Validity and reliability of the Thai version of the leicester cough questionnaire in chronic cough

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Abstract

Background: Chronic cough is a common problem potentially disturbing the quality of life (QoL) of coughers. The Leicester Cough Questionnaire (LCQ), previously developed in England, is a validated, self-completed QoL instrument for assessment of chronic cough. This study aimed to develop a Thai version of the LCQ (LCQ-T) and assess its validity and reliability among adult Thai patients with subacute to chronic cough.

Methods: A total of 146 patients with a cough lasting for more than 3 weeks consented to participate in this study and self-administered the LCQ-T, together with the following 3 instruments: Borg Cough Scale (BCS), Short Form-36 (SF-36), and Hospital Anxiety Depression Scale (Thai-HADS). The LCQ-T was developed by applying a forward-backward translation approach. The LCQ-T comprises 19 items divided into 3 domains: physical (8 items), psychological (7 items), and social (4 items). To validate the LCQ-T, concurrent validity, internal consistency reliability, and test-retest reliability were assessed.

Results: Participants included 96 women and 50 men with a mean (SD) age of 59.6 (14.4) years. The concurrent validity comparing LCQ-T to BCS yielded statistically significant Pearson correlation coefficients (r= -0.74, *P*<0.05). The correlation coefficients for SF-36 and Thai-HADS were also significant. The LCQ-T demonstrated very good internal consistency in all domains and the overall scale, with the Cronbach's alpha coefficients ranging from 0.89 to 0.94. The 3-day repeatability of the LCQ-T in 25 clinically stable patients was high with the intra-class correlation coefficients ranging between 0.81 and 0.90.

Conclusion: LCQ-T is a valid and reliable cough-specific instrument for assessing symptoms and QoL of adult Thai patients with subacute to chronic cough.

Keywords: chronic cough; Leicester Cough Questionnaire; Thai; validation; reliability

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Introduction

Chronic cough is a common medical problem in respiratory outpatient clinics and at times can contribute to problems of diagnosis, evaluation, and management. Chronic cough not only disturbs the coughers physically, but also can interfere with their quality of life (QoL), sleep quality and social life.[1] Given the impact of chronic cough on patients' lives, several guidelines for the diagnosis and management of chronic cough have been developed.[2-5] Identifying the causes of cough should be performed before treatment, although empiric treatment can be given in some cases. The causes of chronic cough are identified in 80% of patients according to a systematic protocol for the investigation of cough.[6]

Evaluation of cough severity can be measured subjectively by asking patients about the frequency of cough and the extent to which cough affects their daily lives and activities. Such measurement, however, has not been validated.[1] More

quantitative systems as such chronic cough scores, cough diaries and visual analog scales (VAS) have been developed and used, but none of them have been validated.[7] A symptom rating scale such as the Borg Cough Scale (BCS), which is a self-administered scale, has been used and validated with VAS.[8] Nevertheless, this scale only measures symptoms without considering patients' psychological and social concerns, as well as QoL. In 2001, Birring et al.[9] developed the original UK version of the Leicester Cough Questionnaire (LCQ), which consists of three components (physical, psychological and social), with more satisfactory psychometric properties as a QoL instrument of chronic cough. To the best of our knowledge, although the LCQ has been translated into several languages, i.e., Dutch (LCQ-D),[10] Chinese[11] and Korean (LCQ-K),[12] no validated Thai version is currently available. This study therefore aimed to develop a Thai version of the LCQ (LCQ-T) and to assess its validity and reliability. The validated LCQ-T would be a very useful tool for assessing the QoL of patients with chronic cough in Thailand.

Methods

Patients and setting

All adult patients with subacute to chronic cough lasting more than three weeks were recruited from September 2014 to February 2015 at the pulmonary clinic, Ramathibodi Hospital. Patients with the following criteria were not eligible: younger than 18 or older than 70 years old, or those with coexisting diseases that seriously affected the patients' health status, i.e., cirrhosis, malignancy, chronic renal failure, or chronic heart failure. Patient demographics, duration of cough, and etiologies of cough were recorded at enrollment. This study was approved by Ramathibodi Hospital's Institutional Review Board. Informed consent was obtained from all patients.

Study instruments

Translation of original LCQ

The LCQ is a self-completed QoL scale of chronic cough which consists of 19 items from 3 domains: physical (8 items), psychological (7 items), and social (4 items). Each item is graded from 1 to 7 on a Likert scale. The domain score (range 1-7) is calculated by adding the item scores in each domain and dividing this figure by the number of items in that corresponding domain. The total score is then calculated by summation of the three domain scores, with a range from 3 to 21; higher scores indicate a better health status.

