related Stressors; DRS: Drive and Desire Related Stressors; GARS: Group Activities Related Stressors.
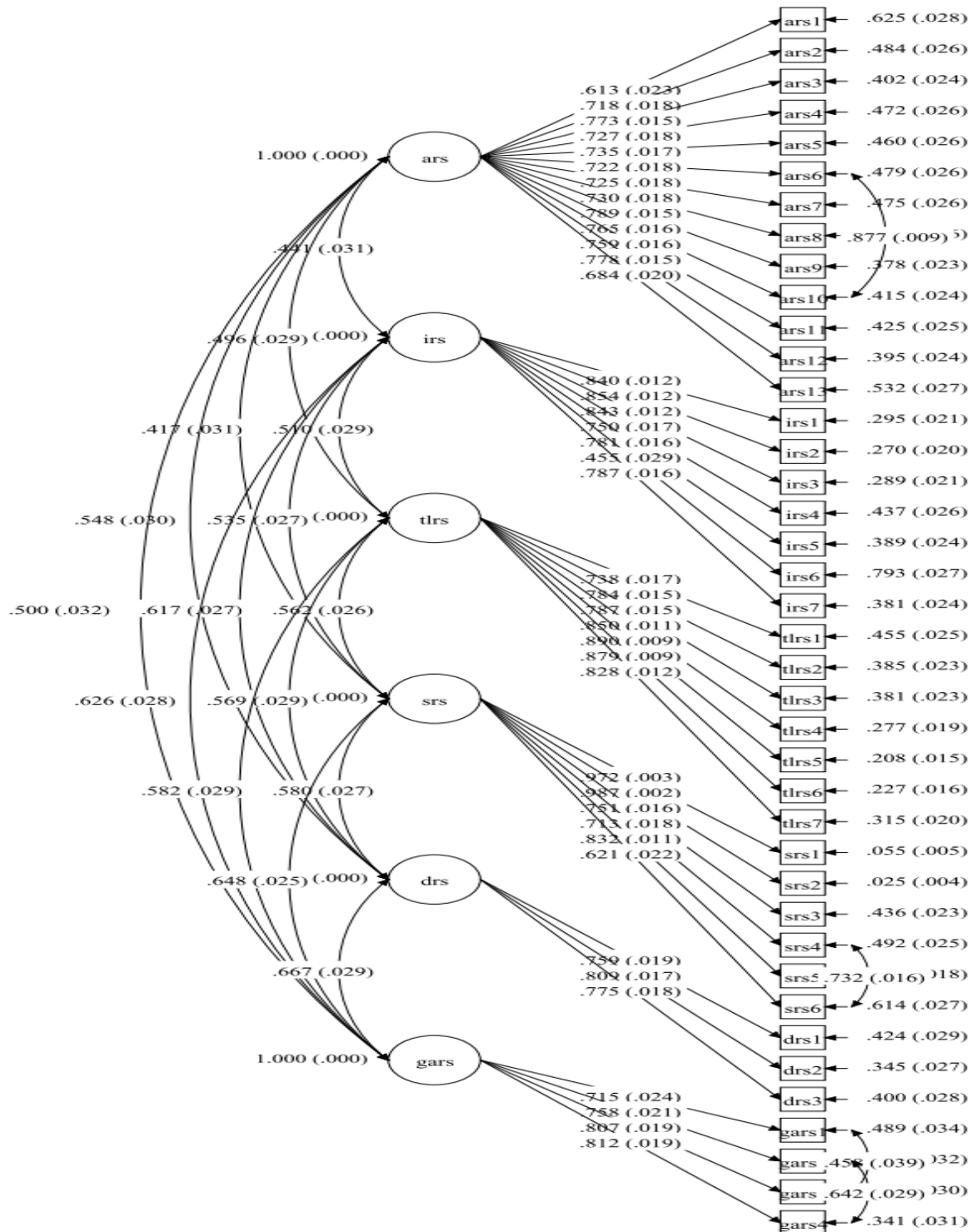

Figure 1. Final model of MSSQ with six factors.

