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Measurement Properties of the Simplified Chinese Version of the Lumbar Spine Instability Questionnaire for Patients With Low Back Pain in Mainland China

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Study Design. A prospective study.

Objective. To develop a simplified Chinese version of Lumbar Spine Instability Questionnaire (SC-LSIQ) and test its measurement properties.

Summary of Background Data. The LSIQ has been translated into several languages. Different versions of LSIQ have proved good reliability and validity in evaluating patients with low back pain. However, there is no simplified Chinese version of LSIQ (SC-LSIQ).

Materials and Methods. The SC-LSIQ has been translated into a simplified Chinese version according to a standard procedure. A total of 155 patients with low back pain completed the SC-LSIQ along with Oswestry Disability Index, Roland-Morris disability questionnaire, Tampa Scale for Kinesiophobia, and visual analogue scale (VAS). The internal consistency, test-retest reliability, and validity of SC-LSIQ were then calculated to evaluate the measurement properties of SC-LSIQ.

Results. The results of SC-LSIQ demonstrated that there was no ceiling or floor effect detected. The Cronbach α coefficient of 0.911 determined a well internal consistency. The intraclass correlation coefficient (0.98) presented an excellent reliability of SC-LSIQ. The Pearson correlation coefficient (r) showed that the SC-LSIQ was excellent correlated to Oswestry Disability Index ($r = 0.809$), Roland-Morris disability questionnaire ($r = 0.870$), and Tampa Scale for Kinesiophobia ($r = 0.945$,). Furthermore, it moderately correlated to visual analogue scale ($r = 0.586$).

Conclusion. The SC-LSIQ features good internal consistency, reliability, and validity for evaluating Chinese patients with LBP. Results suggest that the SC-LSIQ can be appropriately applied to patients with LBP in routine clinical practice.

Key words: low back pain, lumbar spine instability questionnaire, reliability, validity

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Low back pain (LBP) is a common symptom affecting ~7.3% of the population globally.[1] In the past few decades, LBP has become the number one cause of disability worldwide.[2] Since LBP is a condition that is associated with low quality of life and high cost for patients, it is of great importance to assess patients' pain status and mobility and to offer appropriate intervention.

In order to evaluate LBP and consequent disabilities, several different self-reported questionnaires have been proposed for use in clinical practice. These scales include the Oswestry Disability Index (ODI),[3] Roland-Morris Disability Questionnaire (RMDQ),[4] and Tampa Scale for Kinesiophobia (TSK).[5] However, these scales do not stratify patients into subgroups who would likely respond better to motor exercises or graded activity.

In 2006, a Delphi study was performed by Cook *et al*.[6] to confirm the consensus on the features of clinical lumbar instability. Thus, a questionnaire named Lumbar Spine Instability Questionnaire (LSIQ) was developed to identify characteristics of LBP patients who would benefit from motor control exercises or graded activity. The questionnaire contains 15 items with higher total points indicating higher signs of clinical spinal instability. In recent decades, LSIQ has been cross-culturally adapted and translated into Brazilian-Portuguese,[7] Swedish,[8] Turkish,[9] and Thai[10] versions, each with satisfactory reliability and

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validity. However, no simplified Chinese version of LSIQ has yet to be published.

To use LSIQ among the Mandarin-speaking population, it is necessary to develop a simplified Chinese version of LSIQ (SC-LSIQ) and test its measurement properties. Therefore, the present study was performed to validate the SC-LSIQ in mainland China and verify its reliability and validity.

MATERIALS AND METHODS

Linguistic Translation and Cross-cultural Adaptation

Guidelines proposed by Ferraz *et al.*[11] were used to translate the original into an SC-LSIQ. One of the authors wrote the first version of SC-LSIQ (T1). At the same time, another translator who was blind to the present study translated the LSIQ into a simplified Chinese version (T2). Then, the two simplified Chinese versions of LSIQs (T1 and T2) were integrated into a single 15-item Chinese version of LSIQ (T12) by consensus. After that, two new translators who were blind to the study translated the T12 back into English separately (BT1 and BT2). A panel of experts (including one English professor, one orthopedics expert, one rehabilitation expert, and one expert in statistics) reviewed the report and reached consensus on the prefinal version of SC-LSIQ. Finally, 30 patients in the outpatient department were recruited to test the acceptability and interpretability of the instrument in a Chinese population.