We obtained permission for the translation of the original LCQ from Dr. Surinder S. Birring, who was the original developer.[9] The translation process was carried out using an established forward-backward translation systems as follows: First, the conceptual framework for each item and response scale was developed. Second, two pulmonary physicians, who were fluent in both English and Thai and had experience of working in cough clinics, independently translated the English version into Thai. Third, another physician translated the Thai version back into English. Finally, the back-translated English version was checked with the original author (Dr. Surinder S. Birring) and no changes were made. The preliminary LCQ-T was then piloted with 10 adult

Thai patients with chronic cough at Ramathibodi Hospital. It was then revised to make the final version of the LCQ-T readable and understandable while retaining the original meaning

In addition, three other instruments which had been validated amongst Thai population were also used, namely the Short Form (SF-36) version 2.0, Hospital Anxiety and Depression scale (Thai-HADS), and BCS. Written permissions were obtained from the translators of Thai SF-36 (version 2.0) and Thai-HADS questionnaires.[13,14]

The SF-36 is a widely used for measuring general QoL containing 36 items from 8 domains: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), role-emotional (RE), mental health (MH) and social functioning (SF).[13] Several previous studies concluded that the Thai SF-36 was reliable and valid for assessing QoL in patients with chronic diseases in Thailand.[13,15-19] Except for LCQ-T items 9 and 14, which contain cough-specific meanings, other LCQ-T items within the relevant domains were meaningfully acceptable for comparison with items in the PF, RP, BP, VT, SF, RE and MH scales of the SF-36.

The Thai-HADS is a self-administered instrument commonly used to determine the presence of anxiety and depression. It consists of 14 items on a 4-point Likert scale (range 0-3). A score of 11 or greater can identify anxiety in patients with a sensitivity of 100% and specificity of 86%, and depression in patients with a sensitivity of 86% and specificity of 91%.[14] Likewise, Thai-HADS items in the anxiety component were similar to the LCQ-T psychosocial domain.

The BCS was used to measure cough intensity on a scale from 0 (no cough at all) to 10 (maximum cough). It was developed on a 10-cm vertical line fixed at both ends. The patients graded the scale based on their subjective feeling of cough symptom severity.

All patients were asked to complete the self-administered instruments when first enrolled in the study. Patients reporting no change in their cough symptoms were asked to repeat the LCQ-T three days after the first response and return the completed questionnaires by mail thereafter.

Validation

To validate the LCQ-T, three different aspects were considered and assessed, namely concurrent validity, internal consistency reliability, and test-retest reliability. The first aspect describes concurrent validity, i.e., the instrument's ability in a Thai setting to measure what it was intended to measure according to the original version. The concurrent validity was examined by assessing the relationship between the LCQ-T and the other three instruments (SF-36, Thai-HADS, and BCS). The other two aspects covered reliability, i.e., the instrument's ability to produce consistent and repeatable measurements. The internal consistency reliability was determined by assessing the correlation between items within each domain (inter-item correlation). In addition, the corrected item-total correlations were also calculated to evaluate the strength of association between the individual items and the scale as a whole. The test-retest reliability, which measured the repeatability of the LCQ scores over time,

was determined by comparing the LCQ scores of the first assessment with the LCQ scores taken three days after the first response in patients reporting no change in their cough symptoms.

Statistical analysis

Data were reported as means ± standard deviation (SD) unless specified otherwise. Concurrent validity was assessed by estimating the Pearson's correlation coefficients (r) between the LCQ-T scores and the scores from the other three instruments. Internal consistency was determined by estimating the Cronbach's alpha coefficients of the individual domains and the total LCQ scores. A Cronbach's alpha coefficient of 0.7 or higher is considered to be an acceptable internal consistency.[20] Analysis of the test-retest reliability was performed by estimating the intraclass correlation (ICC) for the domain and the total LCQ scores using a mixed-effect linear regression model. The significant level was set at 5% for all analyses. SPSS version 17.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis.

Results

A total of 146 patients were recruited for this study, with a mean age of 59.6 (±14.4) and the majority being female (66%). The most common reported causes of cough were asthma, bronchiectasis, and COPD, respectively. Their demographic data and scores for all instruments are shown in **Table 1**.

