

Prospective Study

e Validation of a Simplified Chinese Version of the Pain Catastrophizing Scale and an Exploration of the Factors Predicting Catastrophizing in Pain Clinic Patients

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Background: Chronic pain is very common worldwide and can lead to disability, depression and absence from work. Catastrophizing has been proven to affect individuals' belief systems and coping strategies, and it is an essential risk factor for chronic pain. The pain catastrophizing scale (PCS) has been developed for the assessment of catastrophizing. However, a Chinese version of this scale is not available, and physicians are therefore unable to determine which patients are prone to catastrophizing. Additionally, the risk factors for catastrophizing are unknown.

Objective: We aimed to cross-culturally adapt and validate the PCS for simplified Chinese (SC-PCS) and explore the risk factors for catastrophizing in patients from a pain clinic.

Study Design: We utilized a prospective, nonrandomized, cross-sectional, descriptive survey design. A second analysis of test-retest reliability was performed in a longitudinal, observational study.

Setting: A convenience sample was recruited from a pain clinic in a tertiary hospital.

Methods: This study was performed in 3 stages. In the first stage, the PCS was translated and culturally adapted to create a Chinese version; in the second stage, the measurement properties of the SC-PCS were tested, including the content validity, construct validity and reliability; and in the third stage, factors affecting catastrophizing in a pain clinic setting were explored. The adaptation was performed using a forward-backward method, and content validity was analyzed by examining the response trend (Z-skewness and item-total correlation). Construct validity was analyzed by assessing structural validity (confirmatory factor analysis [CFA] and exploratory factor analysis [EFA]) and a priori hypothesis testing. Reliability was analyzed by internal consistency (Cronbach's alpha) and test-retest reliability (intraclass correlation coefficient [ICC]). Risk factors for catastrophizing were analyzed by multivariate linear regression.

Results: A total of 153 patients were included, with a response rate of 96%; no items were excluded from the SC-PCS. Both CFA and EFA confirmed a 3-factor structure, and 9/10 of the hypotheses were verified for construct validity. Excellent reliability was acquired with a Cronbach's alpha of 0.91, and an ICC of 0.94 was determined. Risk factors for catastrophizing included college education (beta = 0.47), pain duration (beta = 0.40), female (beta = 0.31), freelancer status (beta = 0.31), and retired status (beta = 0.19).

Limitations: The recruited patients experienced severe pain or long-duration pain in a pain clinic setting. This may limit the applicability of the SC-PCS to patients with low or moderate pain levels.

Conclusion: The PCS has been linguistically translated into simplified Chinese and culturally adapted for a Chinese population with remarkable clinical acceptance, good construct validity, and excellent internal consistency and test-retest reliability. Education, pain duration, marital status, gender, income, and use of pain medications are important factors affecting catastrophizing.

Key words: Chronic pain, catastrophizing, HADS, SF-12, BPI, risk factor, reliability, validity

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Chronic pain has become a growing concern due to its high incidence rate and limited treatment options, especially in patients with persistent pain. It has been reported that over 10% of people worldwide suffer from chronic pain (1-4), and at least 20% of the population of China has experienced chronic pain (5,6). Chronic pain can lead to disability, depression, and absence from work, causing billions of dollars in economic losses (7-9). However, the effectiveness of pain management strategies for chronic pain patients is limited. Currently, increased evidence supports the notion that psychological factors such as beliefs (e.g., catastrophizing, kinesiphobia, and fear-avoidance) and mood (e.g., depression, anxiety, and distress) are closely related to chronic pain (10-15), and psychological therapy has been effective in the management chronic pain patients (16-18).

Catastrophizing, defined as an exaggerated negative response to imagined pain or actual pain, affects an individual's belief system and coping strategies and has been recognized as an essential risk factor for chronic pain (15,16). Catastrophizing could also serve as an important predictor of cognitive distress, pain-related disability, analgesic use, and dysfunctional adjustment to pain in clinical situations (17-20).

To better assess catastrophizing, Sullivan et al (19) developed the Pain Catastrophizing Scale (PCS), which comprises 13 self-reported items. Both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) confirmed that the PCS has a 3-factor structure across different cultures and clinical situations (21-33). Additionally, the PCS has been recognized for its simplicity, broad acceptance, and ease of administration for both physicians and patients. The PCS has been reported to have good reliability and construct validity in Dutch (21,22), Italian (23), Hong Kong (24), Norwegian (25), Korean (36), French (27), South African (28), African American (29), German (30), Sinhala (31), Malay (32), and Catalan (33) cultures. Moreover, applications of the PCS in children, in women experiencing vaginal birth, and in military personnel have been explored.

Unfortunately, physicians in China have been unable to measure catastrophizing in chronic pain patients due to the lack of a Chinese version of the PCS. Moreover, physicians are not aware of which patients are prone to catastrophizing, what the risk factors are, and how to treat catastrophizing effectively. Therefore, the purposes of this study were as follows: 1) to translate the English version of the PCS into simplified Chinese (SC-PCS) and validate this new version; and 2)

to explore the factors affecting catastrophizing in pain clinic patients.

