Adaptation and validation of the Chinese version of the Central Sensitisation Inventory in patients with chronic pain

Dongfeng Liang [ID],[1] Xiangli Yu,[2] Xiaojie Guo,[3] Jie Zhang[1]

[1]Department of Rheumatology and Immunology, First Medical Center of Chinese PLA General Hospital, Beijing, China
[2]Outpatient Department, First Medical Center of Chinese PLA General Hospital, Beijing, China
[3]Department of Psychology, First Medical Center of Chinese PLA General Hospital, Beijing, China

Correspondence to
Dr Dongfeng Liang;
liangdongfeng301@foxmail.com

ABSTRACT

Background The 25-item Central Sensitisation Inventory (CSI-25) is a patient-reported instrument used to screen patients at risk of central sensitisation, a pathophysiological mechanism implicated in many chronic pain syndromes.

Aims To adapt and validate a Chinese version of the CSI-25 in the Chinese population.

Methods The Chinese CSI-25 was developed by the translation of the original English version, back translation, cultural adaptation and revision using the Delphi method. The Chinese CSI-25 was administered to 237 patients with chronic pain and 55 healthy controls. Structural validity (confirmatory factor analysis), construct validity (correlations with other instruments), test–retest reliability and internal consistency were evaluated.

Results Confirmatory factor analysis extracted four main factors ('physical symptoms', 'emotional distress', 'headache/jaw symptoms' and 'urological symptoms'). The Chinese CSI-25 score was positively correlated with the Pain Catastrophic Scale (PCS) total score (r=0.709), PCS subscale scores (r=0.630–0.695), Brief Pain Inventory (BPI) mean item score (r=0.773), BPI total score (r=0.773) and the number of painful sites (r=0.636). The Chinese CSI-25 had excellent test–retest reliability (intragroup correlation coefficient=0.975) and good internal consistency (Cronbach's α=0.930 in the overall population and 0.882 in the chronic pain population).

Conclusions The Chinese CSI-25 had excellent test–retest reliability and satisfactory structural validity and construct validity. This instrument could potentially be used in China as a self-report questionnaire in both clinical practice and research settings.

INTRODUCTION

The prevalence of chronic pain is estimated at 32% in the general Chinese population.[1] The causes of chronic pain are varied and include musculoskeletal disorders such as low back pain, neck pain and osteoarthritis, as well as chronic pain syndromes such as fibromyalgia, headache, temporomandibular joint disorder (TMD) and irritable bowel syndrome (IBS).[2] Chronic pain is associated with various demographic, lifestyle, behavioural and clinical

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The original English version of the 25-item Central Sensitisation Inventory (CSI-25) scale has been translated into various other languages. However, no studies had reported the translation and cross-cultural adaptation of the CSI-25 into Chinese when this study was designed.

WHAT THIS STUDY ADDS

⇒ The present study formulated a new version of the CSI-25 intended for use in China through translation, back translation and cultural adaptation. The CSI-25 had good construct validity, good-to-excellent test–retest reliability, good criterion validity and excellent internal consistency.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The Chinese CSI-25 developed in this study could be used as a tool in both clinical practice and research settings to screen central sensitisation in patients with chronic pain in China.

factors.[3] Chronic pain reduces the quality of life of the affected individual and is associated with restricted mobility, psychological distress, sleep disturbance and economic burden.[4]

Central sensitisation (CS) is a pathophysiological mechanism implicated in the development of many chronic pain syndromes.[5] It has been suggested that CS arises when nociceptor inputs induce an enhancement in the excitability of neurons involved in central nociceptive pathways.[6] CS usually manifests as allodynia (the perception of pain in response to a stimulus that does not normally provoke pain), hyperalgesia (enhanced sensitivity to a normally painful stimulus) and after sensations following the removal of the painful stimulus.[6] CS is thought to contribute to the pathogenesis of chronic pain syndromes such as fibromyalgia,[7] chronic tension-type headaches,[8] TMD[9] and IBS.[10]

CS can be evaluated using quantitative sensory testing, an established set of protocols that measure the responses to thermal and mechanical stimuli.[11] Questionnaires have also been developed as simpler methods of assessing CS. The Central Sensitisation Inventory (CSI) is a patient-reported instrument designed to screen populations at high risk of CS or to evaluate CS-associated physical and emotional symptoms.[12] The 25-item CSI (CSI-25) consists of two sections, namely parts A and B.[12] Part A rates the frequency of occurrence of 25 common symptoms of CS using a 5-point Likert scale (never, rarely, sometimes, often or always). Part B is not scored but is used to report the previous diagnosis of 10 diseases related to central sensitivity syndrome (CSS).

The original English version of the CSI-25 scale has been translated into various other languages, including German,[13] Dutch,[14] Spanish,[15] Italian,[16] Greek,[17] Japanese,[18] Nepali[19] and Persian.[20] Furthermore, the translated versions of the CSI-25 were reported to show good psychometric properties and have been used in the screening or assessment of CS-related symptoms in many countries. Studies have shown that pain is often influenced by culture and that there are differences in pain beliefs, pain assessments, pain treatment methods and pain catastrophic scores across countries and languages.[21–23] However, to the best of our knowledge, no studies had reported the translation and cross-cultural adaptation of the CSI-25 into Chinese when this study was designed. Thus, the researchers contacted the author of the original scale, Randy Neblett, by email in May 2021 and obtained his permission to develop a Chinese version of the CSI-25.

The purpose of this single-centre, observational study was to cross-culturally adapt the CSI-25 to Chinese and assess its psychometric characteristics (including internal consistency, test–retest reliability, construct validity and factor structure) in patients with chronic pain. It was anticipated that the Chinese version of the CSI-25 would provide a new tool that could be used by clinicians and researchers to evaluate chronic pain and CS in Chinese patients.

METHODS
Study participants
This single-centre, cross-sectional study included patients with chronic pain seen at the outpatient department or admitted to a ward of the Rheumatology and Immunology Department in the First Medical Center of Chinese PLA General Hospital between July 2021 and January 2022. A group of healthy people attending the physical examination centre during the same period was recruited as controls.

The inclusion criteria for the patients with chronic pain were as follows: (1) male or female aged >18 years; (2) diagnosed with chronic pain (the presence of pain for at least 3 months), including musculoskeletal pain (such as lumbago, back pain, cervicodynia, hip pain, knee pain,

ankle pain, shoulder pain, elbow pain, hand and wrist pain, lateral epicondylitis and temporomandibular joint pain) or fibromyalgia; (3) pain severity, scored on the Numerical Rating Scale (NRS) of 0–10, was not less than 3 points for most of the time during the previous 1 week; and (4) stable pain symptoms and treatment regimen for more than 1 month. The inclusion criteria for the healthy controls were as follows: (1) male or female aged >18 years; (2) not diagnosed with CS or chronic pain during the past 5 years; and (3) no long-term pain complaints. Patients with chronic pain were excluded from the analysis if any of the following criteria were met: (1) history of trauma or fracture within the past 6 weeks; (2) acute disease (such as acute infection) within the past 4 weeks; (3) cancer; (4) brain or spinal cord injury; (5) neurological disease; (6) serious underlying disease (such as severe cardiopulmonary, gastrointestinal or genitourinary disease) that might affect the scoring of the scale; and (7) mental illness or severe emotional disorder. Additional exclusion criteria for both groups were: (1) the participant had difficulty interpreting Chinese or had a reading disorder; (2) in the opinion of the researchers, the participant would be unable to fully cooperate with the study protocol (including completion of the questionnaire) or had difficulty communicating; (3) the participant did not complete all the questions in the CSI-25 scale; (4) the participant consistently chose a particular option or showed obvious regularity in the selection of answers; and (5) the participant failed to answer the questions in line with the instructions or provided unrelated answers.

Study design
The study was divided into two parts. First, the original CSI-25 scale was translated, back-translated and cross-culturally adapted using the Brislin bidirectional translation method. The opinions and feedback on the initially translated CSI-25 scale were collected from patients with chronic pain through a presurvey, experts were invited to revise and optimise the items of the initially translated CSI-25 scale through the Delphi method and, finally, the official Chinese version of CSI-25 was generated. Second, the sociodemographic data of the patients and healthy controls were collected, and the participants were asked to fill in the Chinese CSI-25, Brief Pain Inventory (BPI) and Pain Catastrophic Scale (PCS) on-site.

