Reliability and validity of the chronic respiratory questionnaire (CRQ)

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Abstract

Background **– The Chronic Respiratory Questionnaire (CRQ) is frequently applied to assess quality of life in patients with chronic obstructive pulmonary disease (COPD). However, the reliability and validity of this questionnaire have not yet been determined. This study investigates the reliability and validity of the four separate dimensions of the CRQ.**

Methods **– The CRQ was administered on two consecutive days to 40 patients with COPD (mean FEV_1 44% predicted, FEV_1/IVC 37% predicted). Internal consistency reliability of each dimension was investigated by Cronbach's α reliability coefficient, test retest reliability by the Spearman-Brown reliability coefficient (*p*), and content validity by Pearson's correlation coefficient between the CRQ and the symptom checklist (SCL-90).**

Results **– Items of the fatigue, emotion, and mastery dimensions showed a high internal consistency reliability ($\alpha = 0{\cdot}71$–$0{\cdot}88$) as well as a high test retest reliability (*p* above 0·90). These three dimensions correlated with comparable dimensions of the SCL-90. Items of the dyspnoea dimension showed a low internal consistency reliability ($\alpha = 0{\cdot}53$) and a test retest reliability of $p = 0{\cdot}73$.**

Conclusions **– Items of the dimensions fatigue, emotion, and mastery of the CRQ are reliable and valid and can be used to assess quality of life in patients with severe airways obstruction. Items of the dyspnoea dimension are less reliable and should not be included in the overall score of the CRQ in comparative research. However, by scoring the items of dyspnoea separately they may be useful for the evaluation of the effects of intervention in a specific patient.**

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Impaired lung function may, in addition to limiting exercise, result in an impaired quality of life.[1–3] A study by Traver showed that health care use by patients with chronic obstructive pulmonary disease (COPD) was related more to impaired quality of life than to the severity of the disease itself.[4] It is therefore important to measure quality of life in COPD as well as lung function and exercise tolerance.

Two general health measurements – the Quality of Well Being scale[5] and the Sickness Impact Profile[6] – were developed for use in these patients. Because these instruments are not sensitive enough to detect small changes[7] after treatment, Guyatt and coworkers developed the Chronic Respiratory Questionnaire (CRQ).[8] They showed that the CRQ was precise, valid, and responsive,[8,9] but did not investigate the internal consistency reliability of the separate dimensions. Furthermore, responsiveness to change is more an indication of the validity of a measuring instrument than a separate characteristic.[10] This means that reproducible and responsive measurement instruments may contain items which have nothing in common[11] – that is, the sets of items do not measure the dimensions they constitute. We have therefore investigated the internal consistency and the test retest reliability of the separate dimensions of the CRQ. The content validity of the CRQ was assessed by correlating it with the symptom checklist (SCL-90).[12]

Methods

PATIENTS

Forty patients with COPD (all smokers or ex-smokers, table 1) with severe airways obstruction, participating in a rehabilitation programme were studied. All were admitted to hospital for two days and were stable (no recent exacerbations) with optimal drug management. Entry criteria were: (1) FEV_1 (forced expiratory volume in one second) $< 60\%$ predicted, and (2) FEV_1/IVC (inspiratory vital capacity) $< 50\%$ both after two inhalations of 40 µg ipratropium bromide. Patients with evidence of ischaemic heart disease, intermittent claudication, musculoskeletal disorders, or other disabling diseases that might restrict a rehabilitation programme were excluded. The study was approved by the medical ethics committee of the University

Table 1 Mean (SD) characteristics of 40 patients with COPD

Sex (M:F)	33:7
Age (years)	62·4 (5·0)
FEV_1b (l)	1·2 (0·3)
FEV_1a (l)	1·3 (0·4)
FEV_1 (%pred)	44·3 (10·6)
FEV_1/IVC (%)	37·2 (7·9)
IVC (l)	3·6 (0·9)
IVC (%pred)	91·3 (17·2)
TLC (%pred)	116·3 (14·1)
RV%/TLC (%pred)	143·0 (25·1)
T_{LCO}/V_A (%pred)	70·1 (27·4)

FEV_1b = forced expiratory volume in one second before bronchodilation; FEV_1a = FEV_1 after bronchodilation; % pred = expressed as a percentage of the predicted value; FEV_1/IVC % = FEV_1 expressed as a percentage of the inspiratory vital capacity; TLC = total lung capacity; RV = residual volume; T_{LCO}/V_A = transfer factor for carbon monoxide divided by alveolar volume.

