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Translation and Validation of a Chinese Version of the Medical Professionals Resilience Scale

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ABSTRACT

Due to its strong psychometric properties, the Medical Professionals Resilience Scale (MeRS) has shown promising results in measuring the resilience of medical professionals. However, a validated Chinese version of the MeRS has yet to be developed. This study aimed to assess the reliability and validity of the Chinese-translated version of the MeRS (MeRS-C) among medical students in Yancheng City, China. The study involved 782 medical student volunteers from Jiangsu Vocational College of Medicine, aged between 19 and 23. The meRS-C comprises 37 items categorised into four factors and was meticulously translated and adapted into Chinese. An exploratory factor analysis (EFA) was conducted using data from Group 1 (n = 391) to evaluate the factor structure and a second-order confirmatory factor analysis (CFA) was performed using data from Group 2 (n = 391) to assess model fit. Before being administered to participants, the questionnaire was reviewed by experts and pre-tested. The results of the EFA supported the validity of the MeRS-C, explaining 71.431% of the total variance, with factor loadings between 0.775 and 0.892. The CFA displayed favourable model fit indices (CMICMIN/DF = 1.756, TLI = 0.96, SRMR = 0.037, CFI = 0.963 and RMSEA = 0.044) and demonstrated good convergent and discriminant validity. The questionnaire exhibited high internal consistency reliability values, ranging from 0.897 to 0.967. Thus, the concise Chinese version of the MeRS showed good reliability and validity, making it suitable for identifying sources of resilience in Chinese healthcare trainees.

Keywords: *MeRS; Translation; Validation ； Resilience*

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INTRODUCTION

Numerous studies have shown that heightened levels of burnout and depression are prevalent among medical students (1–3). Particularly during internships, medical students are confronted with a fresh set of stressors, such as the emotional weight of patient deaths, uncertainties in clinical settings and learning processes, and interpersonal dynamics with colleagues, as well as being required to adapt to evolving work and learning environments (4,5).

Resilience, a construct variously characterised as an intrinsic personality trait or an adaptive process in the face of challenges, emerges during different life stages in response to demanding circumstances (6,7). The role of resilience in averting and recovering from psychiatric conditions is pivotal (8). Extensive research has consistently highlighted the positive impact that resilience can have on both medical practitioners and their patients (9,10).

While several scales exist to measure mental resilience, including the Connor–Davidson Resilience Scale (CD-RISC), the Brief Resilience Scale (BRS), the Resilience Scale for Adults (RSA), the Resilience Scale (RS-14), the Post-Traumatic Growth Inventory (PTGI), and the Ego Resiliency Scale (ERS) (11,12), none of these tools were explicitly designed for healthcare practitioners. The Medical Professionals Resilience Scale (MeRS) was specifically developed to gauge resilience in healthcare providers (13). Comprising 37 items grouped into control, resourcefulness, growth and involvement domains, the MeRS employs a four-point Likert scale for rating responses (1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree). A higher MeRS score indicates greater resilience, while a lower score signifies less resilience. The MeRS has been validated in health professionals in Malaysia and Pakistan, with the total number of items ranging from 14–37 (13,14). Based on the validation results of confirmatory factor analysis, these studies have found that this scale has good reliability and validity.

Thus, this study sought to evaluate the reliability and validity of the Chinese version of the MeRS questionnaire (MeRS-C). The study postulated that the MeRS-C questionnaire would demonstrate significant applicability and efficacy, positioning it as a robust instrument for investigating the resilience levels of Chinese medical student trainees.

METHODS

Procedures And Participants

The research was carried out in July 2022 at Jiangsu Vocational College of Medicine in Yancheng City, China, employing a cross-sectional study design. Students in their third year of healthcare training across various disciplines such as clinical studies, nursing, rehabilitation therapy, stomatology, and others were invited to participate in the research.

The online survey was facilitated through WJX (https://www.wjx.cn/), an open-source platform designed for online surveys that ensures complete respondent anonymity. Upon distribution, the software automatically generates survey access links for all participants. Subsequently, upon survey completion, all identifiable links between participants and their responses are expunged, ensuring that only de-identified data is made available to researchers to safeguard participant anonymity.