METHODS

Overview of the Study Design

This study was performed in 3 stages. The first stage involved translating and culturally adapting a Chinese version of the PCS; the second stage involved testing the measurement properties of the SC-PCS including content validity, construct validity, and reliability; and the third stage involved exploring factors affecting catastrophizing in a pain clinic setting.

Linguistic Translation and Cross-cultural Adaptation

Translation of the PCS for the process of cross-cultural adaptation was performed using established guidelines (34). Two bilingual translators who spoke Chinese as their first language each independently translated the English version to SC. One translator, the author of this article (XMX), was aware of the purpose of translation and the concepts underlying the PCS. The other translator was a professor of English who was blinded to the study's purpose. An expert committee comprising 4 translators, 2 physicians working in a pain clinic, one physician specializing in rehabilitation, and one statistician was established to assess the Chinese versions, and a single Chinese version was established by consensus. Back translation then was performed independently by 2 English speakers who spoke Chinese as their second language. Each English version was compared with the original English version and checked for discrepancies by the expert committee. Finally, the committee reviewed the semantic, idiomatic, empirical, and conceptual equivalences between the original and the target versions.

A pre-test of the SC-PCS was performed in a cohort of 30 patients in a pain clinic. Each patient was asked whether they had difficulties in understanding the items or whether there was ambiguity in the questionnaire. The expert committee recorded the problems confronted and the suggestions proposed by patients; subsequently, the final version of the SC-PCS was developed (see Appendix).

Participants

A cohort of 160 consecutive outpatients complaining of chronic pain were recruited from the pain clinic of Changhai Hospital between December

2013 and May 2014. Terwee et al (35) proposed that a sample size of 100 was sufficient for validity assessment. The inclusion criteria were age over 18 years, ability to read and write Chinese, and pain duration of at least 6 weeks. The exclusion criteria were as follows: malignant tumors, systemic rheumatologic diseases, late-stage cardiovascular or pulmonary disease, and an inability or unwillingness to complete questionnaires independently. When patients visited the pain clinic, they were asked if they would be willing to participate in the investigation. Seven patients were excluded because they only filled out the PCS and did not answer the other questionnaires. Therefore, 153 patients were included in this study. To assess the reproducibility, 55 patients were selected randomly to answer the PCS for a second time at an interval of 5 – 7 days. The project was approved by the Human Research Ethics Committee of Changhai Hospital, and informed consent was obtained from every participant.

Instruments

All participants were required to answer the following 5 instruments.

The Pain Catastrophizing Scale (PCS) is a 13-item self-reported measure focusing on catastrophizing (15). It uses a 5-point Likert scale with scoring options ranging from 0 (mildest symptoms) to 4 (worst symptoms). Previous studies have produced versions of the PCS with a 2-factor and a 3-factor structure. However, accumulated evidence suggest a 3-factor structure that includes rumination, magnification, and helplessness.

The Hospital Anxiety and Depression Scale (HADS) is widely used to evaluate anxiety and depression in hospital outpatients. The HADS consists of 2 domains: the depression (HADS-D) and the anxiety (HADS-A) subscales. It comprises 14 items, each with a score from 0 to 3. A score between 0 and 21 is calculated for each domain, with higher scores indicating worse symptoms. A Chinese version has been successfully developed with excellent reliability (36).

The SF-12 is a short version of the SF-36. The SF-12 is composed of 8 domains: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE), and mental health (MH). Each raw subscale score is transformed to a 100-point scale score. The translated Chinese version has been widely used with solid psychometrics (37).

The Brief Pain Inventory (BPI) is utilized to measure pain intensity and pain-related interference in outpa-

tients. Each item is scored from 0 (no pain or no interference) to 10 (worst pain or worst interference). Pain interference includes interference with general activity, mood, walking ability, normal work, social relations, sleep, and life entertainment. A Chinese version has been developed and used in mainland China (38).

Statistical Analysis

Psychometric properties (content validity, construct validity, and reliability) were analyzed based on methods proposed in the COSMIN checklist (39, 40). Factors affecting catastrophizing were analyzed by linear regression according to the patients' characteristics.

Content Validity

Content validity refers to whether the included items measure the concept properly and sufficiently. All the items were linguistically translated into Chinese and cross-culturally adapted for Chinese individuals. The committee concluded that all the items could be employed to assess catastrophizing with good face validity, as demonstrated by other versions in different cultures. The items were analyzed to test whether they were measuring the same property. Response trends and item-total correlations were employed to exclude items that could not be scored in the normal range or items that had poor relationships with the other items. Items with a Z-skewedness value over 1.96 indicated a response trend that deviated from a normal distribution pattern. Additionally, an item-total correlation coefficient < 0.40 indicated that the items did not measure the same properties (41).

Construct Validity

Construct validity is defined as the extent to which a construct actually measures the concept that it is intended to measure. It includes 3 components as proposed by the COSMIN study: structural validity, hypothesis testing, and cross-cultural validity (40,42). Structural validity is aimed at testing the underlying structure of the items, and confirmatory factor analysis (CFA) is preferred for cross-cultural studies. Hypotheses are formulated according to the conceptual relationships between the questionnaires.