Cross-cultural adaptation
The study researchers contacted the author of the original scale, Randy Neblett, by email in May 2021 and obtained permission to develop a Chinese version of the CSI-25. This process strictly followed the cross-cultural adaptation guidelines to ensure maximum equivalence between the Chinese version scale and the original scale.

The process of translation, back translation and cross-cultural adaptation strictly followed established guidelines to ensure maximum equivalence between the Chinese version of the CSI-25 and the original scale.[24] The Brislin bidirectional translation method was adopted to translate

and back-translate the original CSI-25 to generate a preliminary Chinese version of the scale. First, two participating researchers or persons with relevant medical backgrounds (Chinese natives) and one professional English-to-Chinese translator were invited to translate the original English version of the CSI-25 into Chinese independently. A preliminary version of the Chinese CSI-25 (version A) was then agreed on by the three translators. Version A of the Chinese CSI-25 was back-translated into English by a native English speaker and a Chinese-to-English translator. Finally, the original CSI and all translations were discussed and revised by a committee that included the two participating researchers or medical doctors and the participating translators, and version B of the Chinese CSI-25 was generated.

The final version of the Chinese CSI-25 comprised two parts. Part A consisted of 25 items, each of which was divided into five levels based on a Likert scale with '0' for 'never' and '4' for 'always'. The total score of part A ranged from 0 to 100, with a higher score indicating more severe CS. The severity was divided into five grades: subclinical (0–29 points), mild (30–39 points), moderate (40–49 points), severe (50–59 points) or very severe (60–100 points). Part B was not scored but was used to obtain information regarding the history of CS-related diseases, including restless leg syndrome, chronic fatigue syndrome, fibromyalgia, TMD, migraine or tension-type headaches, IBS, multiple chemical sensitivity, neck injury (including whiplash injury), anxiety or panic attacks, and depression.

Pilot testing of the Chinese CSI-25
Prior to formal testing, six patients with chronic pain (different ages, gender and education levels) who met the inclusion and exclusion criteria were recruited for a pilot test. The respondents filled in the Chinese version of the CSI-25 scale (initial version B). The doctors asked and collected the respondents' opinions on the comprehensibility and accuracy of the questions and answers, as well as the overall evaluation of the scale. Meanwhile, the response time and the response rate of the scale were recorded.

Subsequently, an expert group composed of seven representative experts in chronic pain diagnosis and treatment of chronic pain revised and optimised the expression, wording and structure of the scale items with reference to the patients' opinions and feedback and agreed on the final Chinese version of the CSI-25 scale.

Formal testing of the Chinese CSI-25
All participants were asked to complete paper versions of the Chinese CSI-25 scale and two comparator scales, namely the Chinese version of the BPI scale and the Chinese version of the PCS scale, on-site. The comparator scales were used to evaluate the construct validity of the Chinese CSI-25. The Chinese BPI evaluates pain characteristics, including intensity, location and duration. The Chinese PCS includes 13 items graded on a 5-point Likert scale with '0' for 'never' and '4' for 'always'. The PCS scores range from 0 to 52, with higher scores indicating more catastrophic pain. In addition, sociodemographic data were collected for all participants.

Validity assessment
Structural validity was assessed using confirmatory factor analysis (performed using SPSS V.22.0 and AMOS V.23.0, IBM, Armonk, New York, USA), which evaluated the similarity of the dimensions and factor loadings between the Chinese CSI-25 and the original CSI-25. The principal components were screened by Promax rotation, and items with a factor loading <0.4 were deleted. The following indices were used to determine the model fit: χ^2/df, Goodness-of-Fit Index, Adjusted Goodness-of-Fit Index, Comparative Fit Index, Tucker-Lewis coefficient and root mean square error of approximation.

Construct validity was tested by evaluating the correlations between the Chinese CSI-25 score and the scores of the Chinese PCS and its subscales (rumination, magnification and helplessness), the Chinese BPI total score and mean item score, pain duration and the number of body locations with pain. Each correlation was assessed through the calculation of Spearman's rank correlation coefficient (r).

Criterion validity was examined by comparing the Chinese CSI-25 part A score between patients with/without each CSS-related diagnosis in part B and between patients with/without one CSS-related diagnosis, two CSS-related diagnoses and more than three CSS-related diagnoses according to part B.

Discriminatory analysis was also used to compare the differences in each item between patients with chronic pain and healthy controls.

Reliability assessment
Internal consistency was evaluated by calculation of Cronbach's α coefficient. In this study, reliability was considered to be poor for 0.5≤Cronbach's α<0.6, acceptable for 0.6≤Cronbach's α<0.7, good for 0.7≤Cronbach's α<0.9 and excellent for Cronbach's α≥0.9.

Test–retest reliability was used to evaluate the stability of the scale. All healthy controls and randomly selected patients with chronic pain who had completed the Chinese CSI-25 were asked to fill in the questionnaire a second time 7±1 days after the first test. Only patients with a stable treatment regimen between the first and second tests were included in this analysis. The intragroup correlation coefficient (ICC) was calculated, and test–retest reliability was classified as moderate for 0.50≤ICC<0.75, good for 0.75≤ICC<0.90 and excellent for ICC≥0.900.[25]

Measurement error
Bland-Altman plots were constructed to evaluate the mean differences and visualise systematic errors in the baseline.

Floor and ceiling effects

Floor and ceiling effects were considered to be present if ≥15% of the patients reported the lowest (0) or highest (100) possible CSI score.[26]

Exploratory analysis of the utility of the Chinese CSI-25 as a screening tool for CS

Receiver operating characteristic (ROC) curve analyses were used to evaluate whether the Chinese CSI-25 might have utility as a screening tool for CS. Optimal cut-off values for the CSI-25 score were determined according to the Youden Index. The area under the ROC curve (AUC) and its 95% confidence interval (CI), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were calculated.

Statistical analysis

All analyses were performed using SPSS V.22.0 and AMOS V.23.0 (IBM). All statistical tests were two-sided, with a test level of 0.05. Continuous variables conforming to a normal distribution are shown as the mean (standard deviation (SD)), and those not conforming to a normal distribution are expressed as the median (interquartile range (IQR)). Categorical variables are expressed as the number of cases (percentage). Continuous variables conforming to a normal or approximately normal distribution were compared between two groups using the t-test for independent samples and among multiple groups using a one-way analysis of variance. Non-normally distributed continuous variables were compared between groups using the Mann-Whitney U test (two groups) or the Kruskal-Wallis test (multiple groups). The χ^2 test or Fisher's exact test was used to analyse categorical data.

RESULTS
Cross-cultural adaptation of the CSI-25 into Chinese

The CSI was forward-translated into Chinese and backward translated into English without any major difficulty. Seven experts simplified and colloquialised the expressions of some items through the Delphi method. For example, 'I will grind my teeth or clench my teeth' was amended to 'I grind my teeth or clench my teeth'. Five of the six patients with chronic pain (two males and three females) who participated in the pilot test agreed that the Chinese CSI-25 was easy to understand. The remaining patient who participated in the pilot test expressed difficulty understanding the scale, but this patient had only 1 year of education. Therefore, no subsequent changes were made to the scale.

Baseline characteristics of the study participants

Among 308 patients screened for inclusion, 2 were excluded for repeating information, 5 were excluded for failing to complete the questionnaires appropriately, 5 were excluded because their pain had been present for less than 3 months and 4 withdrew from the study.

Therefore, 292 patients were included in the final analysis (figure 1).

The baseline characteristics of the study participants are summarised in table 1. The study population included 237 patients with chronic pain (114 cases of fibromyalgia and 123 cases of musculoskeletal pain) and 55 healthy controls. There were significant differences among the groups in age (U=7.509; p=0.023), gender (χ^2=8.042; p=0.018), body mass index (U=10.100; p=0.006) and employment status (p<0.001), but not weight, height, marital status or years of education (table 1). Furthermore, the pain severity score, PCS score, PCS subscale scores, CSI-25 scores and CSI severity score were all markedly higher in patients with chronic pain than in healthy controls. Data from CSI-25 part B showed that 161 (67.9%) patients reported at least one physician-confirmed diagnosis, while 32.1% reported no diagnoses (data not shown).

