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Cross-cultural adaptation and validation of the Chinese version of the Trauma Resiliency Scale (tRS-18)

Shihan Li¹, Chunyan Hao^{1,2*} and Jiaxin Ren¹

Abstract

Background Trauma is a prevalent issue in public health, where individuals who experience physical injuries are also at risk of compromised mental health. Psychological resilience is considered a positive indicator that can predict the prognosis of trauma patients throughout their traumatic experiences. Currently, there is a lack of tools in China for measuring the psychological resilience of trauma patients. The aim of this study was to translate and cross-culturally adapt the Trauma Resiliency Scale (tRS-18) into Chinese and to test its reliability and validity in China.

Methods The Trauma Resiliency Scale (tRS-18) was translated into a Chinese version suitable for the Chinese language environment using the Brislin translation model. A convenience sampling method was used to select 588 trauma patients as study subjects. Reliability was assessed using Cronbach's alpha coefficient, 14-day test-retest reliability, and split-half reliability. Validity was examined through the content validity index, structural validity, and convergent validity. Structural validity was specifically evaluated through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Results The total variance explained by the single-factor model in the exploratory factor analysis (EFA) of the Chinese version of the tRS-18 was 62.048%, and the factor loading of each item exceeded 0.4. The results of the CFA indicated that the model demonstrated a favorable fit index ($X^2/df=1.620$; $RMSEA=0.046$; $SRMR=0.026$; $NFI=0.945$; $CFI=0.978$; $GFI=0.927$; $TLI=0.975$; $IFI=0.978$). The Cronbach's alpha coefficient of the reliability index was 0.963, the test-retest reliability was 0.970, and the split-half reliability was 0.964, which were all within the reference value range.

Conclusion The Chinese version of the tRS-18 has good validity and reliability and can be used as an assessment tool for trauma resilience in trauma patients.

Keywords Trauma, Resilience, Assessment tools, Cross-cultural adaptation, Reliability and validity

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Introduction

In today's society, trauma is a pervasive public health problem and has become the fourth leading threat to human health worldwide [1, 2]. According to the Global Burden of Disease (GBD) database, the number of traumatic injuries in China is as high as 300 million per year [3], greatly increasing the economic and medical burden of individuals and society.

Studies have shown that in addition to physical injuries [4, 5], trauma patients may experience serious long-term psychological consequences [6], such as post-traumatic stress disorder (PTSD) and depression [7], substance use disorders [8], agoraphobia [9], chronic mental fatigue [10], increased rates of violent crime, and increased risk of suicide [11, 12]. These psychological disorders may limit the physical recovery of trauma patients and severely impact their quality of life [13, 14]. Psychological resilience is considered to be the capacity to positively address a range of challenges or difficulties [15]. Resilience is a dynamic process that varies with time and situation [16], and can be adapted to and challenged by restoring or increasing the magnitude of resilience [17, 18]. Trauma patients with low levels of resilience are more prone to depression, and measuring resilience levels can aid in the identification of trauma patients who may be susceptible to developing depression [19]. Studies have indicated an inverse relationship between the level of psychological resilience and negative physical health consequences and disability in individuals who have experienced trauma [20]. Patients with moderate to high resilience had fewer symptoms of post-traumatic pain, depression, and fatigue, and better sleep quality than trauma patients with low levels of resilience [21, 22].

A search of the literature revealed that there is currently no psychological resilience scale for trauma patients in China, and most studies on trauma resilience have used the Connor Davidson (CD) scale [23], the Brief Resilience Scale (BRS) [24], and the 10-item Connor Davidson scale (CD-10) [25]. However, these scales are used for a wide range of subjects or the items are too simple and not fully suitable for trauma patients. In 2023, American scholars Sinkler et al. constructed an instrument that can quantify the psychological resilience levels of adult trauma patients, and can measure the resilience of adult trauma survivors during the occurrence of trauma and throughout the recovery process. Compared with other scales that measure resilience, this scale not only focuses on the psychological aspects of the trauma population but also focuses on physical recovery [26].

