

# Comparative analysis of the psychometric parameters of two quality-of-life questionnaires, the SGRQ and CAT, in the assessment of patients with COPD exacerbations during hospitalization: A multicenter study

Ana Folch Ayora<sup>1</sup> , Loreto Macia-Soler<sup>2</sup>,  
María Isabel Orts-Cortés<sup>2</sup> , Carmen Hernández<sup>3</sup>  
and Nuria Seijas-Babot<sup>3</sup>

Chronic Respiratory Disease  
1–10

© The Author(s) 2018

Reprints and permission:

[sagepub.co.uk/journalsPermissions.nav](http://sagepub.co.uk/journalsPermissions.nav)

DOI: 10.1177/1479972318761645

[journals.sagepub.com/home/crd](http://journals.sagepub.com/home/crd)



## Abstract

The aim of this study was to assess health-related quality of life (HRQL) in patients with chronic obstructive pulmonary disease (COPD) and to discuss the different tools available for its assessment. The most widely used assessments are the St. George respiratory questionnaire (SGRQ) and the COPD assessment test (CAT) questionnaire. Both have a different difficulty in exam completion, calculation, and scoring. No studies exist that analyze the validity and internal consistency of using both questionnaires on patients admitted to the hospital for a COPD exacerbation. A multicenter, cross-sectional analytic observational study of patients admitted to the hospital due to a COPD exacerbation (CIE 491.2). During their hospital stay, they were administered the SGRQ and the CAT questionnaire within the framework of a therapeutic education program (APRENDEPOC). Descriptive and comparative analysis, correlations between the scales (Pearson's correlation index), consistency and reliability calculations (Cronbach's  $\alpha$ ), and a forward stepwise multiple linear regression were performed, with significant correlations in both questionnaires considered  $p < 0.01$  with the total scores. A statistical significance of  $p < 0.05$  was assumed. Altogether, 231 patients were admitted for a COPD exacerbation ( $n = 77$ ) at Hospital Clínic of Barcelona (HCB) and ( $n = 154$ ) at Hospital Universitario General of Castellón (HUGC). The sample profile was not homogeneous between both centers, with significant differences in HRQL between hospitals. Correlation were noted between both scales ( $p < 0.01$ ), along with high levels of internal consistency and reliability (CAT 0.836 vs. SGRQ 0.827). The HRQL is related to dyspnea, wheezing, daytime drowsiness, and edema, as well as to the need to sleep in a sitting position, anxiety, depression, and dependence on others in the execution of daily activities. Our regression analysis showed that the SGRQ questionnaire could predict more changes in HRQL with a higher number of variables.

<sup>1</sup> Universitat Jaume I, Castellón, Spain

<sup>2</sup> Universidad de Alicante, Alicante, Spain

<sup>3</sup> Hospital Clínic de Barcelona, Barcelona, Spain

## Corresponding author:

Ana Folch Ayora, Facultad Ciencias de la Salud, Unidad Predepartamental de enfermería, Universitat Jaume I, Av. de Vicente Sos Baynat, s/n, cp: 12071 Castellón de la Plana, Spain.

Email: [afolch@uji.es](mailto:afolch@uji.es)



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<http://www.creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

## Keywords

Quality of life, chronic obstructive pulmonary disease, assessment, psychometrics, hospital

Date received: 19 July 2017; accepted: 21 January 2018

## Introduction

Chronic obstructive pulmonary disease (COPD) is one of the main causes of morbidity and mortality throughout the world.<sup>1</sup> Eighty million individuals endure a moderate or serious stage of the disease.<sup>2</sup> Initiatives to standardize COPD treatment, such as the Spanish COPD (GESEPOC) guide<sup>3</sup> or the Initiative for Chronic Global Obstructive Lung Disease (GOLD),<sup>4</sup> have increased the homogeneity of COPD diagnosis and treatment, although COPD continues to be a disease with high health costs, which among other reasons is because of the high number of readmissions due to exacerbation.<sup>5</sup> Therefore, there is a need to manage these patients in an integral manner, seeking to alleviate their symptoms, improve their exercise tolerance, increase their health status, and improve their overall quality of life.<sup>6,7</sup>

With quality of life being a predictive factor of exacerbation in patients with COPD, it is important to conduct a routine assessment using valid and reliable scales on the impact of COPD on the patient's health status.<sup>8</sup> This makes health-related quality of life (HRQL) one of the most studied items in clinical trials on the patients with COPD.<sup>9</sup> Despite the interest generated by studying HRQL, there is a consensus only on the use of the COPD assessment test (CAT) questionnaire in stable patients with COPD as a method to predict the risk of a future exacerbation, as indicated in the GOLD guide<sup>4</sup> and the Spanish COPD (GESEPOC) guide.<sup>3</sup> There is no consensus on the most indicated questionnaire to evaluate the patients with COPD during an exacerbation, although several extended questionnaires exist for this purpose and have been adapted to different languages<sup>10</sup> and populations. Their reliability, worth, precision, consistency, and sensitivity to change have been demonstrated but important differences exist in their content, ease of calculation, and completion.<sup>9</sup>

One of these questionnaires is the CAT,<sup>8</sup> which consists of eight questions. Each item is scored from 0 to 5 giving a total score range from 0 to 40. It has good internal consistency, and a completion time of 107 seconds, as validated through an international

sample of 1000 patients.<sup>11</sup> Its administration may be through an interview, or self-completed.<sup>12</sup>

Another frequently used questionnaire is the St. George respiratory questionnaire (SGRQ), designed by Jones in 1991,<sup>13</sup> to measure the subjective perception of HRQL. It is the most commonly used questionnaire and considered the gold standard in the assessment of HRQL. It has been validated in several languages for use via telephone.<sup>10,14</sup> It contains 76 questions that are organized into three categories: symptoms, activity, and impact. Each question has an empirically derived weight, making it necessary to calculate the score through a computer application. The SGRQ is therefore more complicated to calculate and is lengthy, with a completion time of 578 seconds.<sup>15</sup> It is difficult to fill out without aid from the health staff, as reported by other authors.<sup>16</sup> Further, controversy exists on the cutoff point of its scale.<sup>17</sup> Given the applicability problems of the SGRQ scale, the SGRQ-c questionnaire was recently created with 40 questions, but its lack of validity in different languages has limited its use, and the SGRQ questionnaire is still the most used.

