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Original Article

Health Management and Policy Section

Health-Related Quality of Life of Vietnamese Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a severe condition that leads to respiratory disability, considerably reduces the comfort of living and affects all aspects of a patient's life.

Aim: This study assessed the Health-Related Quality of Life (HRQL) of patients with COPD by using St. George's Respiratory Questionnaire (SGRQ), as a research tool.

Materials and Methods: A 2-week cross-sectional survey was conducted at Dong Nai General Hospital, Bien Hoa City, Southern Vietnam. Data were collected by performing face-to-face interviews of 317 patients with COPD {Global Initiative for Chronic Obstructive Lung Disease (GOLD) stages III and IV} by using the SGRQ. Statistical analysis was performed using SPSS for Windows version 22.0.

Results: This study included patients with severe and very severe COPD (28.1% patients with GOLD stage III COPD and 71.9% patients with GOLD stage IV COPD). Median (IQR) SGRQ total score was 53.3 (37.7–71.1), which increased with an increase in the GOLD stage {42.9 (27.0–57.2) for patients with GOLD stage III COPD and 56.3 (41.1–75.8) for patients with GOLD stage IV COPD}. Significant differences were observed between the SGRQ total score and patient characteristic sdistribution, including age, gender, place of residence, marital status, BMI, education level, employment status, monthly income, exercise status, health insurance status and Modified Medical Research Council (MMRC) score ($p<0.05$).

Conclusion: The SGRQ seems to be a useful tool for assessing the health status of patients with COPD. Our results indicate that the impact of COPD on the quality of life patients can be assessed using a specific instrument and that an increase in COPD severity is significantly associated with the SGRQ symptom, activity, impact and total scores.

Keywords: COPD, HRQL, HRQoL, St. George's Respiratory Questionnaire (SGRQ), Vietnam

INTRODUCTION

COPD is a slow progressive disease and a major cause of chronic morbidity and mortality worldwide [1].

The World Health Organization (WHO) reported that COPD caused approximately 3 million deaths (5.3% of all deaths) globally in 2016 [2]. The WHO has also predicted that COPD will be the third leading cause of death worldwide by 2030 [3]. Across the WHO regions, the highest COPD prevalence has been estimated in the Americas (13.3% in 1990 and 15.2% in 2010) and the lowest COPD prevalence has been estimated in South East Asia (7.9% in 1990 and 9.7% in 2010) [4]. A 2003 study assessing COPD prevalence in 12 Asian countries reported that Vietnam had the highest percentage ratio of patients aged >30 years with moderate-to-severe COPD (approximately 2.1 million (6.7%) COPD patients) [4]. The prevalence of COPD in GOLD stage II-IV in Vietnam was 3.7% in study of Lam HT et al., [5].

COPD shows a progressive disease course, and its manifestations include dyspnoea and reduced physical capacity, social functioning and subjective well-being. Self-reported HRQL and pulmonary function test assess different aspects of COPD and provide complementary information [6,7]. HRQL is a multidimensional concept that includes aspects related to physical, mental, emotional and social functioning. It extends beyond the direct measures of population health, life expectancy and causes of death and focuses on the impact of health on the quality of life [8,9]. EuroQoL-5 Dimensions (EQ-5D), The Short Form 36 Health Survey (SF-36) are generic measures [7,10,11] and disease-specific quality of life questionnaires commonly used in COPD studies include Chronic Respiratory Questionnaire (CRQ) [12], St. George's Respiratory Questionnaire (SGRQ) [13] and COPD Assessment Test (CAT); however, many other questionnaires are available [14]. The SGRQ is a specific questionnaire that is most widely used to assess the HRQL of patients with COPD and includes 50 items with 76 weighted responses [13].

Some studies have used the SGRQ to assess the HRQL of patients with COPD. Burgel PR et al., assessed 326 French subjects with COPD and reported a median (IQR) SGRQ total score of 44.2 (30.0–61.2) [15]. Shavro et al., reported that the mean (SD) SGRQ total score of 2,291 Indian patients with COPD was 46.69 (21.61) [16]. Xiang et al., reported that mean (SD) score of 360 patients with COPD in Hong Kong was 46.4 (20.6) [17].

