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An empirical comparison of the WHOQOL-BREF and the SGRQ among patients with COPD

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Abstract
Aims To compare the psychometric properties of the World Health Organization Quality of Life-BREF (WHOQOL-BREF) instrument and the St. George's Respiratory Questionnaire (SGRQ), and to examine the association between pulmonary function and domains and items of these questionnaires in patients with chronic obstructive pulmonary disease (COPD).
Methods The WHOQOL-BREF and the SGRQ were administered to 211 patients. The reliability and validity of, and correlations among, the domain scores were examined. Multiple regression analyses were performed to identify which items were independently associated with subjects' lung functions.
Results Both questionnaires showed good internal consistency ($\alpha > 0.8$), except the SGRQ symptoms domain ($\alpha = 0.66$), minimal ceiling and floor effects, and good item convergent and item discriminant validity. There were moderate correlations between physical domain of the WHOQOL-BREF and activity, impacts and total domains of the SGRQ, and between psychological domain of the WHOQOL-BREF and impacts and total domains of the SGRQ. Eighteen items were significantly associated with lung function, particularly those items relating to mobility/walking and activities of daily living (ADL).
Conclusion Both the WHOQOL-BREF and the SGRQ showed comparable reliability and validity. Items related to mobility/walking and ADL may be useful in clinical screening for lung function impairment.

Keywords Chronic obstructive pulmonary disease · Health-related quality of life · SGRQ · WHOQOL-BREF

Abbreviations

COPD	Chronic obstructive pulmonary disease
FEV_1	Forced expiratory volume in 1 s
FVC	Forced vital capacity
GOLD	Global initiative for chronic obstructive lung disease

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HRQL	Health-related quality of life
MTMM	Multitrait-multimethod correlation matrix
QOL	Quality of life
SGRQ	St. George's Respiratory Questionnaire
WHOQOL-BREF	World Health Organization Quality of Life-BREF

Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity and mortality, and represents a substantial economic and social burden throughout the world. It is the fifth leading cause of death worldwide and its prevalence and mortality rate are projected to increase in the coming decades [1]. As they age, patients with COPD must cope with the gradual deterioration of their pulmonary function and with increased psychological, social, and financial stress associated with such a progressive change [2]. Many studies have incorporated health-related quality of life (HRQL) measurement in assessing the impact and progression of chronic diseases, including COPD [3–8].

A good number of questionnaires have been developed and used to assess the HRQL of patients and the general population, and they differ in numerous ways, such as goals, contents, scaling methods and cultural factors. Generic questionnaires, such as the Short-Form 36 (SF-36) [9–11] and the World Health Organization Quality of Life-BREF (WHOQOL-BREF) [12, 13], measure relatively broad domains and can be used to conduct comparisons across different diseases, ethnicities, and cultures. Disease-specific questionnaires, such as the St. George's Respiratory Questionnaire (SGRQ) [14, 15] and the Chronic Respiratory Questionnaire [16], measure the extent to which certain symptoms of a particular disease impact on various HRQL domains.

The WHOQOL-BREF and the SGRQ are two well-validated questionnaires that have been extensively applied in the clinical assessment of HRQL of patients [17–20]. However, to our knowledge, there has been no comparative evaluation of these two questionnaires in COPD patients. By examining the comparative reliability and validity of these two instruments, and determining the extent to which each correlates with pulmonary function of COPD patients, we will be able to have a better understanding of the strengths and weaknesses of each questionnaire, and thus provide information which will help in the interpretation of these two instruments of patient reported outcomes [21]. In addition, since lung function directly reflects the progressive change of a COPD patient, but is not measured at each clinical visit, it may be useful for a clinician to have a quick screening tool for early detection of their changes and prescription for such a test. Thus, we were also interested in whether certain items would be significant predictors for impairment of lung function and potentially useful in daily clinical practice.