Participants

Patients with LBP for over 3 months who received follow-up in the outpatient Orthopedics Department of Changhai Hospital of the Navy Military Medical University from July 2020 to December 2022 were enrolled in the present study. The inclusion criteria were: age above18 years old, chronic LBP for over three months without radiating pain to the lower limbs and being able to read and write Chinese. The exclusion criteria were: age below 18, history of lumbar disk herniation, lumbar tumor, spinal, or abdominal surgery or those who were unable to finish the scales independently.

Ethical Considerations

The study protocol was reviewed and approved by the Internal Review Board (IRB) of Changhai Hospital. All enrolled outpatients provided signed informed consent to participate in the study.

Instruments

Simplified Chinese Version of Lumbar Spine Instability Questionnaire

The SC-LSIQ contains 15 questions with a proper answer of "yes" or "no." The scores range from 0 to 15, with higher scores indicating higher instability of the spine and disability of the patient, as previously described.[10,12] The 15 questions survey different dimensions of LBP such as pain, trauma history, and fear of movement. Previous studies of LSIQ properties have reported good reliability and validity in the different language versions of the specific countries.

Oswestry Disability Index (ODI)

ODI is an index designed to assess the functional status of the spine in patients with LBP. The simplified Chinese version of ODI (SC-ODI) was cross-culturally adapted in 2009; it consists of 10 questions.[13] The final output of SC-ODI is the percentage of patients' perceived disability reached by doubling the score of each question (ranging from 0 to 5).

Roland-Morris Disability Questionnaire (RMDQ)

RMDQ is a 24-item questionnaire with replies of "yes" (score of 1) or "no" (0 score). Results of the RMDQ range from 0 to 24. A higher score represents a more severe disability. The simplified Chinese version of RMDQ was translated in 2012 by Li *et al.*[14]

Tampa Scale for Kinesiophobia (TSK)

The TSK is a 17-item scale to evaluate the fear of movement due to pain. The scores for each section range from 1 (completely disagree) to 4 (completely agree). The items 4, 8, 12, and 16 need to be inverted after the scale is finished. Finally, a higher score represents a higher degree of kinesiophobia. The Chinese version of TSK was cross-culturally adapted by Wei *et al.*[15] and was confirmed to have good reliability and validity.

Visual Analogue Scale (VAS)

VAS is a scale with 10 different levels, allowing patients to rate their pain intensity from 0 (no pain) to 10 (extreme pain). A higher score indicates a higher sensory degree of pain.

Score Distribution

Floor and ceiling effects were used to evaluate the distribution of the final scores of the SC-LSIQ. The skewness value of 1.96 was a threshold between a normal distribution and deviated data. An item-total correlation <0.3 also indicated that the item did not accurately assess the same property, and therefore should be removed.[16]

Internal Consistency

Cronbach α coefficient was used to test the homogeneity of the instrument. For the present study, the internal consistency was regarded as excellent ($\alpha \geq 0.9$), good ($0.8 \leq \alpha < 0.9$), and acceptable ($0.7 \leq \alpha < 0.8$), as described previously.[17]

Test-retest Reliability

Patients were first asked to finish the SC-LSIQ in the outpatient orthopedics department. Then, during follow-up, they were required to complete the SC-LSIQ for a second time approximately seven days later. Test-retest reliability and subject variations were evaluated using the Intraclass

TABLE 1. Participant Demographic and Clinical Characteristics

Sex, n (%)		
Male	86	55.5
Female	69	44.5
Mean age (SD), y	44.16	13.40
Mean BMI (SD), kg/m^2	23.23	2.71
Pain duration in weeks	20.23	2.70
Stage, n ()		
1–3 mo	83	53.5
3–6 mo	19	12.3
6 mo–1 y	30	19.4
>1 y	23	14.8
Occupation, n (%)		
Student	49	31.6
Worker	24	15.5
Merchant	39	25.2
Farmer	25	16.1
Retired	18	11.6
Education, n (%)		
Elementary school	63	40.6
Middle school	19	12.3
High school	37	23.9
University	36	23.2
VAS (mm)	8.48	0.50
SC-ODI	44.80	3.53
SC-RM	12.11	8.06
SC-TSK	25.92	5.58
SC-LSIQ	7.88	4.95