Because of an increase in COPD prevalence and burden, determination of the HRQL of patients with COPD will provide important information to health professionals and decision markers. Studies on factors affecting the HRQL of Vietnamese patients with COPD are scarce. The present study determined SGRQ-specific HRQL of a large cohort of patients with COPD (stage III and stage IV) and compared the assessment properties of and correlations determined using different specific HRQL questionnaires (CAT and SGRQ).

MATERIALS AND METHODS

Study Design and Participants

A cross-sectional study was conducted within a 2-week period in November 2017 at Dong Nai General Hospital, Vietnam. All patients (men and women) with a primary discharge diagnosis of COPD

according to International Classification of Diseases Codes-10 (ICD-10) (J44: Chronic obstructive pulmonary disease) [18] were invited to participate in this study by performing consecutive sampling. Patients discharged with stage III and stage IV COPD according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) classification [19] and with a baseline (post-bronchodilator) FEV1/FVC ratio of ≤70% in the previous 6 months were included in the study. COPD severity was classified using FEV1 as a percentage of predicted normal values (FEV1% predicted) according to the GOLD guidelines, with FEV1 of ≥80% indicating stage I COPD, of 50%–79% indicating stage II COPD, of 30%–49% indicating stage III COPD and of <30% indicating stage IV COPD. FEV1 values were obtained retrospectively from the medical records of patients [19]. Patients with unstable ischemic heart disease, aortic valve stenosis, musculoskeletal disease (which severely limited their exercise capacity) and cognitive problems (e.g., dementia and psychiatric disorder), which impaired their ability to participate in the study and complete the questionnaires, were excluded from the study. Moreover, patients who were unable to speak or read Vietnamese were excluded from the study.

Sample Size:

Sample size was calculated using the following formula [20]:

$$n = \frac{Z_{1-\alpha/2}{}^2 SD^2}{d^2}$$

Where, 'n' is the sample size, $Z_{1-\alpha/2=1.96}$ is the standard normal variate {1.96 at 5% type 1 error (p<0.05) and 2.58 at 1% type 1 error (p<0.001)}, SD is standard deviation of variable and d is absolute error (mean × precision, with precision decided by researcher). Similar to most previous studies, p<0.05 was considered significant; hence, 1.96 was used in the above formula. SD value was taken from a previously performed study or a pilot study.

The pilot study included 30 patients and showed that the SD of SGRQ total score was 22.50 (d=3.57, 95% CI associated with $Z_{1-\alpha 2}$ = 1.96 and refusal rate = 5%) [21]. The above mentioned formula provided a sample size of approximately 153 patients. However, because some patients may have resulted in bias during data collection and actual data collection conditions the sample size was increased to 317 patients.

Study Site

Construction of the Dong Nai General Hospital, which contains 1,400 beds, was started in 2008. The Dong Nai General Hospital is the first public–private hospital in Vietnam [22].

Research Tool Assessment

The SGRQ contains 50 items that are divided into three domains, namely, symptom, activity and impact. Each item has an empirically derived weight, indicating that a key is necessary to calculate a score. Scores are expressed as a percentage of overall impairment, where 100 represent the poorest health status and 0 represents the best health status. High SGRQ scores indicate poor HRQL [23].

The CAT questionnaire consists of eight items, cough, phlegm, chest tightness, breathlessness, activity limitation, confidence, sleep and energy, with scores ranging from 0 to 5 (0 = no impairment) [24]. The authors translated the SGRQ and CAT questionnaire from English to Vietnamese. Next, two native Vietnamese nephrologists who were fluent in English translated the Vietnamese versions into English and merged the translated questionnaires. Finally, a native, professional English translator reviewed the original and the back-translated English versions of the questionnaires. During a panel meeting, the authors discussed ambiguous terms and decided on the final Vietnamese versions of the questionnaires. In all, 30 patients with COPD completed the near-final questionnaires and provided limitations, determining the final version.