Measuring psychological resilience in trauma patients is necessary. The scale can help healthcare professionals assess the coping abilities of trauma population to better understand their recovery process and potential needs. Healthcare professionals can assess an individual's

post-traumatic growth and development and design more individualized interventions and treatment plans to reduce the negative impact of trauma on them [27, 28]. In conclusion, the psychological resilience scale specific to trauma population has important implications.

This research aimed to convert and culturally adjust the Trauma Resiliency Scale (tRS-18) into a Chinese version and evaluate its reliability and validity in Chinese adults who have experienced trauma to confirm its suitability for our population.

Materials and methods

Study design

This research project is an observational study designed to translate and culturally adapt the tRS-18 and to validate the reliability and validity of the Chinese version of the tRS-18.

Participants

A total of 588 adult trauma patients (before discharge) from the emergency department and trauma department of two hospitals in Jinzhou and Shenyang, Liaoning Province from June 2023 to March 2024 were selected by convenience sampling. The inclusion criteria were as follows: (1) visited or were hospitalized for trauma; (2) informed consent and participated voluntarily; (3) were at least 18 years old; and (4) were conscious and able to communicate and answer the questionnaire. The exclusion criteria were as follows: (1) had cognitive impairment; (2) had other serious physical or mental illnesses; (3) had intermittent or prolonged coma or serious craniocerebral injury; and (4) were participating in other clinical pilot studies. During factor analysis, it is advisable to ensure that the sample size is typically 5 to 10 times greater than the total number of items in the questionnaire [29]. To enhance the precision of factor analysis, it is advisable to augment the sample size accordingly [30]. This study ultimately included 599 patients, 588 of whom returned valid questionnaires, resulting in a valid return rate of 97.96%. The flowchart of participants is as follows (Fig. 1).

Instruments

General information survey questionnaire

Psychological resilience scores in trauma patients have been found to increase with lower age and higher years of education [31], and female trauma patients can exhibit lower psychological resilience than male trauma patients [32]. Therefore, a general information survey questionnaire was developed through a review of the literature and group discussions, which included age, gender, education, health insurance, and trauma area.