Structural validity

The results of the structural validity assessment are shown in table 2. Confirmatory factor analysis extracted four main factors that explained most of the variance for the items in part A of the Chinese CSI-25: 'physical symptoms' (factor 1) for items 2, 8, 9, 12, 14, 17 and 22; 'emotional distress' (factor 2) for items 1, 3, 7, 13, 15, 16 and 23; 'headache/jaw symptoms' (factor 3) for items 10, 18 and 20; and 'urological symptoms' (factor 4) for items 5, 11, 21 and 25 (table 2). No factors were extracted for items 4, 6, 19 and 24 (table 2).

Construct validity

Calculation of the Pearson correlation coefficient revealed that the CSI-25 score was positively correlated with the PCS total score (r=0.709; 95% CI: 0.647 to 0.763), PCS rumination (r=0.630; 95% CI: 0.553 to 0.703), magnification (r=0.641; 95% CI: 0.564 to 0.707) and helplessness (r=0.695; 95% CI: 0.634 to 0.752) subscale scores, BPI mean item score (r=0.773; 95% CI: 0.713 to 0.822), BPI total score (r=0.773; 95% CI: 0.720 to 0.823) and the number of body sites experiencing pain (r=0.636; 95% CI: 0.561 to 0.703). However, the CSI-25 score was not correlated with the duration of pain (r=0.012; 95% CI: −0.125 to 0.147).

Test–retest reliability

The CSI-25 was completed twice by 117 of the 308 participants. Subsequently, three participants were excluded because the interval between the two tests was less than 6 days; three participants were excluded because the questionnaires were incomplete or contained obvious errors; and two participants were excluded because chronic pain had been present for less than 3 months. Therefore, 109 patients were included in the test–retest reliability analysis. The test–retest reliability of the CSI-25 total score (table 3) was excellent in the overall population (ICC=0.975) and chronic pain group (ICC=0.934) and was good in the healthy control group (ICC=0.870).
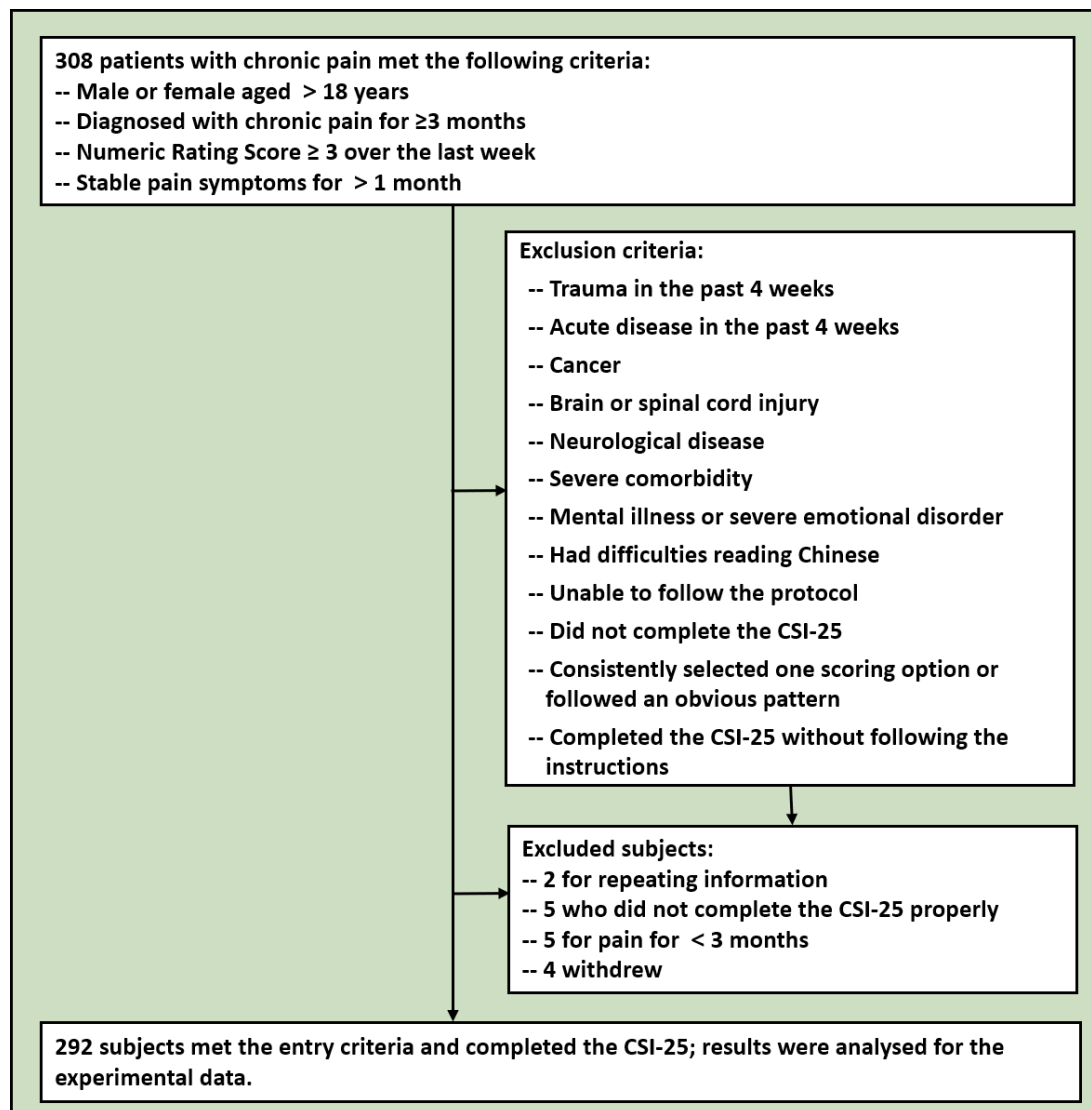
Figure 1 Flowchart of the enrollment of the study participants. CSI-25, 25-item Central Sensitisation Inventory.

Furthermore, the test–retest reliability was good to excellent (ICC≥0.75) for 24 of the 25 items in the overall population, 22 of the 25 items in the chronic pain group, but only 10 of the 25 items in the healthy control group (table 3).

Measurement error
Bland-Altman plots demonstrated that the mean differences for the overall population and chronic pain group did not significantly differ from zero, and no systematic bias was detected (figure 2).

Criterion validity
As shown in table 4, the CSI-25 score was significantly higher in patients with at least one CSS-related diagnosis in part B of the CSI-25 (U=3.254, p<0.001 vs no CSS-related diagnosis), patients with at least two CSS-related diagnoses (U=3.692, p<0.001 vs ≤1 CSS-related diagnosis) and patients with at least three CSS-related diagnoses (U=6.193, p<0.001 vs ≤2 CSS-related diagnoses). When each item in part B was analysed individually, the CSI-25 score was significantly higher in patients who had fibromyalgia (U=8.254, p<0.001), migraine/tension-type headaches (U=4.819, p<0.001), IBS (U=3.219, p=0.001), neck injury (U=2.210, p=0.027), anxiety/panic attacks (U=4.966, p<0.001) and depression (U=4.855, p<0.001) when compared with patients who did not have these CSS-related diagnoses (table 4). A borderline significant result was obtained for patients with TMD (U=1.935, p=0.053), whereas the CSI-25 score did not differ significantly between patients with/without restless leg syndrome, chronic fatigue syndrome or multiple chemical sensitivity (table 4).

Internal consistency
In the overall population, Cronbach's α value was 0.930 for the overall scale and 0.923–0.932 for the individual items, indicating excellent internal consistency (table 5). For patients with chronic pain, Cronbach's α value was 0.882 for the overall scale and 0.871–0.884 for the individual items (table 5).

