ORIGINAL RESEARCH

Cultural Adaptation and Psychometric Evaluation of the Chinese Version of the Perceived Stress Reactivity Scale

Xinlei Qu[1,2], Yu Luo[1,2], Yuanyi Liu[1], Xiangcai He[3], Yu Zhang[1,2]

[1]School of Psychology, Guizhou Normal University, Guiyang, Guizhou, 550025, People's Republic of China; [2]Key Laboratory of Brain Function and Brain Disease Prevention and Treatment of Guizhou Province, Guizhou Normal University, Guiyang, Guizhou, 550025, People's Republic of China; [3]School of Psychology, Chengdu Medical College, Chengdu, Sichuan, 610500, People's Republic of China

Correspondence: Yu Luo, Email yuluo@gznu.edu.cn

Objective: This study aimed to evaluate the cultural adaptation and psychometric properties of the Perceived Stress Reactivity Scale (PSRS) in the Chinese population.

Methods: A total of 3560 Chinese participants aged 18–60 years from various provinces and cities in mainland China were included. Sample 1 (n = 3316) was used for CFA, MI, internal consistency, convergent, criterion-related validity, and difference analysis. Sample 2 (n = 244) was employed to evaluate test–retest reliability over a four-week interval.

Results: The study validated a robust 23-item, five-factor structure for the Chinese PSRS, demonstrating strong reliability with a Cronbach's α of 0.90 and a test–retest reliability of 0.83. The PSRS and its subscales were significantly correlated with measures of depression, stress, anxiety, and self-efficacy. Strict invariance was observed across gender and age groups (18–40 and 41–60 years). Women and young adults scored higher on the overall scale and most subscales compared with their counterparts.

Conclusion: The PSRS is a reliable instrument for assessing perceived stress reactivity within the Chinese population. By validating its cultural adaptation and psychometric properties, this study lays a foundation for its cross-cultural application. The findings contribute to a deeper understanding of perceived stress reactivity differences across gender and age groups and provide practical insights for future interventions and stress management research in the Chinese population.

Keywords: perceived stress reactivity, individual differences, gender, age, measurement invariance, psychometrics

Chronic psychological stress is a significant factor contributing to the development of various mental and physical disorders.[1] However, not all individuals exposed to chronic stress develop such conditions, highlighting the role of individual differences in stress responses.[2] These individual differences can influence both the levels of stress hormones and the duration of their elevation, ultimately affecting health outcomes.[3] _Perceived stress reactivity_, defined as a predisposition that is associated with health outcomes, is the basis for relatively stable individual differences in both physiological and psychological stress responses.[2,4]

The Perceived Stress Reactivity Scale (PSRS),[2] a standardized self-report tool, was designed to assess both the core characteristics of stressors and individual reactivity, as highlighted by a previous study.[5] These two elements are essential to the scale, ensuring that it captures a comprehensive view of stress reactivity. The PSRS assesses typical responses to various stressful circumstances and provides a total perceived stress reactivity score. In contrast to the Perceived Stress Scale,[6] which focuses on general stress levels over a relatively short period (eg, a month), the PSRS evaluates the intensity of an individual's physiological and psychological reactions to specific stressors, providing a multidimensional view of habitual stress reactivity. The PSRS includes five dimensions: Reactivity to Work Overload (RWO), Prolonged Reactivity (PrR), Reactivity to Social Conflicts (RSC), Reactivity to Social Evaluation (RSE), and Reactivity to Failure (RFa), making it better suited for research on individual differences, and studies focused on stress-related health outcomes.

Further validations of the PSRS have supported its applicability across diverse populations and contexts. The original version, comprising 23 items, demonstrates satisfactory internal consistency, temporal stability, and a robust factor structure on a sample from the UK, USA, and Germany.[2] Subsequently, Morgan et al supported the distinction between the reactivity to social conflict and social evaluation subscales, further confirming the PSRS's ability to differentiate between these related but distinct domains of stress reactivity.[7] Britton et al also validated the factor structure of the PSRS in adolescent athletes, extending its applicability to different populations.[8] Its application has been widely studied in understanding the associations between stress reactivity and various mental health outcomes, including depression, anxiety, and sleep disturbances.[9,10] Furthermore, the PSRS has been integrated into ecological momentary assessment platforms like *TrackYourStress*, enabling real-time tracking of stress responses.[11]

Despite its widespread use, the cross-cultural adaptation and validation of the PSRS remain limited among Chinese population. This gap is significant given the cultural factors that may influence perceived stress reactivity. For example, Chinese culture emphasizes collectivism, prioritizing connections, and mutual support within the group.[12,13] In contrast, Western cultures are more individualistic, perceiving themselves as existing independently of others and their environment.[14] Such collective values, like the concept of simpatico, make individuals more sensitive to stressors that threaten group harmony or involve evaluations from others.[15,16] In addition, in cases of low self-esteem, Americans tend to evaluate their agentic qualities more positively than Chinese individuals, while Chinese individuals tend to evaluate their communal qualities more positively than Americans.[17] Consequently, Chinese individuals may demonstrate unique patterns of perceived stress reactivity compared to those from other cultures, especially in scenarios involving social conflict and interpersonal evaluation. Similar to how people with higher agreeableness experience greater stress due to a desire for harmony.[18–20] However, contrary to this general pattern, a study suggests that highly agreeable (an interpersonal quality of collectivism) individuals are less reactive to social conflicts than those with lower agreeableness.[7] This underscores the critical need to develop culturally adapted assessments of perceived stress reactivity that account for the unique cultural characteristics and stressors relevant to the Chinese population.