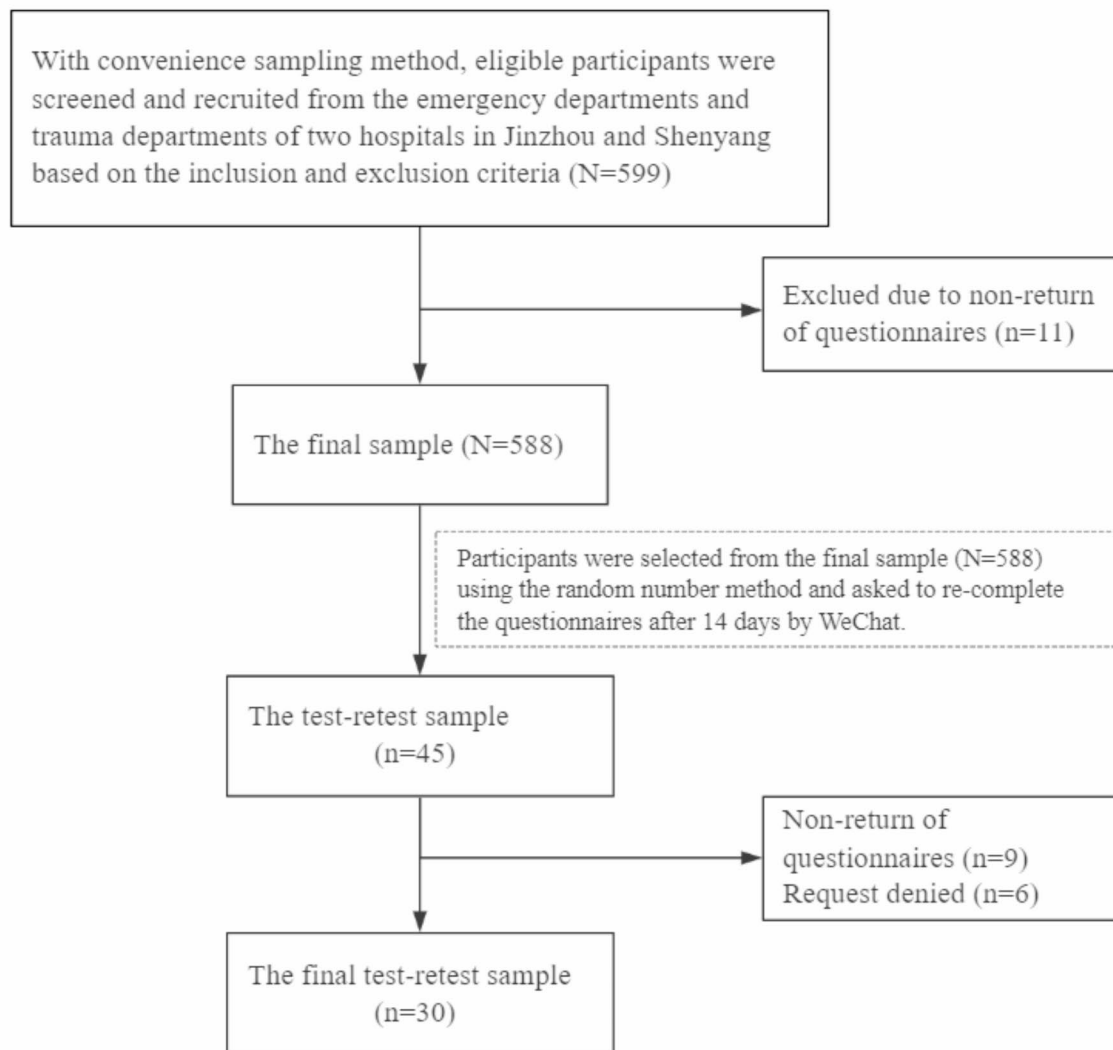


Fig. 1 The participants flowchart for validity and reliability study of the tRS-18

Trauma resiliency scale (tRS-18)

The Trauma Resiliency Scale (tRS-18) was created by Sinikler et al. in 2023 as a tool to measure psychological resilience in trauma patients [26]. The scale is unidimensional and comprises 18 items. Each item is evaluated using a 5-point Likert scale ranging from strongly disagree to strongly agree on a scale ranging from 1 to 5, respectively. The cumulative score of the scale falls within the range of 18 to 90, with elevated scores reflecting increased levels of psychological resilience among individuals affected by trauma. The scale has good psychometric properties, with an ICC > 0.7 (0.793–0.949) for 16 of the 18 questions. The scale is a self-reported, brief instrument for any patient presenting with a traumatic injury, capable of quantifying resilience at any point in time, and may be predictive of outcomes and progress of healing. The developers of the scale conceptualized resilience into six

categories (safety, social connection, health, world view, self view, injury) based on common elements in the originally proposed items. The items of the final scale were determined based on the following conditions: (1) widely recognized; (2) aligned with one of the core aspects of resilience (the existence of adversity; the presence of protective factors to help; and positive outcomes or growth); (3) generalizable; (4) presented at the highest level of the fifth grade.

Translation procedure

This study was conducted after communication and contact with the original authors of the scale to obtain authorized consent for the translation and use of the tRS-18. The translation process was conducted following the translation framework proposed by Brislin [33]. The initial version of the Chinese version of the tRS-18 was

separately translated by a master's degree student and an in-service nurse in the clinical trauma unit, each of whom was a native speaker of Chinese with a high level of English proficiency, and the initial version was compared and modified after a workshop. The reverse translation was carried out by two native English speakers who had no prior exposure to the original scale but were knowledgeable in the Chinese language. The final back-translated version was established after a process of comparison and deliberation. Then, the research team compared and adjusted this version with the forward-translated version and combined it with experts' opinions to finally obtain a version that conformed to the Chinese language environment. The pre-survey process involved recruiting 30 adult trauma patients for this study. The respondents considered that the scale's content was understandable and acceptable, and the semantics of the items were clear. Certain items of the scale were adjusted by synthesizing the results of their feedback and the expert's suggestions, which finally constituted the Chinese version of the TRS-18.