Structural Validity

To test whether the second-order, 3-factor structure was replicated in the Chinese version, CFA was performed for comparisons with a one-factor structure and a 2-factor structure as proposed by Osman et al (43).

Specifically, we expected a best-fit model with a non-significant chi-square result and the following indices: (1) a Satorra–Bentler scaled chi-square ($S-B\chi^2$)/degrees of freedom ratio (CMIN/DF) of 2.0 or less; (2) a non-normed fit index (NNFI) of 0.90 or higher; (3) a Robust-Comparative fit index (Robust-CFI) of 0.90 or higher; (4) a goodness-of-fit index (GFI) of 0.90 or higher; and (5) a low root mean square error of approximation (RMSEA) of 0.08 or less (44). Considering that the 3-factor structure was not always consistent in different cultures, an exploratory factor analysis was performed by principal component analysis (PCA) to explore the structure. To obtain the factorial structure of the SC-TSK, PCA was conducted with or without orthogonal rotation.

A priori Hypotheses

Based on a fear-avoidance model, catastrophizing was proposed to precede depression (45). However, evidence in the literature indicated that depression could be found in pain patients without catastrophizing feelings, or vice versa (46,47). Therefore, the SC-PCS was thought to correlate moderately with the HADS. Catastrophizing occurred after pain sensation, which could lead to further persistent pain via a negative response system (10,13). Thus, the SC-PCS should correlate moderately with pain intensity, bodily pain, and pain interference. Patients with catastrophizing feelings might experience depression and fear of movement, which should negatively correlate with vitality. Catastrophizing could influence social roles because the changes in coping strategies or attitudes toward pain could result in role conversion, such as a change from an active role to a vulnerable role. Compared to helplessness and rumination, magnification is more concerned with depression due to worry about bad things or perceptions. Helplessness is more closely related to bodily pain and daily interference because helplessness is focused on the inability to reduce pain. Therefore, we determined the following:

1. The SC-PCS should correlate moderately with the HADS;
2. The SC-PCS should correlate moderately with pain intensity;
3. The SC-PCS should correlate moderately with pain interference;
4. The SC-PCS should correlate moderately with BP in SF-12;
5. The SC-PCS should correlate moderately with VT in SF-12;

6. The SC-PCS should correlate moderately with RE in SF-12;
7. Compared with helplessness and rumination, magnification should be more highly correlated with depression; and
8. Compared with rumination, helplessness should be more highly correlated with BP in SF-12.

The correlation values were classified as follows: low: $r = 0.00 - 0.30$; moderate: $r = 0.31 - 0.60$; high: $r \geq 0.60$ (48). *P*-values < 0.05 were considered to indicate statistical significance.

Internal Consistency and Test-retest Reliability

To evaluate homogeneity, internal consistency was calculated with Cronbach's α and was considered excellent when Cronbach's α was between 0.80 and 0.95 (35).

To assess the test-retest reliability, a Blant-Altman plot was utilized, and an intra-class correlation coefficient (ICC) was calculated between the scores obtained at test and retest times. An ICC value over 0.70 indicated excellent reliability (35).

Exploration of Factors Affecting Catastrophizing

Demographic characteristics were collected for each patient in the pain clinic. Gender, age, ethnicity, occupation, income, education, religious beliefs, pain duration, and use of pain medications were recorded. A multivariate linear regression analysis was performed incorporating all the characteristics to identify the factors that may lead to catastrophizing. Dummy variables were established to test nominal data and ranked data. A step-in regression was used to select statistically significant variables. The inclusion alpha was 0.10 and the exclusion alpha was 0.15.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 18.0 (IBM, Armonk, NY, USA). Multivariate linear regression was performed using Statistical Analysis System (SAS) release 9.3 (SAS Institute Inc., Cary, NC, USA). CFA was performed using AMOS 18.0 (Chicago, Illinois). Numerical data are expressed as the mean values \pm the standard deviation (SD). *P* values < 0.05 were considered statistically significant.

RESULTS

Cross-cultural Translation and Adaptation

The PCS was successfully translated into simplified Chinese without any difficulties, and most patients

were able to answer the questions with ease. However, some minor modifications were made; for example, item 2 “can’t go on” was translated as “ Γ 以忍受” rather than “不能生活” based on the meaning of the sentence, and item 7 “other painful events” was translated as “以往的痛苦 $\Gamma\Gamma$ ” rather than “其他痛苦的事情” because the former phrasing is easier to understand.

Patient Characteristics

Most patients completed the investigation properly with a response rate of 96% (153/160). Over half of the patients were retired, and most patients were from urban areas (137/153). Notably, nearly half of the patients were on pain medications and over half of the patients were low income. The mean SC-PCS score was 28.66, and the gross mean pain duration was 21 months. Detailed demographic and clinical characteristics of the patients are summarized in Table 1.