The primary objective of this study was to translate the PSRS into Chinese and validate its factor structure through confirmatory factor analysis (CFA). Additionally, the study aimed to evaluate the reliability of the Chinese version of the PSRS by examining internal consistency and test-retest reliability. Criterion validity was assessed by correlating the Chinese PSRS with established measures, including the General Self-Efficacy Scale,[21] and the Depression Anxiety Stress Scale-21.[22] Previous research indicates that higher self-efficacy is associated with lower perceived stress reactivity,[2] while higher levels of depression and anxiety are linked to greater stress reactivity.[2,7] Establishing these correlations was crucial to ensure the validity of the Chinese PSRS.

Furthermore, measurement invariance (MI) of the Chinese PSRS across gender and age groups was examined using multigroup CFA. MI testing determines whether the scale consistently measures the same construct across different groups, enabling meaningful comparisons.[23] Although MI for the PSRS has been established across administration modes, gender, and countries,[2] its applicability to different age groups within Chinese adults remains unexplored. Once MI was established, the study proceeded to examine gender and age differences in perceived stress reactivity, which is crucial for understanding its impact on both psychological and physiological responses. Research indicated that females and males differ in their sensitivity to events. For instance, traditional femininity can shape women's attitudes and behaviours in response to life events, leading to greater sensitivity to emotional experiences and the needs of others.[24–26] Similarly, analysis of age-related differences is significant, as midlife is characterized by high occupational and social demands, whereas younger adults face challenges related to personal growth and development.[5,27]

To close the research gaps in the Chinese version of the PSRS, we propose the following hypotheses: (1) The Chinese version of the PSRS will replicate the five-factor structure found in previous studies, as confirmed by CFA. (2) The scale will exhibit strict MI, allowing for meaningful comparisons across gender and age. (3) The Chinese version of the PSRS will show satisfactory internal consistency and test-retest reliability, supporting its reliability. (4) Higher scores on the PSRS will be positively correlated with measures of depression, anxiety, and stress, and negatively correlated with self-efficacy, supporting a satisfactory convergent and criterion-related validity. (5) There will be significant differences in PSRS scores across gender and age groups.

Materials and Methods

Participants and Sample Selection

Ethical approval for this study (GZNUPSY.N.202401E [0004]) was granted by the Human Research Ethics Committee in January 2024 to ensure adherence to ethical standards and the principles of participant privacy. The survey was conducted between January and March 2024. Informed consent was obtained from all participants.

Sample 1 was used for the primary analysis of the PSRS. A total of 3592 adult participants (aged 18 years or older) were recruited from mainland China through convenience and simple random sampling via the online survey platform *Credamo* (https://www.credamo.com/). The survey consisted of 62 items, with settings requiring participants to complete each question on each page before proceeding, ensuring data integrity.

Data from 276 participants were excluded either owing to invalid responses or abnormal response times, as follows. Invalid responses were defined as responses that contained obvious errors, such as when participants selected the same score for each item on all scales or chose the wrong option for a question with a specified answer.[28,29] Abnormal response time refers to a response rate to the survey items that is faster than 2 seconds per item.[28]

The final sample 1 consisted of 3, 316 individuals, including 2165 women and 1151 men. The sample was divided into two age groups: 2427 young adults (aged 18–40 years, representing 73.19% of the sample) and 889 middle-aged adults (aged 40–60 years, representing 26.81% of the sample). Detailed demographic characteristics are presented in Table 1.

Sample 2 was used to assess test-retest stability. Participants were selected through simple random sampling on the *Credamo* platform, and responses were collected over an approximately 4-week interval, as informed by a previous study.[2] The PSRS was first administered on February 15, 2024. Of the 307 respondents who provided valid data, 244 returning individuals (114 women and 130 men) completed the questionnaire on March 16, 2024. Their demographic data were matched with records from the first administration, and all responses met the predefined criteria.

The total number of participants across Sample 1 and Sample 2 was 3560. Table 1 provides detailed information of the study samples.

Translation and Cultural Adaptation of the PSRS

With the approval of Professor Ilona Sabine Yim, the English version of the PSRS was translated into Chinese by two native Chinese speakers proficient in English following the principles for cross-cultural adaptation of questionnaires.[30] Subsequently, the translated questionnaire was checked for consistency with common usage by two postgraduate students specializing in English. Minor wording adjustments were made based on the feedback. Notably, in Chinese, the phrasal verb "feel warm" in Item 9 originally carried the connotation of emotional warmth. It is commonly used to describe feelings of kindness or of being deeply moved by other people or situations. However, this interpretation is inappropriate in the context of PSRS. Following consultation with Professor Yim, we concurred that "warm" should be translated to reflect the physical sensation of an increase in body temperature owing to emotional arousal associated with social situations (resulting from factors such as nervousness or anxiety), rather than emotional warmth. This refinement ensured the greater cultural appropriateness and accuracy of the Chinese version of the scale.

Table 1 Sample Characteristics

Characteristics	Category	Sample 1		Sample 2	
		n	%	n	%
Gender	Man	1151	34.71	130	53.28%
	Woman	2165	65.29	114	46.72%
Age (years)	18–40	2427	73.19	177	72.54%
	41–60	889	26.81	67	27.46%

Instruments

Age and gender information was collected, along with data from the following self-report instruments.