Data collection

Before collecting patients' data, the researchers offered a thorough elucidation of the study's objectives and content to each participant, ensured their privacy, and distributed the questionnaires after receiving consent from the patients. The investigators collected the questionnaires on the spot, and those with omissions were instructed to complete the questionnaires. The investigators answered questions from those in doubt in a timely manner and attempted to ensure that the questionnaires

returned were valid. The data were entered by two people and then checked twice to remove any noncompliant data. Regular checks and validation of the collected data were carried out to ensure the accuracy of the data. Thirty adult trauma patients were resurveyed after 14 days to calculate the test-retest reliability.

Statistical analysis

The data were analyzed using IBM SPSS 26.0 and AMOSS 26.0 software. Participants' demographic data were analyzed using descriptive statistics, which included frequencies and percentages. The items were analyzed using the Cronbach's alpha coefficient, correlation coefficient, and critical ratio. According to the critical ratio method, the total program scores were ranked from lowest to highest, with the top 27% of the sample in the low subgroup and the bottom 27% in the high subgroup. To determine whether there was a difference between the low- and high-scoring groups, an independent samples T test was performed on the two groups. A critical ratio (CR) greater than 3.000 with a significance level of $p < 0.01$ suggests that the items exhibit a substantial degree of differentiation [34]. The Pearson correlation coefficient (r) is utilized in the correlation coefficient approach to assess the correlation between individual item scores and the overall scale score in order to evaluate item homogeneity. A value of r exceeding 0.4 signifies a strong correlation between the item and scale overall, indicating high homogeneity [29]. The Cronbach's alpha coefficient method involves determining if the Cronbach's alpha coefficient of a scale increases when an item is removed, and if it does, that item is then eliminated [35]. Reliability was assessed through Cronbach's α coefficient, test-retest reliability, and split-half reliability. The validity of the scale was assessed by content validity, structural validity, and convergent validity. When the number of experts is equal to or greater than 6 and the item content validity index (I-CVI) is greater than 0.78, and the scale content validity index (S-CVI) is greater than 0.80, the content validity of the scale is considered good [36]. The scale's structural validity was assessed through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Convergent validity was evaluated by the computation of the average variance extracted (AVE) values and composite reliability (CR) values.

Results

Characteristics of participants

A total of 588 adult trauma patients were investigated, of whom 312 (53.1%) were male and 276 (46.9%) were female. The largest number of patients were aged 18–44 years, with 268 (45.6%). The general information of the participants is presented in Table 1. The psychological resilience scores of the trauma patients in this study

Table 1 Demographic characteristics of research participants ($n = 588$)

Characteristics	Group	N	%
Age	18–44	268	45.6
	45–59	232	39.5
	≥ 60	88	15.0
Gender	Male	312	53.1
	Female	276	46.9
Education	Primary school and below	118	20.1
	Junior high school	126	21.4
	Senior high school	170	28.9
	Undergraduates	150	25.5
	postgraduates	24	4.1
Medical insurance	Yes	560	95.2
	No	28	4.8
Trauma area	Head and neck	83	14.1
	Chest	79	13.4
	Abdomen	80	13.6
	Extremities	195	33.2
	Spine	67	11.4
	Other	84	14.3

fell within the range of 26 to 90, and the mean score was 67.86 ± 16.77 .