Data Collection

The patients were directly interviewed by study research by using the SGRQ. The structured questionnaire included two forms. The first form comprised information about patient sociodemographic and clinical characteristics, namely, age, gender, marital status, education level, monthly income, occupation, place of residence, duration of COPD, comorbidity and exercise status. The second form was a CAT and SGRQ instrument translated into Vietnamese from the original English version. The average time for completing the questionnaire was approximately 15 minutes.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS for Windows version 22.0 (SPSS Inc., Chicago, USA). Chi-square test was used to determine differences in patient characteristics for nominal variables across COPD stages, and Mann–Whitney *U* test was used as appropriate to compare differences between specific groups. Differences in the means of continuous variables were examined using an equivalent non-parametric test (Kruskal–Wallis test). Normality of data was evaluated using Kolmogorov–Smirnov test. Relationship between HRQL scores and continuous variables was assessed using Spearman's correlation coefficients. A p-value of <0.05 was considered significant. The present study used USD for all mentioned costs, with an exchange rate for 2018 (1USD=22,455 VNĐ) [25].

Ethical approval

The study protocols were approved by the Dong Nai General Hospital. All the patients provided informed consent after receiving an explanation of the study. All the study information was used for research purposes only. During 2-week period in November 2017, anonymity of each patient was maintained by assigning alphanumeric codes.

RESULTS

Patient Characteristics

Patient demographic characteristics indicated that the median (IQR) age of the patients was 68.0 (62.0–76.5) years [Table/Fig-1]. Moreover, 89.0% study patients were men. Clinical characteristics of the patients indicated that the median (IQR) duration of COPD at baseline was 4.0 (3.0–5.0) years. Most patients (77.9%) had comorbidities, with the median (IQR) number of comorbidities per patient being 2.0 (2.0–3.0). Most patients (47.0%) developed cardiovascular diseases {I10: essential (primary) hypertension, I110: hypertensive heart disease with (congestive) heart failure and I251: atherosclerotic heart disease}.

Smoking, a common risk factor of COPD development and progression, was reported in 86.1% patients (18.3% patients were current smokers), with a smoking duration of 30.0 (10.0-40.0) years. Assessment of the socioeconomic characteristics showed that most patients (61.8%) had no income and 30.9%, 33.2% and 33.1% patients had primary school, junior high school and high school and above education level. Average BMI was in the normal range, with 53.3% patients having a BMI of 18.5–22.9 kg/m^2.

[Table/Fig-1] shows the characteristics of patients with COPD according to the GOLD severity stage. In all, 28.1% patients had GOLD stage III COPD and 71.9% patients had GOLD stage IV COPD. Distribution of the GOLD stages was comparable with respect to gender, place of residence, marital status, education level, monthly income, exercise status, COPD duration, smoking status, smoking duration and comorbidity number but was significantly different with respect to age, BMI, employment status, family history status