The Chinese Version of the PSRS

The PSRS is developed to assess inter-individual differences in subjective stress responses. Comprising 23 questions, each with three corresponding answers ranging in value from "0" to "2", the scale presents scenarios of typical stressful situations (stressors) that may occur, as well as possible stress responses that individuals may perceive.[2] For example, the item "When I am unsure what to do or say in a social situation…" 0 = "I generally stay cool", 1 = "I often feel warm", and 2 = "I often begin to sweat". A higher total score indicates a greater degree of perceived stress reactivity. The five factors include the RWO (five items), PrR (four items), RSC (five items), RFa (four items), and RSE (five items).

The 10-Item General Self-Efficacy Scale (GSES)

The 10-item GSES is a popular tool for evaluating self-perceived efficacy levels. Respondents were asked to rate each item on a four-point Likert scale, with 1 denoting "not at all true" and 4 signifying "exactly true". The overall score, which was determined by summing all the responses, ranged from 10 to 40. A higher score corresponds to a greater sense of self-efficacy. The psychometric properties of the Chinese version of the GSES were assessed, yielding a Cronbach's alpha of 0.87 for the total scale, confirming its suitability for use in Chinese settings.[21]

The Depression Anxiety Stress Scale-21 (DASS-21)

The DASS-21 is a widely employed screening questionnaire containing seven items per subscale to evaluate specific symptoms related to depression, anxiety, and stress. Using a four-point Likert scale, respondents indicated the frequency and intensity of symptoms they encountered in the preceding week. The scale ranges from 0 (no applicability to the respondent) to 3 (high applicability). Each subscale can reach a maximum score of 21, with higher scores representing more intense negative emotions. The psychometric properties of the DASS-21 have been evaluated in a Chinese context, yielding a Cronbach's alpha of 0.92 for the total scale.[22]

Data Analysis

Sample 1 (n = 3316) was used for a CFA with maximum likelihood estimation. Model fit was evaluated using the following indices and their corresponding cut-off values for adequate fit: Comparative Fit Index (CFI > 0.9), Tucker–Lewis Index (TLI > 0.9), and Root Mean Squared Error of Approximation (RMSEA < 0.08).[31] To ensure discriminant validity, estimated correlations and their statistical significance between factors were checked to confirm they were not excessively high (eg, < 0.90 in absolute value).[32]

MI for the Chinese version of the PSRS was tested using multigroup CFA (MGCFA) across gender and age groups. Cross-group constraints were imposed, and more constrained models were compared with less constrained models.[23] Criteria for MI were set as ΔCFI $\leq$ 0.01,[33] ΔRMSEA $\leq$ 0.015,[34] and ΔSRMR $\leq$ 0.030 at the loading level or $\leq$ 0.010 at the intercept or residual variance level.[23]

Internal consistency reliability, convergent validity, and criterion-related validity were also assessed. Corrected item-total correlations[35] and Cronbach's alpha coefficients were calculated for the PSRS subscales and total reactivity scores, with alpha values interpreted as questionable (0.60–0.69), acceptable (0.70–0.79), or good to excellent ($\geq$ 0.80).[32] Convergent validity was evaluated by examining correlations between the PSRS and the DASS-21, using Pearson's correlation coefficients. Criterion-related validity was supported by the inverse association between the PSRS and the GSES.

Group differences in gender and age were analyzed using independent sample *t*-tests with Cohen's d effect sizes (small, $d = 0.2$; medium, $d = 0.5$; large, $d = 0.8$). Statistical significance was set at $p < 0.05$.

Test–retest reliability was examined in Sample 2. Intraclass correlation coefficients (ICCs) were calculated using a two-way mixed-effects model with absolute agreement and single measure. ICCs were interpreted as moderate (0.40–0.59) or substantial (0.60–0.79) reliability.[36]

The data obtained were analyzed using SPSS version 27.0, and Mplus version 7.0.

Results

CFA

The results from the CFA indicated that the five-factor correlation model demonstrated a good fit (Table 2). Additionally, all standardized estimates fell below the cut-off threshold of 0.9, suggesting acceptable discriminant validity among the factors (Table 3).

MI

MI Across Gender

We conducted CFAs separately for male and female participants (G1 and G2), both showing satisfactory fit, supporting further MI tests. Configural invariance (Model G3) demonstrated a good fit (CFI = 0.942, RMSEA = 0.043, SRMR = 0.036), indicating a shared factor structure across gender. Weak MI (Model G4), with factor loadings constrained equal, showed minimal deviations from Model G3 (ΔCFI = −0.002, ΔRMSEA = 0.000, ΔSRMR = 0.002), supporting factor loadings invariance. Strong MI (Model G5), which constrained both factor loadings and intercepts, showed negligible differences (ΔCFI = −0.005, ΔRMSEA = 0.000, ΔSRMR = 0.000), confirming that the latent variable scores are comparable across groups. Finally, the test for strict invariance (Model G6) resulted in a decrease in CFI of 0.004 along with a marginal increase in RMSEA of 0.001 and SRMR of 0.003, providing evidence that factor loadings, intercepts, and error variances were consistent across gender groups. All these changes suggest that the PSRS functions in the same way across gender.