Discriminant Validity. The discriminant validity was checked based on the correlations among the factors. Table 5 provides the correlation values for the model. All correlations are below the recommended threshold of 0.85, indicating good discriminant validity of the 6-factor MSSQ model.

Table 5. Correlations between latent variables in Model 2 for MSSQ.

Variables	ARS	IRS	TLRS	SRS	DRS	GARS
ARS	1					
IRS	0.441	1				
TLRS	0.496	0.510	1			
SRS	0.417	0.535	0.562	1		
DRS	0.548	0.617	0.569	0.580	1	
GARS	0.500	0.626	0.582	0.648	0.667	1

Correlation is significant at the 0.01 level (two-tailed); ARS: Academic Related Stressors; IRS: Intrapersonal and Interpersonal Related Stressors; TLRS: Teaching and Learning-Related Stressors; SRS: Social Related Stressors; DRS: Drive and Desire Related Stressors; GARS: Group Activities Related Stressors.

DISCUSSION

Translating and validating the MSSQ into Chinese represents a crucial step in assessing stressors among Chinese-speaking medical students. The original English version of the MSSQ has demonstrated strong reliability, validity, and temporal stability across various populations in previous research (33). It has been widely adapted and utilized in multiple languages to evaluate sources of stress in medical education settings. Despite the large number of Chinese-speaking medical students globally, there remains a significant shortage of rigorously validated instruments in Chinese for measuring academic-related stressors. Our Chinese adaptation of the MSSQ addresses this gap and provides a culturally relevant, psychometrically sound tool for educational research, student mental health screening, and curriculum development within Chinese-speaking contexts.

This study employed Confirmatory Factor Analysis (CFA), a statistical technique within the structural equation modelling (SEM) framework specifically designed for testing measurement models. CFA evaluates the strength of the association between observed indicators and their underlying latent constructs through factor loadings (31). Since the factor structure and item composition of the original MSSQ have been clearly established in earlier studies, we conducted a confirmatory study of the Chinese-translated version. The objective was to assess whether the six-factor, 40-item measurement model fit the data well. Results from the CFA supported the construct validity and internal consistency of the Chinese MSSQ, confirming a final model with 40 retained items. Additionally,

discriminant validity was demonstrated, indicating that each latent factor within the MSSQ-C contributes unique information that does not overlap with the other constructs in the model.

During the CFA process, the overall fit indices of the initially hypothesized model were unsatisfactory. Modification indices suggested adding four correlated error terms (ARS10 with ARS6, SRS6 with SRS4, GARS3 with GARS1, GARS4 with GARS2) significantly improved the model fit. This need for structural modifications may reflect culturally specific patterns in stress perception among Chinese medical students. The high factor loadings on items related to academic performance and peer competition likely echo the strong emphasis on academic achievement within Chinese culture and the highly competitive medical education environment. It is worth noting that in a similar study conducted in Italy, a poor first-time model fit was similarly found, possibly due to differences in the education system, curriculum, and sources of stress among medical students in different countries (22).

Notably, the Academic-Related Stressors (ARS) domain recorded the highest score (2.25), suggesting that academic overload and competition are perceived as the most salient stressors. This perception aligns with physiological evidence; such pressures can activate the hypothalamic-pituitary-adrenal (HPA) axis, thereby elevating cortisol levels in medical students (34, 35). This neurobiological mechanism highlights potential targets for intervention. This neurobiological mechanism highlights the potential goals of the intervention. For instance, studies have shown that mindfulness

courses can effectively reduce elevated cortisol levels among the student population (36).

These findings can be interpreted through broader psychological frameworks, such as Lazarus and Folkman's transactional model (37). The salience of academic stressors suggests that Chinese students may appraise these demands as threatening, possibly exceeding their perceived coping resources. Cultural norms, such as the importance of "face" (mianzi) and avoidance of public failure, may further shape this appraisal process, influencing stressor perception and coping mechanisms.