As the SGRQ is somewhat inadequate in routine clinical practice, it is necessary to use short questionnaires that gather appropriate information and improve the communication between patients and health staff.<sup>18</sup> An example is the CAT questionnaire.<sup>19</sup>

For all of the above, the CAT questionnaire can replace the SGRQ questionnaire, as there are studies that have evaluated the metric parameters of both questionnaires and noted a significant correlation between both scales in the stable COPD population<sup>15,20–22</sup> and displays good sensitivity levels to change and internal consistency in patients with stable and exacerbated COPD in the primary care setting.<sup>8,11,23,24</sup> This correlation between both scales has also been studied in patients with interstitial lung disease.<sup>25</sup> No studies have assessed their correlation and similarity in a population with exacerbated COPD in the hospital setting during a hospital admission for the exacerbation of their respiratory pathology.

Our general objective was to evaluate and compare the psychometric properties of the SGRQ and CAT

questionnaires in patients with COPD admitted for an exacerbation (CIE 491.2) to two national hospitals.

Secondary objectives:

- Gain knowledge of and compare the characteristics of the population using all of the studied variables (sociodemographic, clinical, psychological and activity index, and HRQL).
- Understand the homogeneity and reliability of the total results of both the SGRQ and CAT questionnaires, as well as between the subgroups of the SGRQ questionnaire (symptoms, activity, and impact) and questions from the CAT.
- Know what population characteristics have a greater association with the total scores obtained in the SGRQ and CAT and determine which questionnaire can best explain a greater variance.

## Methodology

### Design

A cross-sectional, observational study of patients admitted to two hospitals with diagnosis of a COPD exacerbation with CIE code 491.2 and who were administered the SGRQ and CAT questionnaires within the first 3 days of hospitalization. Completion of the questionnaires was conducted during the initial assessment of an experimental study with two assignment groups, with analysis before and after the intervention. The subjects were randomly assigned to an experimental group or a comparison group. The intervention consisted of four education and telephone follow-up sessions, with evaluation after 3 months.<sup>26</sup>

### Population and setting

The Hospital Clínic of Barcelona (HCB; Barcelona-Izquierda, 323,000 inhabitants) and Hospital Universitario General de Castellón (HUGC; Area 2, Department of Health of Castellón, 268,231 inhabitants).

Selection criteria: Patients diagnosed with COPD, based on a history of smoking (active or previous) of at least 20 packs per year, along with the presence of a scarcely reversible airflow obstruction, are defined as a forced expiratory volume ratio on the first second (FEV<sub>1</sub>)/forced vital capacity (FVC) below 70 after bronchodilation. Patients presented to our emergency service and required admission to the hospital for dyspnea produced by COPD exacerbation with the CIE 491.2 diagnosis code. They participated in the study voluntarily after receiving an

explanations and understanding the purpose and interventions of the study.

Exclusion criteria: All patients who could not communicate due to physical or mental disabilities were in an advanced state with a life expectancy of less than 6 months or who fulfilled the inclusion criteria but refused to participate in the study.

The recruitment period was 2 years and 3 months (February 2014 to May 2016) by means of consecutive sampling, with estimated a sample size, per center, based on the annual average of patients who fulfilled the inclusion criteria. This produced a sample size of  $n = 50$  from HCB and  $n = 150$  for HUGC, with an expected loss of 22% based on prior literature.<sup>27</sup>

## Variables

*Main variables.* The HRQL measured through:

- The SGRQ<sup>28</sup> adapted into Spanish and consisted of 50 items (covering 76 levels) divided into three subscales: symptoms (8 questions), activity (16 questions), and impact (26 questions). All the questions were measured as percentages and means, and each question has an attributed weight. The total score was obtained from the sum of the three categories, ranging from 0 to 100, with the highest scores indicating a worse quality of life. The full scale has a Cronbach's  $\alpha$  of 0.94, with subscale scores of 0.72 for symptoms, 0.89 for activity, and 0.89 for impact.
- The CAT questionnaire<sup>8</sup> consisted of eight questions (cough, phlegm, chest tightness, breathing difficulty during daily life activities, limitation in household activities, confidence to leave the house, sleep, and energy). The range of scores for each element is between 0 and 5, and the total result is the sum of the eight questions. Its Cronbach's  $\alpha$  was 0.88.<sup>11,23</sup>

## Sociodemographic variables

Gender, age, and educational level.

## Clinical variables

The degree of dyspnea was measured with the Medical Research Council (MRC) scale,<sup>29</sup> which has five classification options that range from 0 to 4—ranging from a low to high degree of difficulty in the execution of physical activities. The presence of absence of

coughing, expectoration, fever, the need to sleep in a sitting position, and edema was evaluated. Pain was assessed with a numeric rating scale (NRS) that range from 0 to 10, from least to greatest pain. Variables were obtained through interviews with patients. Co-morbidities were based on a review of the patient's clinical history (no. of comorbidities), and the Charlson index modified by age, which classifies the degree of comorbidity into three categories (absence 0–1; low 2; high  $\geq 3$ ),<sup>30</sup> was calculated.