Methods

Study populations and data collection

Patients with a diagnosis of COPD according to the 2003 global initiative for chronic obstructive lung disease (GOLD) [22–24] were enrolled in the study. According to the World Health Organization GOLD, smoking is a major cause of COPD [22]. In Taiwan, prevalence of smoking (including ex-smokers) among males over 50 years is approximately 54%, compared with only about 4% in females in the same age group in 2001 [25]. There were relatively few female patients with COPD compared with males in the clinical setting. Thus, we focused our analysis on male COPD patients. A total of 211 patients were consecutively recruited from outpatient clinics of two teaching hospitals and two local hospitals in central Taiwan from January 1, 2003 to April 1, 2005. Those who had cognitive problems and lung cancer were excluded. All consented participants were interviewed in person by a trained nurse in each of the four outpatient clinics.

HRQL was assessed by the WHOQOL-BREF Taiwanese version [26] and the Chinese version of the St. George's respiratory questionnaire (SGRQ) [27, 28]. Data about socio-demographic characteristics and medical history were also obtained. Lung function examinations were performed on the same visit and included forced expiratory volume in 1 s (FEV_1), forced vital capacity (FVC), and FEV_1/FVC ratio from spirometry (JAEGER, MasterScreen PFT). Patients were then divided into five groups based on their lung function parameters as defined by the 2003 GOLD guidelines: stage 0 (at risk), stage I (mild COPD), stage II (moderate COPD), stage III (severe COPD), and stage IV (very severe COPD) [23].

Measurement tools

The WHOQOL-BREF

The WHOQOL-BREF Taiwanese version is comprised of two general items, 24 items universally adopted for the WHOQOL-BREF to cover four domains (physical, psychological, social, and environment), and two culturally-specific items for use in Taiwan ("Do you feel respected by others?" and "Are you usually able to get the things you like to eat?") [26]. Negatively-worded items are recoded, so a higher score always indicates a better HRQL, ranging

from 1 to 5. Each domain score was transformed to a 4–20 score according to the WHOQOL guidelines [29].

The SGRQ

A translated and validated version of the SGRQ for use in Taiwan was utilized [27, 28]. The SGRQ is composed of 50 items measuring three domains: (1) symptoms—to assess the frequency and severity of the patient's symptoms; (2) activity—to determine how a patient's respiratory status affects their daily activities; and (3) impacts—to investigate the socio-functional and psychological impairment imposed upon the patient by respiratory diseases. The response options range from 2- to 5-point ordinal scales and each question is weighted individually for scoring. The domain score is expressed as a percentage of the weighted total of all the questions; the numerator is the weighted score of the patient in that domain, and the denominator is the highest score that can be obtained in that domain, ranging from 0 to 100%. The total domain sums up all weighted items of the above three domains, which reflects the overall health situation. Higher scores indicate poorer HRQL [30].

Statistical analysis

Known-groups validity

Patients' HRQL scores were presented as means for each disease stage. Analysis of variance was used to test whether the domain scores in the two questionnaires could discriminate among different disease stages. Simple regression analysis was used to test whether there was a linear trend between disease stages and the domain scores.

Reliability

The internal consistency reliability of each domain was assessed by Cronbach's coefficient alpha. A value of 0.7 or greater was considered to be acceptable [31, 32].

Floor and ceiling effects

The floor effect was shown as the percentage of subjects with the lowest possible domain scores. The ceiling effect was presented as the percentage of subjects with the highest possible domain scores.

Item convergent validity and item discriminant validity

Item convergent validity and item discriminant validity were assessed to evaluate the scale construct for each questionnaire. Item convergent validity within each domain was evaluated by correlating each item with its respective scale (corrected for overlap). A corrected correlation greater than 0.4 was considered to be appropriate [10]. Item discriminant validity was assessed by comparing the correlation of each item with its own domain (corrected for overlap) with the correlation of each item with the other domains in the same questionnaire. An item was considered to be valid when it correlated significantly higher (two standard errors or more) with its own domain than with other domains in the same questionnaire [10].