Cross-cultural adaptation

In this research, translation, cultural adaptation, and pre-surveying of the scale were strictly carried out to fully ensure the equivalence between the Chinese version of the tRS-18 and the initial scale. During the translation process, the scale was adapted according to the suggestions of experts and the discussion of the research team. For item 3, "I feel positive about my mental health" was adjusted to "I have a positive attitude towards my mental health" to fit the Chinese context. For item 9, "I feel positive about my physical health" was changed to "I am confident about my physical health". For ease of understanding, the phrase "a comfortable and safe place to live" in item 18 was changed to "a comfortable and safe home", which is close to the way Chinese people speak in their daily lives. During the presurvey, a questionnaire was administered to 30 adult trauma patients. The patients completed the translated and adapted scale, which they found to be easy to understand and fill out, and suitable for use. Eventually, the Chinese version of the tRS-18 with 18 items was finalized by combining the feedback from all parties.

Item analysis

The Chinese version of the tRS-18 has 18 items. The critical ratio (CR) values of 18 items ranged from 22.943 to 28.647, all of which were > 3.000 ($P < 0.01$), indicating that all the items in the scale differed and could be retained.

Table 2 Item analysis for the Chinese version of the tRS-18

Item	Critical ratio	Correlation coefficient between item score and total score	Cronbach's α coefficient after deletion of items
Q1	24.115	0.799	0.960
Q2	25.275	0.775	0.961
Q3	28.647	0.833	0.960
Q4	22.943	0.785	0.960
Q5	24.573	0.784	0.960
Q6	26.553	0.795	0.960
Q7	23.529	0.685	0.963
Q8	26.173	0.801	0.960
Q9	24.765	0.777	0.961
Q10	26.982	0.807	0.960
Q11	24.925	0.766	0.961
Q12	26.823	0.795	0.960
Q13	26.171	0.804	0.960
Q14	25.138	0.770	0.961
Q15	24.853	0.789	0.960
Q16	25.341	0.785	0.960
Q17	24.842	0.788	0.960
Q18	23.350	0.780	0.960

The correlation coefficient (r) between individual item scores and the overall scale score was 0.685–0.833 ($P < 0.01$), which exceeded 0.4, and the correlation was significant. Following the removal of each item separately, the Cronbach's α coefficient fell within the range of 0.960 to 0.963, none of which exceeded the Cronbach's α coefficient of 0.963 for the scale, so each item could be retained (Table 2).

Validity analysis

Content validity

The content validity evaluation included the item content validity index (I-CVI) and scale content validity index (S-CVI). In this study, there were 7 expert panel members. The I-CVI of the Chinese version of the tRS-18 ranged from 0.86 to 1.00 (> 0.78), all exceeding the recommended threshold of 0.78. Additionally, the S-CVI was 0.89 (> 0.80), surpassing the acceptable level of 0.80. These results collectively suggest that the Chinese version of the tRS-18 has strong content validity [36, 37].

Structural validity

Bartlett's test of sphericity yielded a X^2 value of 7754.591 ($p < 0.001$), demonstrating a significant result. Additionally, the Kaiser-Meyer-Olkin (KMO) test yielded a value of 0.984, which exceeds the recommended threshold of 0.700 for the adequacy of sampling in factor analysis [38, 39]. The total sample data were randomly divided into two subsamples, one subsample ($n_1 = 294$) for EFA and the other subsample ($n_2 = 294$) for CFA. Principal component analysis (PCA) and orthogonal rotation of the maximum variance were employed to identify a shared factor with an eigenvalue exceeding 1, and combined with the number of slope folds that suddenly changed from steep to smooth in the gravel map as 1 (Fig. 2), a single-factor structure consistent with the dimensions of the original scale was formed. The factor loadings of items varied between 0.662 and 0.837, contributing to a cumulative variance explained of 62.048% (Table 3).

A one-factor structural model was constructed based on the EFA results, and the model was subjected to CFA using AMOS 27.0. The model validation process adopted the maximum likelihood method, and the measured outcomes of each indicator in the model fitness test reached the standard level (Table 4). The CFA model diagram is shown in Fig. 3.