After confirming the factor structure of the MSSQ, we assessed its reliability and validity. In this questionnaire, the CR and AVE values for all factors exceeded the recommended thresholds, indicating that the factors have high structural reliability (38). The correlations between the factors were also below 0.85, providing strong evidence of discriminant validity. In addition, the Cronbach's alpha values for the factors ranged from 0.823 to 0.939, which exceeded the recommended values (39). A study conducted among Sri Lankan medical students also reported a higher internal consistency of the questionnaire, with a Cronbach's alpha of 0.95. Cronbach's alpha values of the subscales ranged from 0.54 to 0.90 (26).

The Chinese version of the MSSQ (MSSQ-C) demonstrates strong potential as a reliable and accessible tool for assessing stressors among Chinese medical students. A key strength of this study lies in its relatively large sample size of 811 participants, which enhances the robustness of the validation process. However, several limitations should be considered. First, the study's cross-sectional nature prevents conclusions about changes in stressors over time; future longitudinal research is needed to assess the temporal stability of the MSSQ-C. Second, the reliance on self-reported data may introduce response bias, although anonymity and confidentiality were emphasized to encourage honest responses. Third, the sample had a gender imbalance, with female students comprising approximately two-thirds of participants, which reflects the gender distribution in Chinese medical schools but may affect generalisability. Future studies should adopt stratified sampling to achieve a more balanced representation. Lastly, participants were all undergraduate students from a single city (Yancheng), limiting the applicability of the

findings to other regions or educational levels. Further research should explore the utility and replicability of the MSSQ-C in more diverse Chinese-speaking populations across different age groups, academic stages, and healthcare disciplines.

CONCLUSION

This study successfully translated, culturally adapted, and validated the Chinese Medical Students' Stressor Questionnaire (MSSQ) version. The results demonstrated that the Chinese MSSQ possesses good reliability and validity, indicating it is a promising tool for assessing stressors among Chinese medical students. The questionnaire exhibited strong internal consistency, satisfactory construct validity, and a clear factor structure consistent with the original version. Given that the sample was limited to one site, these findings should be regarded as preliminary evidence rather than nationwide applicability. Nevertheless, they support the potential use of the Chinese MSSQ in both academic research and practical settings to identify and address stress-related issues in Chinese medical education. Future studies are recommended to examine further its longitudinal stability and applicability across diverse regions and subgroups in China.

APPLICABLE REMARKS

- The MSSQ-C demonstrates strong reliability and validity, making it a suitable tool for identifying key stressors among Chinese medical students. For instance, the Academic Related Stressors (ARS) subscale consistently showed high factor loadings, suggesting that interventions should prioritize academic stress management within medical curricula.
- Compared with lower-scoring domains such as Drive and Desire Related Stressors (DRS), these findings highlight the need for targeted curriculum reforms and stress-management programs tailored to the specific stressor patterns of Chinese medical students.

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AUTHORS' CONTRIBUTIONS

Study concept and design: Shiyue Wang, Garry Kuan. Acquisition of data: Shiyue Wang, Le Li. Analysis and interpretation of data: Shiyue Wang, Yee Cheng Kueh. Drafting the manuscript: Shiyue Wang. Critical revision of the manuscript for important intellectual content: Le Li, Garry Kuan, Yee Cheng Kueh, Rajesh Kumar. Statistical analysis: Shiyue Wang, Yee Cheng Kueh. Administrative, technical, and material support: Shiyue Wang, Le Li, Rajesh Kumar. Study supervision: Yee Cheng Kueh, Garry Kuan.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

FINANCIAL DISCLOSURE

This study has no financial interests related to the material in the manuscript.

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ETHICAL CONSIDERATION

This study was approved by the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/22050283). The study adhered to the principles outlined in the Declaration of Helsinki, and written informed consent was obtained from all participants.

ROLE OF THE SPONSOR

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There was no use of artificial intelligence for preparation, writing, or editing this manuscript.

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