### Psychological variables

Anxiety and depression were assessed with the Hospital Anxiety and Depression scale<sup>31,32</sup> which consists of 14 questions (seven aspects of anxiety, seven of depression) with four possible answers, with values that ranged from 0 to 3. The final result is separate sum of questions about anxiety and depression. Results were interpreted in the following manner: 0–7, no case; 8–10, a doubtful case; and >11, a probable case.

### Activity variables

The variables were evaluated using the Barthel questionnaire on the patient's dependence on others in the performance of activities of daily living. The metric is composed of 10 Likert-type items. The score categories are as follows: 0–20, total dependence; 21–60, severe dependence; 61–90, moderate dependence; 91–99, scarce dependence; and 100, independence.<sup>33</sup>

### Statistical analysis

Descriptive analysis of population characteristics was presented as percentages and means ( $\times$ )  $\pm$  typical standard deviation (SD). Comparative analysis of patients' characteristics was by centers. For nonparametric data, Fisher's exact test was used for qualitative data and the Mann–Whitney *U*-test was used for quantitative data. For parametric data, the chi-squared test was used for qualitative data and Student's *t*-test was used for quantitative data.

Relationship between the three dimensions of the SGRQ (symptoms, activity, and impact) and the eight questions from the CAT questionnaire and Pearson's correlation (*R*) index was used. To calculate the reliability and internal consistency of these metrics, Cronbach's index and Cronbach's  $\alpha$  coefficients at a 95% confidence interval were calculated.

To identify the variables that influence the total scores of the CAT and the SGRQ questionnaires, a univariate analysis was performed with Pearson's *R* index. The variables that were statistically significant ( $p < 0.05$ ) in both questionnaires were selected as independent variables for a forward stepwise multiple linear regression analysis. The first variable introduced in the model was the variable that had the greatest correlation with the total score of the SGRQ and CAT questionnaires, with the rest of the variables that correlated with the total scores of the questionnaires successively added.

For purposes of interpretation, all *p* values were reported, and  $p < 0.05$  was considered statistically significant. Our statistical study used the SPSS software v.23 for Windows.

### Ethical considerations

This study was approved by the bioethics and research committee at HCB, HUGC, and the Deontological Commission at Universitat Jaume I. Its design and implementation were carried out following the rules specified to the Helsinki Declaration. Data treatment was based on the Organic Law on the Protection of Personal Data, 15/1999 of 13 December. Participant anonymity and data confidentiality were guaranteed. Data were not accessible to individuals outside of the study.

## Results

### Population characteristics

A total of 231 patients were admitted for a COPD exacerbation, 77 to HCB, and 154 to HUGC. The population profile was 81.4% ( $n = 188$ ) male, with a mean age of  $73.3 \pm 9.3$  years and basic studies performed in 47.6% ( $n = 110$ ) of the cases.

Clinically, 37.6% ( $n = 85$ ) had grade III dyspnea according to the MRC scale, 66.8% ( $n = 157$ ) had a cough, 75.3% ( $n = 177$ ) had expectoration, 40.9% ( $n = 96$ ) had wheezing, and high comorbidity burden was present in 89.6% ( $n = 207$ ). Anxiety was present in 18.3% ( $n = 42$ ) of patients, and depression was diagnosed in 20.9% ( $n = 48$ ). The need for help to carry out basic daily life activities was moderate in 40.3% ( $n = 93$ ) of the cases.

The patient profile was homogeneous in variables such as age ( $p = 0.189$ ), gender ( $p = 0.141$ ), and expectoration ( $p = 0.410$ ). The remaining variables studied were different between the hospitals