MI Across Age

Consistent with the approach used for gender, we tested CFAs in young and middle-aged adults. Models A1 and A2 demonstrated excellent fit indices, supporting the feasibility of conducting MGCFA across age groups. Age invariance of the PSRS was examined sequentially. Configural (Model A3), weak (Model A4), and strong invariance (Model A5) were all supported, as the changes in fit indices were within acceptable thresholds. For strict invariance (Model A6), ΔCFI was 0.011,

Table 2 Confirmatory Factor Analysis for the Chinese Version of the PSRS

	χ^2	df	p	RMSEA	RMSEA 90% CI	CFI	TLI	GFI
Chinese version	1598.185	220	< 0.001	0.043	0.041 ~ 0.045	0.942	0.933	0.976

Abbreviations: χ^2, Robust chi-square test of exact fit; *df*, Degrees of freedom; RMSEA, Root mean square error of approximation; CI, Confidence interval; CFI, Comparative fit index; TLI, Tucker–Lewis's index; GFI, Goodness-of-fit index.

Table 3 Factor Correlation Estimates and Statistical Tests for the Chinese Version of the PSRS

	Estimate	Std. Error	z-value	p	95% CI		Std. Est.
					Lower	Upper	
RWO ↔ PrR	0.679	0.018	37.69	< 0.001	0.644	0.714	0.679
RWO ↔ RSC	0.796	0.012	64.26	< 0.001	0.772	0.820	0.796
RWO ↔ RSE	0.858	0.011	78.13	< 0.001	0.837	0.880	0.858
RWO ↔ RFa	0.660	0.015	42.69	< 0.001	0.629	0.690	0.660
PrR ↔ RSC	0.783	0.017	46.46	< 0.001	0.750	0.816	0.783
PrR ↔ RSE	0.738	0.018	41.26	< 0.001	0.703	0.774	0.738
PrR ↔ RFa	0.858	0.016	55.06	< 0.001	0.827	0.888	0.858
RSC ↔ RSE	0.840	0.013	67.19	< 0.001	0.816	0.865	0.840
RSC ↔ RFa	0.877	0.012	75.98	< 0.001	0.855	0.900	0.877
RSE ↔ RFa	0.783	0.014	55.77	< 0.001	0.755	0.810	0.783

Abbreviations: RWO, Reactivity to Failure; PrR, Prolonged Reactivity; RSC, Reactivity to Social Conflicts; RSE, Reactivity to Social Evaluation; Rfa, Reactivity to Failure; CI, Confidence interval; Std. Est., Standardized Estimate between factors.

Table 4 Multigroup Goodness-of-Fit Indices and Model Comparisons for the PSRS

	Model	χ2	df	CFI	ΔCFI	RMSEA	ΔRMSEA	SRMR	ΔSRMR
Gender	G1: Men only	770.546	220	0.935		0.047		0.041	
	G2: Women only	1009.178	220	0.946		0.041		0.033	
	G3: Configural invariance	1779.724	440	0.942		0.043		0.036	
	G4: Weak invariance	1830.799	458	0.940	−0.002	0.043	0.000	0.038	0.002
	G5: Strong invariance	1966.502	476	0.935	−0.005	0.043	0.000	0.038	0.000
	G6: Strict invariance	2093.921	499	0.931	−0.004	0.044	0.001	0.041	0.003
Age	A1: Young adults only	1105.922	220	0.935		0.041		0.036	
	A2: Middle-aged adults only	846.018	220	0.935		0.057		0.040	
	A3: Configural invariance	1951.940	440	0.935		0.046		0.037	
	A4: Weak invariance	2073.863	458	0.931	−0.004	0.046	0.000	0.043	0.006
	A5: Strong invariance	2271.074	476	0.923	−0.008	0.048	0.002	0.045	0.002
	A6: Strict invariance	2548.234	499	0.912	−0.011	0.050	0.002	0.050	0.005

Abbreviations: $χ^2$, Robust chi-square test of exact fit; df, Degrees of freedom; CFI, Comparative fit index; RMSEA, Root mean square error of approximation; SRMR, Standardized root mean square residual.

slightly exceeding the recommended threshold of 0.01. However, the minimal changes in ΔRMSEA (0.002) and ΔSRMR (0.005) indicate that the deviations are negligible. The results of MI across gender and age are presented in Table 4.

Internal Consistency and Test–Retest Reliability

Corrected item-total correlations and Cronbach's alpha values were calculated for the PSRS. As shown in Table 5, most item-total correlations were satisfactory, with Item 11 having the lowest (r = 0.26). However, removing it did not

Table 5 Corrected Item-Total Correlation, Alpha Without the Item, Cronbach Alpha, and Intraclass Correlation Coefficients With 95% Upper and Lower Confidence Intervals for the Chinese Version of the PSRS