Measure n (%)	Stage III n=89	Stage IV n=228	Total N=317	p-value	Measure n (%)	Stage III n=89	Stage IV n=228	Total N=317	p-value
Age (years)					**Duration of COPD (years)**				
<50	4 (4.5)	1 (0.4)	5 (1.6)	0.020	<1	4 (4.5)	6 (2.6)	10 (3.2)	0.634
50-59	15 (16.9)	32 (14.0)	47 (14.8)		1-<3	15 (16.9)	45 (19.7)	60 (18.9)	
60-69	36 (40.4)	95 (41.7)	131 (41.3)		3-<5	16 (18.0)	39 (17.1)	55 (17.4)	
70-79	25 (28.1)	53 (23.3)	78 (24.6)		5-<10	24 (27.0)	48 (21.1)	72 (22.6)	
≥80	9 (10.1)	47 (20.6)	56 (17.7)		≥ 10	30 (33.6)	90 (39.5)	120 (37.9)	
Median (Q1-Q3)	68.0 (62.0-72.0)	68.0 (62.0-78.0)	68.0 (62.0-76.5)	0.263*	Median (Q1-Q3)	6.0 (3.0-10.0)	6.0 (3.0-10.0)	4.0 (3.0-5.0)	0.828*
Gender					**Smoking status**				
Male	78 (87.6)	204 (89.5)	282 (89.0)	0.640	Non-smoker	14 (15.7)	30 (13.2)	44 (13.9)	0.837
Female	11 (12.4)	24 (10.5)	35 (11.0)		Ex-smoker	16 (18.0)	42 (18.4)	215 (67.8)	
Residence					Current smoker	59 (66.3)	156 (68.4)	58 (18.3)	
Urban	83 (93.3)	200 (87.7)	283 (89.3)	0.152	**Family history**				
Rural	6 (6.7)	28 (12.3)	34 (10.7)		Yes	2 (2.2)	25 (11.0)	27 (8.5)	0.012
Marital status					No	87 (97.8)	203 (89.0)	290 (91.5)	
Single	2 (2.2)	5 (2.2)	7 (2.2)		**(ICD-10) Comorbidities**				
Married	87 (97.8)	219 (96.0)	306 (96.5)		None	22 (24.7)	44 (19.3)	66 (20.8)	
Separated/ Divorced	-	4 (1.8)	4 (1.3)		N188, N189	-	8 (3.5)	8 (2.5)	
BMI (kg/m^2)					E119	7 (7.9)	25 (11.0)	32 (10.1)	
<18.5	9 (10.1)	66 (28.9)	75 (23.7)	<0.001	D648, D649	-	4 (1.8)	4 (1.3)	
18.5-22.9	61 (68.5)	108 (47.4)	169 (53.3)		I10, I110, I251	50 (56.2)	99 (43.4)	149 (47.0)	
23-24.9	12 (13.5)	22 (9.6)	34 (10.7)		K219	9 (10.1)	31 (13.6)	40 (12.6)	
≥25	7 (7.9)	32 (14.0)	39 (12.3)		M814, M819	2 (2.2)	8 (3.5)	10 (3.2)	
Median (Q1-Q3)	20.7 (18.7)	19.8 (17.8-22.8)	20.1 (18.0-22.8)	0.096*	**Health insurance status (%)**				
Education level					80	48 (53.9)	114 (50.0)	162 (51.1)	0.531
No school/ Illiterate	2 (2.2)	7 (3.1)	9 (2.8)	0.216	95	4 (4.5)	18 (7.9)	22 (6.9)	
Primary school	22 (24.7)	76 (33.3)	98 (30.9)		100	37 (41.6)	96 (42.1)	133 (42.0)	
Junior high school	37 (41.6)	68 (29.8)	105 (33.2)		**No. of Comorbidities**				
High school or over	28 (31.5)	77 (33.8)	105 (33.1)		None	21 (23.6)	49 (21.5)	70 (22.1)	0.327
Employment					1	40 (44.9)	119 (52.2)	159 (50.1)	
Employed	6 (6.7)	30 (13.2)	36 (11.4)	0.009	2	26 (29.3)	49 (21.5)	75 (23.7)	
Unemployment	25 (28.0)	42 (18.4)	67 (21.1)		≥3	2 (2.2)	11 (4.8)	13 (4.1)	
Retirement	43 (48.3)	82 (36.0)	125 (39.5)		Median (Q1-Q3)	1.0 (1.0-2.0)	1.0 (1.0-2.0)	2.0 (2.0-3.0)	0.817*
Other	15 (17.0)	74 (32.4)	89 (28.1)		**MMRC**				
Monthly income (USD)					1	23 (25.8)	28 (12.3)	51 (16.1)	0.013
No income	57 (64.0)	139 (61.0)	196 (61.8)	0.300	2	19 (21.3)	35 (15.4)	54 (17.0)	
< 200	26 (29.2)	71 (31.1)	97 (30.6)		3	6 (6.7)	16 (7.0)	22 (6.9)	
200-<350	4 (4.6)	12 (5.3)	16 (5.0)		4	30 (33.7)	110 (48.2)	140 (44.2)	
≥350	2 (2.2)	6 (2.6)	8 (2.6)		5	11 (12.5)	39 (17.1)	50 (15.8)	
Median (Q1-Q3)	0.0 (0.0-89.1)	0.0 (0.0-89.1)	0.0 (0.0-89.1)	0.513*	**Exercise**				
Years of smoking					Yes	45 (50.6)	106 (46.5)	151 (47.6)	0.718
Median (Q1-Q3)	25.0 (10.0-40.0)	30.0 (10.0-40.0)	30.0 (10.0-40.0)	0.226*	No	30 (33.7)	88 (38.6)	118 (37.2)	
					Past	14 (15.7)	34 (14.9)	48 (15.2)	