**Table 1.** Characteristics of the total sample and by hospital.

Sociodemographic	Total (N = 231)	HCB (n = 77)	HUGC (n = 154)	p
Gender n (%) <sup>b</sup>				
Males	188 (81.4)	66 (85.7)	122 (79.2)	0.189
Females	43 (18.6)	11 (14.3)	32 (20.8)	
Age mean $\pm$ (SD) <sup>c</sup>	73.3 $\pm$ 9.3	72.4 $\pm$ 7.9	73.7 $\pm$ (9.8)	0.141
Level of studies <sup>b</sup>				
Without studies	33 (14.3%)	7 (9.1%)	26 (16.9%)	0.062
Basic studies	110 (47.6%)	35 (45.5%)	75 (48.7%)	
Secondary studies or FP	65 (28.1%)	23 (29.9%)	42 (27.3%)	
University studies	23 (10.0%)	12 (15.6%)	11 (7.1%)	
Clinical variables				
Dyspnea (MRC) n (%) <sup>c</sup>				
0	5 (2.2%)	2 (2.6%)	3 (2.0%)	<0.001
I	24 (10.6%)	18 (23.4%)	6 (4.0%)	
II	69 (30.5%)	39 (50.6%)	30 (20.1%)	
III	85 (37.6%)	18 (23.4%)	67 (45.0%)	
IV	43 (19.0%)	–	43 (28.9%)	
Cough n (%) <sup>a</sup>	157 (66.8%)	64 (83.1%)	93 (60.4%)	0.001
Expectoration n (%) <sup>a</sup>	177 (75.3%)	62 (80.5%)	115 (74.7%)	0.410
Wheezing n (%) <sup>a</sup>	96 (40.9%)	22 (28.6%)	74 (48.1%)	0.005
Daytime drowsiness <sup>a</sup>	53 (22.6%)	6 (7.8%)	47 (30.5%)	0.000
Fever n (%) <sup>a</sup>	27 (11.5%)	3 (3.9%)	24 (15.6%)	0.009
Edema n (%) <sup>a</sup>	63 (26.8%)	6 (7.8%)	57 (37.0%)	<0.001
Need to sleep in sitting position <sup>a</sup>	93 (39.6%)	4 (5.2%)	89 (57.8%)	<0.001
Pain (VAS) mean $\pm$ (SD) <sup>d</sup>	0.97 $\pm$ 1.9	0.09 $\pm$ 0.4	1.4 $\pm$ (2.3)	<0.001
No. of comorbidities mean $\pm$ (SD) <sup>c</sup>	3.1 $\pm$ 2.1	3.6 $\pm$ 2.3	2.9 $\pm$ 2.0	0.010
Charlson index n (%) <sup>a</sup>				
Absence	7 (3.0%)	4 (5.2%)	3 (2.0%)	0.008
Low	13 (5.6%)	9 (11.7%)	4 (2.7%)	
High	207 (89.6%)	64 (83.1%)	143 (95.3%)	
Psychological variables				
Anxiety n (%) <sup>a</sup>				
No case	136 (59.1%)	51 (66.2%)	85 (55.5%)	0.037
Doubtful case	52 (22.6%)	13 (16.9%)	39 (25.5%)	
Probable case	42 (18.3%)	13 (16.9%)	29 (19.0%)	
Depression n (%) <sup>a</sup>				
No case	129 (56.1%)	50 (64.9%)	79 (51.6%)	0.003
Doubtful case	53 (23.0%)	16 (20.8%)	37 (24.2%)	
Probable case	48 (20.9%)	11 (14.3%)	37 (24.2%)	
Basic daily life activities <sup>d</sup>				
Barthel's index n (%) <sup>a</sup>				
Total dependence	8 (3.4%)	–	8 (5.2%)	<0.001
Severe dependence	33 (14.3%)	1 (1.3%)	32 (20.8%)	
Moderate dependence	93 (40.3%)	17 (22.1%)	76 (49.4%)	
Scarce dependence	12 (5.2%)	3 (3.9%)	9 (5.8%)	
Independence	85 (36.8%)	56 (72.7%)	29 (18.8%)	
HRQL				
CAT_total mean $\pm$ (SD)	41.9 $\pm$ 8.6	18.6 $\pm$ 7.6	23.6 $\pm$ 7.6	<0.001
SGRQ_total mean $\pm$ (SD)	50.2 $\pm$ 19.6	51.2 $\pm$ 17.8	49.6 $\pm$ 20.5	<0.001

HCB: Hospital Clínic of Barcelona; HUGC; Hospital Universitario General of Castellón; p: p-value; MRC: Medical Research Council; VAS: visual analogue scale; HRQL: health-related quality of life.

<sup>a</sup>Fisher's exact test.

<sup>b</sup>Pearson's chi-squared test.

<sup>c</sup>Student's t-test.

<sup>d</sup>Mann-Whitney U-test.

**Table 2.** Internal consistency and correlation between scales.

	Possible range of scores	Questions	Correlation	Cronbach's $\alpha$ coefficient (95% CI)	Mean $\pm$ SD	Ma-xMin
CAT_total	(0–40)	8	0.614 <sup>a</sup>	0.827 (0.791–0.859)	21.9 $\pm$ 8.0	65–2
SGRQ_total	(0–100)	50		0.836 (0.795–0.869)	50.2 $\pm$ 19.6	96–8

CAT: COPD assessment test; SGRQ; St. George Questionnaire; CI: confidence interval; SD: standard deviation; Max: maximum; Min: minimum.

<sup>a</sup>The correlation is significant on level 0.01 (bilateral).

**Table 3.** Correlation matrix of the health-related quality-of-life questionnaires.

	SRGQ_SYMPTOMS	SGRQ_ACTIVITY	SGRQ_IMPACT
CAT cough	0.330 <sup>a</sup>	0.124	0.197 <sup>a</sup>
CAT phlegm	0.416 <sup>a</sup>	0.207 <sup>a</sup>	0.255 <sup>a</sup>
CAT tightness	0.370 <sup>a</sup>	0.282 <sup>a</sup>	0.330 <sup>a</sup>
CAT climbing stairs	0.422 <sup>a</sup>	0.544 <sup>a</sup>	0.525 <sup>a</sup>
CAT household activities	0.372 <sup>a</sup>	0.514 <sup>a</sup>	0.496 <sup>a</sup>
CAT security outside the house	0.392 <sup>a</sup>	0.465 <sup>a</sup>	0.540 <sup>a</sup>
CAT sleeping	0.465 <sup>a</sup>	0.435 <sup>a</sup>	0.518 <sup>a</sup>
CAT energy	0.391 <sup>a</sup>	0.482 <sup>a</sup>	0.501 <sup>a</sup>

CAT: COPD Assessment Test; SGRQ: St. George Questionnaire.

<sup>a</sup>The correlation is significant on level 0.01 (bilateral).

