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Original Research

Development of an Italian version of the Leicester cough questionnaire and its relationship with other symptom-specific measures for patients with chronic cough

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ABSTRACT

Objective: To implement subjective methods for measuring the impact of chronic cough on patients' daily life, including an Italian version of the symptom-specific, health status measure for patients with chronic cough, i.e. the Leicester Cough Questionnaire (LCQ).

Methods: Sixty-five chronic cough patients attended a tertiary cough clinic on two separate occasions 8 weeks apart. The visual analogue scale for cough severity (VAS), the LCQ and the cough disturbance score (CDS) were administered on both occasions. The LCQ was adapted for Italian conditions following a forward-backward translation procedure. Concurrent validation, internal consistency, repeatability and responsiveness were determined.

Results: The CDS, VAS and LCQ were correlated (r coefficients ranging from 0.69 to 0.94, $p < 0.01$). The internal consistency for each LCQ domain was high (alpha coefficient range 0.87–0.93), as was the 8-week repeatability of the LCQ in the patients (n = 36, 60 %) who displayed no change in CDS and VAS (intra-class correlation coefficient = 0.86, $p < 001$) over the same period. Patients who reported an improvement in CDS and VAS after 8 weeks (n = 29) also demonstrated significant improvements in each LCQ domain. The mean difference in LCQ total score before and after improvements was 2.26 (95 % CI: 1.58–4.47).

Conclusions: The Italian version of the LCQ appears to be just as valid as the other language versions of the questionnaire. In addition, the CDS appears to be a clinically useful, symptom-specific measure of the overall disturbance provoked by cough.

1. Introduction

Chronic cough is widely recognised as a major disturbing symptom affecting up to 10 % of the general population worldwide [1]. A number of recent clinical studies have examined the effect of chronic cough on the quality of life and the efficacy of various pharmacological interventions [2–5]. In most of these studies, audio-recording devices were employed for the objective assessment of cough frequency [2–5]. However, it is well known that the availability of such devices is strongly limited. Furthermore, the experiences of cough are unique to the individual patient and are most likely influenced by multiple factors [6,7]. Accordingly, recent guidelines [8] also recommended the use of simple subjective measures such as the visual analogue scale (VAS) for cough severity and the Borg scale, as well as questionnaires specifically designed to assess cough-related quality of life, particularly the Leicester Cough Questionnaire [9]. Subjective instruments provide a valuable insight into patients' personal experiences of cough, assessing psychosocial elements of cough that may otherwise be underestimated [10]. Noticeably, a validated Italian version of the LCQ is currently unavailable. In previous clinical investigations, we used a categorical 0–9 scale, hereafter termed cough disturbance score (CDS), to rate the overall disturbance caused by chronic cough on the daily life of an unselected

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population of patients referred to a tertiary level cough clinic in Florence, Italy [11,12].

In this study performed on a group of patients with chronic cough, we aimed at validating an Italian version of the LCQ and assessing the relationship between the LCQ and other subjective, cough-related measures such as the CDS for cough disturbance and the VAS for cough severity.

2. Methods

All participants were adult patients with chronic cough referred to the Florence (IT) cough clinic by either their primary care physician (89 %) or a pulmonary specialist between February 2023 and July 2023. None complained of recent acute pulmonary disorders. Patients were clinically evaluated at presentation and after 8 weeks. The local Institutional Review Board approved the study protocol (OSS_14131) and informed consent was obtained from all patients.

2.1. Measurements

Patients were assessed using three different cough rating methods. The LCQ is a cough-specific, 19-item, 3-domain questionnaire widely used in the assessment of cough-related quality of life (9). A high LCQ score indicates a good quality of life [9]. The translation into the Italian language followed an established forward-backward procedure, with independent translations and counter-translation. Independent translations into Italian of the LCQ by two of the Authors (FL and GAF) were pooled into a common version. A native English speaker fluent in Italian (see Acknowledgements) also with a medical background translated the provisional Italian version back into English. The back translation turned out to be almost identical to the source document (see appendix 1 and 2 in the supplemental material).

The VAS consists of a 10-cm bar commonly used to rate cough severity [13]. The extremes of the bar (i.e. 'no cough at all' and 'extremely severe cough') corresponded to 0 and 10 cm respectively. The VAS only has descriptors at the extreme ends of the scale, and nothing in between to guide patients.

The CDS, previously termed 'cough score' [11,12], is a categorical scale consisting of a rated numerical score (0–9) with step-by-step descriptors (Table 1) that was developed to measure the disturbance caused by the cough over a definite time interval. Patients were presented the scale descriptors but not the corresponding scores. For the purposes of this study, the selected time interval was two weeks prior to the ongoing consultation. More specifically, patients were asked 'How much has the cough bothered you during the last 2 weeks?'. The magnitude of the disturbance was subsequently rated using the corresponding 0–9 values where 0 was 'not bothered at all' and 9 was 'worst disturbance I can possibly imagine' (Table 1). For the CDS, the minimum detectable change (MDC) value [14] was also determined.

Table 1
The categorical scale, termed Cough Disturbance Score, used to rate the overall disturbance caused by chronic cough on patients' daily life.