Content Validity

The committee reviewed the translation and cultural adaptation process and developed the final version of the SC-PCS (see Appendix I). The scores for each item were normally distributed, and none of the items showed a low item-total correlation ($r < 0.40$, see Table 2). Therefore, all the items were included in the Chinese version of the PCS.

Missing Items

Nearly all the items were addressed by the participants. Items 8 and 11 were missed once, and item 12 was missed twice.

Construct Validity

Structural Validity

The preliminary CFA analysis showed that no

Table 1. Demographic characteristics of the patients from the pain clinic.

	Mean (SD) or N
Age (ys)	58.37 (13.62)
Male/Female	51/102
Ethnicity (Han/Other)	150/3
Household(Citizen/Rural)	137/16
Occupation	
Labor	32
Peasant	12
White Collar	11
Free Lancer	14
Retired	81
Unemployed	3
Marital status	
Unmarried	17
Married	124
Divorced	3
Widowed	9
Education	
Primary school	12
Middle school	58
High school	53
College	30
Religious Belief (Y/N)	33/120
Pain Duration (mths)	21.11 (31.12)

	Mean (SD) or N
Pain Medication (Y/N)	69/84
Income (RMB)	
Low < 3000	90
Medium 3000 – 6000	42
High 60 – 1000	12
Very high >10000	9
SC-PCS	28.66 (10.84)
HADS	22.31 (6.39)
Anxiety	11.06 (3.55)
Depression	11.25 (3.30)
SF-12	
GH	62.25 (25.18)
PF	58.50 (29.41)
RP	60.13 (39.05)
RE	56.54 (27.92)
BP	45.92 (28.89)
MH	51.11 (15.67)
VT	41.18 (28.12)
SF	68.14 (34.08)
BPI	
Pain Intensity	18.52 (7.59)
Pain Interference	31.10 (22.76)

SD, standard deviation; N, number; Y/N, yes or no; RMB, SC-PCS, simplified Chinese version of pain catastrophizing scale; HADS, hospital anxiety and depression scale; GH, general health perception; PF, physical functioning; RP, role limitations due to physical health; RE, role limitations due to emotional problems; BP, bodily pain; MH, mental health; VT, vitality; SF, social functioning; BPI, brief pain inventory.

Table 2. Corrected item-total correlation and response trend for each item in the SC-PCS.

	Z-skewedness	Corrected item-total correlation
Item 1	-0.79	0.64
Item 2	-0.10	0.73
Item 3	-0.04	0.72
Item 4	0.14	0.73
Item 5	-0.15	0.74
Item 6	-0.18	0.70
Item 7	0.16	0.75
Item 8	-1.30	0.63
Item 9	0.19	0.75
Item 10	-0.08	0.72
Item 11	-1.00	0.65
Item 12	-0.69	0.61
Item 13	0.03	0.72

single model fit the data perfectly. Each model was then adjusted according to modification indices, which suggested adding covariance between error items 1, 2 and 8, 11. After adjustment, the second-order, 3-factor model was the only model with an acceptable goodness of fit (Fig. 1). The CMIN/DF was 1.68. The NNFI, CFI, and GFI were all greater than 0.90, and the RMSEA was less than 0.08. The goodness of fit was not statistically acceptable for the 2-factor model or the one-factor model. Details are shown in Table 3.

PCA also suggested a 3-factor structure, accounting for 68% of the total variance (24%, 22%, and 22% for factors 1, 2, and 3, respectively). Moreover, the first factor included items 1, 2, 3, 4, 5, and 12 and was identified as helplessness. The second factor included items 6, 7, and 13 and was referred to as magnification. The third factor comprised items 8, 9, 10, and 11 and was labeled rumination (Table 4). Both PCA and CFA suggested the same factor structure.