**Table 4.** Correlation coefficients of the questionnaires and sample characteristics.

	CAT score (R)	SGRQ score (R)
Age	0.029	0.103
Level of studies	–0.057	–0.070
Dyspnea (MRC)	0.548 <sup>a</sup>	0.419 <sup>a</sup>
Cough	0.116	0.096
Expectoration	0.115	0.100
Wheezing	0.247 <sup>a</sup>	0.270 <sup>a</sup>
Daytime drowsiness	0.188 <sup>a</sup>	0.234 <sup>a</sup>
Fever	0.034	0.035
Edema	0.169 <sup>b</sup>	0.197 <sup>a</sup>
Need to sleep in sitting position	0.249 <sup>a</sup>	0.156 <sup>b</sup>
Pain (VAS)	0.261	0.248 <sup>a</sup>
No. of comorbidities	–0.071	0.071
Charlson index	0.063	–0.006
Anxiety	–0.450 <sup>a</sup>	0.549 <sup>a</sup>
Depression	0.456 <sup>a</sup>	0.571 <sup>a</sup>
Barthel's index	–0.450 <sup>a</sup>	–0.405 <sup>a</sup>

MRC: Medical Research Council; VAS: visual analogue scale; CAT: COPD Assessment Test; SGRQ: St. George Questionnaire.

<sup>a</sup>The correlation is significant on level 0.01 (bilateral).

<sup>b</sup>The correlation is significant on level 0.05 (bilateral).

( $p < 0.05$ ), with the most significant ( $p < 0.001$ ) differences being dyspnea, daytime drowsiness, edema, pain, the number of comorbidities, and

**Table 5.** Multiple linear regression.

Independent variables	CAT score		SGRQ score	
	B <sup>a</sup>	p <sup>b</sup>	B <sup>a</sup>	p <sup>b</sup>
Dyspnea (MRC)	3.155	0.000	2.625	0.073
Wheezing	1.504	0.108	5.068	0.022
Daytime drowsiness	–0.585	0.602	1.541	0.561
Edema	–1.054	0.305	–0.376	0.884
Need to sleep in sitting position	–1.193	0.274	–0.603	0.014
Anxiety	–0.053	0.039	1.305	0.001
Depression	0.335	0.048	1.352	0.001
Barthel's index	0.264	0.113	–0.147	0.016
Summary of the model (R <sup>2</sup> )	0.394		0.435	

MRC: Medical Research Council; CAT: COPD Assessment Test; SGRQ: St. George Questionnaire.

<sup>a</sup>Regression coefficient.

<sup>b</sup>Statistical significance for Wald's Chi squared.

dependence in the performance of daily activities (Table 1).

### *The homogeneity and reliability of the total results of both questionnaires*

Patients presented with greatly affected HRQL, independent of the scale used, despite the significant

differences ( $p < 0.01$ ) between the hospitals (Table 1). There was a significant correlation ( $r = 0.614$ ;  $p < 0.01$ ) between the total scores of the CAT and SGRQ questionnaires, as seen in the dispersion diagram and Table 2. This strong correlation ( $p < 0.01$ ) was also noted between all of the questions from the CAT questionnaire and the subscales (symptoms, activity, impact) of the SGRQ questionnaire, except for the presence of a cough in the CAT questionnaire with the activity subscale of the SGRQ ( $r = 0.124$ ,  $p > 0.05$ ; Table 3).

### *The correlation between population characteristics and total SGRQ and CAT scores*

Regarding the internal consistency and reliability of the scales, both had Cronbach's  $\alpha$  coefficients above 0.8 (CAT 0.827 vs. SGRQ 0.836; Table 2).

With respect to the relationship between the total scores of the CAT and SGRQ with sample characteristics, Pearson's correlation coefficients showed a significant correlation ( $p < 0.01$ ) between both questionnaires with the presence of dyspnea (CAT  $r = 0.548$ ,  $p < 0.01$  vs. SGRQ  $r = 0.419$ ,  $p < 0.01$ ), wheezing (CAT  $r = 0.247$ ,  $p < 0.01$  vs. SGRQ  $r = 0.270$ ,  $p < 0.01$ ), daytime drowsiness (CAT  $r = 0.188$ ,  $p < 0.01$  vs. SGRQ  $r = 0.270$ ,  $p < 0.01$ ), anxiety (CAT  $r = 0.450$ ,  $p < 0.01$  vs. SGRQ  $r = 0.549$ ,  $p < 0.01$ ), depression (CAT  $r = 0.456$ ,  $p < 0.01$  vs. SGRQ  $r = 0.571$ ,  $p < 0.01$ ), and increased dependence on others in the performance of activities of daily life (CAT  $r = 0.450$ ,  $p < 0.01$  vs. SGRQ  $r = 0.405$ ,  $p < 0.01$ ). Other variables, such as the presence of edema, had greater correlation with the SGRQ ( $r = 0.419$ ,  $p < 0.01$ ) than the CAT ( $r = 0.197$ ,  $p < 0.05$ ). The need to sleep in a sitting position had inverse results with the CAT ( $r = 0.249$ ,  $p < 0.01$ ) vs. the SGRQ ( $r = 0.156$ ,  $p < 0.05$ ). However, pain was significantly correlated only with the SGRQ score ( $r = 0.248$ ,  $p < 0.01$ ; Table 4).

To best determine which questionnaire can best predict changes in variables related to HRQL, a multiple linear regression analysis was performed, introducing into the regression model those variables that had a significant correlation  $p < 0.01$  with both questionnaires (dyspnea, wheezing, daytime drowsiness, anxiety, depression, and dependence in performing daily life activities). Three variables were obtained from the CAT questionnaire that could predict HRQL, with dyspnea, anxiety, and depression explaining 39.4% of the variance. The SGRQ had five variables that could predict HRQL, with the wheezing, the need

to sleep in a sitting position, anxiety, depression, and dependence in the execution of activities of daily living able to explain 43.5% of the variance (Table 5).