Score	Descriptor
0	Cough does not bother me at all
1	Cough bothers me very slightly
2	Cough bothers me a little
3	Cough bothers me
4	Cough bothers me moderately
5	Cough bothers me fairly severely
6	Cough bothers me severely
7	Cough bothers me very severely
8	Cough bothers me most severely
9	My cough is the worst disturbance I can imagine

2.1.1. Validation

To validate the Italian version of the LCQ, we tested four different aspects of the questionnaire, i.e. concurrent validity, internal consistency, repeatability and responsiveness. Concurrent validity was tested by comparing the LCQ with other health outcome instruments at the first visit, namely the VAS for cough severity and the CDS. Internal consistency of each LCQ domain was assessed using Cronbach's alpha coefficients, which indicate the extent to which items are related. Internal consistency is generally acceptable if Cronbach's alpha coefficient is greater than 0.7 [15,16]. The repeatability (or test-retest reliability) of the LCQ was assessed by calculating the intra-class correlation coefficient (ICC) in patients reporting a change in CDS and VAS not greater than 1 point or 3 cm respectively, over an 8-week interval. $^{An\ ICC}$ $\geq$0.4 is generally regarded as a moderate intra-class correlation and >0.75 as a strong correlation. Responsiveness was considered as the capacity to detect important changes over time [17]. Here, responsiveness was determined by comparing the LCQ scores at the first visit and those after 8 weeks in patients who reported a change in CDS and VAS greater than 1 point or 3 cm respectively, following pharmacological treatments performed in accordance with current guidelines [8]. Concurrent validity was assessed by correlating the LCQ scores with the CDS and the CDS with the VAS. A correlation coefficient $\geq$0.4 demonstrates a moderate correlation and a correlation coefficient greater than 0.75 indicates strong correlation [17].

2.2. Statistical analysis

Continuous variables are presented as means ± standard deviation (SD) or Confidence Intervals (CI) when appropriate; categorical variables are expressed as relative frequencies. Spearman's non-parametric correlation coefficients between LCQ, VAS and CDS were calculated for concurrent validity. Internal consistency and repeatability of the LCQ were assessed as described above. Paired *t* tests were used to assess LCQ responsiveness. The MDC for the CDS was determined using distribution-based methods where, in accordance with previous reports [18], variability was calculated as follows: *standard deviation * 0.3*. The analysis included both an improvement and a worsening in CDS and gave these changes equal consideration, ensuring a comprehensive analysis of the overall response to the treatment. Statistical analyses were performed using SPSS (version 28.01, SAS Institute, Cary, NC, USA).

3. Results

We enrolled 65 consecutive outpatients (Table 2) who had symptoms

Table 2
Clinical and demographic characteristics of the patients (n = 65).

Female (%)	48 (74)
Age (year)	53 ± 7.1
Duration of cough (year)*	3.2 (1–4.1)
Never smoked, n (%)	50 (77)
Ex-smoker, n (%)	15 (25)
Wheezing and/or chest tightness, n (%)	15 (25)
Nasal obstruction, n (%)	21 (32)
Post-nasal drip, n (%)	20 (31)
Heartburn, n (%)	34 (52)
Regurgitation, n (%)	34 (52)
Physical LCQ domain	4.22 ± 1.20
Psychological LCQ domain	3.70 ± 1.58
Social LCQ domain	3.93 ± 1.85
Total LCQ score	11.85 ± 4.19
CDS	4.65 ± 2.15
VAS	5.10 ± 2.50

Data are mean ± standard deviation unless otherwise indicated.
LCQ, Leicester cough questionnaire; CDS, cough disturbance score; VAS, visual analog scale for cough severity; *, Median (range).

suggesting one or more of the commonest causes of chronic cough. Spearman's correlation coefficient of the concurrent validity between the CDS and the VAS was 0.94 (95 % CI, 0.88–0.98); the correlation coefficients of the concurrent validity between the LCQ and the CDS are reported in Table 3. All coefficients were significant ($p < 0.0001$). Cronbach's alpha coefficients for the physical, psychological and social domains and the total questionnaire were 0.87, 0.91, 0.92, and 0.93, respectively. The ICC of the LCQ was calculated in 36 patients (60 %) who complied with the acceptability criteria described above. The ICC turned out to be 0.86 ($p < 0.0001$). Patients who reported an improvement in cough ($n = 29$), i.e. those who displayed an improvement in CDS and VAS greater than 1 point or 3 cm respectively, also demonstrated significant improvements in each of the domains of the LCQ (Table 4) on follow-up. There was a significant difference in the total and in each LCQ domain for clinically improved patients ($P = 0.0001$). The value of the MDC for the CDS is reported in Table 5.

