ORIGINAL ARTICLE

# Validation of the Mandarin Chinese version of the Leicester Cough Questionnaire in non-small cell lung cancer patients after surgery

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## Abstract

**Background:** There are no validated and reliable cough-specific instruments to assess health-related quality of life with respect to postoperative cough in non-small cell lung cancer (NSCLC) patients. We used the Leicester Cough Questionnaire in Mandarin-Chinese (LCQ-MC) and investigated the validity, reliability, and repeatability of this instrument.

**Methods:** A total of 130 NSCLC patients (average age 58.75 ± 9.43 years, 65 men, 65 women) completed the LCQ-MC, cough Visual Analogue Scale (VAS), Cough Symptom Score (CSS), Hospital Anxiety and Depression Scale (HADS), and Medical Outcomes Study 36-item Short-Form Health Survey (SF-36). Forty patients completed the LCQ-MC again one week later. Concurrent validity, internal consistency, and repeatability were assessed.

**Results:** Analyses of concurrent validity showed significant correlations between the LCQ-MC and the cough VAS (r = −0.488 to −0.660) and CSS (r = −0.495 to −0.601). The corresponding domains of the LCQ-MC and the SF-36 exhibited moderate correlations (r = 0.421–0.432). However, there was no significant correlation between the LCQ-MC and the HADS ($P > 0.05$). Internal consistency was acceptable (Cronbach's α of 0.74–0.90). Test-retest reliability was high (intraclass correlation coefficients of 0.89–0.95).

**Conclusion:** The LCQ-MC is a reliable, valid instrument for assessing postoperative cough in NSCLC patients.

## Introduction

Enhanced recovery after surgery pathways have increasingly been applied to treat many patients who have undergone thoracic surgery, and symptomatic recovery after thoracic surgery has become increasingly important to assess quality of care and guide patient management.[1–3] A cough, one of the most common respiratory symptoms after surgery, is an important determinant of quality of life.[4–6] Therefore, it has become necessary to address the issue of how a postoperative cough can accurately be assessed.

However, it is extremely difficult to directly measure the frequency of a cough. The metrics typically evaluated are the severity and impact of a cough on quality of life.[7–10] There are no validated and reliable cough-specific instruments to assess health-related quality of life (HRQOL) with respect to postoperative cough in non-small cell lung cancer (NSCLC) patients. Therefore, an appropriate method of assessment is urgently required.

American College of Chest Physicians (ACCP) guidelines for the diagnosis and management of a cough state that two HRQOL questionnaires, the Leicester Cough Questionnaire (LCQ) and the Cough-Specific Quality of Life Questionnaire (CQLQ), are widely used to assess adult patients with a cough.[8,9,11–13] The LCQ, which was originally designed for the assessment of a chronic cough, consists of 19 items and three domains.[11] This instrument has been used to evaluate patients with chronic or acute coughs, bronchiectasis, and/or chronic obstructive pulmonary disease.[11,14–16] Compared to the CQLQ (which includes six domains and 28 items), the LCQ is simpler

and more convenient. Therefore, we chose the LCQ in Mandarin-Chinese (LCQ-MC) as the instrument to be evaluated in this study.[17]

We investigated and confirmed the validity, reliability, and repeatability of the LCQ-MC in NSCLC patients.

## Methods

This study was part of a validation of the Mandarin Chinese version of the Leicester Cough Questionnaire in patients undergoing lung resection for lung disease (Clinicaltrials.gov, number ChiCTR-DDD-17014237). West China Hospital of Sichuan University, Sichuan, China approved the study. All participants provided written informed consent.

### Subjects

A total of 130 patients who underwent thoracic surgery performed by a single medical team between February 2016 and April 2017 at the Thoracic Surgery Department of West China Hospital of Sichuan University were enrolled.

The inclusion criteria were: (i) age ≥ 18 years; (ii) cough symptom not experienced within two weeks prior to surgery; (iii) provided signed informed consent; (iv) underwent surgery performed via video-assisted thoracic surgery (VATS); and (v) postoperative pathological findings indicative of NSCLC.

The exclusion criteria were: (i) conversion to thoracotomy or bleeding > 1000 mL; (ii) pneumonectomy performed; (iii) rejected survey or dropped out; and (iv) lung cancer tumor node metastasis stage pT4, pN3, and/or M1.