Subscales	Item	M (SD)	Corrected Item-Total Correlation	Alpha Without the Item	Alpha of Subscales	Total Alpha	ICC of Subscales [95% CI]	Total ICC [95% CI]
RWO	Q1	0.68(0.66)	0.58	0.90	0.81		0.72***[0.65–0.77]	
	Q7	0.76(0.76)	0.58	0.90				
	Q12	0.69(0.71)	0.58	0.90				
	Q16	0.55(0.71)	0.54	0.90				
	Q23	0.62(0.72)	0.59	0.90				
PrR	Q2	0.73(0.58)	0.28	0.91	0.60		0.64***[0.55–0.70]	
	Q10	0.67(0.58)	0.33	0.90				
	Q20	0.67(0.65)	0.55	0.90				
	Q21	0.93(0.64)	0.49	0.90				
RSE	Q4	0.83(0.60)	0.62	0.90	0.67		0.72***[0.65–0.77]	
	Q9	0.49(0.66)	0.50	0.90		0.90		0.83***[0.78–0.86]
	Q11	1.04(0.89)	0.26	0.91				
	Q14	0.58(0.62)	0.57	0.90				
	Q22	0.92(0.64)	0.57	0.90				
RSC	Q3	1.18(0.64)	0.53	0.90	0.74			
	Q5	0.98(0.52)	0.54	0.90			0.74***[0.68–0.79]	
	Q6	0.63(0.63)	0.57	0.90				
	Q17	0.70(0.59)	0.50	0.90				
	Q19	0.92(0.57)	0.59	0.90				
RFa	Q8	0.73(0.61)	0.59	0.90	0.74			
	Q13	1.03(0.46)	0.51	0.90			0.63***[0.55–0.70]	
	Q15	1.04(0.54)	0.54	0.90				
	Q18	0.94(0.51)	0.54	0.90				

Note: *p < 0.05, **p < 0.01, ***p < 0.001.
Abbreviations: RWO, reactivity to failure; PrR, prolonged reactivity; RSE, reactivity to social evaluation; RSC, reactivity to social conflict; Rfa, reactivity to failure; ICC, intraclass correlation coefficients; 95% CI, 95% confidence interval.

significantly improve the scale's internal consistency, so it was retained. Cronbach's alpha ranged from 0.60 to 0.90 across the subscales and total scale. The ICC for the total score was 0.83, and for the subscales, it ranged from 0.63 to 0.74, indicating sufficient consistency over time.

Convergent and Criterion-Related Validity

The PSRS replicated the correctional orientation and magnitude observed in other well-established measurements of the DASS-D, DASS-A, DASS-S, and GSES (Table 6). Notably, the PSRS (total scale and its five subscales) exhibited significant positive correlations with DASS-D (ranging from 0.32 to 0.47, $p < 0.001$), DASS-A (ranging from 0.37 to 0.51, $p < 0.001$), and DASS-S (ranging from 0.41 to 0.57, $p < 0.001$). Conversely, significant negative correlations were observed between PSRS (total scale and its five subscales) and GSES, with correlation coefficients ranging from −0.60 to −0.43 ($p < 0.001$).

Difference Analysis

Table 7 presents the mean and standard deviation of the subscale and total scale scores for each group. Women reported significantly higher stress reactivity than men on the total scale ($d = 0.37$) and the subscales RWO ($d = 0.37$), RSC ($d = 0.38$), RSE ($d = 0.33$), and RFa ($d = 0.23$). Similarly, young adults scored significantly higher than middle-aged adults on the total scale and most subscales (effect sizes ranged from $d = 0.31$ to $d = 0.60$), except for the PrR subscale, where the difference was negligible ($d = 0.14$). There were almost no differences in the PrR scores between these groups, both in terms of gender and age

Table 6 Correlations Between the PSRS in Relation and Other Well-Established Scales

	DASS-21-D	**DASS-21-A**	**DASS-21-S**	**GSES**
PSRS-tot	0.47***	0.51***	0.57***	−0.60***
RWO	0.43***	0.45***	0.51***	−0.51***
PrR	0.36***	0.39***	0.45***	−0.43**
RSC	0.34***	0.38***	0.46***	−0.46***
RSE	0.40***	0.44***	0.43***	−0.55***
RFa	0.32***	0.37***	0.41***	−0.44***
M (SD)	3.91(3.73)	4.27(3.50)	5.14(3.61)	25.36(5.84)

Notes: *p < 0.05, **p < 0.01, ***p < 0.001.
Abbreviations: PSRS – Tot, Perceived Stress Reactivity total score: sum of the five scale scores; RWO, Reactivity to Failure; PrR, Prolonged Reactivity; RSE, Reactivity to Social Evaluation; RSC, Reactivity to Social Conflicts; RFa, Reactivity to Failure; DASS-21-D, Depression subscale of Depression Anxiety Stress Scale-21; DASS-21-A, Anxiety subscale; DASS-21-S, Stress subscale; GSES, General Self-Efficacy Scale.

Table 7 Gender and Age Differences for the Chinese Version of the PSRS

	Men	**Women**	**t**	**d**	**Young Adults**	**Middle-Aged Adults**	**t**	**d**
	M (SD)	**M (SD)**			**M (SD)**	**M (SD)**		
PSRS-Tot	16.35(8.23)	19.35(8.11)	−10.08***	0.37	19.25(7.43)	15.73(9.78)	9.77***	0.43
RWO	2.66(2.49)	3.64(2.70)	−10.42***	0.37	3.53(2.61)	2.66(2.75)	8.20***	0.33
RSC	3.92(2.07)	4.69(2.03)	−10.30***	0.38	4.59(1.90)	3.96(2.45)	7.01***	0.31
RSE	3.37(2.21)	4.10(2.25)	−8.91***	0.33	4.20(2.05)	2.89(2.53)	13.90***	0.60
RFa	3.50(1.71)	3.86(1.51)	−6.06***	0.23	3.86(1.45)	3.38(1.88)	6.95***	0.31
PrR	2.90(1.74)	3.06(1.60)	−2.63**	0.10	3.07(1.57)	2.84(1.85)	3.22**	0.14
Sample size	1151	2165			2427	889		

Notes: *p < 0.05, **p < 0.01, ***p < 0.001.
Abbreviations: PSRS-Tot, Perceived Stress Reactivity total score, sum of the five scale scores; RWO, Reactivity to Failure; PrR, Prolonged Reactivity; RSE, Reactivity to Social Evaluation; RSC, Reactivity to Social Conflicts; Rfa, Reactivity to Failure.