Correlation analysis

A multitrait-multimethod correlation matrix (MTMM) [33, 34] was used to evaluate the relationships between the domains of the WHOQOL-BREF and the SGRQ. Moreover, the domain scores of these two instruments were also tested for correlations with the more objective pulmonary functions (FEV_1 percent predicted and FEV_1/FVC ratio). As a general guideline, correlations from 0.00 to 0.25 indicate little or no relationship, from 0.25 to 0.50 a fair degree of relationship, from 0.50 to 0.75 a moderate to good relationship, and above 0.75 a good to excellent relationship [32]. For inter-domain, intra-instrument correlations, we expected that the all domains within each of the two instruments were moderately correlated with each other, as our study subjects were homogenous male senior citizens suffering from COPD. For inter-domain, inter-instrument correlations, we hypothesized that: (1) the physical domain of the WHOQOL-BREF would have moderate to high correlations with the activity, impact and total domains of the SGRQ; (2) the psychological domain of the WHOQOL-BREF would have moderate to high correlations with the impact and total domains of the SGRQ; (3) the social domain of the WHOQOL-BREF would have moderate to high correlations with the impact and total domains of the SGRQ; and (4) the environmental domain of the WHOQOL-BREF would have a fair correlation with any domain of the SGRQ.

Items related to lung function impairment

We were interested in identifying whether certain items in the two instruments would be useful predictors that can serve as a sentinel to clinicians for early detection of progression of disease and subsequent prescription of lung function test. Two multiple regression models (one with FEV_1 percent predicted and the other one with FEV_1/FVC ratio as the dependent variable) were performed with each item separately as an independent variable to assess its ability in predicting a patient's lung function. Both models were adjusted for age, education level, marital status and smoking status. An item was considered to be a potential predictor if it was statistically significant ($P < 0.01$) in both models.

Results

Characteristics of subjects

A total of 211 male patients were enrolled and studied, with age ranging from 46 to 88 years and an average of 70.4. Mean FEV_1 percent predicted was 56.2% and the mean FEV_1/FVC ratio was 56%. About two-thirds of the participants had elementary school education or below, 183 (87.1%) lived with a spouse, and about a quarter were still current smokers. Most patients were in GOLD stage II or III, as summarized in Table 1. Because this study was designed and conducted during 2002–2005, we applied the 2003 GOLD criteria and therefore included patients with stage 0 or at risk.

Scaling properties of the WHOQOL-BREF and the SGRQ

Table 2 shows each of the mean domain scores decreased for the WHOQOL-BREF and increased for the SGRQ (all $P < 0.05$ for both analysis from ANOVA and test for a linear trend) at the later stages of COPD, indicating that patients' HRQL significantly deteriorated as their COPD became more severe. Both questionnaires had good internal consistency ($\alpha > 0.8$), except the SGRQ symptoms domain ($\alpha = 0.66$). Neither questionnaire showed a marked floor effect or ceiling effect (all domains were $< 7\%$). Table 2 also shows that both questionnaires had a high item discriminant validity, but the success rates for the item convergent validity for domains of the WHOQOL-BREF seemed higher than those of the SGRQ.

Table 1 Demographic and clinical characteristics of the COPD patients enrolled in this study ($n = 211$)

Variable	
Age, mean years (SD)	70.4 (8.1)
Lung function, mean % (SD)	
FEV_1[a] % predicted	56.2 (22.0)
FEV_1/FVC[b] ratio	56.0 (12.4)
Education, *n* (%)	
Elementary school and below	142 (67.6)
Junior and senior high school	58 (27.6)
Junior college and above	10 (4.8)
Married and lives with spouse, *n* (%)	183 (87.1)
Current smokers, *n* (%)	58 (27.6)
Disease severity[c], *n* (%)	
Stage 0: at risk	23 (10.9)
Stage I: mild	13 (6.2)
Stage II: moderate	74 (35.1)
Stage III: severe	84 (39.8)
Stage IV: very severe	17 (8.0)