Table 1. Patient's characteristics

Clinical characteristics	Values
Age, years, mean±SD	59.6±14.4
Female, number (%)	96 (66)
Etiologies of cough, number (%)	
Allergic rhinitis	8 (5.5)
Asthma	59 (40.4)
COPD	35 (24)
Bronchiectasis	42 (28.8)
Postinfectious cough	1 (0.7)
Interstitial lung disease	1 (0.7)
Duration of cough, months, median (range)	3 (2-60)
BCS, mean±SD	4.1±2.2
SF-36, mean±SD	4.1±2.2
General health score	46.6±21.5
LCQ-T scores, mean±SD	
Physical	4.7±1.2
Psychological	4.5±1.6
Social	4.7±1.7
Total	13.9±4.3
Thai-HADS scores, median (range)	
Anxiety	5 (0–17)
Depression	4 (0–15)

COPD: chronic obstructive pulmonary disease, BCS: Borg Cough Scale, SF-36: Short Form-36, LCQ-T: Thai version of the Leicester Cough Questionnaire, HADS: Hospital Anxiety Depression Scale

Concurrent validity

The correlation coefficients between the LCQ-T and the other instruments are illustrated in **Table 2**. All Pearson's correlation coefficients were statistically significant from zero (*P*< 0.05), with the value of r ranging from 0.26 to -0.74. The total LCQ-T correlated best with the BCS with an r coefficient of -0.74, followed by SF-36 for vitality (r = 0.49), role-physical, role-emotional, and mental (r = 0.48), and Thai-HADS anxiety (r = -0.47). It correlated lowest with the SF-36 physical function domain with an r of 0.33.

Table 2. Assessment of relationships between LCQ-T score and other scores: concurrent validity

| Scores | LCQ-T | | | |
	Physical	Psychological	Social	Total
BCS	-0.74	-0.69	-0.70	-0.74
Thai-HADS Anxiety	-0.47	-0.45	-0.43	-0.47
Thai-HADS Depression	-0.41	-0.39	-0.37	-0.40
SF-36 General Health	0.39	0.39	0.34	0.38
SF-36 Physical Functioning	0.39	0.31	0.26	0.33
SF-36 Role-Physical	0.50	0.44	0.45	0.48
SF-36 Role-Emotional	0.50	0.45	0.44	0.48
SF-36 Social Functioning	0.46	0.43	0.45	0.46
SF-36 Bodily Pain	0.42	0.32	0.30	0.36
SF-36 Vitality	0.45	0.48	0.47	0.49
SF-36 Mental	0.45	0.48	0.45	0.48

Pearson's correlation coefficients (r) between scores (BCS, SF-36, and HADS) and the domain scores and the total scores of the LCQ-T. All correlation coefficients *P* <0.05. Negative r value indicates an inverse relationship between two variables.

Table 3. Estimation of Cronbach's alpha coefficients between the total LCQ-T scores and sub-domain scores between LCQ-T compared with LCQ in other languages

Domains	LCQ-T	LCQ-K[a]	LCQ-D[b]	LCQ[c]
Physical	0.89	0.84	0.77	0.79
Psychological	0.93	0.86	0.84	0.89
Social	0.94	0.87	0.83	0.85
Total	0.96	0.91	0.93	0.92

Data are presented as Cronbach's alpha coefficients, [a]Korean version, [b]Dutch version, [c]Data from Birring

Table 4. Estimation of test-retest reliability of the LCQ-T in 25 participants compared with LCQ in other languages

Domains	Mean difference	SD difference	95%CI of difference	LCQ-T	LCQ-K[a]	LCQ-D[b]
Physical	-0.06	0.60	-0.31-0.19	0.81	0.53	0.86
Psycho logical	-0.21	0.69	-0.49-0.07	0.88	0.70	0.93
Social	-0.25	0.64	-0.52-0.02	0.90	0.44	0.93
Total	-0.52	1.57	-1.17-1.27	0.91	0.58	0.93

Data are presented as Intraclass correlation coefficients, [a]Korean version, [b]Dutch version, [c]Data from Birring. *P* <0.001 for all correlations of the LCQ-T

Internal consistency reliability

The Cronbach's alpha coefficients for the domain scores (physical, psychological, and social domains) and the total LCQ-T score were estimated, with the highest value for the social domain (Cronbach's alpha coefficient = 0.94), followed by the psychosocial domain (Cronbach's alpha coefficient = 0.93), and the physical domain (Cronbach's alpha coefficient = 0.89) (see **Table 3**). The corrected item-total correlations were higher than 0.3 for all items (range 0.47 [item 1] to 0.90 [item 6]).

Test-retest reliability

An ICC was performed on the data of 25 subjects who had been assessed using the LCQ-T at enrollment and 3 days later. This suggested that the ICC was very high for each domain, i.e., 0.90, 0.88, and 0.81 for the social, psychological, and physical domains, respectively, and 0.91 for the LCQ-T total (see **Table 4**). The mean difference of the test-retest scores and the ICCs of the LCQ-T are illustrated together with the ICCs of the LCQ in different language versions (LCQ-K, LCQ-D, and the original LCQ) derived from previous studies.[9,10,12]

Discussion

This study shows that the Thai version of the LCQ is a valid and reliable tool for measuring the QoL among adult Thai patients with subacute to chronic cough.