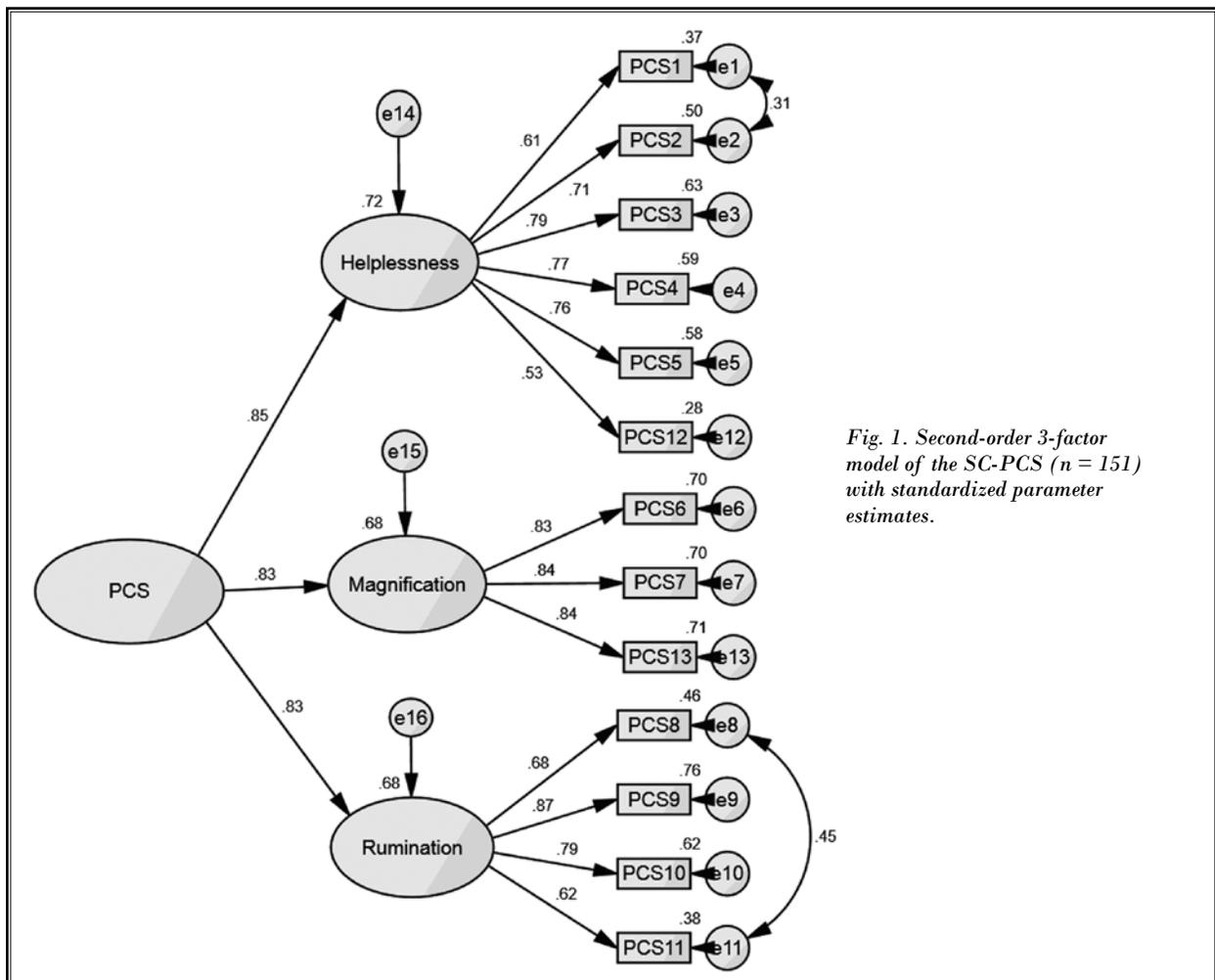


Fig. 1. Second-order 3-factor model of the SC-PCS (n = 151) with standardized parameter estimates.

Table 3. Goodness of fit for the confirmatory factor analysis of the models tested.

	CMIN/DF	NNFI	CFI	GFI	RMSEA
Second-order three-factor	1.681	0.948	0.96	0.907	0.068
Two-factor	4.23	0.754	0.798	0.781	0.148
One-factor	4.779	0.712	0.76	0.727	0.16

A priori Hypotheses

The SC-PCS showed a moderate correlation with the HADS, with pain intensity and with pain interference. Additionally, moderate correlations were observed between the SC-PCS, BP, and VT in the SF-12 (Table 5). No statistically significant correlations were found between the SC-PCS and RE in the SF-12. Specifically, magnification had a higher correlation with depression in the HADS than did helplessness and rumination (rho: 0.48 vs. 0.35 and 0.33, respectively). Moreover, compared with rumination, helplessness was more highly correlated with BP and pain intensity. Therefore, 9/10 of the hypotheses were verified.

Internal Consistency and Test-retest Reliability

The SC-PCS and its 3 factors showed excellent internal consistency, as the Cronbach’s alpha values