## **Discussion**

Based on our results, both questionnaires are similar based on their psychometric properties. The SGRQ is more precise than the CAT in the measurement of HRQL in exacerbated patients in the hospital settings. However, both questionnaires have high levels of consistency for use in this type of population.

The sociodemographic profile of the sample was similar in both centers and similar to data presented in epidemiological work in Spain<sup>34</sup> or internationally.<sup>35</sup> Differences close to significance existed in aspects such as educational level, where one of the centers had a greater number of patients with university degrees, which could justify the lower HRQL of patients from the HUGC.<sup>36,37</sup>

Despite the homogeneity of the inclusion criteria of both centers, patients had a higher degree of dyspnea, expectoration, wheezing, daytime drowsiness, fever, edema, the need to sleep in a sitting position, the pain, number of comorbidities, anxiety, depression, and dependence in the performance of daily activities in the HUGC versus the HCB.

Both HRQL evaluation scales identified great affectation of HRQL in COPD patients, results evidenced through three questionnaires in the Wacker study.<sup>22</sup> Our data are therefore in line with studies that state that hospital admission and its duration are associated with a reduced quality of life in patients with COPD and greatly impact the patient's HRQL.<sup>38,39</sup> Nonetheless, the degree of this impact varied based on the questionnaire used and the center, regardless of the initial clinical differences. The CAT questionnaire scores were higher in the hospital whose patients had the worst health statuses.

Both the SGRQ and CAT questionnaires have a degree of internal consistency above 0.7, which is similar to the review published by Weldam (9) on the attributes of the questionnaires designed for HRQL assessment in patients with respiratory problems, or with other studies that have measured this item in patients with stable COPD.<sup>21</sup> SGRQ had the highest levels of internal consistency in unstable COPD population COPD with requirement of hospital admission; these results were also identified in patients with stable COPD.<sup>21</sup>

A correlation between the results of both questionnaires has been previously evaluated, with values that range from 0.72 to 0.84,<sup>8,11,15</sup> which have even achieved a correlation between the SGRQ subscales with the total results of the CAT.<sup>25</sup> However, the study by Morishita-Katsu (21) with an outpatient population calculated a correlation of 0.668.

All the variables that were statistically significant in the CAT questionnaire were significant in the SGRQ, indicating that HRQL was related to variables, such as dyspnea,<sup>37,40–43</sup> depression,<sup>43–45</sup> and degree of immobility<sup>46,47</sup> with a high level of significance and support from prior scientific literature. However, age was identified only by the SGRQ as a predictor of changes in HRQL, and the results are supported by prior scientific evidence.<sup>36,37,43,48</sup> Pain had a statistical relationship only with the SGRQ scale, and it was associated with a worse perception of HRQL and higher levels of perceived health.<sup>43</sup> This observation could be explained by the existence of an item that evaluates pain in the SGRQ questionnaire, which was not present in the CAT questionnaire.

In contrast, other variables such as age<sup>36,39,48–50</sup> and the number and type of comorbidities<sup>24,51</sup> were not related to HRQL, standing against other studies that do establish a relationship between them.

The multiple regression analysis revealed that only 39.4% of the variance of the CAT scores were explained by dyspnea, anxiety, and depression, results that would indicate the existence of other unmeasured factors that would explain the CAT scores, like lung function.<sup>47,49</sup> The SGRQ revealed a greater explanation of variance, with 43.5% explained by a higher number of variables, including wheezing, the need to sleep in sitting position, anxiety, depression, and dependence. A similar result occurs in a population with stable COPD, where the SGRQ can better predict HRQL (63%) compared with the CAT (37%).<sup>21</sup>

Our results therefore support prior research that concludes that the most suitable questionnaires for assessing HRQL in patients with COPD are those created specifically for patients with respiratory pathology, given that they are not sensitive enough to detecting changes in patient's health status.<sup>51</sup>

This study is part of a broader evaluation of a structured therapeutic education program, whose principal objective is not to compare both HRQL measurement scales. Due to this, the time needed to complete the questionnaire has not been evaluated and a test–retest has not been performed on the same population to confirm the temporal stability of both questionnaires. Our

data collection method, which consists of a self-administered modality vs. interview modality, has not been considered. While both questionnaires are reliable in both modalities, these have not been analyzed in patients with exacerbated COPD in the hospital settings.

## Conclusion

In conclusion, the CAT questionnaire has psychometric properties similar to those of the SGRQ questionnaire, their internal consistency is similar, and there is a strong correlation between both metrics. Hence, the CAT questionnaire is a good assessment tool for HRQL in exacerbated patients with COPD in the hospital settings, when time is limited. Although the questionnaires are similar, in our regression analysis, the SGRQ questionnaire was better able to predict changes in HRQL with a higher number of variables. The CAT questionnaire may differ from the SGRQ in the measurement of HRQL because of the multiple circumstances that alter HRQL in exacerbated patients in the hospital settings. Measurement may therefore be more precise with the SGRQ questionnaire.


## Declaration of conflicting interests

The author(s) declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The study was partially funded by the Spanish Society of Pneumology and Thoracic Surgery (SEPAR), Nursing area (191/2013).