Table 1 Baseline data of the participants for the Chinese 25-item Central Sensitisation Inventory (CSI-25) validation

Variable	Overall population (N=292)	Fibromyalgia (n=114)	Musculoskeletal pain population (n=123)	Healthy population* (n=55)	Statistic	P value
Age (years)					U=7.509	0.023
Mean (SD)	44.07 (12.70)	41.55 (11.97)	46.07 (13.98)	44.80 (10.26)		
Median (Q1, Q3)	44.00 (34.00, 53.00)	41.00 (32.00, 49.25)	48.00 (34.00, 55.00)	47.00 (39.00, 52.00)		
Gender, n (%)					χ^2=8.042	0.018
Male	69 (23.6)	17 (14.9)	37 (30.1)	15 (27.3)		
Female	223 (76.4)	97 (85.1)	86 (69.9)	40 (72.7)		
Weight (kg)					t=5.214	0.061
Mean (SD)	63.00 (10.55)	61.45 (9.95)	63.34 (10.84)	65.45 (10.75)		
Median (Q1, Q3)	61.00 (34.00, 53.00)	60.00 (55.00, 69.25)	62.00 (55.00, 70.00)	63.00 (57.00, 71.00)		
Height (cm)					t=4.043	0.114
Mean (SD)	163.69 (7.44)	163.30 (7.07)	164.67 (7.89)	162.29 (6.97)		
Median (Q1, Q3)	162.00 (158.00, 170.00)	162.00 (158.00, 168.00)	163.00 (160.00, 170.00)	160.00 (158.00, 170.00)		
BMI (kg/m²)					U=10.100	0.006
Mean (SD)	23.48 (3.35)	23.03 (3.32)	23.30 (3.19)	24.82 (3.48)		
Median (Q1, Q3)	23.44 (21.16, 25.65)	23.07 (20.62, 25.01)	23.34 (21.48, 25.64)	24.65 (22.23, 26.71)		
Marital status, n (%)					–	0.846
Married	245 (83.9)	94 (82.5)	104 (84.6)	47 (85.5)		
Single	32 (11.0)	15 (13.2)	11 (8.9)	6 (10.9)		
Divorced	10 (3.4)	3 (2.6)	5 (4.1)	2 (3.6)		
Widowed	5 (1.7)	2 (1.8)	3 (2.4)	0		
Education level (years)					t=6.636	0.086
Mean (SD)	11.71 (4.09)	12.27 (4.01)	11.48 (4.49)	11.04 (3.15)		
Median (Q1, Q3)	12.00 (9.00, 15.00)	12.00 (9.00, 16.00)	12.00 (9.00, 15.00)	12.00 (9.00, 12.00)		
Employment status, n (%)					–	<0.001
Unemployed	91 (31.2)	42 (36.8)	40 (32.5)	9 (16.4)		
Employed	149 (51.0)	49 (43.0)	57 (46.3)	43 (78.2)		
Retired	45 (15.4)	18 (15.8)	25 (20.3)	2 (3.6)		
Student	7 (2.4)	5 (4.4)	1 (0.8)	1 (1.8)		
Pain severity: BPI					U=150.797	<0.001
Mean (SD)	42.27 (27.03)	58.83 (18.57)	45.63 (19.13)	0.44 (1.74)		
Median (Q1, Q3)	45.50 (20.00, 63.00)	60.50 (47.00, 71.00)	43.00 (33.00, 61.00)	0.00 (0.00, 0.00)		
Pain duration (days)					U=0.895	0.743
Mean (SD)	2030.16 (2689.22)	1970.43 (2786.58)	2085.52 (2605.95)	0.00 (0.00)		
Median (Q1, Q3)	831.00 (316.00, 2377.50)	749.00 (277.00, 2162.50)	971.00 (393.00, 3031.00)	0.00 (0.00, 0.00)		
Location of pain, n (%)						

Continued

Table 1 Continued

Variable	Overall population (N=292)	Fibromyalgia (n=114)	Musculoskeletal pain population (n=123)	Healthy population* (n=55)	Statistic	P value
Head	81 (27.7)	56 (49.1)	24 (19.5)	1 (1.8)	–	<0.001
Neck	135 (46.2)	79 (69.3)	55 (44.7)	1 (1.8)	–	<0.001
Chest	50 (17.1)	37 (32.5)	13 (10.6)	0 (0.0)	χ^2=33.973	<0.001
Back	148 (50.7)	85 (74.6)	63 (51.2)	0 (0.0)	χ^2=82.543	<0.001
Abdomen	35 (12.0)	30 (26.3)	5 (4.1)	0 (0.0)	χ^2=36.995	<0.001
Waist	151 (51.7)	79 (69.3)	71 (57.7)	1 (1.8)	–	<0.001
Hip	107 (36.6)	70 (61.4)	37 (30.1)	0 (0.0)	χ^2=64.195	<0.001
Left shoulder	124 (42.5)	78 (68.4)	46 (37.4)	0 (0.0)	χ^2=73.321	<0.001
Left upper arm	84 (28.8)	61 (53.5)	23 (18.7)	0 (0.0)	χ^2=62.351	<0.001
Left elbow	70 (24.0)	51 (44.7)	19 (15.4)	0 (0.0)	χ^2=49.216	<0.001
Left forearm	58 (19.9)	43 (37.7)	15 (12.2)	0 (0.0)	χ^2=41.011	<0.001
Left palm	71 (24.3)	43 (37.7)	28 (22.8)	0 (0.0)	χ^2=28.961	<0.001
Left thigh	74 (25.3)	52 (45.6)	22 (17.9)	0 (0.0)	χ^2=47.044	<0.001
Left knee	120 (41.1)	69 (60.5)	51 (41.5)	0 (0.0)	χ^2=56.159	<0.001
Left lower leg	69 (23.6)	53 (46.5)	14 (11.4)	2 (3.6)	–	<0.001
Left foot	79 (27.1)	55 (48.2)	24 (19.5)	0 (0.0)	χ^2=49.884	<0.001
Right shoulder	125 (42.8)	78 (68.4)	47 (38.2)	0 (0.0)	χ^2=72.776	<0.001
Right upper arm	83 (28.4)	63 (55.3)	20 (16.3)	0 (0.0)	χ^2=71.149	<0.001
Right elbow	73 (25.0)	56 (49.1)	17 (13.8)	0 (0.0)	χ^2=61.911	<0.001
Right forearm	66 (22.6)	51 (44.7)	15 (12.2)	0 (0.0)	χ^2=55.604	<0.001
Right palm	75 (25.7)	41 (36.0)	33 (26.8)	1 (1.8)	–	<0.001
Right thigh	80 (27.4)	58 (50.9)	22 (17.9)	0 (0.0)	χ^2=57.945	<0.001
Right knee	131 (44.9)	73 (64.0)	58 (47.2)	0 (0.0)	χ^2=61.953	<0.001
Right lower leg	73 (25.0)	59 (51.8)	14 (11.4)	0 (0.0)	χ^2=74.019	<0.001
Right foot	81 (27.7)	54 (47.4)	27 (22.0)	0 (0.0)	χ^2=45.082	<0.001
PCS score					U=122.058	
Mean (SD)	24.65 (14.37)	32.86 (9.93)	25.46 (12.47)	5.85 (7.18)		<0.001
Median (Q1, Q3)	26.00 (13.00, 37.00)	35.00 (25.00, 41.00)	25.00 (15.00, 35.00)	4.00 (0.00, 8.00)		
PCS subscale score						
Rumination	10.00 (2.00, 13.00)	12.00 (9.00, 14.00)	11.00 (7.00, 13.00)	2.00 (0, 4.00)	U=100.590	<0.001
Magnification	5.00 (2.00, 8.00)	7.00 (5.00, 9.00)	5.00 (2.00, 8.00)	0.00 (0.00, 2.00)	U=107.167	<0.001
Helplessness	11.00 (4.00, 17.00)	16.00 (12.00, 19.00)	11.00 (5.00, 16.00)	1.00 (0.00, 3.00)	U=119.779	<0.001
CSI score					U=169.781	<0.001
Mean (SD)	37.23 (18.87)	51.78 (12.99)	35.61 (12.37)	10.67 (7.05)		