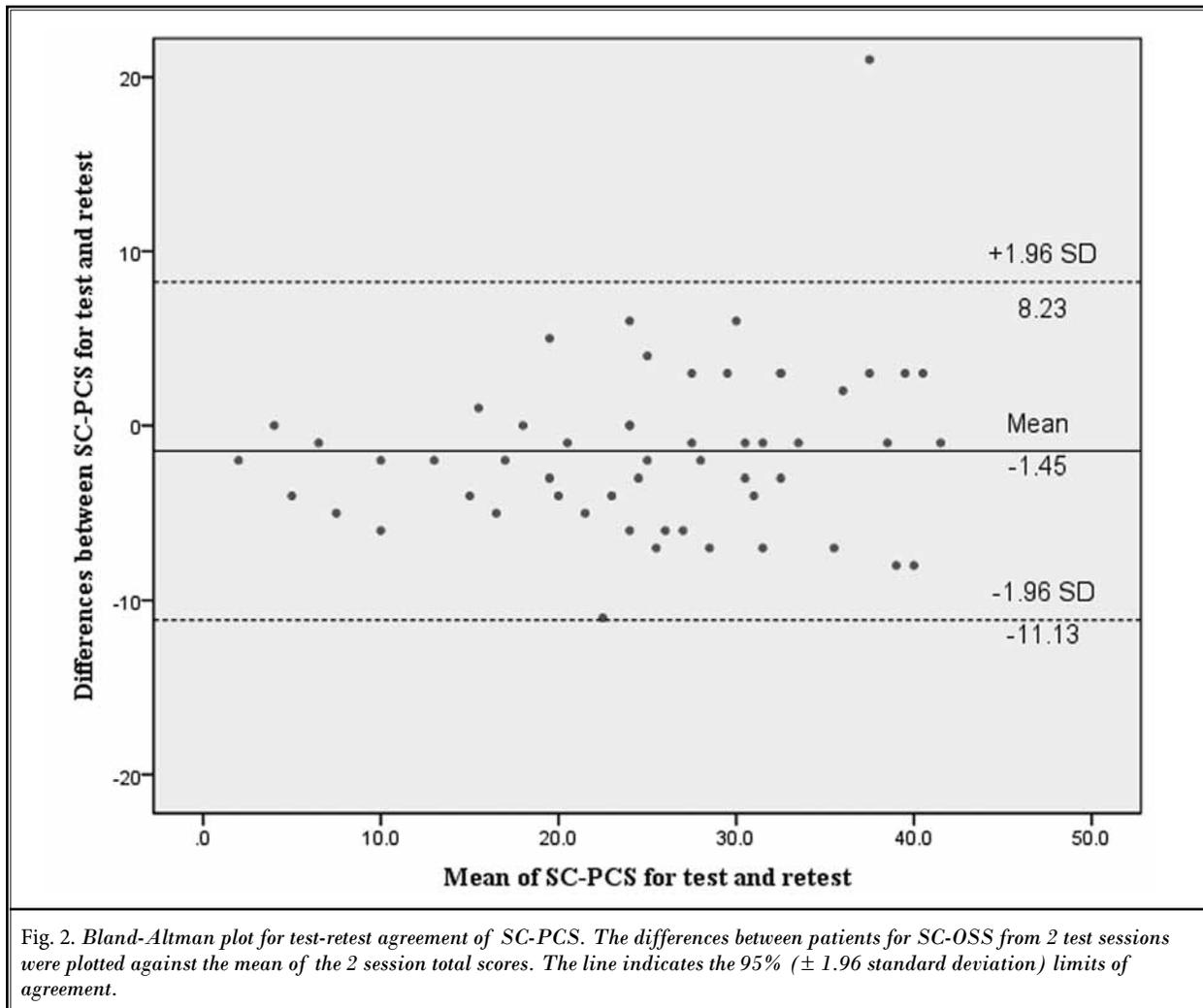
Table 4. Adjusted principle component analysis for the SC-PCS.

Item	Factor		
	Helplessness	Magnification	Rumination
PCS3	0.79	0.30	0.11
PCS2	0.73	0.19	0.30
PCS1	0.73	0.07	0.28
PCS5	0.66	0.39	0.19
PCS4	0.63	0.51	0.07
PCS12	0.51	0.04	0.48
PCS13	0.23	0.84	0.18
PCS6	0.12	0.81	0.32
PCS7	0.31	0.80	0.20
PCS8	0.11	0.21	0.83
PCS11	0.22	0.11	0.83
PCS9	0.24	0.45	0.66
PCS10	0.32	0.32	0.63

Table 5. Correlation between SC-PCS and pain related measures.

	SC-PCS	Helplessness	Magnification	Rumination
HADS	0.48**	0.39**	0.50**	0.36**
Anxiety	0.46**	0.39**	0.46**	0.34**
Depression	0.44**	0.35**	0.48**	0.33**
SF-12				
GH	0.24**	0.18*	0.18*	0.26**
PF	0.29**	0.25**	0.23**	0.26**
RP	0.23**	0.15	0.34**	0.14
RE	0.03	0.03	0.14	0.01
BP	0.31**	0.26**	0.42**	0.13
MH	0.10	0.20*	0.09	0.08
VT	0.37**	0.30**	0.36**	0.31**
SF	0.15	0.06	0.24**	0.12
BPI				
Pain intensity	0.52**	0.53**	0.38**	0.37**
Pain interference	0.59**	0.54**	0.52**	0.46**

SC-PCS, simplified Chinese version of pain catastrophizing scale; HADS, hospital anxiety and depression scale; GH, general health perception; PF, physical functioning; RP, role limitations due to physical health; RE, role limitations due to emotional problems; BP, bodily pain; MH, mental health; VT, vitality; SF, social functioning; BPI, brief pain inventory.



were 0.91, 0.86, 0.88, and 0.85 for SC-PCS, helplessness, magnification, and rumination, respectively. The ICCs for the SC-PCS, helplessness, magnification, and rumination were 0.94 (95%CI, 0.90 – 0.97), 0.90 (95%CI, 0.82 – 0.94), 0.84 (95%CI, 0.73 – 0.91), and 0.86 (95%CI, 0.75 – 0.92), respectively. A Bland-Altman plot also showed that there were no significant differences between the measures from the 2 test sessions for the individual patients in terms of the overall means of the 2 sessions (Fig. 2).