Discussion

The PSRS employed in this study was intended to comprehensively evaluate perceived stress reactivity across multiple dimensions and levels. Despite its foundation in robust theoretical frameworks, this measure has not been validated among Chinese adults. Consequently, the current results offer compelling evidence that the Chinese version of the PSRS has satisfactory psychometric indicators, rendering it suitable for assessing Chinese adults.

The CFA results confirmed that the revised scale retained its original five-factor structure with good fit indices, indicating strong construct validity suitable for Chinese adults. Subsequently, we tested MI across gender and age groups. Using MGCFA, the analytical results strongly supported the MI of factor loadings, thresholds, and uniqueness within the PSRS across the groups. Despite the sample size disparity (ratio approximately 3:1) and considering the sensitivity of SRMR to sample size and its potential instability,[23,37] ΔSRMR remained within acceptable ranges, further supporting the robustness of the results. Therefore, the Chinese version of the PSRS is validated for direct comparisons across gender and age groups, ensuring meaningful and unbiased interpretations of the results.

The internal consistency and test–retest reliability of the revised scale were good. Specifically, the internal reliability coefficient of the Chinese version of the PSRS yielded a high value of 0.90. In previous studies, the total scale has also been reported to have excellent internal consistency, with Cronbach's alpha coefficients ranging from 0.87 to 0.91.[2,11] In this sense, the alpha values of the Chinese version of the PSRS closely resemble those of the original scale. Further, the test–retest reliability of the total scale and partial subscales was good in this study, indicating minimal random error attributable to temporal factors.[32] Nevertheless, the ICC values for the subscales of PrR and RFa fell below 0.7, indicating some variability in the repeated measures. These results were consistent with those reported in the previous study.[2] One possible explanation for this variance could be the unique characteristics of our subsample, where young people outnumber middle-aged individuals. Many of these young people were university students, who typically experience fluctuations in stress exposure. The first administration of the questionnaire coincided with the final exam period, a time generally marked by heightened stress, while the second assessment occurred during the holidays, a period typically characterized by a reduction in stress levels. These two time points were in completely different phases of the academic calendar, which likely contributed to the variations in stress exposure. Stress reactivity varies as it depends on an individual's past and current stress exposures.[2,38] This could explain the unsatisfactory test–retest reliability of the two subscales.

The results demonstrated good convergent and criterion-related validity for the Chinese version of the PSRS, as it showed consistent relationships with related scales, including measures of depression, anxiety, stress, and self-efficacy. Specifically, significant positive correlations were found between the PSRS and stress and depression measures.[2,7,8] These findings suggest that individuals with higher stress reactivity are more likely to experience elevated stress and depressive symptoms. Additionally, a positive correlation was observed between PSRS scores and anxiety, further supporting the validity of the scale. Moreover, neuroticism, a closely related personality trait, was positively correlated with perceived stress reactivity.[2,7] In contrast, PSRS scores were negatively correlated with self-efficacy, consistent with previous findings,[2] supporting the notion that individuals with lower self-efficacy may experience greater reactivity to stress. These correlations collectively reinforce the satisfactory convergent and criterion-related validity of the Chinese version of the PSRS.

We employed the *t*-test to analyze gender and age differences in perceived stress reactivity. Our results showed that women scored higher than men on most scales, especially in their responses to social conflict, evaluation, and work overload, indicating that they are more reactive to socially relevant and workload-related stressors. This finding aligns with prior results,[2,8,39] suggesting that women are more responsive to their social environment. One possible explanation for women heightened emotional reactivity is their greater sensitivity to events within their social networks.[40] For instance, compared with men, women place greater importance on emotional feedback in their interactions with others, particularly with partners. Additionally, structural inequalities in the social environment, such as income disparities between women and men,[41] may contribute to heightened stress responses in women. Lastly, evolving sociocultural norms regarding women's participation in the workforce may have contributed to a narrowing of the gender gap in

occupational stress exposure. Women now prioritize professional and economic success more than in previous decades,[42] which may contribute to increased stress as they balance career and social expectations.

Age differences in the PSRS scores provided further support for the validity of the adult-adapted version. Specifically, middle-aged adults had lower scores on the total scale and RSE than young adults, indicating a potential decline in perceived stress reactivity as age increased. According to socioemotional selectivity theory, making connections with others is important to young adults. Therefore, they may feel anxious or upset when they receive negative evaluations that may threaten their self-image. Conversely, as people age, they tend to shift their focus toward emotional goals, allocating resources to mitigate the negative emotional impacts of stressors, thereby enhancing their ability to cope with daily challenges.[43,44] In addition, young adults are likely to face various social and economic pressures. In the context of globalization and national transformation, the responsibilities associated with adulthood have shifted, as evidenced by the prolongation of educational pursuits and the postponement of marriage and parenthood.[45]

This study provides important insights into the cultural adaptation and psychometric properties of the PSRS among Chinese adults. Our findings contribute to a deeper understanding of individual differences in stress reactivity and have important implications for both theoretical development and practical applications. By validating the PSRS in a Chinese population, we lay a foundation for future cross-cultural comparisons and interventions targeting stress reactivity.