[Table/Fig-1]: Demographic and clinical characteristics of study subjects (2018, N=317).
Abbreviations: Q1-Q3: 25th - 75th quartile; BMI: Body Mass Index; COPD: Chronic Obtructive Pulmonary Disease; MMRC: Modified Medical Research Council; GOLD: The Global Initiative for Chronic Obstructive Lung Disease; ICD-10 International Classification of Diseases version 10- N188: Chronic kidney disease; N189: Chronic kidney disease, unspecified; I10: Essential (primary) hypertension; I110: Hypertensive heart disease with (congestive) heart failure; I251: Atherosclerotic heart disease ;D648: Other specified anaemias; D649: Anaemia, unspecified; E119: Non-insulin-dependent diabetes mellitus: Without complication; K219: Gastro-oesophageal reflux disease without oesophagitis; M814: Drug-induced osteoporosis; M819: Osteoporosis, unspecified; Health insurance status(100%): patients are 100% covered by insurance for costs;
p-value based on the Chi-square test and Mann-Whitney U (*)
MMRC scale: 1= only breathless with strenuous exercise; 2=breathless when hurrying on level or up a slight hill; 3= walk slower than people of same age on the level due to breathlessness or stop for breath when walking on level at own pace; 4=stop for breath after walking 100 yards or a few minutes on the level; 5=too breathless to leave house or breathless when dressing

and MMRC (Modified Medical Research Council) score. Moreover, patients with different MMRC scores showed a significant difference in COPD severity (p=0.013).

HRQL of Patients with COPD

The HRQL of patients with COPD depended on disease severity [Table/Fig-2]. The median SGRQ symptom, activity, impact and total scores of patients with GOLD stage IV COPD were significant higher than those of patients with GOLD stage III COPD (p<0.001).

[Table/Fig-3,4] show the SGRQ symptom, activity and impact scores with respect to patient characteristics. The median SGRQ

domain (symptom, activity and impact) scores were significantly associated with place of residence (p<0.05), BMI (p<0.05), education level (p<0.05), exercise status (p<0.001) and MMRC score (p<0.001) of the patients. Particularly, patients living in rural areas had significantly higher median SGRQ score than those living in urban areas (symptom score: 55.6 and 67.2, respectively; activity score: 59.5 and 72.8, respectively and impact score: 44.6 and 58.4, respectively). Moreover, the median SGRQ score was the highest for patients with an MMRC score of 5 (symptom, activity and impact scores of 72.1, 100.0 and 80.3, respectively). According to COPD patients having exercise status recently, they had the lowest median symptom, activities, impact score that was 50.0; 59.5; 38.3 respectively.