[a] *FEV_1* Forced expiratory volume in 1 s

[b] *FVC* Forced vital capacity

[c] Classified according to 2003 GOLD criteria

Correlation analysis among HRQL domains and lung functions

Table 3 summarizes the results of correlation analysis between the WHOQOL-BREF and the SGRQ as well as correlations between their individual domains and lung function indicators. As expected, there were moderate to high inter-domain, intra-instrument correlations within the domains of each of the two instruments, except between the domains of symptoms and activity of the SGRQ. For inter-domain, inter-instrument analysis, all magnitudes of correlations were as we expected, except that the correlations between social domain of the WHOQOL-BREF and domains of impacts and total of the SGRQ were fair. There were fair correlations between both indicators of lung function and the physical domain of the WHOQOL-BREF as well as between lung function indicators and domains of the activity, impacts and total of the SGRQ.

Selection of potential predicting items of lung function impairment

Table 4 summarizes the significant items in predicting both major parameters of lung function (FEV_1 percent predicted and FEV_1/FVC ratio), which were obtained from multiple regression analyses with one HRQL item in each model after the adjustments for age, education, marriage, and smoking status. Three out of 7 items in the physical domain from the WHOQOL-BREF, and 15 items out of the SGRQ (1 in the 8-item symptoms domain, 7 in the 16-item activity domain, and 7 in the 26-item impacts domain) were significantly associated with lung functions ($P < 0.01$ for both models). In the WHOQOL-BREF, there were three potential items in physical domain, among them one item related to mobility and one item related to activity of daily living (ADL). Among the seven potential items in the activity domain of the SGRQ, there were a set of five hierarchical items related to mobility/walking; the other two items were related to patient's ADL.

Discussion

This study found that both the WHOQOL-BREF and the SGRQ had good reliability and acceptable degrees of item convergent and item discriminant validity for measuring HRQL in patients with COPD. The Cronbach's alpha coefficients of both instruments were mostly greater than 0.8 and

Table 2 Scaling properties of domains and items of the two questionnaires ($n = 211$): the WHOQOL-BREF (World Health Organization Quality of Life-Brief version) and the SGRQ (St. George's Respiratory Questionnaire)

	Stage (known groups validity)								(%) at floor	(%) at ceiling	Item convergent validity		Item discriminant validity	
	At risk	I	II	III	IV	P^a	P^b	α			Success items[c]/ total items (%)		Success items[d]/ total items (%)	
WHOQOL-BREF														
Physical	15.2	13.8	12.9	12.3	9.8	**	**	0.80	1.0	0.5	6/7	(85.7)	25/28	(89.3)
Psychological	15.4	11.9	12.3	12.5	10.7	**	**	0.85	1.0	1.0	6/6	(100)	24/24	(100)
Social	15.9	11.8	13.0	12.7	11.4	**	**	0.85	2.8	5.2	4/4	(100)	16/16	(100)
Environmental	16.4	13.7	14.6	14.3	13.5	**	**	0.85	0	1.0	9/9	(100)	35/36	(97)
SGRQ														
Symptoms	40.2	47.8	51.4	53.5	61.9	*	**	0.66	0	1.4	6/8	(75.0)	23/24	(95.8)
Activity	29.5	35.6	48.2	57.9	68.5	**	**	0.90	2.4	6.2	15/16	(93.8)	45/48	(93.8)
Impacts	17.1	20.1	27.1	35.7	41.4	**	**	0.90	0	5.2	19/26	(73.1)	71/78	(91.0)
Total	24.6	29.4	37.4	45.4	53.0	**	**	0.94	0	0	–		–	

[a] $*P < 0.05$, $**P < 0.01$, based on one-way ANOVA

[b] $**P < 0.01$, based on test for a linear trend

[c] In which correlation between an item and its own domain was −0.4

[d] In which correlation between an item and its own domain was significantly greater than the item and other domains in the same questionnaire