### Assessment measures

The LCQ-MC, which assesses the impact of a cough after surgery, consists of 19 items divided into three domains: physical (8 items), psychological (7 items) and social (4 items). A seven-point Likert scale was used to score individual domains. Total scores ranged from 3 to 21, with a higher score indicative of better health status.[11,17]

In addition to the LCQ-MC, the cough Visual Analogue Scale (VAS), Cough Symptom Score (CSS), Medical Outcomes Study 36-item Short-Form Health Survey (SF-36), and Hospital Anxiety and Depression Scale (HADS) were concurrently utilized. The cough VAS uses a scale from 0 to 100 mm, with 0 mm indicating no cough and 100 mm indicating the worst possible cough. The CSS is a simple, useful tool for measuring cough severity that consists of two questions about the subjective recognition of cough frequency during the day and at night.[18] The SF-36, which assesses the impact of a postoperative cough, consists of 36 items divided into nine domains.[19] Individual and total scores on the SF-36 range from 0 to 100, with higher scores indicating better health status. The HADS, which is used to assess emotional impact after surgery, includes seven items on depression and seven items on anxiety, with scores ranging from 0 to 3 for each domain.[20] The Chinese versions of all of these questionnaires have been validated.[17,21–24]

Postoperative diagnoses were determined using the 2015 World Health Organization Classification of Lung Tumors and the eighth edition of the Union for International Cancer Control (UICC)/American Joint Committee on Cancer (AJCC) Lung Cancer Stage Classification Guidelines.[25,26]

### Validation

Concurrent validity, internal consistency, and repeatability were evaluated to validate the LCQ-MC for the assessment of NSCLC patients after surgery.

Concurrent validity indicates the validity of an instrument relative to other standards. The LCQ-MC was compared with the cough VAS, CSS, SF-36, and HADS to assess concurrent validity. We calculated Spearman's rank correlations between corresponding domains of the LCQ-MC and other questionnaires. Empirically, correlations between the LCQ-MC and other questionnaires that had correlation coefficients of at least 0.1, 0.3, and 0.5 were regarded as weak, moderate, and strong correlations, respectively.[27]

Internal consistency, which is used to estimate degree of homogeneity in an individual's results, was calculated by determining Cronbach's α coefficients. Values of Cronbach's α coefficient ≥ 0.7 indicate sufficient acceptability and good reliability.[28]

Test–retest reliability is an indicator of the stability of LCQ scores over time. In our study, a subset of patients completed the LCQ-MC one week after the initial examination.

### Data collection

Our investigators assisted hospitalized patients to complete paper questionnaires. The data was then uploaded to the network database for management and analysis.

### Statistical analysis

Patient characteristics are presented as means ± standard deviation for continuous variables and as relative frequencies for categorical variables. All comparisons were two-sided, and differences of $P \leq 0.05$ were considered statistically significant. Statistical analyses were performed using SPSS version 19.0 (IBM Corp., Armonk, NY, USA).

# Results

## Patient characteristics

Table 1 presents the characteristics of 130 patients diagnosed with NSCLC. The mean age of patients was 58.75 ± 9.43 years, and 65 were male (50.0%). Individual domain and total scores for the LCQ-MC, cough VAS, CSS, SF-36, and HADS are also listed.

## Concurrent validity

With respect to corresponding individual domains and total score, the LCQ-MC exhibited significant correlations with the cough VAS, CSS, and SF-36 (Table 2). In particular, the physical and psychological domains and total scores for the LCQ-MC were strongly correlated with cough VAS score (r = −0.641, r = −0.620, and r = −0.660, respectively). The social domain of the LCQ-MC was moderately correlated with the cough VAS (r = 0.488). The physical and social domains and total scores for the LCQ-MC were strongly correlated with scores on the cough CSS (r = −0.507, r = −0.515, and r = −0.601, respectively). The psychological domain of the LCQ-MC was also moderately correlated with the cough CSS (r = −0.495). Only the social domain and total scores on the LCQ-MC were moderately correlated with total score on the SF-36 (r = 0.432 and r = 0.421, respectively). The LCQ-MC was more strongly correlated with the cough VAS and CSS than with the SF-36. There was no significant correlation between the LCQ-MC and the HADS (P > 0.05) (Table 2).