	Stage III (n=89)		Stage IV (n=228)		Total (n=317)		p-value
Item	Mean (SD)	Median (Q1-Q3)	Mean (SD)	Median (Q1-Q3)	Mean (SD)	Median (Q1-Q3)	
SGRQ Symptom	45.3 (18.6)	42.6 (29.0-59.2)	59.3 (20.9)	61.5 (41.7-74.0)	55.4 (21.2)	57.0 (37.7-69.9)	<0.001
SGRQ Activity	51.7 (27.8)	53.5 (26.4-67.0)	68.8 (25.8)	66.2 (53.2-100.0)	64.0 (27.4)	60.7 (53.2-92.5)	<0.001
SGRQ Impact	36.4 (22.3)	35.5 (14.5-51.2)	49.4 (24.8)	49.5 (30.2-69.9)	45.7 (24.8)	44.3 (26.5-64.7)	<0.001
SGRQ Total	42.5 (20.2)	42.9 (27.0-57.2)	56.9 (21.8)	56.3 (41.1-75.8)	52.9 (22.3)	53.3 (37.7-71.1)	<0.001

[Table/Fig-2]: Health-related quality of life (HRQL) scores of SGRQ by COPD GOLD Stage (N= 317).
Abbreviations: Q1-Q3: 25th - 75th quartile; SD: Standard deviation; SGRQ: St. George's Respiratory Questionnaire
p-value compared between stage III and stage IV based on Mann-Whitney U test
HRQL among COPD patients depend on disease severity showing on Table/Fig 2. The SGRQ mean (SD) scores on symptoms, activities, impact and total score of the patients with GLOD stage IV were significant higher than that of stage IV patients (p<0.001)

Median (Q1-Q3)	Symptoms	Activities	Impacts
Age (years)	†		†
<50	25.4 (23.5-50.7)	41.7 (23.3-85.4)	35.5 (11.8-36.8)
50-59	50.0 (35.6-67.9)	62.8 (26.8-73.5)	47.5 (23.5-61.5)
60-69	54.9(37.1-68.6)	59.5 (53.2-92.5)	43.1 (26.1-59.9)
70-79	59.9 (34.5-76.2)	59.5 (53.2-86.6)	45.4 (25.4-63.9)
≥80	61.9 (45.9-82.8)	72.8 (56.5-100.0)	53.3 (35.2-77.3)
Gender		†	
Male	57.4(37.1-71.4)	60.0 (53.2-92.5)	45.4 (27.7-62.1)
Female	59.1 (52.0-69.7)	72.8 (53.3-100.0)	54.0 (25.5-78.6)
Residence	†	†	†
Urban	55.6 (36.2-68.7)	59.5 (53.2-86.1)	43.7 (26.4-61.3)
Rural	67.2 (50.4-84.2)	72.8 (54.7-100.0)	65.9 (35.3-82.4)
Marital status			†
Single	61.2 (46.5-64.0)	72.8 (53.5-72.8)	62.2 (57.8-82.4)
Married	56.6 (38.3-70.9)	59.5 (53.2-92.5)	44.2 (26.6-63.9)
Separated/ Divorced	73.7 (41.8-78.8)	96.3 (72.8-100.0)	70.6 (53.7-92.8)
BMI (kg/m^2)	†	††	†
<18.5	67.9 (46.6-84.2)	79.5 (56.5-100.0)	56.1 (34.0-78.4)
18.5-22.9	50.7 (34.7-67.8)	59.5 (53.2-77.0)	45.4 (29.3-63.9)
23-24.9	59.2 (35.4-69.9)	66.2 (53.2-94.0)	41.6 (14.9-58.8)
≥25	53.6 (38.7-65.4)	59.5 (35.3-69.9)	30.3 (22.5-48.8)
Education level	†	†	†
No school/ Illiterate	50.0 (40.9-87.6)	56.3 (11.9-72.8)	46.8 (15.9-72.8)
Primary school	61.5 (45.6-79.4)	66.2 (58.0-100.0)	51.8 (34.1-74.6)
Junior high school	59.1 (38.3-69.9)	60.7 (47.5-92.5)	47.6 (23.4-62.5)
High school or over	46.7 (34.1-64.4)	59.5 (47.2-79.9)	37.8 (25.5-59.6)
Employment		†	†
Employed	56.6 (31.5-68.1)	53.2 (38.2-82.5)	32.4 (24.2-52.9)
Unemployment	50.0 (38.7-69.6)	73.7 (53.2-100.0)	56.4 (37.4-78.0)
Retirement	56.1 (35.4-72.6)	59.5 (53.2-79.7)	41.7 (25.5-59.9)
Other	63.0 (41.0-76.5)	59.5 (53.2-74.7)	50.1 (30.5-67.4)
Monthly income (USD)		††	††
No income	56.6 (38.7-69.5)	66.2 (53.2-92.5)	47.5 (27.3-64.1)
<200	59.2 (38.5-74.7)	59.5 (47.7-92.5)	42.6 (25.2-63.2)
200-<350	57.0 (31.9-78.4)	66.6 (53.2-93.2)	39.4 (27.3-61.5)
≥350	58.9 (36.7-62.9)	67.5 (59.5-93.2)	62.2 (45.3-77.1)