Limitations

Two potential limitations to our study should be noted. First, owing to the age distribution of participants using the questionnaire platform, we were unable to assess the PSRS in older adults. This constraint arose because the online questionnaire platform was predominantly populated by individuals younger than 60 years of age, primarily students and workers. Consequently, the generalizability of our results, particularly to broader social and cultural contexts, may be limited. To mitigate this limitation, we employed a substantial sample of Chinese adults (N = 3316). This study had the largest sample size reported in the literature for PSRS validation. Nevertheless, future studies should include samples of older adults to examine the psychometric properties of the PSRS. Second, our study utilized cross-sectional data for the MI analysis. Therefore, longitudinal research designs should be used in future studies to examine the temporal stability of this operationalization.

Conclusion

This study confirmed that the Chinese version of the PSRS exhibits robust psychometric properties and preserves a stable five-factor structure across both gender and age groups. This stability allows for valid comparisons of perceived stress reactivity in future studies, ensuring that observed differences reflect meaningful variations across gender and age groups. Notably, women reported higher levels of perceived stress reactivity than men, particularly in relation to work and social pressures. Additionally, young adults showed higher levels of perceived stress reactivity than middle-aged adults, especially in socially evaluative settings.

Data Sharing Statement

All data analyzed in this study are available on request from the authors.

Ethical Approval Statement

This study was approved by the Human Subjects Protection Committee of the School of Psychology, Guizhou Normal University (Approval Number: GZNUPSY, N202401E [0004]). Written informed consent was obtained from all participants prior to the study, and the research adhered to ethical principles of confidentiality, voluntary participation, and participant safety.

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Disclosure

The authors declare no competing interests in this work.

References

1. Cohen S, Murphy ML, Prather AA. Ten surprising facts about stressful life events and disease risk. *Annu Rev Psychol*. 2019;70:577–597. doi:10.1146/annurev-psych-010418-102857
2. Schlotz W, Yim IS, Zoccola PM, Jansen L, Schulz P. The perceived stress reactivity scale: measurement invariance, stability, and validity in three countries. *Psychol Assess*. 2011;23(1):80–94. doi:10.1037/a0021148
3. Dhabhar FS. Effects of stress on immune function: the good, the bad, and the beautiful. *Immunol Res*. 2014;58(2–3):193–210. doi:10.1007/s12026-014-8517-0
4. Lazarus RS. Psychological stress and the coping process. *Am J Psychol*. 1966;83(4). doi:10.2307/1420698
5. Epel ES, Crosswell AD, Mayer SE, et al. More than a feeling: a unified view of stress measurement for population science. *Front Neuroendocrinol*. 2018;49:146–169. doi:10.1016/j.yfrne.2018.03.001
6. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24(4):385–396. doi:10.2307/2136404
7. Morgan ES, Umberson KM, Hertzog C. Construct validation of self-reported stress scales. *Psychol Assess*. 2014;26(1):90–99. doi:10.1037/a0034714
8. Britton D, Kavanagh E, Polman R. The perceived stress reactivity scale for adolescent athletes. *Pers Individ Differ*. 2017;116:301–308. doi:10.1016/J.PAID.2017.05.008
9. Herr RM, Barrech A, Riedel N, Gündel H, Angerer P, Li J. Long-term effectiveness of stress management at work: effects of the changes in perceived stress reactivity on mental health and sleep problems seven years later. *Int J Environ Res Public Health*. 2018;15(2):255. doi:10.3390/ijerph15020255
10. Suh H, Liou PY, Jeong JS, Kim SY. Perfectionism, prolonged stress reactivity, and depression: a two-wave cross-lagged analysis. *J Ration Emot Cogn Behav Ther*. 2022;1–15. doi:10.1007/s10942-022-00483-x
11. Pryss R, John D, Schlee W, et al. Exploring the time trend of stress levels while using the crowdsensing mobile health platform, trackyourstress, and the influence of perceived stress reactivity: ecological momentary assessment pilot study. *JMIR mHealth uHealth*. 2019;7(10):e13978. doi:10.2196/13978
12. Morling B, Lamoreaux M. Measuring culture outside the head: a meta-analysis of individualism-collectivism in cultural products. *Pers Soc Psychol Rev*. 2008;12(3):199–221. doi:10.1177/1088868308318260
13. Markus HR, Kitayama S. Cultures and selves: a cycle of mutual constitution. *Perspectives Psychol Sci*. 2010;5(4):420–430. doi:10.1177/1745691610375557
14. Chiao JY, Harada T, Komeda H, et al. Neural basis of individualistic and collectivistic views of self. *Hum Brain Mapp*. 2009;30(9):2813–2820. doi:10.1002/hbm.20707
15. Holloway RA, Waldrip AM, Ickes W. Evidence that a simpático self-schema accounts for differences in the self-concepts and social behavior of Latinos versus Whites (and Blacks). *J Pers Soc Psychol*. 2009;96(5):1012–1028. doi:10.1037/a0013883
16. Nisbett RE. Violence and U.S. regional culture. *Am Psychol*. 1993;48(4):441–449. doi:10.1037//0003-066x.48.4.441
17. Brown JD, Cai HJ. Self-esteem and trait importance moderate cultural differences in self-evaluations. *J Cross Cult Psychol*. 2010;41:116–123. doi:10.1177/0022022109349509
18. Suls J, Martin R, David JP. Person-environment fit and its limits: agreeableness, neuroticism, and emotional reactivity to interpersonal conflict. *Pers Soc Psychol Bull*. 1998;24(1):88–98. doi:10.1177/0146167298241007
19. Jensen-Campbell LA, Graziano WG. Agreeableness as a moderator of interpersonal conflict. *J Pers*. 2001;69(2):1467–6494. doi:10.1111/1467-6494.00148
20. Ilies R, Johnson M, Judge TA, Keeney J. A within-individual study of interpersonal conflict as a work stressor: dispositional and situational moderators. *J Organ Behav*. 2011;32(1):44–64. doi:10.1002/job.677
21. Caikang W. Evidences for reliability and validity of the Chinese version of general self-efficacy scale. *Chin J Appl Psychol*. 2001;7(1):37–40.
22. Wang K, Shi HS, Geng FL, et al. Cross-cultural validation of the depression anxiety stress scale-21 in China. *Psychol Assess*. 2016;28(5):100. doi:10.1037/pas0000207
23. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. *Struct Equation Model*. 2007;14(3):464–504. doi:10.1080/10705510701301834
24. Afifi M. Gender differences in mental health. *Singapore Med J*. 2007;48(5):385–391. doi:10.3109/09540261.2010.512865
25. Gibson PA, Baker EH, Milner AN. The role of sex, gender, and education on depressive symptoms among young adults in the United States. *J Affect Disord*. 2016;189:306–313. doi:10.1016/j.jad.2015.08.067
26. Gao W, Ping S, Liu X. Gender differences in depression, anxiety, and stress among college students: a longitudinal study from China. *J Affect Disord*. 2020;263:292–300. doi:10.1016/j.jad.2019.11.121
27. Ebner NC, Freund AM, Baltes PB. Developmental changes in personal goal orientation from young to late adulthood: from striving for gains to maintenance and prevention of losses. *Psychol Aging*. 2006;21(4):664–678. doi:10.1037/0882-7974.21.4.664
28. Huang JL, Curran PG, Keeney J, Poposki EM, DeShon RP. Detecting and deterring insufficient effort responding to surveys. *J Bus Psychol*. 2012;27(1):99–114. doi:10.1007/S10869-011-9231-8
29. Desimone JA, Harms PD, Desimone AJ. Best practice recommendations for data screening. *J Organ Behav*. 2015;36(2):171–181. doi:10.1002/JOB.1962
30. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaption of self-report measures. *Spine*. 2000;25 (24):3186–3191. doi:10.1097/00007632-200012150-00014
31. Marsh HW, Hau KT, Wen Z. In search of golden rules: comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Struct Equation Model*. 2004;11(3):320–341. doi:10.1207/s15328007sem1103_2
32. Kline RB. *Principles and Practice of Structural Equation Modeling*. 3rd ed. The Guilford Press; 2011.