Table 3 Correlations among domain scores of the WHOQOL-BREF and the SGRQ and lung functions ($n = 211$)

	WHOQOL-BREF				SGRQ			
	Physical	Psycho.	Social	Environ.	Symptoms	Activity	Impacts	Total
WHOQOL-BREF								
Physical	1							
Psychological	0.71**	1						
Social	0.53**	0.73**	1					
Environmental	0.57**	0.72**	0.65**	1				
SGRQ								
Symptoms	−0.39**	−0.40**	−0.42**	−0.29**	1			
Activity	−0.59**	−0.40**	−0.35**	−0.31**	0.46**	1		
Impacts	−0.69**	−0.56**	−0.43**	−0.40**	0.54**	0.63**	1	
Total	−0.71**	−0.56**	−0.46**	−0.41**	0.68**	0.85**	0.93**	1
Lung functions								
FEV_1% predicted	0.32**	0.17**	0.13	0.12	−0.19**	−0.39**	−0.29**	−0.36**
FEV_1/FVC	0.27**	0.20**	0.15*	0.16*	−0.23**	−0.30**	−0.25**	−0.30**

$*P < 0.05$, $**P < 0.01$, based on Student's t test

generally comparable to results of previous studies [35–38]. The alpha value ($\alpha = 0.66$) of the SGRQ symptoms domain was similar with two other validation studies [37, 39], but lower than those of previous studies on COPD and other diseases of the lungs [35, 36, 40]. Rutten-van Molken et al. [36] reported alpha values of all SGRQ domains ranging from 0.76 to 0.77 in 144 moderate to severe COPD patients, while this study included patients with "at risk" and mild, yielding a diversified coverage and wider range of different levels of symptoms and therefore a lower reliability.

In the WHOQOL-BREF, the inter-domain, intra-instrument correlation between physical and social domains ($r = 0.53$) was the lowest, indicating social relationships were usually not affected so much before the physical condition severely deteriorated, as was also found in another study conducted on HIV patients by Hsiung et al. [38]. In the SGRQ, the correlations between symptoms and activity ($r = 0.46$) and between symptoms and impacts ($r = 0.54$) were the two lowest, which is consistent with the findings in previous studies [41, 42]. This may be

Table 4 Items that are predictive of lung function impairment within the WHOQOL-BREF and the SGRQ in multiple regression analyses with one HRQL item in each model after adjustment for age, education, marriage, and smoking status ($n = 211$)

Item	Model I FEV_1% predicted P[a]	Model II FEV_1/FVC P[a]
WHOQOL-BREF		
Physical		
Do you feel that physical pain prevents you from doing what you need to do	0.0006	0.003
How is your ability to get around[b]	<0.0001	<0.0001
Are you satisfied with your ability to perform routine daily activities[c]	0.0003	0.0001
SGRQ		
Symptoms (frequency of respiratory symptom)		
Shortness of breath	0.0075	0.0076
Activity (activities that cause or are limited by breathlessness)		
Walking around the home[b]	<0.0001	0.0033
Walking outside on the level[b]	<0.0001	0.0024
Walking up a flight of stairs[b]	0.0009	0.0071
Walking up hills[b]	0.0056	0.0004
I walk more slowly than other people, or I stop for rests[b]	<0.0001	0.0032
Getting washed or dressed[c]	<0.0001	0.0019
Jobs such as housework take a long time, or I have to stop for rests[c]	<0.0001	0.0001
Impacts (aspects concerned with daily life, social functioning and psychological disturbances resulting from airways disease)		
How would you describe your chest condition cause you problems	<0.0001	0.0053
I get breathless when I talk	0.0014	0.0007
I have become frail or an invalid because of my chest	<0.0001	0.0055
I cannot play sports or games	0.0002	0.0045
I cannot go out for entertainment or recreation	<0.0001	0.0014
I cannot go out of the house to do the shopping	0.0002	0.0014
The extent to which your chest affects you doing things	<0.0001	0.0018