Continued

Table 1 Continued

Variable	Overall population (N=292)	Fibromyalgia (n=114)	Musculoskeletal pain population (n=123)	Healthy population* (n=55)	Statistic	P value
Median (Q1, Q3)	39.00 (22.00, 51.75)	53.00 (43.00, 61.00)	37.00 (26.00, 43.00)	10.00 (6.00, 15.00)		
CSI severity, n (%)					–	<0.001
Subclinical (0–29)	102 (34.9)	4 (3.5)	43 (35.0)	55 (100.0)		
Mild (30–39)	49 (16.8)	19 (16.7)	30 (24.4)	0 (0.0)		
Moderate (40–49)	59 (20.2)	26 (22.8)	33 (26.8)	0 (0.0)		
Severe (50–59)	45 (15.4)	32 (28.1)	13 (10.6)	0 (0.0)		
Extreme (>60)	37 (12.7)	33 (28.9)	4 (3.3)	0 (0.0)		
Number of diagnosis by CSI part B					χ^2=98.286	<0.001
Mean (SD)	0.83 (1.12)	1.50 (1.26)	0.58 (0.87)	0.00 (0.00)		
Median (Q1, Q3)	0.00 (0.00, 1.00)	1.00 (1.00, 2.00)	0.00 (0.00, 1.00)	0.00 (0.00, 0.00)		

*Healthy population excluded those who had a history of chronic pain or complained of chronic pain, but acute pain might be included.
BMI, body mass index; BPI, Brief Pain Inventory; PCS, Pain Catastrophic Scale; SD, standard deviation.

Discriminatory analysis

Comparing answers for each item between patients with chronic pain and healthy controls revealed obvious differences (all patients with chronic pain had higher scores than the healthy controls) (online supplemental material 1).

Floor and ceiling effects

Five participants (1.7%) had a CSI-25 score of 0, whereas no participant had a CSI-25 score of 100 points. Therefore, ceiling and floor effects were not observed.

Exploratory analysis of the utility of the Chinese CSI-25 as a screening tool for CS

ROC curve analysis revealed that a CSI-25 score >29 points (the optimal cut-off value) detected the presence of CS in the overall population with an AUC of 0.859 (95% CI: 0.814 to 0.897), a sensitivity of 91.3%, a specificity of 67.2%, a PPV of 77.4%, an NPV of 86.3% and an accuracy of 80.5% (online supplemental material 2). Interestingly, the sensitivity, NPV and accuracy were lower when a cut-off value of 40 points was used, although the specificity and PPV were higher using a cut-off value of 40 points (online supplemental material 2). In the chronic pain group, a CSI-25 value >42 points (the optimal cut-off value) predicted the presence of CS with an AUC of 0.762 (95% CI: 0.702 to 0.814), a sensitivity of 63.4%, a specificity of 77.6%, a PPV of 85.7%, an NPV of 50.0% and an accuracy of 67.9% (online supplemental material 2).

DISCUSSION
Main findings

The present study formulated a new version of the CSI-25 intended for use in China through translation, back translation and cultural adaptation. The CSI-25 had good construct validity, good-to-excellent test–retest reliability, good criterion validity and excellent internal consistency. Furthermore, confirmatory factor analysis identified four main factors ('physical symptoms', 'emotional distress', 'headache/jaw symptoms' and 'urological symptoms') that explained most of the total variance for the items in part A of the Chinese CSI-25. The new scale developed in this study could potentially be used as a tool to screen for CS in patients with chronic pain in China (online supplemental material 3). During the preparation of the current manuscript, a study by Feng *et al* conducted in Hong Kong was published,[27] which also generated and validated a Chinese CSI. Nevertheless, Hong Kong differs greatly from mainland China with regard to culture, language and Chinese characters. In terms of the great difference in cultural and regional backgrounds, a CSI in simplified Chinese for Mandarin-speaking areas is warranted.

Our study was more rigorously designed with concurrent healthy controls and all-around evaluation indicators compared with the previous study, which recruited patients only and did not observe criterion validity, measurement error and floor and ceiling effects.[27]

Table 2 Structural validity of the Chinese 25-item Central Sensitisation Inventory (CSI-25)

No.	CSI items	Mean (SD)	Factor 1 Physical symptoms	Factor 2 Emotional distress	Factor 3 Headache/jaw symptoms	Factor 4 Urological symptoms	Items not loading on factors
1	I feel unrefreshed when I wake up in the morning	2.22 (1.26)		0.688			
2	My muscles feel stiff and achy	2.60 (1.36)	0.724				
3	I have anxiety attacks	1.88 (1.19)		0.798			
4	I grind or clench my teeth	0.61 (1.04)					×
5	I have problems with diarrhoea and/or constipation	1.39 (1.19)				0.472	
6	I need help in performing my daily activities	0.51 (0.94)					×
7	I am sensitive to bright lights	0.92 (1.29)		0.427			
8	I get tired very easily when I am physically active	2.36 (1.30)	0.796				
9	I feel pain all over my body	2.18 (1.49)	0.842				
10	I have headaches	1.33 (1.22)			0.603		
11	I feel discomfort in my bladder and/or burning when I urinate	0.61 (0.93)				0.565	
12	I do not sleep well	2.17 (1.39)	0.693				
13	I have difficulty concentrating	1.58 (1.26)		0.789			
14	I have skin problems such as dryness, itchiness, or rashes	1.38 (1.34)	0.450				
15	Stress makes my physical symptoms get worse	1.50 (1.32)		0.754			
16	I feel sad or depressed	1.59 (1.29)		0.770			
17	I have low energy	1.97 (1.35)	0.826				
18	I have muscle tension in my neck and shoulders	2.33 (1.38)			0.733		
19	I have pain in my jaw	0.30 (0.78)					×
20	Certain smells, such as perfumes, make me feel dizzy and nauseated	0.89 (1.09)			0.420		
21	I have to urinate frequently	1.18 (1.26)				0.440	
22	My legs feel uncomfortable and restless when I am trying to go to sleep at night	1.88 (1.37)	0.606				
23	I have difficulty remembering things	2.14 (1.25)		0.640			
24	I suffered from trauma as a child	0.27 (0.80)					×
25	I have pain in my pelvic area	1.43 (1.47)				0.643	

SD, standard deviation.

Furthermore, both patients with musculoskeletal pain and fibromyalgia were included in this study, while Feng *et al* only enrolled patients with musculoskeletal pain.[27] The mean age of subjects in the Chinese version and the Hong Kong version was 44 and 64 years old,[27] respectively. Considering the strict design and the representativeness of subjects, the Chinese CSI-25 might provide a valid and accurate tool for clinicians and researchers to evaluate chronic pain and CS in Chinese patients.

Structural validity describes the extent to which a test can measure psychological traits or theoretical constructs. Confirmatory factor analysis demonstrated that there were common factors between the items in part A of the

Chinese CSI-25 scale. The analysis extracted four main factors that explained the majority of the total variance for the items in part A of the scale: 'physical symptoms' (items 2, 8, 9, 12, 14, 17 and 22), 'emotional distress' (items 1, 3, 7, 13, 15, 16 and 23), 'headache/jaw symptoms' (items 10, 18 and 20) and 'urological symptoms' (items 5, 11, 21 and 25). No factors were extracted for items 4, 6, 19 and 24. Confirmatory factor analysis of the original English version of the CSI identified the same four main factors (accounting for 53.4% of the variance): 'physical symptoms' (items 2, 6, 8, 9, 12, 17, 18 and 22), 'emotional distress' (items 2, 13, 15, 16, 17, 23 and 24), 'headache/jaw symptoms' (items 4, 7, 10, 19 and 20) and

Table 3 Test–retest reliability of the Chinese 25-item Central Sensitisation Inventory (CSI-25)