Adherence to ethical guidelines was paramount throughout the study, aligning with the ethical standards stipulated in the Declaration of Helsinki (15) and the regulations set forth by Jiangsu Vocational College of Medicine's Ethics Committee to uphold the integrity of the research process

and the well-being of study participants. In addition, the study also received ethical approval from the Universiti Sains Malaysia Human Research Ethics Committee (USM/JePEM/22050283).

Measures

Demographic information

During the study, participants were required to provide demographic information, including their age, gender, and field of study. The inclusion criteria included individuals aged between 18 and 30 years who willingly consented to partake in the research. They were healthcare students from the Jiangsu Vocational College of Medicine. Conversely, participants were excluded from the study if their completion time for the questionnaire was under 200 seconds or if they provided identical responses to distinct questions. These criteria were implemented to ensure the reliability and validity of the data collected and to maintain the integrity of the study results.

Medical Professionals Resilience Scale (MeRS)

The Medical Professionals Resilience Scale (MeRS), initially developed by Rahman et al. (13) and subsequently validated within the Malaysian medical professional population (13), comprises 37 items organized into four distinct factors: control, resourceful, involvement, and growth. The number of items for each factor are 6, 4, 12, and 15, respectively. Control refers to maintaining composure in challenging situations, influenced by one's inner cognitive processes; Resourceful denotes the ability to identify solutions using available means; Involvement pertains to effectively managing adversity, while growth signifies personal development amid challenges. Respondents rate these items on a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree).

The MeRS demonstrated satisfactory content and face validity while exhibiting a high level of internal consistency. Individual item Content Validity Index (CVI) and Face Validity Index (FVI) values exceeded 0.80. Factor loading values for the final MeRS items ranged from 0.41 to 0.76, with resilience domain Cronbach's alpha coefficients falling between 0.72 and 0.89. Notably, a higher MeRS score indicates elevated resilience, with lower scores suggesting the opposite. These outcomes underscore the robust psychometric properties of the MeRS, affirming its utility as a reliable and valid instrument for assessing resilience among healthcare professionals.

Cross-cultural translation of the MeRS

The process of forward-and backward translating and culturally adapting the original Medical Professionals Resilience Scale (MeRS) into Chinese underwent multi-stages to ensure reliability and validity. As a first step, communication was initiated with the authors of the MeRS to procure the English version of the questionnaire. Following this, a multi-stage approach, outlined by Chai et al. (16) and Yao et al. (17), was employed for translation and cultural adaptation.

Two bilingual and bicultural translators, both native Chinese speakers well-versed in psychology, individually translated the MeRS into Chinese. Subsequently, the author compared the two forward translations, enabling them to address any discrepancies and ambiguities in collaboration with the translators. This iterative process led to the creation of a preliminary Chinese version of the MeRS.

To validate the translated version, a third bilingual and bicultural translator back translated the preliminary Chinese questionnaire into English. Notably, the back-translator, being a native English speaker without a psychology background, provided an unbiased perspective. The authors then

meticulously compared the back-translated version with the original MeRS to ensure conceptual, semantic, and content equivalence across both English versions.

In the final validation step, a pilot test was conducted online with ten native Chinese-speaking medical students, representing the target demographic for the Chinese MeRS. These participants were asked to complete the Chinese MeRS without access to the English version. Subsequently, they provided feedback on the clarity of instructions, response format, and overall comprehensibility of the items. The feedback indicated that the Chinese MeRS was clear, easy to comprehend, and swift to complete. Consequently, no further modifications were deemed necessary based on the positive outcomes of the pilot test.

Statistical Analysis

Descriptive statistics were utilised to analyse the sample characteristics and item distribution within the study. Construct validity was assessed through both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The cohort of 782 participants was divided randomly into two equal groups for data analysis purposes: one group for EFA consisting of 391 participants and another for CFA also comprising 391 participants.