Convergent validity

As illustrated in Table 5, the standardized factor loading coefficients of the one-factor model were 0.652 to 0.827 (> 0.5), the average variance extracted (AVE) was 0.591 (> 0.5), and the CR value of the combined reliability was 0.963, exceeding the threshold of 0.7. This suggested that

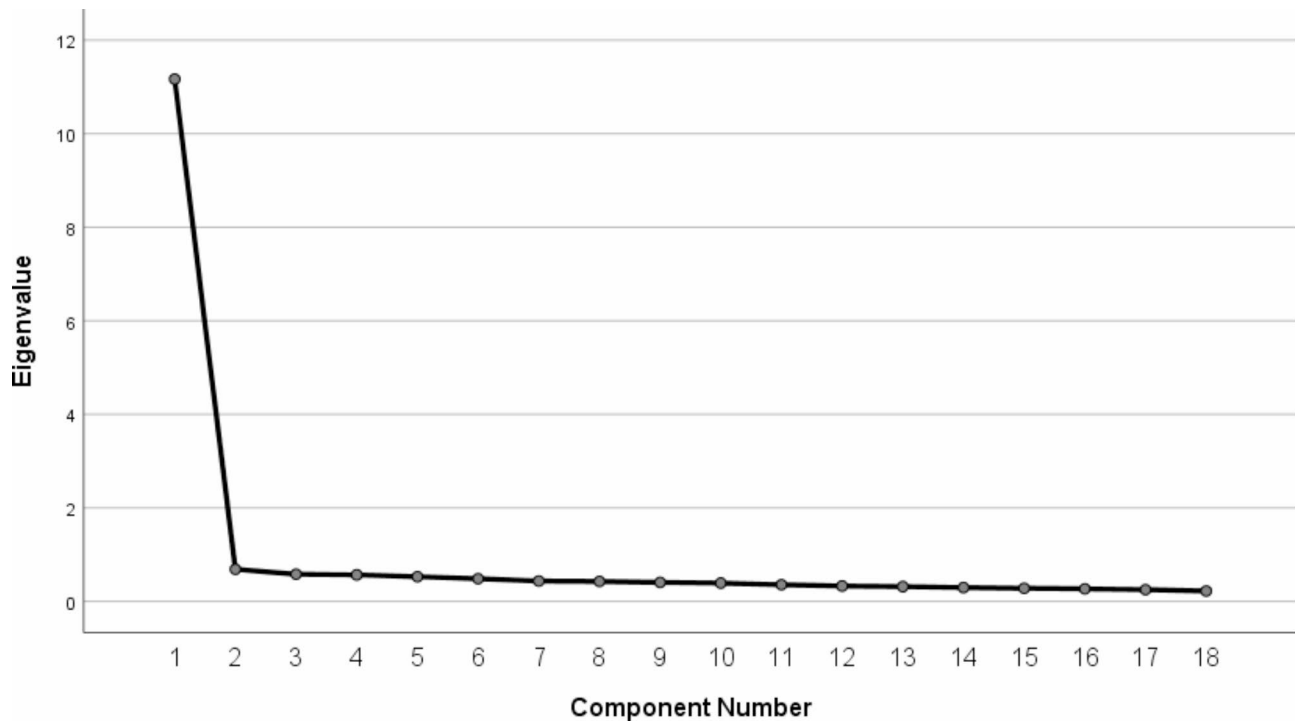


Fig. 2 Screen plot of EFA for the Chinese version of the tRS-18 ($n_1 = 294$)

Table 3 Factor loadings of EFA for the Chinese version of the tRS-18 ($n_1 = 294$)

Item	Factor 1
Q1 I have goals for my life	0.817
Q2 I ask for help when I need it	0.772
Q3 I feel positive about my mental health	0.837
Q4 A challenge may be an opportunity for me to grow	0.800
Q5 I adapt to difficult situations	0.784
Q6 I am passionate about life	0.787
Q7 I have spiritual or religious beliefs	0.662
Q8 I have friends or family who can support me	0.791
Q9 I feel positive about my physical health	0.784
Q10 I can handle an unexpected obstacle	0.807
Q11 I am hopeful about my future	0.760
Q12 I trust my friends or family	0.814
Q13 I believe I am mentally tough	0.827
Q14 I am confident in my ability to achieve a goal	0.792
Q15 I am stronger from past experiences	0.796
Q16 I have control over my life	0.780
Q17 I cope with stress	0.786
Q18 I have a comfortable and safe place to stay	0.765
Eigenvalue	11.169
Explained variance (%)	62.048

the aggregation validity was good and that the composite reliability was ideal.