4. Discussion

The present findings suggest that the Italian version of the LCQ remains an as valid tool for assessing the impact of chronic cough on quality of life as other linguistic version of the same questionnaire. In addition, we found that the LCQ, the CDS and the VAS were highly correlated. Noticeably, it has been reported that severity, intensity and frequency are different and non-overlapping cough features [19]. It seems logical to assume that, in a given patient, the perception of cough severity is influenced by both the frequency and the intensity of the cough efforts, occurring either as single events or as cough bouts. In addition, although not formally evaluated, we repeatedly observed that patients were often unable to discriminate between these features, particularly between the intensity and severity of cough. Conversely, the measure of the CDS aims at assessing the overall disturbance caused by any property of cough, be it its frequency, or intensity, or both. In our experience, the majority of patients most readily understood the CDS rating method [12]. Of note, the MDC value attained by the CDS overlaps that of a previous investigation performed on a similar number of chronic cough patients whose quality of life was assessed by the LCQ (14). By comparison, a ⩾ 30-mm reduction in the cough severity VAS was estimated as a clinically meaningful change threshold for clinical trials in chronic cough [20].

Our results also show that the Italian version of the LCQ represents a valid tool to measure the impact of chronic cough on patients' daily life. Indeed, the relationship between the Italian version of the LCQ and both the VAS and CDS was positive, albeit less so than that between the VAS and the CDS. The finding that the CDS showed a higher correlation with the VAS than the LCQ is not surprising, since the latter also consists of domains not assessed by either the CDS or the VAS. It has recently been found that the Korean [15] and Lithuanian [21] versions of the LCQ were also correlated with patients' perception of cough severity and the cough symptom score.

Long-term recordings (up to 24 h) of the cough audio signal is widely considered the most appropriate method to objectively document the frequency of cough efforts in clinical studies. Accordingly, portable devices specifically designed for this purpose have been developed but their use is strongly limited due to poor availability. In keeping with this, the use of simple, subjective cough rating methods, along with well-established questionnaires specifically designed to assess cough-related quality of life such as the LCQ [9], remains highly recommendable in clinical practice. Accordingly, the development of the CDS and the availability of an Italian version of the LCQ are an addition to the existing tool used for assessing the properties of cough in the clinical setting.

This study has some limitations. First, this was a single-centre study of chronic cough patients mainly (about 80 %) living in Tuscany and neighbouring regions. The fact that the demographic and clinical characteristics of the patients examined here and in previous studies from our department are comparable with studies performed in other world areas [1] points to the possibility that the Italian version of the LCQ can broadly be used. Second, the number of recruited patients was relatively small. Some previous studies aimed to similar purposes enrolled 35 [22] – 74 [23] patients, respectively, whereas other validation studies from South Korea [15] and Netherland [16] included up to 200 patients. Notably, values of internal consistency and repeatability of the LCQ in the above-mentioned studies turned out to be similar regardless the sample size. Similar considerations apply to the concurrent validity of the VAS. Therefore, we deemed 65 patients an appropriate number of patients for the purposes of the study. Third, we have calculated the MDC rather than the more widely used minimal clinically important difference, a variable that requires external standards of meaningfulness [24]. These standards are not currently available for the CDS. The MDC used here may not influence or make no inference about whether or not the change in the CDS is clinically meaningful. Nonetheless, a change in CDS greater than the MDC indicates that the change is unlikely to be due to chance variability. Last, the Italian LCQ version remains to be validated for clinical conditions other than chronic cough.

In conclusion, the results demonstrate that the Italian version of the LCQ remains as repeatable and responsive to change as the LCQ versions currently available in other languages. Furthermore, the study provides insights into the efficacy of a novel symptom-specific measure, the CDS. The data obtained might aid clinicians and researchers in making meaningful interpretations of the impact of chronic cough on patients' daily life, as well as in evaluating the results of therapeutic interventions.

Table 3
Concurrent validity of the Italian version of the Leicester cough questionnaire.

	Leicester Cough Questionnaire			
	Physical	Psychological	Social	Total
CDS Mean (95 % CI)	−0.70 (−0.83–0.49)	−0.61 (−0.79 ~ −0.40)	−0.59 (−0.75 ~ −0.33)	−0.69 (−0.82 ~ −0.47)
CDS (0–9) VAS (95 % CI)	0.94 (0.88–0.98)			

CDS, Cough disturbance score.

Table 4
Mean (95 % confidence intervals) increases in all domains of the Italian version of the Leicester Cough Questionnaire (LCQ) after an 8 week follow up.

Physical LCQ domain	0.49 (0.29–1.88)
Psychological LCQ domain	0.78 (0.43–1.93)
Social LCQ domain	1.03 (0.46–1.73)
Total LCQ score	2.26 (1.58–4.47)

Data are mean (95 % CI).

Table 5
Determination of the minimal detectable difference (MDC) for the Cough Disturbance Score.

	SEM of differences	SD of differences	0.5 of the SD
MDC	0.33	2.04	1.02

SD: Standard Deviation; SEM: Standard error of Mean.

CRediT authorship contribution statement

Alessandra Sorano: Writing – review & editing, Methodology, Investigation. **Carlo Fumagalli:** Writing – review & editing, Validation, Software, Methodology. **Elenia Cinelli:** Writing – review & editing,

Visualization, Investigation. **Surinder S. Birring:** Writing – review & editing, Visualization, Validation, Methodology. **Giovanni A. Fontana:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Federico Lavorini:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rmed.2024.107642.

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