The initial exploratory analysis and assessment of factor reliability were conducted using SPSS 28.0 software, while the subsequent confirmatory factor analysis was executed utilising Mplus 8.3. Maximum likelihood (ML) is a common estimation method used by CFA, which assumes that the data is multivariate normal distribution (18). The ML method has good statistical properties such as consistency and unbiasedness when the sample is large and the data satisfy the assumption of normal distribution (19). When the data deviate from the normal distribution, the robust maximum likelihood (MLR) method should be chosen (20). MLR can handle non-normally distributed data and provide more robust parameter estimates (21). Since the data did not conform to a normal distribution, the maximum likelihood with robust maximum likelihood (MLR) approach was adopted to estimate the parameters of the model. To achieve good psychometric properties, factors with high standardized factor loadings (>0.4) were selected (22).

Based on the four-factor structure and 37-item measurement model of this study, the fit indices used and the recommended fit values are as follows: Chi-square divided by degrees of freedom ($\chi 2/df$) < 3, Comparative Fit Index (CFI) >0.90. the Tucker-Lewis index (TLI) >0.90, Root Mean Square Error of Approximation (RMSEA) < 0.08, Standardized Root Mean Square Residual (SRMR) < 0.08 (23).

The Cronbach's alpha coefficient (CA) represents the internal consistency reliability of a scale, and it is the most commonly used method in scientific research (24). CA > 0.8 indicates that the scale has good internal consistency (25). However, CA tends to underestimate the reliability of the underlying structure (26). The minimum acceptable range for composite reliability (CR) is ≥0.60 (23). Therefore, this study will use both CA and CR to assess the internal consistency of the scale. An average variance extracted (AVE) value of 0.50 or higher is considered acceptable (27). Discriminant validity was assessed by examining the correlations between the factors in the model. Discriminant validity is established when the correlations between the factors are less than 0.85 (28).

RESULTS

Demographics

A total of 857 participants initially completed the online survey. Subsequently, after screening for validity, 782 questionnaires were found acceptable for analysis, resulting in a response rate of 91.25%. The average age among the participants stood at 21.3 years, with a standard deviation of 2.0 years. Among the respondents, 365 were male, constituting 46.7% of the sample, while 417 were female, making up the remaining 53.3% (refer to Table 1 for demographic information).

Table 1: Participants' demographic information

Variables	Frequency (*n*)	Percentage (%)
Gender		
Female	417	53.3
Male	365	46.7
Subject / Major		
Clinical medicine	152	19.4
Dentistry	97	12.4
Rehabilitation therapy	223	28.5
Pharmacy	62	7.9
Nursing	248	31.8

Reliability analysis

The Cronbach's alpha coefficient for the MeRS-C scale, calculated with a sample size of 782 participants, yielded a high value of 0.942. Furthermore, the individual Cronbach's alpha coefficients for the growth, involvement, control, and resourceful factors were notably strong at 0.967, 0.956, 0.948, and 0.897, respectively. These values surpassed the standard threshold of 0.7, signifying robust internal consistency reliability within the variables assessed (refer to Table 2).

Table 2: Reliability analysis

Domains	Cronbach's alpha	Items
Growth	0.967	15
Involvement	0.956	12
Control	0.948	6
Resourceful	0.897	4
Overall	0.942	37

Exploratory Factor analysis

Exploratory Factor Analysis was conducted on a dataset of 391 entries, revealing a Kaiser-Meyer-Olkin (KMO) value of 0.952. Significantly, the Bartlett spherical test yielded a statistically significant result ($\chi 2 = 17636.247$, $df = 666$, $p < 0.001$), affirming suitability for factor analysis.

Given the MeRS's focus on measuring four dimensions of resilience, we extracted four common factors to align the Chinese version of the questionnaire with its original version. Utilising the principal component analysis method for factor extraction, we identified common factors with eigenvalues exceeding 1. Notably, the cumulative variance explained by these four common factors stood at 71.431%.

Applying the maximum variance method for orthogonal rotation, the factor loadings across the questionnaire ranged from 0.775 to 0.892. Specifically, factor loadings for each dimension were as follows: growth (factor 1) = 0.792–0.864; involvement (factor 2) = 0.775–0.853; control (factor 3) = 0.849–0.892; resourceful (factor 4) = 0.780–0.867. These findings underscored the robustness and dimensionality of the MeRS in capturing various facets of resilience among healthcare professionals.