Factors Predicting Pain Catastrophizing

Multivariate factor analysis demonstrated that 8 demographic variables affecting pain catastrophizing were statistically significant. Details are provided in

Table 6. The F value was 6.65 for the regression, and the unadjusted and adjusted R² values were 0.47 and 0.40. Noticeably, the predisposing factors for catastrophizing were college education (beta = 0.47), pain duration (beta = 0.40), women (beta = 0.31), freelancer status (beta = 0.31), retired status (beta = 0.19), middle school education (beta = 0.17), divorced status (beta = 0.13), pain medication use and low income. Factors related to reduced catastrophizing were married or widowed marital status (beta = -0.29, -0.11), no regular use of pain medications (beta = -0.14), unemployed status (beta = -0.16), blue collar (beta = -0.06) or white collar job status (beta = -0.03), and non-Han ethnicity (beta = -0.19).

Validation of SC-PCS and Exploration Risk Factors

Table 6. Predictors for pain catastrophizing in patients from pain clinic by multivariate liner regression.

	beta	SD	t	P	Standardized beta
Gender					
Male	0.00				
Female	0.25	0.10	2.63	0.01	0.31
People					
Han	0.00				
Other	-15.13	8.20	-1.84	0.07	-0.19
Occupation					
Labor	0.00				
Peasant	-2.38	3.34	-0.71	0.48	-0.06
White Collar	-1.58	5.93	-0.27	0.79	-0.03
Free Lancer	18.55	4.87	3.81	0.00	0.31
Retired	7.06	3.55	1.99	0.05	0.19
Unemployed	-3.52	2.38	-1.48	0.14	-0.16
Marital status					
Unmarried	0.00				
Married	-6.29	1.71	-3.68	0.00	-0.29
Divorced	10.32	5.70	1.81	0.07	0.13
Widowed	-5.01	3.65	-1.37	0.17	-0.11
Education					
Primary school					
Middle school	3.89	2.84	1.37	0.17	0.17
High school	-0.55	2.97	-0.18	0.85	-0.02
College	12.78	3.52	3.63	0.00	0.47
Pain Duration	0.14	0.03	4.75	<.0001	0.40
Pain Medication					
Yes	0.00				
No	-3.01	1.65	-1.82	0.07	-0.14
Income					
Low	0.00				
Medium	-4.10	2.00	-2.05	0.04	-0.17
High	-6.28	3.60	-1.75	0.08	-0.16
Very high	-8.92	3.71	-2.41	0.02	-0.19
<i>Multivariate regression analyses (R² = 0.47).</i>				adjusted 0.40	
F Value	Pr > F				
6.65	<.0001				

DISCUSSION

In this study, the PCS was successfully translated into simplified Chinese and validated with excellent construct validity and reliability. Notably, the SC-PCS had a high completion rate, and the participants re-

sponded to all the items. Factors predicting catastrophizing were analyzed in pain clinic patients.

Minor changes were made during the adaptation process to ensure that the Chinese version was culturally suitable for Chinese individuals. The current study

demonstrated that the SC-PCS had good clinical acceptability with a completion rate of 96%. In particular, the scored responses for each item followed a normal distribution, and none of the items had a poor item-total correlation. Therefore, no items were deleted from the SC-PCS. Additionally, only a few items were missed by some of the participants, and this happened infrequently. Therefore, the SC-PCS has remarkable clinical utility. The mean score obtained for each patient was 28.66, indicating that the pain clinic patients experienced a high level of catastrophizing. It has been reported that patients with a PCS score over 24 points should be followed up, and a post-therapy score over 14 indicates a long duration of pain and work leave (49). Thus, most patients from pain clinics may be experiencing pain over a long duration and may not be able to fulfill their work responsibilities. If catastrophizing cannot be treated effectively, most patients will experience chronic pain with deterioration in their quality of life.

Both CFA and PCA suggested the same 3-factor structure. It is apparent that the 3-factor structure remains consistent in the English (50), African-American (29), Norwegian (25), Italian (23), Korean (26), French (27), German (30), Catalan (33), Sinhala (31), Malay (32), and Hong Kong (24) versions. Studies also suggest that a 3-factor structure is applicable to the children's version of the PCS. In the present study, the adjusted 3-factor structure obtained an excellent goodness-of-fit with a low RMSEA and a high fitting index. However, some versions in other languages, including the African American (29), Korean (26), and German (30) versions, did not obtain a statistically acceptable goodness-of-fit in the 3-factor structure, indicating that the 3-factor structure is not the best possible structure in those cultures. To test whether the 3-factor structure was the best model for the Chinese culture, PCA was applied, and the results were the same as those obtained with CFA. Therefore, the 3-factor structure model of the PCS best suits mainland China.