## Internal consistency

The Cronbach's α coefficients for the three domains and total score were between 0.74 and 0.90 (Table 3). A Cronbach's α coefficient > 0.7 generally indicates acceptable internal consistency. Our results were similar to those reported in studies of chronic cough, bronchiectasis, and patients with chronic obstructive pulmonary disease (Table 3).[11,16,17]

## Test–retest repeatability

A total of 33 patients completed the LCQ-MC one week after the first assessment. Intraclass correlation coefficients for physical, psychological, social, and total scores were 0.95, 0.89, 0.90, and 0.91, respectively. Our results were comparable to those of Birring *et al.* and Gao *et al.* (Table 4).[11,17]

# Discussion

This study is the first investigation to use the LCQ-MC to assess Chinese NSCLC patients. The LCQ-MC was well

**Table 1** Clinical characteristics of 130 patients with NSCLC

| Characteristic | All patients (mean ± SD) | Range |
|---|---|---|
| Age, years | 58.75 ± 9.43 | 34–79 |
| Gender ratio, male:female | 65:65 | |
| Smoking history, *n* (%) | | |
| Yes | 53 (40.8) | |
| No | 77 (59.2) | |
| Pathological diagnosis, *n* (%) | | |
| Adenocarcinoma | 112 (86.2) | |
| Squamous cell carcinoma | 15 (11.5) | |
| Large cell carcinoma | 2 (1.5) | |
| Carcinoid tumor | 1 (0.8) | |
| Staging, *n* (%) | | |
| I | 91 (70.0) | |
| II | 14 (10.8) | |
| IIIa | 25 (19.2) | |
| LCQ-MC scores | | |
| Physical | 5.59 ± 1.06 | 2.38–7.00 |
| Psychological | 6.04 ± 1.03 | 2.43–7.00 |
| Social | 6.43 ± 0.80 | 4.00–7.00 |
| Total | 18.05 ± 2.58 | 11.13–20.88 |
| Cough VAS | | |
| Length (cm) | 2.93 ± 1.97 | 0.45–7.58 |
| CSS | | |
| Daytime | 1.16 ± 0.41 | 0.00–2.00 |
| Night-time | 0.80 ± 0.81 | 0.00–3.00 |
| Total | 1.96 ± 0.98 | 1.00–5.00 |
| SF-36 scores | | |
| Total | 91.27 ± 6.28 | 75.67–100.00 |
| HADS scores | | |
| Depression | 1.18 ± 1.10 | 0.00–4.00 |
| Anxiety | 1.82 ± 1.21 | 0.00–4.00 |
| Total | 3.00 ± 2.12 | 0.00–8.00 |

CSS, Cough Symptom Score; HADS, Hospital Anxiety and Depression Scale; LCQ-MC, Leicester Cough Questionnaire in Mandarin-Chinese; NSCLC, non-small cell lung cancer; SD, standard deviation; SF-36, Short Form Health Survey; VAS, Visual Analogue Scale.

correlated with the cough VAS, CSS, and SF-36. Our results indicate that the LCQ-MC has highly acceptable concurrent validity, internal consistency, and repeatability. However, we found no significant correlation between the LCQ-MC and the HADS.

The issue of how to accurately and conveniently evaluate a cough after surgery is important for both research and clinical practice because specific treatment depends on the accuracy of assessment.[9] Our results showed that the LCQ-MC performed well with respect to assessment of NSCLC patients after surgery. Furthermore, individual domain and total scores on the LCQ-MC were significantly correlated with scores on the cough VAS and CSS. In accordance with previous reports on the application of the LCQ, we found that the LCQ had strong correlations with the cough VAS and CSS and weak-to-moderate correlations with the

**Table 2** Concurrent validity of LCQ-MC

| | LCQ-MC | | | |
|---|---|---|---|---|
| Reference | Physical | Psychological | Social | Total |
| Cough VAS | −0.641* | −0.620* | −0.488* | −0.660* |
| CSS | | | | |
|    Daytime | −0.339* | −0.252* | −0.512* | −0.420* |
|    Nighttime | −0.445* | −0.474* | −0.367* | −0.519* |
|    Total | −0.507* | −0.495* | −0.515* | −0.601* |
| SF-36 | | | | |
|    Total | 0.173 | 0.327 | 0.432* | 0.421* |
| HADS | | | | |
|    Anxiety | −0.033 | −0.0196 | −0.133 | −0.251 |
|    Depression | −0.261 | −0.114 | −0.028 | −0.171 |
|    Total | −0.166 | −0.165 | −0.016 | −0.167 |

*$P < 0.05$. CSS, Cough Symptom Score; HADS, Hospital Anxiety and Depression Scale; LCQ-MC, Leicester Cough Questionnaire in Mandarin-Chinese; NSCLC, non-small cell lung cancer; SD, standard deviation; SF-36, Short Form Health Survey; VAS, Visual Analogue Scale.