The concurrent validity assessment revealed that the correlation of the LCQ-T total was stronger with the BCS than with the SF-36 and the Thai-HADS. The LCQ-T total and LCQ-physical score demonstrated good correlation with BCS in an opposite direction. In other words, the higher BCS (more severity of cough) was associated with the lower LCQ-T total and physical score (worse health status). This is in contrast to what had been earlier reported in the validation studies of LCQ-D and LCQ-K, which demonstrated relatively lower correlations with the BCS (r= -0.41 and r= -0.28, respectively).[10,12] The low correlation of the LCQ-T total and the SF-36 general health (r=0.38) also contradicts the findings from the LCQ-D (r=0.41) and the LCQ-K (r=0.50).[10,12] In those studies, the authors postulated that the low correlation between the LCQ and the BCS is because the BCS only addresses the cough intensity and is not specific to the QoL. We speculate, however, that different scale properties can be found among different populations.

We found that the QoL in our patients who had chronic cough being measured by SF-36 was lower when compared with the QoL of healthy Thai volunteers, as reported by Leurmarnkul et al.,[21] in the areas of physical functioning (mean scores of 60±24 vs 86.1±13) and general health (mean scores of 46.6 ±21.5 vs 64.7± 18.9), while other aspects of QoL such as vitality, social functioning and mental health were relatively less affected. In our population, we found that the higher cough intensity perceived by the patients reflects a worse QoL as measured by LCQ-T. This indicates that the LCQ-T which measures the cough-specific QoL fitted well with our patient's perception. In addition, the lower correlations of the LCQ-T with the SF-36 and the Thai-HADS were expected due to the fact that the SF-36 and Thai-HADS are generic instruments, and are not designed specifically for chronic cough.

With regard to reliability, the LCQ-T demonstrated very good internal consistency reliability based on the high Cronbach's alpha coefficient and corrected item-total correlation of all items. The overall Cronbach's alpha coefficient of the LCQ-T (0.96) was a little higher than the reported values (range 0.91 to 0.93) for the other three versions.[10,12] Likewise, the Cronbach's alpha coefficients for each domain of the LCQ-T were also satisfactory (range 0.89 to 0.94) and a little higher than the published results from the other LCQ studies.

With regard to the test-retest reliability, the LCQ-T was shown to be repeatable in clinically stable patients (n=25) with ICCs of 0.81 and greater for all domains and the overall scale. Apart from the physical domain, these ICCs were comparable to the values reported in the original LCQ and LCQ-D.[9,10] Although the ICC for the physical domain was lower than that of the original version, it was statistically significant and considered a reasonable agreement.[22] Compared to the LCQ-K, the LCQ-T and the other two LCQ versions (original LCQ, LCQ-D) reported substantially higher ICCs in all domains and in total.[9,10] We are aware that the excellent ICCs for the LCQ-T may be at least partly due to the short between-assessment time gap (three days), compared to that of the LCQ-K study (two weeks).[12] Nevertheless, a shorter interval was chosen to avoid a larger number of participant dropouts which could compromise the ability to draw conclusions on the test-retest reliability of the LCQ-T.[23] We acknowledge that the shorter time interval possibly results in a recalled bias.

We acknowledge several potential limitations of this study. Firstly, the responsiveness of the LCQ-T has not been evaluated

in this study. Further studies are required to determine this important property and to identify the smallest change in domain and total scores of the LCQ-T which patients might perceive as being beneficial or which would mandate a change in patient management. Secondly, the majority of patients included in this study were those with obstructive airway diseases and bronchiectasis, hence potentially limiting the generalizability for patients with other cough etiologies. Nevertheless, given the fact that these conditions are common causes of chronic cough, it seems reasonable to deduce that our study participants could represent the majority of patients encountered in the general outpatient setting. In practice, using the LCQ-T to assess changes in specific conditions such as interstitial lung disease or cough-related gastroesophageal reflux disease which certainly have different pathophysiology and treatment should require more studies. Additionally, it is noteworthy that validation of a QoL instrument is an ongoing process requiring more data over time for the improvement of its measurement properties, especially for use in real-life practice.

Conclusion

Validated cough-specific QoL instruments should be used to supplement the objective markers of disease severity and to assess the impact of cough particularly in clinical trials. In this study, the LCQ-T demonstrated satisfactory validity, internal consistency reliability and repeatability. Therefore, it is deemed to be a promising tool for assessing the symptoms and QoL of adult Thai patients with subacute to chronic cough.

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Conflicts of interest

All authors declare no conflicts of interest.

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