BMI indicates body mass index; LSIQ, Lumbar Spine Instability Questionnaire; ODI, Oswestry Disability Index; RMDQ, Roland-Morris disability questionnaire; SC, simplified Chinese version; TSK, Tampa Scale for Kinesiophobia; VAS, visual analogue scale

Correlation Coefficient (ICC) and Bland-Altman plot. The test-retest reliability was evaluated as being weak (ICC value <0.5), moderate (0.5< ICC value <0.75), good (0.75< ICC value <0.9) or excellent (ICC value >0.9), as described previously.[18]

Validity

The construct validity reveals the degree to which a specific result of an instrument relates to another measurement property. The validity of the SC-LSIQ was evaluated by the Pearson correlation coefficient (r), which was calculated for the SC-LSIQ versus the other four scales. The final value of r represents poor (0–0.25), fair (0.25–0.5), moderate to good (0.5–0.75), and excellent (0.75–1) correlation, respectively.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS V. 22.0; IBM SPSS, Chicago, IL). Statistical significance was designated by $P<0.05$.

RESULTS

Cross-cultural Adaptation

No major problems were encountered during translation from English into Chinese. The expert panel reached consensus on the final version of the SC-LSIQ (Supplemental file, Supplemental Digital Content 1, http://links.lww.com/BRS/B917), and all experts acknowledged excellent acceptance of the SC-LSIQ compared with the original scale.

Participants

A total of 155 patients with LBP were recruited from the outpatient department of Changhai Hospital, among which 86 were male and 69 were female. The average age of the participants was 44.16, and the average duration of LBP was 20.23 weeks. The detailed data of the participants are shown in Table 1.

Score Distribution

The skewness value was <1.96 for every item, which demonstrated the normal distribution of the data in this study (Table 2). The ceiling and floor effect showed that none of the items had dissociation over 15%. The combined results demonstrated a well-distributed questionnaire, and therefore none of the items should be omitted in the adapted SC-LSIQ.

Internal Consistency

None of the score correlations for individual items had a poor result ($r<0.3$), which indicated that all items correlated well with the SC-LSIQ. Cronbach α was 0.911 for the total questionnaire, and the Cronbach α calculated after each item was deleted ranged from 0.90 to 0.91 (Table 2). Together these results demonstrated good internal consistency of the SC-LSIQ.

Test-retest Reliability

The mean total score of SC-LSIQ was 7.88 ± 4.95 the first time and 7.71 ± 5.01 the second time. The ICCs for the total scale and each item ranged from 0.90 to 0.98, exhibiting excellent reliability of the SC-LSIQ (Table 3). Meanwhile, Bland and Altman plots demonstrated no significant systematic bias, supporting excellent test-retest reliability of the scale (Fig. 1).

Validity

The results of the Pearson correlation coefficient (r) showed that the SC-LSIQ had excellent correlated with the ODI ($r=0.809$, $P<0.001$), RMDQ ($r=0.870$, $P<0.001$), and TSK ($r=0.945$, $P<0.01$). It correlated moderately with VAS ($r=0.586$, $P<0.01$) (Table 4), confirming that the subsections of the LSIQ such as pain, disability, kinesiophobia, and depression correlated well with personnel-report outcomes caused by clinical instability.

TABLE 2. Score Distribution and Internal Consistency of the SC-LSIQ

SC-LSIQ	Z-Skewness	Item-total Score Correlation(r)	Cronbach α	Cronbach α If Item Deleted	Ceiling Effect (%)	Floor Effect (%)
SC-LSIQ-total	−0.15	—	0.911	—	5	0.6
1	−0.22	0.61	—	0.91	—	—
2	−0.30	0.66	—	0.90	—	—
3	−0.25	0.65	—	0.90	—	—
4	−0.22	0.69	—	0.90	—	—
5	−0.30	0.69	—	0.90	—	—
6	0.44	0.58	—	0.91	—	—
7	0.44	0.58	—	0.91	—	—
8	0.28	0.42	—	0.91	—	—
9	0.33	0.42	—	0.91	—	—
10	0.33	0.51	—	0.91	—	—
11	−0.53	0.65	—	0.90	—	—
12	−0.44	0.61	—	0.91	—	—
13	−0.44	0.65	—	0.90	—	—
14	−0.36	0.71	—	0.90	—	—
15	−0.33	0.69	—	0.90	—	—

SC-LSIQ indicates simplified Chinese version Lumbar Spine Instability Questionnaire.