[Table/Fig-3]: Health-Related Quality of Life (HRQL) scores of SGRQ by demographic characteristics (N= 317).
Abbreviations: Q1-Q3: 25th - 75th quartile; SGRQ: the St. George's Respiratory Questionnaire. BMI, Body Mass Index; COPD, Chronic Obstructive Pulmonary Disease; MMRC, Modified Medical Research Council; GOLD, The Global Initiative for Chronic Obstructive Lung Disease. Health insurance status (100%): patients are 100% covered by insurance for costs; p-value based on Kruskal-Wallis test and Mann-Whitney U.
† p-value <0.05; †† p-value <0.001

[Table/Fig-5] shows significant differences in the SGRQ total score according to the patient characteristics, including age, gender, place of residence, marital status, BMI, education level, employment status, monthly income, exercise status, health insurance status and MMRC score, (p<0.05). The median SGRQ total score was the lowest for patients aged <50 years, male patients, patients living in urban areas, married patients, patients with a BMI of 18.5–22.9 kg/m^2, patients with high school or above education level, employed patients, patients with a monthly income of <200 USD, patients who exercised regularly, patients with 95% insurance cover and patients with MMRC score of 1.

Correlation between Patient Clinical Characteristics and HRQL

The SGRQ domain (symptom, activity and impact) scores and total score were not correlated or were weakly correlated with the clinical characteristics (age, monthly income, duration of COPD, years of smoking) of patients with COPD. The MMRC score showed a stronger correlation with the SGRQ activity, impact and total scores than with the SGRQ symptom score. Moreover, the SGRQ total score showed a strong correlation with the SGRQ domain (symptom, activity and impact) scores (r>0.5, p<0.001). Furthermore, CAT score showed a strong correlation with the SGRQ symptom, activity, impact and total scores (r>0.5, p<0.001; [Table/Fig-6,7]).

DISCUSSION

In this study, the SGRQ scores were used to measure the quality of life of patients with COPD and to identify factors influencing the HRQL of these patients. Comparison of our results with those of related foreign studies showed that the mean (SD) SGRQ total score was generally higher in Vietnamese patients with COPD {52.9 (22.3)} than in their counterparts in Hong Kong {46.4 (20.6)} [17] and the USA {41.3 (19.7)} [26].

The study findings showed that the HRQL of patients with GOLD stage IV COPD was lower than that of patients with GOLD stage III COPD. In the present study, the median (IQR) SGRQ total score was 53.3 (37.7–71.1); moreover, the median (IQR) SGRQ total score of patients with GOLD stage III COPD was 42.9 (27.0–57.2) and that of patients with GOLD stage IV COPD was 56.3 (41.1–75.8). Burgel PR et al., reported that the HRQL increased with an increase in COPD severity {49.3 (34.5–60.2) for patients with GOLD stage III COPD and 63.3 (45.6-70.9) for patients with GOLD stage IV COPD} [15]. Our findings confirm these results, with a statistically significant difference being observed in the SGRQ score of patients