## ORCID iD

Ana Folch Ayora  <http://orcid.org/0000-0002-0210-6162>  
 María Isabel Orts-Cortés  <http://orcid.org/0000-0002-1504-575X>

## References

1. Godtfredsen NS, Lam TH, Hansel TT, et al. COPD-related morbidity and mortality after smoking cessation: status of the evidence. *Eur Respir J* 2008; 32(4): 844–853.
2. Mathers CD, Fat DM, Inoue M, et al. Counting the dead and what they died from: an assessment of the global status of cause of death data. *Bull World Health Organ* 2005; 83(3): 171–177.
3. Miravittles M, Soler-Cataluña J, Calle M, et al. Guía española de la enfermedad pulmonar obstructiva



- crónica (GesEPOC) 2017. Tratamiento farmacológico en fase estable. *Arch Bronconeumol* 2017; 53(6): 324–335. Doi: 10.1016/j.arbres.2017.03.018.
4. Vestbo J, Hurd SS, Agustí AG, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *Am J Respir Crit Care Med* 2013; 187(4): 347–365.
  5. Sullivan SD and Ramsey SC. The economic burden in COPD. *Chest* 2000; 117: S5–S9.
  6. Sedeno MF, Nault D, Hamd DH, et al. A self-management education program including an action plan for acute COPD exacerbations. *COPD* 2009; 6(5): 352–358.
  7. Soler JJ, Martínez-García MA, Román P, et al. Effectiveness of a specific program for patients with chronic obstructive pulmonary disease and frequent exacerbations. *Arch Bronconeumol* 2006; 42(10): 501–508.
  8. Jones PW, Harding G, Berry P, et al. Development and first validation of the COPD Assessment Test. *Eur Respir J* 2009; 34(3): 648–654.
  9. Weldam SWM, Schuurmans MJ, Liu R, et al. Evaluation of quality of life instruments for use in COPD care and research: a systematic review. *Int J Nurs Stud* 2013; 50(5): 688–707.
  10. Ferrer M, Alonso J, Prieto L, et al. Validity and reliability of the St George's Respiratory Questionnaire after adaptation to a different language and culture: the Spanish example. *Eur Respir J* 1996; 9(6): 1160–1166.
  11. Jones PW, Brusselle G, Dal Negro RW, et al. Properties of the COPD assessment test in a cross-sectional European study. *Eur Respir J* 2011; 38(1): 29–35.
  12. Agusti A, Soler-Cataluña JJ, Molina J, et al. Does the COPD assessment test (CAT™) questionnaire produce similar results when self- or interviewer administered? *Qual Life Res* 2015; 24(10): 2345–2354.
  13. Jones PW. Quality of life measurement for patients with diseases of the airways. *Thorax* 1991; 46: 676–682.
  14. Jones PW, Quirk FH, Baveystock CM, et al. A self-complete measure of health status for chronic airflow limitation: the St. George's respiratory questionnaire. *Am Rev Respir Dis* 1992; 145(6): 1321–1327.
  15. Ringbaek T, Martinez G, and Lange P. A comparison of the assessment of quality of life with CAT, CCQ, and SGRQ in COPD patients participating in pulmonary rehabilitation. *COPD J Chronic Obstr Pulm Dis* 2012; 9(1): 12–15.
  16. Harper R, Brazier JE, Waterhouse JC, et al. Comparison of outcome measures for patients with chronic obstructive pulmonary disease (COPD) in an outpatient setting. *Thorax* 1997; 52(10): 879–887.
  17. Tsiligianni IG, Alma HJ, de Jong C, et al. Investigating sensitivity, specificity, and area under the curve of the Clinical COPD Questionnaire, COPD Assessment Test, and Modified Medical Research Council scale according to GOLD using St George's Respiratory Questionnaire cutoff 25 (and 20) as reference. *Int J Chron Obstruct Pulmon Dis* 2016; 11: 1045–1052.
  18. Ninot G, Soye F, and Préfaut C. A short questionnaire for the assessment of quality of life in patients with chronic obstructive pulmonary disease: psychometric properties of VQ11. *Health Qual Life Outcomes* 2013; 11: 179.
  19. Chaplin E, Gibb M, Sewell L, et al. Response of the COPD assessment tool in stable and postexacerbation pulmonary rehabilitation populations. *J Cardiopulm Rehabil Prev* 2015; 35(3): 214–218.
  20. Hajiro T, Nishimura K, Tsukino M, et al. Comparison of discriminative properties among disease-specific questionnaires for measuring health-related quality of life in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1998; 157(4): 785–790.
  21. Morishita-Katsu M, Nishimura K, Taniguchi H, et al. The COPD assessment test and St George's Respiratory Questionnaire: are they equivalent in subjects with COPD? *Int J Chron Obstruct Pulmon Dis* 2016; 11: 1543–1551.
  22. Huber MB, Wacker ME, Vogelmeier CF, et al. Comorbid influences on generic health-related quality of life in COPD: a systematic review. *PLoS One* 2015; 10(7): e0132670.
  23. Jones PW, Tabberer M, and Chen WH. Creating scenarios of the impact of COPD and their relationship to COPD Assessment Test (CAT™) scores. *BMC Pulm Med* 2011; 11: 42.
  24. Smid DE, Wilke S, Jones PW, et al. Impact of cardiovascular comorbidities on COPD Assessment Test (CAT) and its responsiveness to pulmonary rehabilitation in patients with moderate to very severe COPD: protocol of the Chance study. *BMJ Open* 2015; 5(7): e007536.
  25. Nagata K, Tomii K, Otsuka K, et al. Evaluation of the chronic obstructive pulmonary disease assessment test for measurement of health-related quality of life in patients with interstitial lung disease. *Respirology* 2012; 17(3): 506–512. DOI: 10.1111/j.1440-1843.2012.02131.x
  26. Hernandez Carcereny C, Seijas N, Folch A, et al. Impact of therapeutic education program for COPD patients on preventing readmissions (Aprendeepoc). In: 93 Nurses. *Eur Respir Soc* 2016; PA1614.
  27. Folch A, Orts-Cortés MI, Hernández-Carcereny C, et al. Programas educativos en pacientes con Enfermedad Pulmonar Obstructiva Crónica. Revisión integradora. *Enfermería Glob* 2016; 16(1): 537.