DISCUSSION

With the advancement of clinical research and globalization, a greater emphasis has been placed on patients' quality of life. Instability of the lumbar spine causes mechanical pain and consequently induces fear of movement and activity in LBP patients.[19] Consequently, there is a critical demand for a tool to provide an accurate evaluation of patients with LBP objectively and subjectively and to further recommend appropriate treatment for rest or movement in clinical practice.[20] Therefore, the present study aimed to cross-culturally adapt LSIQ into an SC-LSIQ version to assess patients with LBP in mainland China.

In the present study, all participants showed excellent responses and good compliance with the translated LSIQ. The SC-LSIQ is relatively easy to understand and can be completed conveniently, which leads to successful completion of the questionnaire by patients. The whole 15-item questionnaire with "yes" or "no" answers can be completed within approximately one minute.

TABLE 3. Test-retest Reliability and Distribution of the SC-LSIQ

SC-LSIQ	First Test	Second Test	ICC (CI)
Total	7.88 ± 4.95	7.71 ± 5.01	0.98 (0.98–0.99)
1	0.55 ± 0.5	0.55 ± 0.5	0.97 (0.95–0.98)
2	0.57 ± 0.5	0.56 ± 0.5	0.97 (0.96–0.98)
3	0.56 ± 0.5	0.55 ± 0.5	0.98 (0.97–0.99)
4	0.55 ± 0.5	0.55 ± 0.5	0.98 (0.97–0.99)
5	0.57 ± 0.5	0.56 ± 0.5	0.98 (0.97–0.99)
6	0.39 ± 0.49	0.38 ± 0.49	0.90 (0.86–0.92)
7	0.39 ± 0.49	0.38 ± 0.49	0.90 (0.86–0.93)
8	0.43 ± 0.5	0.42 ± 0.49	0.92 (0.89–0.94)
9	0.42 ± 0.5	0.41 ± 0.49	0.92 (0.89–0.94)
10	0.42 ± 0.5	0.4 ± 0.49	0.94 (0.92–0.96)
11	0.63 ± 0.49	0.61 ± 0.49	0.97 (0.96–0.98)
12	0.61 ± 0.49	0.6 ± 0.49	0.97 (0.96–0.98)
13	0.61 ± 0.49	0.59 ± 0.49	0.97 (0.96–0.98)
14	0.59 ± 0.49	0.56 ± 0.5	0.98 (0.97–0.99)
15	0.58 ± 0.5	0.56 ± 0.5	0.98 (0.97–0.99)

CI indicates confidence interval; ICC, Intraclass Correlation Coefficient; SC-LSIQ, simplified Chinese version Lumbar Spine Instability Questionnaire.

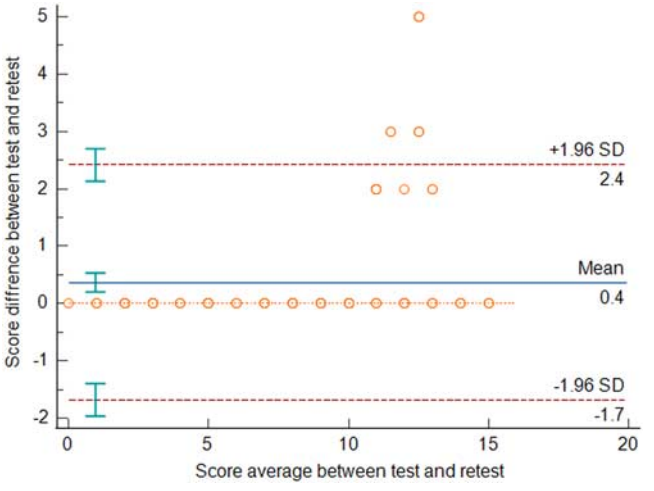

Figure 1. Bland-Altman plot of test-retest agreement of the simplified Chinese version of Lumbar Spine Instability Questionnaire in patients with low back pain. Dashed line indicates 95% limits of agreement.