**Table 4** Test–retest reliability (repeatability) of the LCQ-MC (one week apart)

| Domain | Birring et al.[11]† | Gao et al.[17]‡ | This study |
|---|---|---|---|
| Physical | 0.93 | 0.84 | 0.95 |
| Psychological | 0.90 | 0.82 | 0.89 |
| Social | 0.88 | 0.89 | 0.90 |
| Total | 0.96 | 0.89 | 0.91 |

Patients with: †chronic cough; ‡bronchiectasis. LCQ-MC, Leicester Cough Questionnaire in Mandarin-Chinese.

SF-36.[14,16,24,29] However, the correlation between the LCQ-MC and the HADS was not particularly strong.[17] The weak-to-moderate correlation between the LCQ-MC and the HADS suggested that the LCQ-MC is inadequate for assessing psychological aspects. Analyses may indicate that the following considerations are relevant to this phenomenon. On the one hand, patients received overall and detailed knowledge about their surgical procedures and postoperative complications prior to undergoing surgery to relieve unnecessary psychological burden. On the other hand, patients were more concerned about postoperative diagnosis and non-cough symptoms, such as pain and fatigue, among others, than a postoperative cough.[2]

Construct analysis of the LCQ-MC showed acceptable internal consistency for the three domain and total scores, similar to results obtained in other studies.[11,16,17] In our study test–retest reliability, which was calculated using intraclass correlation coefficients, was highly acceptable over a one week period.

To our knowledge, no validated and reliable cough-specific HRQOL questionnaire for NSCLC patients after surgery has previously been identified.[10] At present, only Huang et al. has reported using the LCQ as a follow-up tool to investigate the status of postoperative HRQOL after one month, and there have been no other relevant reports from China.[30,31] Therefore, the validation of an appropriate cough-specific instrument to assess postoperative cough for NCLC patients is urgently required. Our study showed the suitability of an instrument for accurately assessing postoperative cough. This instrument can be used to guide effective treatment, accelerate recovery from postoperative cough, and achieve the objective of enhanced recovery after surgery.[1–9]

Our study has several limitations that should be considered. First, the sample size was inadequate for reliable calculation of a minimal clinically important difference.[32] Second, patients required > 15 minutes to complete all questionnaires, particularly the SF-36, which may be considered excessive.

We have three suggestions for future research. First, certain items in the psychological domain of the LCQ-MC should be deleted and revised as appropriate for both research and clinical practice, such as items 5, 6, 12, and 13 (my cough has made me feel embarrassed, anxious, frustrated, and fed up). These items are too similar to accurately distinguish between. Second, the HADS is unsuitable for validating the LCQ-MC in NSCLC patients, and the SF-36 is too complex for use in clinical practice. More HRQOL questionnaires, such as the CQLQ, should be used as the reference standard.[12]

In conclusion, the LCQ-MC is a reliable, valid HRQOL instrument for assessing postoperative cough in Chinese NSCLC patients. However, limitations remain that must be addressed by additional research.

## Disclosure

No authors report any conflict of interest.

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**Table 3** Internal consistency of LCQ-MC

| Cronbach's α coefficient | Birring et al.[11]† | Berkhof et al.[16]§ | Gao et al.[17]§ | This study |
|---|---|---|---|---|
| Physical | 0.79 | 0.67 | 0.83 | 0.76 |
| Psychological | 0.89 | 0.75 | 0.88 | 0.84 |
| Social | 0.85 | 0.74 | 0.82 | 0.74 |
| Total | 0.92 | 0.86 | 0.93 | 0.90 |

Patients with: †chronic cough; ‡chronic obstructive pulmonary disease; §bronchiectasis. LCQ-MC, Leicester Cough Questionnaire in Mandarin-Chinese.

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