No.	Items	Overall population (N=109)		Chronic pain (n=58)		Healthy controls (n=51)	
		ICC	95% CI	ICC	95% CI	ICC	95% CI
1	I feel unrefreshed when I wake up in the morning	0.854	(0.794 to 0.898)	0.778	(0.652 to 0.862)	0.700	(0.529 to 0.817)
2	My muscles feel stiff and achy	0.970	(0.956 to 0.979)	0.788	(0.667 to 0.869)	0.902	(0.831 to 0.943)
3	I have anxiety attacks	0.872	(0.818 to 0.911)	0.740	(0.597 to 0.837)	0.828	(0.718 to 0.898)
4	I grind or clench my teeth	0.868	(0.813 to 0.908)	0.860	(0.774 to 0.914)	0.889	(0.813 to 0.935)
5	I have problems with diarrhoea and/or constipation	0.908	(0.868 to 0.936)	0.922	(0.872 to 0.953)	0.806	(0.666 to 0.888)
6	I need help in performing my daily activities	0.878	(0.827 to 0.915)	0.850	(0.760 to 0.908)	1.000	–
7	I am sensitive to bright lights	0.777	(0.690 to 0.841)	0.753	(0.617 to 0.846)	0.792	(0.663 to 0.876)
8	I get tired very easily when I am physically active	0.912	(0.875 to 0.939)	0.820	(0.714 to 0.890)	0.658	(0.469 to 0.790)
9	I feel pain all over my body	0.927	(0.895 to 0.949)	0.821	(0.715 to 0.890)	0.490	(0.253 to 0.672)
10	I have headaches	0.826	(0.755 to 0.877)	0.845	(0.750 to 0.905)	0.371	(0.105 to 0.586)
11	I feel discomfort in my bladder and/or burning when I urinate	0.647	(0.522 to 0.745)	0.620	(0.434 to 0.756)	0.417	(0.164 to 0.618)
12	I do not sleep well	0.862	(0.804 to 0.903)	0.876	(0.800 to 0.925)	0.498	(0.258 to 0.680)
13	I have difficulty concentrating	0.840	(0.775 to 0.888)	0.775	(0.647 to 0.860)	0.726	(0.566 to 0.833)
14	I have skin problems, such as dryness, itchiness, or rashes	0.877	(0.823 to 0.915)	0.850	(0.755 to 0.910)	0.898	(0.828 to 0.940)
15	Stress makes my physical symptoms get worse	0.818	(0.745 to 0.872)	0.743	(0.601 to 0.840)	0.633	(0.434 to 0.773)
16	I feel sad or depressed	0.850	(0.789 to 0.895)	0.830	(0.728 to 0.886)	0.530	(0.301 to 0.701)
17	I have low energy	0.865	(0.807 to 0.906)	0.762	(0.630 to 0.852)	0.558	(0.340 to 0.721)
18	I have muscle tension in my neck and shoulders	0.892	(0.846 to 0.925)	0.804	(0.690 to 0.879)	0.739	(0.582 to 0.843)
19	I have pain in my jaw	0.813	(0.738 to 0.868)	0.828	(0.726 to 0.894)	0.000	(−0.253 to 0.261)
20	Certain smells, such as perfumes, make me feel dizzy and nauseated	0.827	(0.757 to 0.878)	0.782	(0.658 to 0.865)	0.908	(0.844 to 0.946)
21	I have to urinate frequently	0.836	(0.769 to 0.884)	0.779	(0.654 to 0.863)	0.889	(0.814 to 0.935)
22	My legs feel uncomfortable and restless when I am trying to go to sleep at night	0.870	(0.815 to 0.909)	0.801	(0.685 to 0.877)	0.785	(0.653 to 0.871)
23	I have difficulty remembering things	0.899	(0.855 to 0.929)	0.930	(0.885 to 0.958)	0.599	(0.390 to 0.749)
24	I suffered from trauma as a child	0.866	(0.809 to 0.906)	0.874	(0.797 to 0.924)	0.662	(0.476 to 0.792)
25	I have pain in my pelvic area	0.929	(0.899 to 0.951)	0.892	(0.824 to 0.935)	0.653	(0.464 to 0.785)
All	Total score	0.975	(0.964 to 0.983)	0.934	(0.890 to 0.960)	0.870	(0.784 to 0.924)

CI, confidence interval; ICC, intragroup correlation coefficient.

Overall population

Chronic pain population
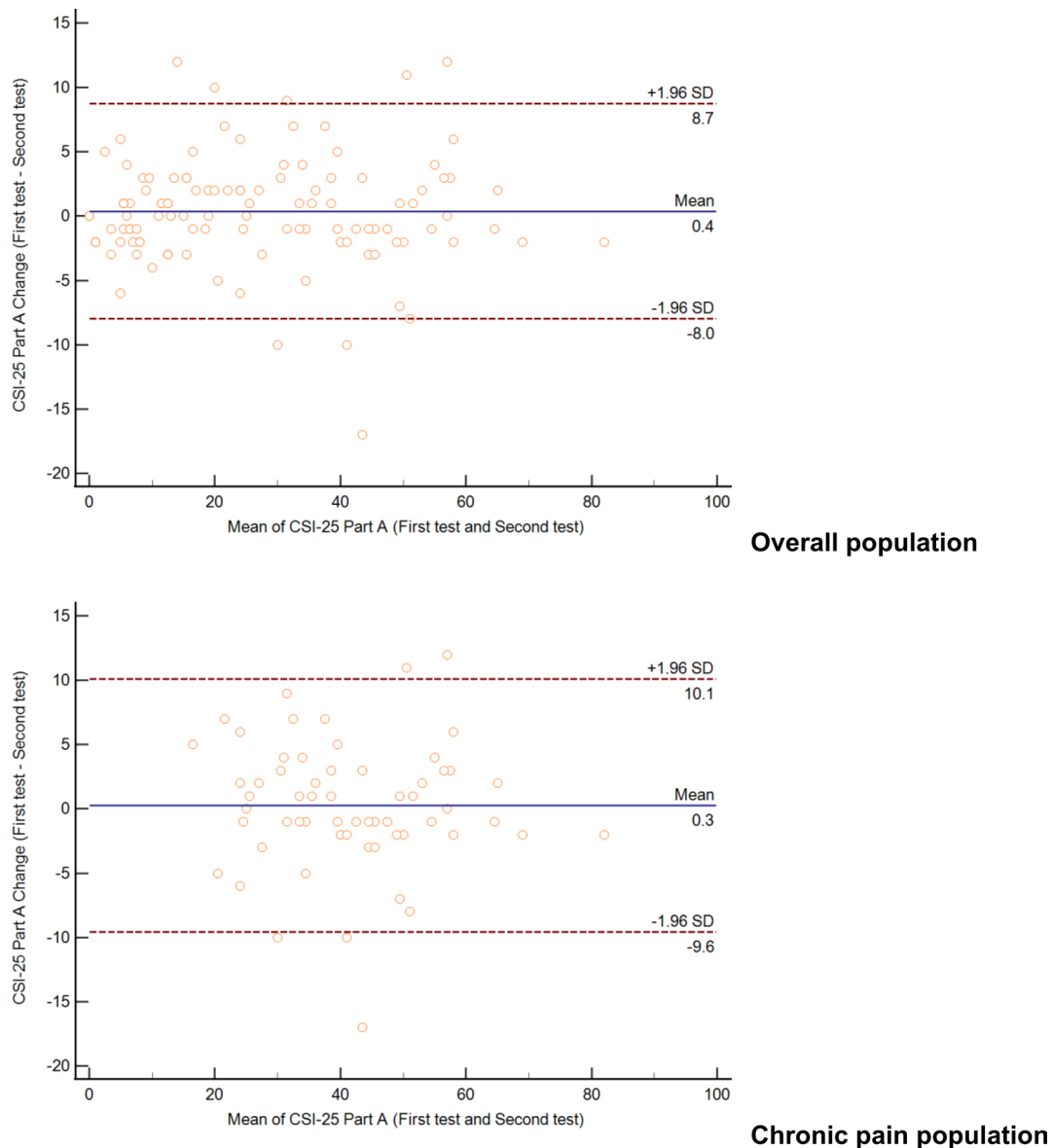
Figure 2 Bland-Altman plots in the overall population and in the chronic pain population. CSI-25, 25-item Central Sensitisation Inventory.