Confirmatory Factor Analysis

To further validate the questionnaire, confirmatory factor analysis was conducted using Mplus 8.3, building upon the insights outlined in the exploratory factor analysis and involving a sample of 391 participants. The fit indices derived from this analysis were outlined as follows: CMIN/DF = 1.756, RMSEA = 0.044, CFI = 0.963, TLI = 0.96, and SRMR = 0.037 (refer to Table 3 for detailed results). All of these fitting indices adhered to general research standards, indicating a favourable model fit for the questionnaire.

Table 3: Goodness-of-fit indexes of the four-factor model for the Chinese version of MeRS ($n = 391$)

Model	CMIN	DF	CMIN/DF	SRMR	TLI	CFI	RMSEA
Fitness criteria	-	-	<3	<0.08	>0.9	>0.9	<0.08
4-factor model	1093.921	623	1.756	0.037	0.96	0.963	0.044

The validation process of the scale involved assessing its reliability through Composite Reliability (CR) and evaluating its convergence validity through Average Variance Extracted (AVE). Notably, the factor loadings of the items corresponding to the four resilience factors - growth, involvement, control, and resourceful hopelessness - surpassed 0.6, signifying a high level of item representativeness within the scale.

Additionally, all four dimensions exhibited AVE values ranging from 0.645 to 0.758, exceeding the benchmark of 0.5, and CR values ranging from 0.904 to 0.968, surpassing the threshold of 0.7. These outcomes underscored the strong convergent validity of the MeRS-C, indicating that the scale effectively measures the intended constructs with high reliability and consistency.

Table 4: Convergent validity of the Chinese version of the MeRS ($n = 391$)

Factor	Item	STD.Estimate	S.E.	Est./S.E.	*p*-Value	CR	AVE
Growth	Q1	0.812	0.018	44.890	>0.001	0.968	0.669
	Q2	0.825	0.017	48.384	>0.001		
	Q3	0.807	0.019	43.485	>0.001		
	Q4	0.787	0.020	39.093	>0.001		
	Q5	0.836	0.016	51.883	>0.001		
	Q6	0.783	0.020	38.352	>0.001		
	Q7	0.789	0.020	39.582	>0.001		
	Q8	0.841	0.016	53.549	>0.001		
	Q9	0.833	0.016	50.844	>0.001		
	Q10	0.772	0.021	36.220	>0.001		
	Q11	0.831	0.017	50.218	>0.001		
	Q12	0.776	0.021	36.871	>0.001		
	Q13	0.862	0.014	61.947	>0.001		
	Q14	0.839	0.016	52.974	>0.001		
	Q15	0.864	0.014	62.717	>0.001		
Involvement	Q16	0.841	0.016	52.458	>0.001	0.956	0.645
	Q17	0.816	0.018	44.961	>0.001		
	Q18	0.869	0.014	63.312	>0.001		
	Q19	0.819	0.018	45.704	>0.001		
	Q20	0.744	0.024	31.272	>0.001		
	Q21	0.836	0.017	50.650	>0.001		
	Q22	0.830	0.017	48.795	>0.001		
	Q23	0.794	0.020	39.898	>0.001		
	Q24	0.749	0.023	31.969	>0.001		
	Q25	0.762	0.022	33.965	>0.001		
	Q26	0.784	0.021	37.809	>0.001		
	Q27	0.779	0.021	36.995	>0.001		
Control	Q28	0.840	0.016	51.220	>0.001	0.949	0.758
	Q29	0.859	0.015	58.009	>0.001		
	Q30	0.863	0.014	59.739	>0.001		
	Q31	0.898	0.012	77.830	>0.001		
	Q32	0.904	0.011	82.046	>0.001		
	Q33	0.857	0.015	57.024	>0.001		
Resourceful	Q34	0.762	0.023	32.927	>0.001	0.904	0.703
	Q35	0.879	0.015	60.445	>0.001		
	Q36	0.738	0.025	29.742	>0.001		
	Q37	0.956	0.010	93.810	>0.001		

The discriminant validity was examined based on the correlational relationships among various factors. Table 5 presents the correlation coefficients between the factors of the model. All the correlations are below the recommended value of 0.85, indicating that the four factors possess good discriminant validity.