[a] Items selected when P values were <0.01 from both models

[b] Related to mobility/walking

[c] Related to activity of daily living (ADL)

because the symptoms domain contains many diverse questions about respiratory symptoms (cough, sputum, wheezing and so on), which is shown in the lower internal consistency in this domain ($\alpha = 0.66$). The fair inter-domain, inter-instrument correlations between social and environmental domains in the WHOQOL-BREF with all domains in the SGRQ seemed to indicate that the former has a broader coverage on these two issues. Similarly, the fair correlations between symptoms domain of the SGRQ and all domains in the WHOQOL-BREF indicated that the symptoms were not appropriately reflected in any domain of the latter.

Although all domains in the SGRQ and physical domain in the WHOQOL-BREF showed a consistent deterioration of HRQL scores associated with increased disease stage, such a trend did not seem apparent in the psychological, social, and environmental domains of the WHOQOL-BREF. In other words, the WHOQOL scores in these three domains dropped in stage I, recovered a little in stages II and III, and become worse in stage IV. This finding suggests that patients entering into stage I of COPD might have experienced a period of psychological, social, and environmental adjustments as they learned to cope with the condition [43]. Thus, a timely care and emotional support provided by clinicians and/or family members at this stage may be very crucial to improve their HRQL, and can proactively help these patients establish a more positive outlook and healthy lifestyle.

The domains of activity, impact, and total of the SGRQ correlated fairly with the lung function of patients with COPD, as did the physical domain of the WHOQOL-BREF. In general, the activity and total domains of the SGRQ showed the highest correlation, as has been previously reported [3, 35, 37, 44, 45], but all the correlation coefficients were below 0.5. Instead, among the 18 potential items selected from multiple regression models, 9 were

related to mobility/walking and activity of daily living that were predictive of lung function impairment. In the WHOQOL-BREF, the items "How is your ability to get around?" and "Are you satisfied with your ability to perform routine daily activities?" are general measures of mobility and ADL, respectively. In the SGRQ, there are five items related to different cardiopulmonary load by walking, from the lowest level of "Walking around the home" to "Walking up hills" plus one item of comparing with others, namely, "Walk more slowly than other people". There are also two items which measure ADL limited by breathlessness: "Getting washed and dressed" and "Jobs such as housework take a long time, or I have to stop for rests." These results corroborated clinical intuition that cardiopulmonary impairment or breathlessness usually first appear as functional insufficiency in mobility/walking [4, 43] and/or in performing ADL [4, 46], which could be detected by both the WHOQOL-BREF and the SGRQ, while the latter seems more sensitive because of more items and more focused in COPD.

Although the 7 items out of 26 in the impacts domain also showed a significant trend with both lung functions (both $P < 0.01$; Table 4), these items are more diversified, not easily remembered, and thus less feasible in clinical application. Thus, we had some reservation on recommending any specific collected items from the impacts domain of the SGRQ for clinical screening as a sentinel for prescribing lung function test.

Some limitations of the present study should be mentioned. First, the patient population tested was relatively small. Second, the patient population included only male COPD patients and most patients were of stages II and III. Thus, the generalization should be cautious. Third, the patients in this study were outpatients. Hospitalized patients were usually too sick to be interviewed or perform lung function test. Therefore, our results cannot be generalized to the most severe patients. Finally, although use of the SGRQ and/or the WHOQOL at the item levels were generally not recommended by the developer, the items we obtained in predicting lung function impairment may be useful in daily practice as a screening tool for early detection of deterioration of lung function in COPD patients.

In conclusion, both questionnaires showed comparable reliability and validity for patients with COPD. The SGRQ had a higher discriminatory power in predicting lung function impairment for COPD patients than the WHOQOL-BREF, while the latter seemed more reflective to the patient's psychological and/or social adjustment. Items related to mobility/walking and ADL may be useful to clinicians as a quick screening tool for decision to prescribe lung function test and detect the progression of COPD.

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