A priori hypotheses are made based on the underlying concepts of each construct. It has been proposed that a construct has good construct validity when 75% of the hypotheses are confirmed (35). In this study, 9/10 of the hypotheses were confirmed when examining correlations between the SC-PCS and other pain-related questionnaires. Catastrophizing correlated moderately with anxiety, depression, disability, and pain intensity, as shown by the correlations with the HADS, the BPI, and BP and VT in the SF-12. In this scenario, pain could lead to catastrophizing in certain patients, and catastroph-

izing results in chronic pain. Catastrophizing then could result in anxiety and depression. Other investigators also found that the PCS is a predictor of depression (45). In the current study, catastrophizing was found to interfere in daily life to a large extent, especially in elderly patients, in whom catastrophizing is related to lower vitality and increased fatigue. Items in helplessness are focused on pain intensity and daily activity prediction. The results confirmed that compared with rumination, helplessness was more highly correlated with pain intensity. Magnification due to psychological pressure caused by pain was shown to be more highly correlated with depression than helplessness and rumination. Previous reports also found a moderate correlation between the PCS and other measures of pain intensity, disability, and distress (23-36). Our results are in accordance with other adapted versions, such as the Italian (23), Hong Kong (24), Norwegian (25), Korean (26), African (28), German (30), and Dutch (21) versions. Therefore, the SC-PCS demonstrated excellent construct validity in evaluating pain clinic patients.

Excellent internal consistency was noted in the SC-PCS and its factors with a Cronbach's alpha over 0.70, and this indicated that all the items aimed to measure catastrophizing. Both the ICC analysis and the Bland-Altman plot showed that the SC-PCS had excellent test-retest reliability, indicating that SC-PCS responses remain stable over time. Other adapted versions also demonstrate excellent reliability, including the Dutch (α 0.93), Catalan (α 0.91), German (α 0.92, ICC 0.80), Hong Kong (α 0.93, ICC 0.97), Italian (α 0.92, ICC 0.84), Malay (α 0.90, ICC 0.73), Sinhala (α 0.84, ICC 0.81), Norwegian (α 0.86, ICC 0.85), Korean (α 0.93, ICC 0.79), and African versions (α 0.98, ICC 0.91) (22-26, 28, 30-33). Therefore, the PCS is a stable tool for measuring catastrophizing across different cultures.

In this study, factors were analyzed that could predict catastrophizing in pain clinic patients. The multivariate linear analysis included 8 variables affecting catastrophizing that can explain 40% of the instances of catastrophizing. The most aggravating factors were college education, long pain duration, female gender, and freelancer status. It is interesting that a higher educational level could result in higher rates of catastrophizing. A possible explanation for this result is that more highly educated people are more concerned about health status and are afraid of pain sensation, which could be a sign of an aggressive disease. Women were found to have worse catastrophizing, partly due to psychosocial factors (19,43,50). Thorn et al (55) discovered

that these findings were caused to some extent by a dispositional tendency to describe oneself as emotionally vulnerable. However, some investigators, such as those in Hong Kong and some areas of America, did not observe gender differences in catastrophizing due to cultural influences (24,52). Freelancer status was also an important factor in catastrophizing, which may be due to a relatively low income and poor social insurance. Marriage was a protective factor against catastrophizing, whereas divorce was a risk factor. Higher income was associated with lower levels of catastrophizing. This observation is likely due to the fact that these patients have more resources to address this problem, whereas low income families have limited resources and may have a greater sense of insecurity. We found that regular use of pain medications was associated with worse catastrophizing, and numerous studies have shown that catastrophizing is a unique predictor of opioid misuse (53,54). A typical patient with increased catastrophizing is a poor, college-educated, divorced female freelancer with a long pain duration who regularly uses pain medications.

There are some limitations to this study. The recruited patients were experiencing severe pain or long-duration pain in a pain clinic setting; thus, the applicability of the SC-PCS in patients with low or medium levels of pain may be limited. Also, because there is no gold standard measure of catastrophizing worldwide, criterion validity cannot be established for the SC-PCS.

CONCLUSION

The PCS has been linguistically translated into simplified Chinese and culturally adapted with remarkable clinical acceptance, good construct validity, and excellent internal consistency and test-retest reliability. Education, pain duration, marital status, gender, income, and pain medication use are important factors that affect catastrophizing. The SC-PCS is appropriate for clinical and research uses in mainland China.

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Appendix I.

中文版疼痛灾难量表

	一点也不	少程度	中等程度	很大程度	非常重
1. 我一直受疼痛困扰, 不知其何停止	0	1	2	3	4
2. 疼痛我得承受	0	1	2	3	4
3. 疼痛非常可怕, 我得不可能好	0	1	2	3	4
4. 情况很糟糕, 我得被疼痛打	0	1	2	3	4
5. 我再也不能忍受疼痛了	0	1	2	3	4
6. 我开始担心疼痛越来越重	0	1	2	3	4
7. 我回忆痛苦的	0	1	2	3	4
8. 我迫切希望疼痛消失	0	1	2	3	4
9. 我无法疼痛的想法	0	1	2	3	4
10. 我一直在想害有多痛	0	1	2	3	4
11. 我一直想着我有多希望不再疼	0	1	2	3	4
12. 我有法疼痛	0	1	2	3	4
13. 我担不好的事情生	0	1	2	3	4

Chinese Version of Pain Catastrophizing Scale

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