28. Alonso-Ferrer J, Mon-Plaza L, and Prieto V. St George validity and reliability of the Spanish version of the St. George's Respiratory Questionnaire.
29. Casanova Macarioa C, García-Talavera Martín I, and de Torres Tajés JP. La disnea en la EPOC. *Arch Bronconeumol* 2005; 41(Supl 3): 24–32.
30. Wang R and Ma X. Clarification on the categorization of comorbidities. *Leuk Res* 2010; 34(2): e74.
31. Tejero A, Guimerá E, Farré J, et al. Uso clínico del HAD (Hospital Anxiety and Depression Scale) en población psiquiátrica: Un estudio de su sensibilidad; fiabilidad y validez. *Rev del Dep Psiquiatr la Fac Med Barcelona* 2015; 13: 233–238.
32. Vallejo MA, Rivera J, Esteve-Vives J, et al. Use of the Hospital Anxiety and Depression Scale (HADS) to evaluate anxiety and depression in fibromyalgia patients. *Rev Psiquiatr y salud Ment* 2012; 5(2): 107–114.
33. Cid-Ruzafa J and Damián-Moreno J. Valoración de la discapacidad física: el índice de Barthel. *Rev Esp Salud Publica* 1997; 71(2): 127–137.
34. Soriano JBM. Datos epidemiológicos de EPOC en España. *Arch Bronconeumol* 2007; 43(Supl 1): 2–9.
35. Siddique HH, Olson RH, Parenti CM, et al. Randomized trial of pragmatic education for low-risk COPD patients: impact on hospitalizations and emergency department visits. *Int J Chron Obstruct Pulmon Dis* 2012; 7: 719–728.
36. Mroczek B, Sitko Z, Augustyniuk K, et al. *Socioeconomic Indicators Shaping Quality of Life and Illness Acceptance in Patients with Chronic Obstructive Pulmonary Disease*. In: Pokorski M. (eds) *Respiratory Health. Advances in Experimental Medicine and Biology*, vol 861. Springer International Publishing, 2015, p. 19–30.
37. Hong Y, Lim MN, Kim WJ, et al. Influence of environmental exposures on patients with chronic obstructive pulmonary disease in Korea. *Tuberc Respir Dis (Seoul)* 2014; 76(5): 226–232.
38. Sahadevan A, Baily C, Cullen L, et al. The efficacy of COPD outreach in reducing length of stay and improving quality of life. *Ir Med J* 2015; 108(6): 169–171.
39. Hong JY, Kim SY, Chung KS, et al. Factors associated with the quality of life of Korean COPD patients as measured by the EQ-5D. *Qual Life Res* 2015; 24(10): 2549–2558.
40. Barusso MS, Gianjoppe-Santos J, Basso-Vanelli RP, et al. Limitation of activities of daily living and quality of life based on COPD combined classification. *Respir Care* 2015; 60(3): 388–398.
41. Siebeling L, Musoro JZ, Geskus RB, et al. Prediction of COPD-specific health-related quality of life in primary care COPD patients: a prospective cohort study. *NPJ Prim care Respir Med* 2014; 24: 14060.
42. Weldam SWM, Lammers JWJ, Heijmans MJWM, et al. Perceived quality of life in chronic obstructive pulmonary disease patients: a cross-sectional study in primary care on the role of illness perceptions. *BMC Fam Pract* 2014; 15: 140.
43. Villar Balboa I, Carrillo Muñoz R, Regí Bosque M, et al. Factores relacionados con la calidad de vida de los pacientes con enfermedad pulmonar obstructiva crónica. *Atención Primaria* 2014; 46(4): 179–187.
44. Sundh J, Johansson G, Larsson K, et al. Comorbidity and health-related quality of life in patients with severe chronic obstructive pulmonary disease attending Swedish secondary care units. *Int J Chron Obstruct Pulmon Dis* 2015; 10: 173–183.
45. Ioanna T, Kocks J, Tzanakis N, et al. Factors that influence disease-specific quality of life or health status in patients with COPD: a systematic review and meta-analysis of Pearson correlations. *Prim Care Respir J* 2011; 20(3): 257–268.
46. Caulfield B, Kaljo I, and Donnelly S. Use of a consumer market activity monitoring and feedback device improves exercise capacity and activity levels in COPD. In: *2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*. 26-30 August 2014, p. 1765–1768. Chicago: IEEE.
47. Nonato NL, Díaz O, Nascimento OA, et al. Comportamiento de la calidad de vida (SGRQ) en pacientes con EPOC según las puntuaciones BODE. *Arch Bronconeumol* 2015; 51(7): 315–321.
48. Wu M, Zhao Q, Chen Y, et al. Quality of life and its association with direct medical costs for COPD in urban China. *Health Qual Life Outcomes* 2015; 13: 57.
49. Nagai K, Makita H, Suzuki M, et al. Differential changes in quality of life components over 5 years in chronic obstructive pulmonary disease patients. *Int J Chron Obstruct Pulmon Dis* 2015; 10: 745–757.
50. Holm KE, Plaufcan MR, Ford DW, et al. The impact of age on outcomes in chronic obstructive pulmonary disease differs by relationship status. *J Behav Med* 2014; 37(4): 654–663.
51. Wacker ME, Jörres RA, Karch A, et al. Assessing health-related quality of life in COPD: comparing generic and disease-specific instruments with focus on comorbidities. *BMC Pulm Med* 2016; 16(1): 70.