TABLE 4. Construct Validity of the SC-LSIQ Compared With the SC-ODI, SCI-RMDQ, SC-TSK, and VAS

	SC-LSIQ	SC-ODI	SC-RM	SC-TSK	VAS
SC-LSIQ	1				
SC-ODI	0.809 ($P < 0.001$)	1			
SC-RMDQ	0.870 ($P < 0.001$)	0.923 ($P < 0.001$)	1		
SC-TSK	0.945 ($P < 0.001$)	0.855 ($P < 0.001$)	0.956 ($P < 0.001$)	1	
VAS	0.586 ($P < 0.001$)	0.851 ($P < 0.001$)	0.815 ($P < 0.001$)	0.684 ($P < 0.001$)	1

LSIQ indicates Lumbar Spine Instability Questionnaire; ODI indicates Oswestry Disability Index; RMDQ, Roland-Morris disability questionnaire; SC, simplified Chinese version; TSK, Tampa Scale for Kinesiophobia; VAS, visual analogue scale.

No ceiling or floor effect was detected in the present study, similar to the original study and other versions of the LSIQ. The Cronbach α was 0.911 in the present study, which was higher than the original version (0.69)[12]; and the Cronbach α of the Brazilian-Portuguese version (0.79),[7] Turkish version (0.818),[9] and Swedish version (0.64),[8] indicated higher internal consistency for the SC-LSIQ. The item-total correlation of each item exceeded the acceptable value. Thus, all items of the adapted SC-LSIQ were included in the questionnaire.

Test-retest reliability shed light on the consistency of the questionnaire during a period of intervals. The ICC value of the present study was 0.98, indicating excellent reliability of the SC-LSIQ. Compared with the Brazilian-Portuguese version (0.74),[7] Thai version (0.91),[10] and Turkish version (0.839),[9] the ICC value of the present study was higher. The higher ICC value can possibly be explained by the fact that too short or too long a period may lead to a memory effect or clinical treatment effect. Therefore, a time interval of seven days was chosen. The ICC value for each item ranged from 0.90 to 0.98, which also demonstrated an excellent level of reliability.

Construct validity results showed that the SC-LSIQ correlated strongly with the ODI, RMDQ, and TSK, and correlated moderately with VAS, demonstrating the convergent validity of the SC-LSIQ. In other studies, the Turkish version of LSIQ showed a good to excellent correlation with VAS (0.702), BQ (0.667), RMDQ (0.767), and TSK (0.520).[9] The Brazilian-Portuguese version showed a fair to moderate correlation with the Numerical Rating Scale (0.46), TSK (0.49), and Beck Depression Inventory (0.66).[7] The Swedish version also demonstrated a fair to moderate correlation with Numerical Rating Scale (0.47) and RMDQ (0.58).[8] Collectively, the results of these studies suggest good construct validity of the SC-LSIQ. It was interesting that SC-LSIQ had a superior correlation with TSK (0.945) compared with the Turkish (0.520) and Brazilian-Portuguese (0.49) version of LSIQ. One possible reason might be that our hospital was a comprehensive 3A class hospital in Shanghai, China. Thus the patients who come to our hospital was more likely to have lumbar instability and complain about more serious LBP symptom. The mechanical pain caused by lumbar instability avoid patients from movement, which leading LSIQ to highly correlate with TSK.

Several instruments can be used to evaluate chronic LBP (VAS, ODI, TSK, RMDQ, etc.). However, the SC-LSIQ may be an alternative self-reported tool by which to estimate spine instability in addition to clinical examinations such as the Prone Instability Test[21] and radiographic examinations such as flexion-extension flat film.[22] Furthermore, LSIQ has its advantage as it can identify patients who benefit from motor control exercise, which would be helpful for doctors during decision making in clinical practice.

The present study has several limitations, including that it is a single-center study conducted at Changhai Hospital in Shanghai, China, and most patients in the hospital are from the eastern part of mainland China. Thus, generalization to other locations, populations, or ethnic groups may be limited. Secondly, the patients' perceptions of and responsiveness to SC-LSIQ were not assessed in the present study, which remains to be done in further study.

CONCLUSION

The SC-LSIQ features good internal consistency, reliability, and validity for evaluating Chinese patients with LBP. Results suggest that the SC-LSIQ can be appropriately applied to patients with LBP in routine clinical practice.

➢ Key Points

- ❑ The LSIQ underwent cross-culture adaptation into a simplified Chinese to help assess patients with LBP in mainland China.
- ❑ The newly developed SC-LSIQ demonstrated good internal consistency, test-retest reliability and construct validity.
- ❑ The 15-item SC-LSIQ is convenient to complete and easy to understand, and it would be useful in clinical practice in the future.

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