Table 5: Correlations between latent variables in for MeRS

Factor	Growth	Involvement	Control	Resourceful
Growth	1	-		
Involvement	0.467	1		
Control	0.626	0.569	1	
Resourceful	0.482	0.618	0.617	1

DISCUSSION

The medical profession places significant demands on medical students due to the specialised nature of the field, resulting in the widespread experience of substantial stress and occupational burnout among them (29). These pressures can lead to various negative effects, including reduced empathy, diminished professional motivation, fatigue, deteriorating health, substance abuse, psychological distress and increased suicide rates (30–32). In this context, resilience is crucial as it plays a key role in helping medical students manage stressors. Individuals with robust psychological resilience can better navigate challenges and stressors in their professional lives, including long work hours, significant responsibilities and emotional strain (33,34). As future healthcare providers, the psychological resilience of medical students has a direct impact on their performance and adaptability in healthcare environments. Therefore, evaluating the psychological resilience of medical students is essential for their personal growth and holds significant importance for advancing and improving the entire healthcare sector. Strengthening and nurturing the psychological resilience of medical students enhances not only their ability to manage work pressures and challenges but also the quality and efficiency of healthcare services, which has a significant impact on societal well-being (35). The scale's original authors meticulously analysed the psychological measurement properties of 21 resilience scales. They revamped the resilience concept by amalgamating three resilience perspectives (traits, processes and outcomes) into a novel conceptual framework, culminating in a holistic resilience model featuring four key themes: growth, control, involvement and resourcefulness. This model conceptualises the relationship between resilience and present and future states, as well as between internal and external conditions, as an inseparable continuum.

The current study is the first to translate the Medical Professionals Resilience Scale (MeRS) into Chinese and test its reliability and validity with a cohort of college medical students. The findings revealed that the Chinese MeRS demonstrated strong internal consistency reliability, construct validity and convergent validity. The study investigated the scale's reliability by examining internal consistency, which resulted in a Cronbach's α coefficient of 0.942 for the overall scale and coefficients ranging between 0.897 and 0.967 for the individual dimensions. Comparisons with the CD-RISC (Cronbach's alpha of 0.794; 36), the BRS (Cronbach's alpha of 0.80; 37) and the ARS (Cronbach's alpha of 0.82; 38), indicate reliability comparable with that of other resilience measurement scales.

Regarding construct validity, the study utilised both exploratory factor analysis and confirmatory factor analysis techniques. Bartlett's Spherical Test exhibited a statistically significant result ($\chi 2 = 17636.247$, $p < 0.001$), with a Kaiser–Meyer–Olkin value exceeding 0.5, indicating the appropriateness of factor analysis. Principal component analysis and orthogonal rotation were conducted, elucidating four common factors that explained 71.431% of the total variance. The model

fit indices, including CMICMIN/DF, TLI, CFI and RMSEA, all met the standard thresholds, affirming a robust fit for the model. The factor loadings of the items in the four sub-scales were generally consistent with the analysis conducted by the original authors, indicating acceptable construct validity (13). In a study conducted in Pakistan, the fit indices for MeRS-37 were relatively poor, possibly due to differences in demographic characteristics, healthcare personnel, and medical students' work environments, all of which could have had an impact on the results (14).

The current study assessed convergent validity by computing average variance extracted (AVE) and composite reliability (CR) values while also evaluating discriminant validity using the square root of AVE. The results of the discriminant validity tests demonstrated that each factor of the MeRS was distinct and did not greatly overlap with the other factors. The research outcomes validated the questionnaire's structural validity and discriminant validity, emphasising the efficiency of the Chinese MeRS as a tool for evaluating the resilience of Chinese medical professionals and healthcare trainees.

Despite the valuable insights gained from this study, some limitations are noted. The reliance on convenience sampling of college students in Jiangsu Province may restrict the generalisability of the findings to a broader population of Chinese medical students. Furthermore, the lack of matching on sociodemographic characteristics, such as gender, could introduce biases. To enhance the robustness and inclusivity of the results, future research should strive to increase sample diversity and demographic balance.

CONCLUSION

The Chinese version of the MeRS was found to be a reliable and valid instrument suitable for assessing resilience factors among Chinese healthcare trainees. Its robust psychometric properties lend credibility to its utility as an effective tool for assessing the resilience levels of Chinese healthcare professionals.

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