Hospital of Groningen and all patients gave informed consent.

LUNG FUNCTION TESTS

On the first day static and dynamic lung volumes and transfer factor for carbon monoxide (TLCO) were measured. Static lung volumes were determined in a constant volume whole body plethysmograph (Jaeger, Wurzburg, Germany). FEV_1 and FVC were measured with a pneumotachograph (Jaeger, Wurzburg, Germany). TLCO was measured by the single breath method. Reversibility was assessed by measuring FEV_1 before and after bronchodilation with two inhalations of 40 μg ipratropium bromide. Predicted values were derived from the ECCS.[13]

PSYCHOLOGICAL PARAMETERS

All patients completed two questionnaires: the Chronic Respiratory Questionnaire (CRQ)[8] and the SCL-90.[12]

Chronic Respiratory Questionnaire (CRQ)

The questionnaire was translated into Dutch and was administered on the first and second day before lung function was measured. It consists of 20 items which measure physical and emotional function divided into four dimensions: dyspnoea, fatigue, emotion, and mastery. Physical function assessment includes asking patients to quantify their dyspnoea during five activities that are frequently performed and important in day to day life. Each patient is asked to choose five activities from a list of 25 or he can mention other activities that are not on the list. This means that the dimension dyspnoea is strictly individualised. Physical function was also investigated by four items relating to fatigue and energy level. Assessment of emotional function, related to the dimensions of emotion and mastery, included questions about frustration, depression, anxiety, panic, and fear of dyspnoea. Patients were asked to rate their function on a seven point category scale; for example 1 = "not tired at all", 7 = "extremely tired." The internal consistency and test retest reliability were measured for each of the four dimensions.[11]

Symptom checklist (SCL-90)

The symptom checklist (SCL-90)[12] contains 90 items relating to nine separate dimensions: anxiety, depression, hostility, obsessive-compulsiveness, sensitivity, sleeping disturbances, agoraphobia, somatisation, and psychoticism. The questionnaire was administered on the first day. Patients were asked to rate their function on a five point scale; for example 1 = "not anxious at all", 5 = "extremely anxious." Internal consistency reliability was assessed for each of the nine dimensions of the SCL-90.

The content validity of four dimensions of the CRQ was established by correlating patients' scores with their scores on comparable dimensions of the SCL-90: dyspnoea with somatisation; fatigue with depression and somatisation; emotion and mastery with anxiety, depression, hostility, sensitivity, and somatisation.

STATISTICAL ANALYSIS

Cronbach's reliability coefficient α was used to assess the internal consistency of the four dimensions of the CRQ as well as the nine dimensions of the SCL-90. Cronbach's $\alpha > 0{\cdot}7$ was taken as reliable.[11] Test retest reliability of each dimension of the CRQ was investigated by means of the Spearman-Brown reliability coefficient p, taking $p > 0{\cdot}7$ as reliable.[11] Content validity of the dimensions of the CRQ was assessed by correlating these dimensions with comparable dimensions of the SCL-90 (Pearson's r). The inflated α risk resulting from multiple comparisons was taken into account ($p < 0{\cdot}01$). The Kolmogorov-Smirnov test was used to compare distributions of the items with standard normal distributions, smaller p values indicating a more skewed distribution.

Results

LUNG FUNCTION

All patients had severe airways obstruction (mean FEV_1 44% predicted, mean FEV_1/IVC 37% predicted) and little reversibility (mean increase in FEV_1 0·15 l). Lung function variables and the items of both the CRQ and the SCL-90 were normally distributed.

INTERNAL CONSISTENCY RELIABILITY AND REPRODUCIBILITY OF CRQ AND SCL-90

The internal consistency reliability coefficient of the dyspnoea dimension of the CRQ was low at both the first and second administration ($\alpha = 0{\cdot}51$ and $\alpha = 0{\cdot}53$, table 2). The internal consistency reliability coefficients of the CRQ dimensions fatigue, emotion, and mastery ranged from $\alpha = 0{\cdot}71$ to $\alpha = 0{\cdot}88$ at both administrations. These three dimensions showed a high test retest reliability, p ranging from 0·90 to 0·93, while the reproducibility of the dyspnoea dimension was lower ($p = 0{\cdot}73$).