'urological symptoms' (items 11, 21 and 25).[12] Similarly, assessment of the German CSI-25 identified the same factors: 'physical symptoms' (items 1, 2, 5, 6, 8, 9, 12, 14, 17, 18 and 22), 'emotional distress' (items 3, 13, 15, 16, 23 and 24), 'headache' (items 4, 7, 10, 19 and 20) and 'urological symptoms' (items 11, 21 and 25).[13] Four major factors were also described for the Dutch version ('general disability and physical symptoms', 'emotional distress', 'higher central sensitivity' and 'urological and dermatological symptoms'),[14] while the Japanese version identified five factors ('emotional distress', 'headache/jaw symptoms', 'urological and general symptoms', 'muscle symptoms' and 'sleep disturbance').[18] Thus, the findings of the present study are broadly consistent with those reported previously. The factors extracted in our analysis and those of others all relate to common somatic and emotional symptoms experienced by patients with CSS.

The construct validity of the Chinese CSI-25 was evaluated through comparisons with other scales (the PCS and BPI) that measure similar qualities. The Chinese CSI-25 score was positively correlated with the total PCS score (r=0.709) and its rumination, magnification and helplessness subscale scores (r=0.630–0.695). Furthermore, the Chinese CSI-25 score was also positively correlated with the BPI mean item score (r=0.773), BPI total score (r=0.773) and the number of painful body sites (r=0.636). Hence, the Chinese CSI-25 showed moderate-to-good correlations with instruments that assess pain characteristics such as intensity, location and duration (BPI) as well as an individual's experience of pain (PCS). The results are broadly in agreement with prior studies examining the construct validity of the CSI, although the correlations were slightly stronger for the Chinese CSI-25 than for other versions of the instrument. For example, the Greek version of the CSI-25 correlated with the PCS score

Table 4 Impact of central sensitivity syndrome diagnosis on the Chinese 25-item Central Sensitisation Inventory (CSI-25) score (n=292)

No.	CSS diagnosis (CSI part B)	Presence of symptoms	n (%)	Median (Q1, Q3)	U	P value
1	Restless leg syndrome	Y	4 (1.4)	52.50 (25.50, 60.00)	1.067	0.286
		N	288 (98.6)	39.00 (22.00, 51.00)		
2	Chronic fatigue syndrome	Y	2 (0.7)	44.50 (32.00, –)	0.529	0.596
		N	290 (99.3)	39.00 (21.75, 51.25)		
3	Fibromyalgia	Y	121 (41.4)	52.00 (41.00, 61.00)	8.254	<0.001
		N	171 (58.6)	27.00 (14.00, 40.00)		
4	Temporomandibular joint disorder	Y	4 (1.4)	53.00 (42.75, 71.50)	1.935	0.053
		N	288 (98.6)	39.00 (21.25, 51.00)		
5	Migraine or tension headaches	Y	40 (13.7)	52.00 (40.25, 61.00)	4.819	<0.001
		N	252 (86.3)	37.00 (20.00, 49.00)		
6	Irritable bowel syndrome	Y	8 (2.7)	61.00 (45.75, 67.75)	3.219	0.001
		N	284 (97.3)	38.00 (21.00, 50.75)		
7	Multiple chemical sensitivities	Y	5 (1.7)	46.00 (35.00, 58.00)	1.138	0.255
		N	287 (98.3)	39.00 (21.00, 51.00)		
8	Neck injury (including whiplash)	Y	11 (3.8)	46.00 (41.00, 59.00)	2.210	0.027
		N	281 (96.2)	38.00 (21.00, 51.00)		
9	Anxiety or panic attacks	Y	50 (17.1)	48.50 (39.75, 59.25)	4.966	<0.001
		N	242 (82.9)	36.00 (19.00, 49.00)		
10	Depression	Y	30 (10.3)	53.50 (42.00, 63.00)	4.855	<0.001
		N	262 (89.7)	37.00 (20.00, 48.25)		
	1 CSS	Y	91 (31.2)	43.00 (34.00, 54.00)	3.254	<0.001
		N	201 (68.8)	36.00 (17.00, 50.00)		
	2 CSS	Y	39 (13.4)	48.00 (39.00, 58.00)	3.692	<0.001
		N	253 (86.6)	36.00 (20.00, 50.00)		
	≥3 CSS	Y	31 (10.6)	59.00 (50.00, 64.00)	6.193	<0.001
		N	261 (89.4)	37.00 (20.00, 48.00)		

CSS, central sensitivity syndrome; N, no; Y, yes.

(r=0.680).[17] Furthermore, the Nepali CSI-25 correlated with the PCS score (r=0.50), pain intensity measured by the NRS (r=0.25) and the total number of pain types (r=0.35).[19] The Japanese CSI-25 was found to be positively correlated with the pain intensity (r=0.42) and pain interference (r=0.48) scores of the BPI,[18] while the Italian version of the CSI-25 correlated with the NRS score (r=0.427).[16] The Hong Kong version correlated with pain intensity (r=0.188).[27] The Chinese CSI-25 score was not correlated with the duration of pain, which agrees with previous research.[18 19 27]

The test–retest reliability of the Chinese CSI-25 was excellent in the overall population (ICC=0.975), which is consistent with previous evaluations of the English (ICC=0.817),[12] German (ICC=0.917),[13] Dutch (ICC=0.88–0.91),[14] Greek (ICC=0.991),[17] Japanese (ICC=0.85),[18] Hong Kong (ICC=0.932),[27] Nepali (ICC=0.98)[19] and Persian (ICC=0.934)[20] versions of the scale. Furthermore, the internal consistency of the Chinese CSI-25 was Cronbach's α=0.930 in the overall population and 0.882 in the chronic pain population,

which compares with Cronbach's α values of 0.879 for the English version,[12] 0.928 for the German version,[13] 0.78 for the Dutch version,[14] 0.872 for the Spanish version,[15] 0.87 for the Italian version,[16] 0.993 for the Greek version,[17] 0.89 for the Japanese version,[18] 0.896 for the Hong Kong version,[27] 0.91 for the Nepali version[19] and 0.87 for the Persian version.[20]

A previous exploratory analysis using an optimal cut-off value of 40 points reported that the English CSI-25 distinguished patients with CSS from controls with AUC, sensitivity and specificity values of 0.86, 81% and 75%, respectively.[28] Furthermore, the Turkish CSI-25 differentiated between patients with fibromyalgia and control subjects with a sensitivity of 87% and a specificity of 90% when the recommended cut-off value of 40 points was used.[29] In addition, the Hong Kong version figured out the cut-off value of 42, which was able to identify patients with two or more CSS from those with persistent pain, with a sensitivity of 71.4% and a specificity of 70%.[27] The French version of the

No.	Items	Overall population Cronbach's α (n=292)	Chronic pain population Cronbach's α (n=237)
1	I feel unrefreshed when I wake up in the morning	0.926	0.875
2	My muscles feel stiff and achy	0.926	0.880
3	I have anxiety attacks	0.925	0.874
4	I grind or clench my teeth	0.932	0.883
5	I have problems with diarrhoea and/or constipation	0.929	0.881
6	I need help in performing my daily activities	0.931	0.884
7	I am sensitive to bright lights	0.929	0.879
8	I get tired very easily when I am physically active	0.924	0.876
9	I feel pain all over my body	0.923	0.872
10	I have headaches	0.927	0.877
11	I feel discomfort in my bladder and/or burning when I urinate	0.928	0.878
12	I do not sleep well	0.926	0.876
13	I have difficulty concentrating	0.925	0.872
14	I have skin problems, such as dryness, itchiness, or rashes	0.929	0.881
15	Stress makes my physical symptoms get worse	0.925	0.873
16	I feel sad or depressed	0.925	0.872
17	I have low energy	0.924	0.871
18	I have muscle tension in my neck and shoulders	0.925	0.876
19	I have pain in my jaw	0.930	0.881
20	Certain smells, such as perfumes, make me feel dizzy and nauseated	0.929	0.879
21	I have to urinate frequently	0.930	0.882
22	My legs feel uncomfortable and restless when I am trying to go to sleep at night	0.927	0.879
23	I have difficulty remembering things	0.927	0.879
24	I suffered from trauma as a child	0.930	0.881
25	I have pain in my pelvic area	0.928	0.880
	All items (total)	0.930	0.882

CSI-25 also had a high sensitivity (95%) and specificity (90%) when a cut-off value of 40 points was used.[30] By contrast, the optimal cut-off value of the Chinese CSI-25 was 29 points, and the sensitivity, NPV and accuracy were lower when a cut-off value of 40 points was used. In addition, the sensitivity, NPV and accuracy were lower when a cut-off value of 40 points was used, as described previously,[28] although the specificity and PPV were higher using a cut-off value of 40 points. The reasons for the difference in the optimal cut-off value between the Chinese and English versions of the CSI-25 could be that NPV was higher in the Chinese version and might be due to the differences in the actual number of patients with CSS and in the number of patients with different CSS among studies. It could also be due to cultural differences in the perception and management of pain. Still, the present study was not designed to explore the reasons for these differences. Further research is needed to confirm the optimal cut-off value for the CSI-25 in Chinese patients.

