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. In the past few decades, LBP has become the number one cause of disability worldwide. 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), Roland-Morris Disability Questionnaire (RMDQ), and Tampa Scale for Kinesiophobia (TSK). 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. 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, Swedish, Turkish, and Thai versions, each with satisfactory reliability and
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 above 18 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 $\alpha$ 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
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 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/m² | 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
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. 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. 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 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.

### 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 2 3 4 5 6 7 8 9 10 11 12 13 14 15 | 0.55 ± 0.5 0.57 ± 0.5 0.56 ± 0.5 0.55 ± 0.5 0.57 ± 0.5 0.39 ± 0.49 0.39 ± 0.49 0.43 ± 0.5 0.42 ± 0.5 0.42 ± 0.5 0.63 ± 0.49 0.61 ± 0.49 0.61 ± 0.49 0.59 ± 0.49 that “yes” or “no” answers can be completed within approximately one minute.

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.
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 and radiographic examinations such as flexion-extension flat film. 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.

References
1. Hoy D, Bain C, Williams G, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum.* 2012;64:2028–37.
2. Hartvigsen J, Hancock MJ, Kongsted A, et al. What low back pain is and why we need to pay attention. *Lancet.* 2018;391:2356–67.

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

|           | SC-LSIQ   | SC-ODI    | SC-RMDQ   | 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.
3. Fairbank JC, Couper J, Davies JB, et al. The Oswestry low back pain disability questionnaire. Physiotherapy. 1980;66:271–3.
4. Roland M, Morris R. A study of the natural history of back pain. Part I: development of a reliable and sensitive measure of disability in low-back pain. Spine (Phila Pa 1976). 1983;8:141–4.
5. French DJ, France CR, Vigneau F, et al. Fear of movement/(re) injury in chronic pain: a psychometric assessment of the original English version of the Tampa scale for kinesiophobia (TSK). Pain. 2007;127:42–51.
6. Cook C, Brismée J-M, Sizer PS Jr. Subjective and objective descriptors of clinical lumbar spine instability: a Delphi study. Man Ther. 2006;11:11–21.
7. Araujo AC, da CM Costa L, de Oliveira CB, et al. Measurement properties of the Brazilian-Portuguese Version of the Lumbar Spine Instability Questionnaire. Spine (Phila Pa 1976). 2017;42:E810–6.
8. Krantz R, Rasmussen-Barr E. The Swedish version of the Lumbar Spine Instability Questionnaire: a clinimetric study of validity and reliability. Physiother Theory Pract. 2021;1–9. doi:10.1080/09593985.2021.1999353
9. Gunaydin G, Gunaydin OE, Yakut H. Turkish version, validity and reliability of the Lumbar Spine Instability Questionnaire. Turk Neurosurg. 2021;32:466–70.
10. Chatprem T, Puntumetakul R, Boucaut R, et al. A screening tool for patients with lumbar instability: a criteria-related validity of Thai version. Spine (Phila Pa 1976). 2020;45:E1431–8.
11. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000;25:3186–91.
12. Macedo LG, Maher CG, Hancock MJ, et al. Predicting response to motor control exercises and graded activity for patients with low back pain: preplanned secondary analysis of a randomized controlled trial. Phys Ther. 2014;94:1543–54.
13. Liu H, Tao H, Luo ZJ. Validation of the simplified Chinese version of the Oswestry Disability Index. Spine (Phila Pa 1976). 2009;34:1211–6.
14. Yi H, Ji X, Wei X, et al. Reliability and validity of simplified Chinese version of Roland-Morris questionnaire in evaluating rural and urban patients with low back pain. PLoS One. 2012;7:e30807.
15. Wei XZ, Xu XM, Zhao YF, et al. The Chinese version of the Tampa Scale for Kinesiophobia was cross-culturally adapted and validated in patients with low back pain. J Clin Epidemiol. 2015;68:1205–12.
16. Ware JE Jr, Gandek B. Methods for testing data quality, scaling assumptions, and reliability: the IQOLA Project approach. International Quality of Life Assessment. J Clin Epidemiol. 1998;51:945–52.
17. DeVellis RF. Scale Development: Theory and Applications. Los Angeles, CA: Sage; 2012.
18. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med. 2016;15:155–63.
19. Kumar SP. Efficacy of segmental stabilization exercise for lumbar segmental instability in patients with mechanical low back pain: a randomized placebo controlled crossover study. N Am J Med Sci. 2011;3:456–61.
20. Oakman J, Ketels M, Clays E. Low back and neck pain: objective and subjective measures of workplace psychosocial and physical hazards. Int Arch Occup Environ Health. 2021;94:1637–44.
21. Alqarni AM, Schniders AG, Hendrick PA. Clinical tests to diagnose lumbar segmental instability: a systematic review. J Orthop Sports Phys Ther. 2011;41:130–40.
22. Chou SH, Lin SY, Shen PC, et al. Pain control affects the radiographic diagnosis of segmental instability in patients with degenerative lumbar spondylolisthesis. J Clin Med. 2021;10:3984.