Reliability analysis

In this study, the Cronbach alpha coefficient of the Chinese version of the tRS-18 was 0.963, the test-retest reliability was 0.970, and the split-half reliability was 0.964, which met the reliability standard.

Discussion

Quantifying the magnitude of resilience in trauma patients can serve as a positive predictor of patient prognosis [26]. There is currently no psychological resilience scale developed specifically for trauma patients in China. This study translated the tRS-18 and evaluate the reliability and validity of the Chinese version of the tRS-18 in a Chinese trauma population.

In the item analysis of this study, all items of the scale were retained, and the individual items were well differentiated. In the factor analysis, the factor loading of the seventh item of the scale, “I have spiritual or religious beliefs”, did not exceed 0.7, which may be related to the differences in the cultural environment in China. Most native Chinese do not have religious beliefs, the

Table 4 The model fitness index of CFA for the Chinese version of the tRS-18 ($n_2 = 294$)

Index	CMIN/DF	RMSEA	GFI	NFI	CFI	TLI	IFI	SRMR
Criteria	1 ~ 3	< 0.1	> 0.9	> 0.9	> 0.9	> 0.9	> 0.9	< 0.05
Result	1.620	0.046	0.927	0.945	0.978	0.975	0.978	0.026

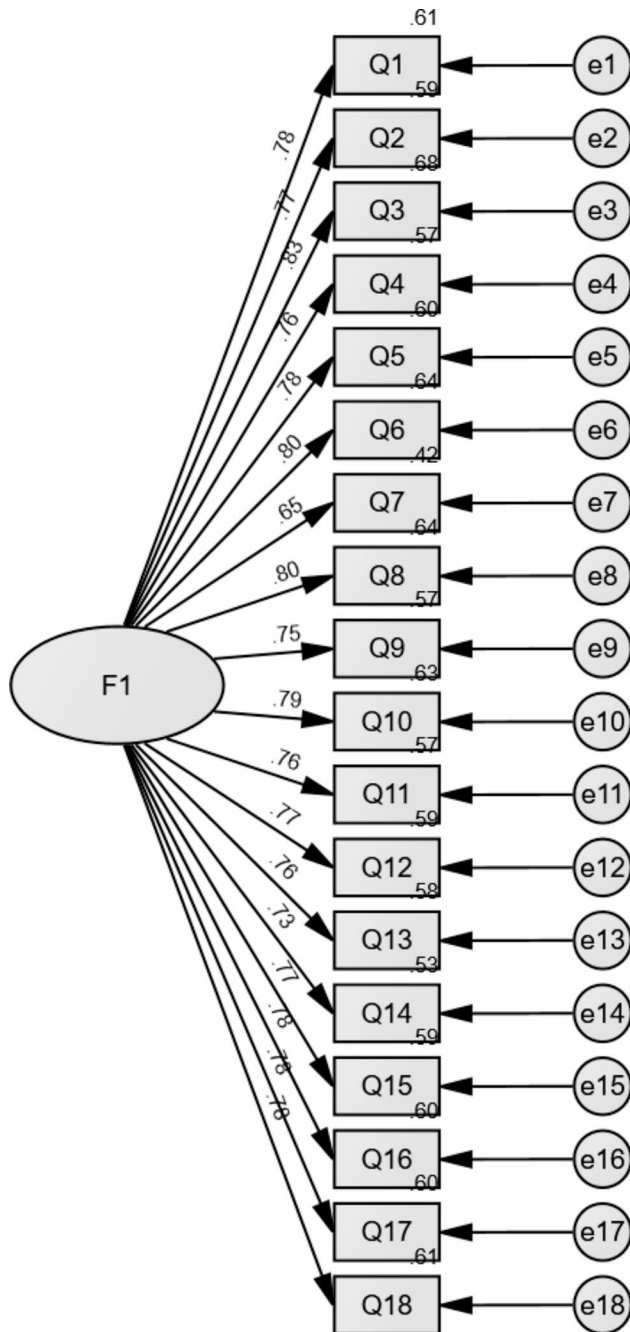


Fig. 3 Standardized single-factor structural model for the Chinese version of the tRS-18 ($n_2 = 294$)

characteristic contributed to the difference in results. Future studies can be conducted in a population of spoken Chinese speakers in different settings. The model fitness test of CFA showed that the results of the various indexes were in accordance with the standard requirements [40]. The average extraction variance was within an acceptable range, indicating the good convergent validity of the Chinese version of tRS-18.

Table 5 Convergent validity for the Chinese version of the tRS-18 ($n_2 = 294$)

Item			Standardized factor loading	AVE	CR
Q1	<---	F1	0.783	0.591	0.963
Q2	<---	F1	0.769		
Q3	<---	F1	0.827		
Q4	<---	F1	0.758		
Q5	<---	F1	0.777		
Q6	<---	F1	0.798		
Q7	<---	F1	0.652		
Q8	<---	F1	0.800		
Q9	<---	F1	0.755		
Q10	<---	F1	0.795		
Q11	<---	F1	0.758		
Q12	<---	F1	0.766		
Q13	<---	F1	0.763		
Q14	<---	F1	0.728		
Q15	<---	F1	0.767		
Q16	<---	F1	0.775		
Q17	<---	F1	0.777		
Q18	<---	F1	0.780		

The Chinese version of tRS-18 showed good internal consistency and stability. The Cronbach α coefficient reached 0.963 [29]. The test-retest reliability after 14 days was 0.970, and the retest reliability reflects the stability of the scale, with the test-retest reliability closer to 1 indicating better stability of the scale [41].