Limitations

This study has some limitations. This was a single-centre study based only on an adult patient sample, so the findings may not generalise to other populations, like paediatric patients with chronic pain. The utility of the Chinese CSI-25 in the detection of CS was not evaluated in a separate validation group. Some patients in the study were receiving treatment, which may have reduced the severity of their chronic pain/CS symptoms. In addition, the mood was not assessed. Finally, we did not perform a responsiveness analysis to evaluate the effects of therapy.

Implications

In conclusion, a Chinese version of the CSI-25 was successfully developed through translation, back translation and cultural adaptation. The Chinese CSI-25 had excellent test–retest reliability and satisfactory structural validity and construct validity. We suggest that this instrument could be used in China as a self-report questionnaire in both clinical practice and research settings. However, further studies will be needed to establish the optimal cut-off value if the instrument is to be used to screen for patients with CS.

ORCID iD
Dongfeng Liang http://orcid.org/0000-0002-9830-0225

REFERENCES

1 Yongjun Z, Tingjie Z, Xiaoqiu Y, *et al*. A survey of chronic pain in China. *Libyan J Med* 2020;15:1730550.
2 Crofford LJ. Chronic pain: where the body meets the brain. *Trans Am Clin Climatol Assoc* 2015;126:167–83.
3 Mills SEE, Nicolson KP, Smith BH. Chronic pain: a review of its epidemiology and associated factors in population-based studies. *Br J Anaesth* 2019;123:e273–83.
4 Cohen SP, Vase L, Hooten WM. Chronic pain: an update on burden, best practices, and new advances. *Lancet* 2021;397:2082–97.
5 Harte SE, Harris RE, Clauw DJ. The neurobiology of central sensitization. *J Appl Biobehav Res* 2018;23:e12137.
6 Woolf CJ. Central sensitization: implications for the diagnosis and treatment of pain. *Pain* 2011;152:S2–15.
7 Siracusa R, Paola RD, Cuzzocrea S, *et al*. Fibromyalgia: pathogenesis, mechanisms, diagnosis and treatment options update. *Int J Mol Sci* 2021;22:3891.
8 Ashina S, Mitsikostas DD, Lee MJ, *et al*. Tension-type headache. *Nat Rev Dis Primers* 2021;7:24.
9 Campi LB, Visscher CM, Ongaro PCJ, *et al*. Widespread pain and central sensitization in adolescents with signs of painful temporomandibular disorders. *J Oral Facial Pain Headache* 2020;34:83–91.
10 Midenfjord I, Grinsvall C, Koj P, *et al*. Central sensitization and severity of gastrointestinal symptoms in irritable bowel syndrome, chronic pain syndromes, and inflammatory bowel disease. *Neurogastroenterol Motil* 2021;33:e14156.
11 Weaver KR, Griffioen MA, Klinedinst NJ, *et al*. Quantitative sensory testing across chronic pain conditions and use in special populations. *Front Pain Res* 2021;2:779068.
12 Mayer TG, Neblett R, Cohen H, *et al*. The development and psychometric validation of the central sensitization inventory. *Pain Pract* 2012;12:276–85.
13 Klute M, Laekeman M, Kuss K, *et al*. Cross-cultural adaptation and validation of the German central sensitization inventory (CSI-GE). *BMC Musculoskelet Disord* 2021;22:708.
14 Kregel J, Vuijk PJ, Descheemaeker F, *et al*. The Dutch central sensitization inventory (CSI): factor analysis, discriminative power, and test-retest reliability. *Clin J Pain* 2016;32:624–30.
15 Cuesta-Vargas AI, Roldan-Jimenez C, Neblett R, *et al*. Cross-cultural adaptation and validity of the Spanish central sensitization inventory. *Springerplus* 2016;5:1837.
16 Chiarotto A, Viti C, Sulli A, *et al*. Cross-cultural adaptation and validity of the Italian version of the central sensitization inventory. *Musculoskelet Sci Pract* 2018;37:20–8.
17 Bilika P, Neblett R, Georgoudis G, *et al*. Cross-cultural adaptation and psychometric properties of the Greek version of the central sensitization inventory. *Pain Pract* 2020;20:188–96.
18 Tanaka K, Nishigami T, Mibu A, *et al*. Validation of the Japanese version of the central sensitization inventory in patients with musculoskeletal disorders. *PLoS One* 2017;12:e0188719.
19 Sharma S, Jha J, Pathak A, *et al*. Translation, cross-cultural adaptation, and measurement properties of the Nepali version of the central sensitization inventory (CSI). *BMC Neurol* 2020;20:286.
20 Noorollahzadeh K, Kahrizi S, Fesharaki MG, *et al*. Cross-cultural adaptation and psychometric validation of the Persian version of the central sensitization inventory. *Musculoskelet Sci Pract* 2021;51:102314.
21 Sharma S, Abbott JH, Jensen MP. Why clinicians should consider the role of culture in chronic pain. *Braz J Phys Ther* 2018;22:345–6.
22 Orhan C, Van Looveren E, Cagnie B, *et al*. Are pain beliefs, cognitions, and behaviors influenced by race, ethnicity, and culture in patients with chronic musculoskeletal pain: a systematic review. *Pain Physician* 2018;21:541–58.
23 Pillay T, Zyl HAvan, Blackbeard D. Chronic pain perception and cultural experience. *Procedia Soc Behav Sci* 2014;113:151–60.
24 Beaton DE, Bombardier C, Guillemin F, *et al*. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine* 2000;25:3186–91.
25 Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 2016;15:155–63.
26 Terwee CB, Bot SDM, de Boer MR, *et al*. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol* 2007;60:34–42.
27 Feng B, Hu X, Lu WW, *et al*. Cultural validation of the Chinese central sensitization inventory in patients with chronic pain and its predictive ability of comorbid central sensitivity syndromes. *J Pain Res* 2022;15:467–77.
28 Neblett R, Cohen H, Choi Y, *et al*. The central sensitization inventory (CSI): establishing clinically significant values for identifying central sensitivity syndromes in an outpatient chronic pain sample. *J Pain* 2013;14:438–45.
29 Düzce Keleş E, Birtane M, Ekuklu G, *et al*. Validity and reliability of the Turkish version of the central sensitization inventory. *Arch Rheumatol* 2021;36:518–26.
30 Pitance L, Piraux E, Lannoy B, *et al*. Cross cultural adaptation, reliability and validity of the French version of the central sensitization inventory. *Man Ther* 2016;25:e83–4.

Dr Dongfeng Liang obtained a bachelor's degree in medicine from the First Military Medical University (renamed Southern Medical University) in Guangzhou, China in 1996 and a doctorate in medicine from the Chinese PLA Medical School in Beijing, China in 2009. He is now working as an associate chief physician of the Department of Rheumatology and Immunology in the First Medical Center, Chinese PLA General Hospital. In addition, Dr Liang is also the director of the Psychosomatics and Rheumatology Cross-subject Group in the Chinese Medical Psychosomatic Society, a standing member of the Psychosomatic Medicine Society of the Beijing Medical Association, and a member of the Rheumatology-Immunology Committee of the Health Exchange and Cooperation across the Taiwan Straits Association. He specializes in the cross-subject field of psychosomatics and rheumatology, focusing on fibromyalgia and has conducted studies on the clinical characteristics of Chinese patients with fibromyalgia.