33. Cheung GW, Rensvold RB. Evaluating goodness-of-fit indexes for testing measurement invariance. *Struct Equation Model*. 2002;9(2):233–255. doi:10.1207/S15328007SEM0902_5

34. Rutkowski L, Svetina D. Assessing the hypothesis of measurement invariance in the context of large-scale international surveys. *Educ Psychol Meas*. 2014;74(1):31–57. doi:10.1177/0013164413498257

35. Nunnally JC, Bernstein IH. *Psychometric Theory*. McGraw-Hill; 1994.

36. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159–174. doi:10.2307/2529310

37. Meade AW, Johnson EC, Braddy PW. Power and sensitivity of alternative fit indices in tests of measurement invariance. *J Appl Psychol*. 2008;93(3):568–592. doi:10.1037/0021-9010.93.3.568

38. McEwen BS. Protective and damaging effects of stress mediators. *N Engl J Med*. 1998;338(3):171–179. doi:10.1056/NEJM199801153380307

39. Helminen EC, Scheer JR, Felver JC. Gender differences in the associations between mindfulness, self-compassion, and perceived stress reactivity. *Mindfulness*. 2021;12(9):2173–2183. doi:10.1007/s12671-021-01672-y

40. Helgeson VS. Gender, stress, and coping. In: Folkman S, editor. *The Oxford Handbook of Stress, Health, and Coping*. Oxford University Press; 2011:63–85.

41. Feizi A, Aliyari R, Roohafza H. Association of perceived stress with stressful life events, lifestyle and sociodemographic factors: a large-scale community-based study using logistic quantile regression. *Comput Math Methods Med*. 2012;2012:151865. doi:10.1155/2012/151865

42. McLeod GF, Horwood LJ, Fergusson DM, Boden JM. Life-stress and reactivity by gender in a longitudinal birth cohort at 30 and 35 years. *Soc Psychiatry Psychiatr Epidemiol*. 2016;51(10):1385–1394. doi:10.1007/s00127-016-1254-z

43. Carstensen LL, Isaacowitz DM, Charles ST. Taking time seriously: a theory of socioemotional selectivity. *Am Psychol*. 1999;54(3):165–181. doi:10.1037/0003-066X.54.3.165

44. Neupert SD, Almeida DM, Charles ST. Age differences in reactivity to daily stressors: the role of personal control. *J Gerontol B Psychol Sci Soc Sci*. 2007;62(4)–26. doi:10.1093/GERONB/62.4.P216

45. Arnett JJ. Emerging adulthood: a theory of development from the late teens through the twenties. *Am Psychol*. 2000;55(5):469–480. doi:10.1037/0003-066X.55.5.469