Limitations

In this study, the data were self-reported by participants and may have social desirability bias. This may be related to Chinese cultural values. Traditional Chinese culture emphasizes social harmony, which may have led participants to prefer answers that conform to social expectations. Additionally, in Chinese culture, “Face Culture” is very important, which is related to personal dignity and social status. In order to “save face,” participants may choose answers that are more socially desirable or acceptable. Another limitation of this study is that the calibration validity test was not performed. In the future, calibration validity tests should be carried out with other toughness related scales to further improve the research. Moreover, only adult trauma patients from selected cities in Liaoning Province were included in this study, which has some geographical limitations and may affect representativeness. A multicenter stratified sampling, larger sample survey study can be conducted in follow-up to further validate the applicability and reliability of the tRS-18 in China.

Conclusion

After a rigorous translation process and cross-cultural adaptation, a one-dimensional, 18-item Chinese version of the tRS-18 was formed, which has good reliability and validity in this study. It can be used to assess the psychological resilience level of Chinese adult trauma patients.

Abbreviations

tRS-18	Trauma Resiliency Scale
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
RMSEA	Root Mean Square Error of Approximation
NFI	Normed Fit Index
CFI	Comparative Fit Index
GFI	Goodness of Fit Index
TLI	Tucker-Lewis Index
IFI	Incremental Fit Index
SRMR	Standardized Root Mean Square Residual
KMO	Kaiser-Meyer-Olkin
PCA	Principal Component Analysis
AVE	Average Variance Extracted

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Author contributions

SHL wrote the main manuscript. CYH supervised the study, SHL and JXR completed the data collection. SHL, CYH and JXR completed the final manuscript revisions. All authors have read and approved the final manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The study complied with the ethical standards of the Declaration of Helsinki for medical research involving human subjects. The study was approved by the Ethics Committee of Jinzhou Medical University for ethical review (No. JZMULL2023039). Participants involved in this study completed a written informed consent form prior to the study phase.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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