On the SCL-90 the reliability of the dimensions agoraphobia, hostility, and psychoticism was low (Cronbach's $\alpha = 0{\cdot}68$, 0·54, and 0·62, respectively). The dimensions anxiety, depression, somatisation, obsessive-compulsiveness, sensitivity, and sleeping disturbances of the SCL-90 showed an internal consistency reliability with a Cronbach's α ranging from 0·73 to 0·85.

CONTENT VALIDITY OF THE CRQ

No comparison was made between the dimensions of the CRQ and the hostility dimension of the SCL-90 because the latter showed a low internal consistency reliability. The fatigue dimension showed a significant ($p < 0{\cdot}001$) correlation with the depression and somatisation dimensions (table 3). Significant correla-

Table 2 Internal consistency reliability and test retest reliability within each dimension of the Chronic Respiratory Questionnaire (CRQ)

	n	α_1	α_2	p_{1-2}
Dyspnoea	5	0·51	0·53	0·73
Fatigue	4	0·78	0·71	0·90
Emotion	7	0·81	0·87	0·93
Mastery	4	0·83	0·88	0·91

n = number of items; $\alpha_{1,2}$ = internal consistency reliability coefficient (Cronbach's α) at the first (α_1) and second administration (α_2), respectively; p_{1-2} = test retest reliability expressed as Spearman-Brown reliability coefficient.

Table 3 Pearson correlation coefficients between the dimensions of the Chronic Respiratory Questionnaire (CRQ) and comparable dimensions of the symptom checklist (SCL-90)

CRQ	*SCL-90*			
	Anxiety	*Depression*	*Somatisation*	*Sensitivity*
Dyspnoea	—	—	0·09	—
Fatigue	—	0·53**	0·55**	—
Emotion	0·50**	0·49**	0·52**	0·24
Mastery	−0·55**	−0·48**	−0·40*	−0·27

* $p < 0·01$; ** $p < 0·001$.

tions ($p < 0·001$) were found between the emotion and mastery dimensions of the CRQ on the one hand, and the anxiety, depression, and somatisation dimensions of the SCL-90 on the other. The dyspnoea dimension of the CRQ showed no significant correlation with the somatisation dimension of the SCL-90.

Discussion

Our study shows a high internal consistency reliability and a high test retest reliability for the dimensions fatigue, emotion, and mastery of the CRQ. Significant correlations were found between fatigue, emotion, and mastery dimensions of the CRQ and anxiety, depression, and somatisation dimensions of the SCL-90. The dyspnoea dimension showed low internal consistency and a moderate test retest reliability.

Unlike the other dimensions, the assessment of dyspnoea in the CRQ can be individualised for each patient.[7] The patients quantify their dyspnoea during five self-selected activities that are frequently performed and important in their day to day life. In our study the patients scored 35 different activities which caused dyspnoea. The sensation of breathlessness will depend on the intensity and type of work at which breathlessness develops. Some people will adapt and slow down their activities to become less dyspnoeic, while others will give up their activities and will not experience dyspnoea at all. These differences of adaptation to various activities may give rise to the low internal consistency of the dyspnoea dimension.

In contrast to fatigue, emotion, and mastery, the dyspnoea dimension showed a low test retest reliability. Nevertheless, dyspnoea showed a $p > 0·7$ which is a reliable result,[11] and is in accordance with Guyatt and coworkers[8] who found a reproducibility for all four dimensions ranging from 6% to 12%. However, in our study the dyspnoea dimension showed a low and unreliable internal consistency. This means that reproducible measurement instruments such as dyspnoea may contain items which have nothing in common.[11] Unlike Guyatt and coworkers who did not investigate the internal consistency,[8] we therefore suggest scoring the items of dyspnoea separately without reporting an overall score. On the other hand, the high internal consistency reliability of the items which measure fatigue, emotion, and mastery indicates that an overall score can be used for these three dimensions.

The SCL-90 has been shown to be valid and reliable in psychiatric patients.[12] Anxiety, depression, somatisation, obsessive-compulsiveness, sensitivity, and sleeping disturbances could be assessed with a high degree of internal consistency in patients with COPD. High scores for fatigue, emotion, and mastery with the CRQ were significantly associated with depression, anxiety, and somatisation of the SCL-90. This result suggests that, if patients are more anxious and depressed they show more fatigue, are more emotionally distressed, and are less capable of controlling their disease. We therefore conclude that fatigue, emotion, and mastery are valid measurements for assessing quality of life in patients with COPD. On the other hand, we found no correlation between dyspnoea and the somatisation of the SCL-90. This is not surprising when one considers the low internal consistency reliability of the dimension dyspnoea.

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