Median (Q1-Q3)	Symptoms	Activities	Impacts
Duration of COPD (years)			
<1	47.9 (28.3-65.2)	59.5 (20.9-79.6)	30.3 (22.9-56.1)
1-<3	52.3 (38.7-67.9)	66.2 (53.2-82.7)	41.8 (23.0-65.4)
3-<5	59.2 (42.6-81.8)	59.7 (49.1-92.5)	51.2 (25.7-69.1)
5-<10	49.7 (33.9-70.9)	59.5 (53.2-92.5)	44.8 (28.4-55.6)
≥ 10	60.6 (38.3-73.4)	66.2 (53.2-92.5)	47.6 (28.7-68.8)
Exercise	††	††	††
Yes	50.0 (32.5-66.7)	59.5 (47.6-72.8)	38.3 (23.6-53.5)
No	61.0 (41.2-72.6)	66.5 (53.2-100.0)	52.2 (28.5-74.5)
Past	66.2 (53.7-84.1)	72.8 (59.5-100.0)	63.9 (43.3-74.9)
Smoking status			†
Non-smoker	44.3 (34.6-65.6)	59.5 (35.8-92.5)	34.0 (21.2-56.5)
Ex-smoker	52.4 (33.9-72.3)	59.5 (42.9-100.0)	51.9 (22.1-72.0)
Current smoker	59.2 (38.7-72.6)	66.2 (53.2-92.5)	46.4 (30.2-64.4)
Family history			
Yes	58.5 (40.3-81.7)	73.7 (53.2-94.0)	51.3 (41.6-68.8)
No	57.4 (38.3-70.9)	59.5 (53.2-92.5)	44.0 (25.5-63.9)
No. of Comorbidities			
0	59.2 (36.5-71.3)	64.2 (53.2-76.9)	42.9 (24.8-61.9)
1	57.0 (38.7-68.6)	60.7 (53.2-92.5)	46.5 (27.0-65.9)
2	52.3 (35.4-70.1)	59.5 (53.2-73.7)	43.7 (26.2-62.3)
≥3	72.5 (50.4-85.2)	66.9 (59.5-100.0)	54.7 (40.1-78.4)
Health insurance status (%)	†		†
80	54.7 (34.3-68.6)	59.5 (53.2-92.5)	44.0 (25.5-57.9)
95	41.7 (33.3-61.6)	53.2 (35.4-62.8)	32.4 (22.8-46.0)
100	61.6 (44.2-79.4)	66.2 (53.2-92.5)	53.3 (33.5-74.1)
MMRC	††	††	††
1	31.7 (25.4-44.4)	23.3 (17.1-53.2)	14.1 (7.6-28.9)
2	44.2 (34.4-67.9)	53.2 (38.5-62.2)	32.9 (21.6-49.2)
3	62.0 (57.3-70.5)	59.5 (51.7-73.7)	50.3 (25.7-59.9)
4	59.2 (42.8-73.6)	66.2 (59.5-91.0)	50.1 (34.8-61.9)
5	72.1 (60.1-85.0)	100.0 (92.5-100.0)	80.3 (66.0-86.1)

[Table/Fig-4]: Health-Related Quality Of Life (HRQL) scores of SGRQ by demographic characteristics (N= 317) (Continue).
Abbreviations: SD: Standard deviation; SGRQ: the St. George's Respiratory Questionnaire. BMI, Body Mass Index; COPD, Chronic Obstructive Pulmonary Disease; MMRC, Modified Medical Research Council; GOLD, The Global Initiative for Chronic Obstructive Lung Disease Health insurance status (100%): patients are 100% covered by insurance for costs; p-value based on Kruskal-Wallis test and Mann-Whitney U
† p-value <0.05; †† p-value <0.001

with different COPD severities (p<0.001), which was similar to that reported by Stahl E et al., (p=0.0005) [27].

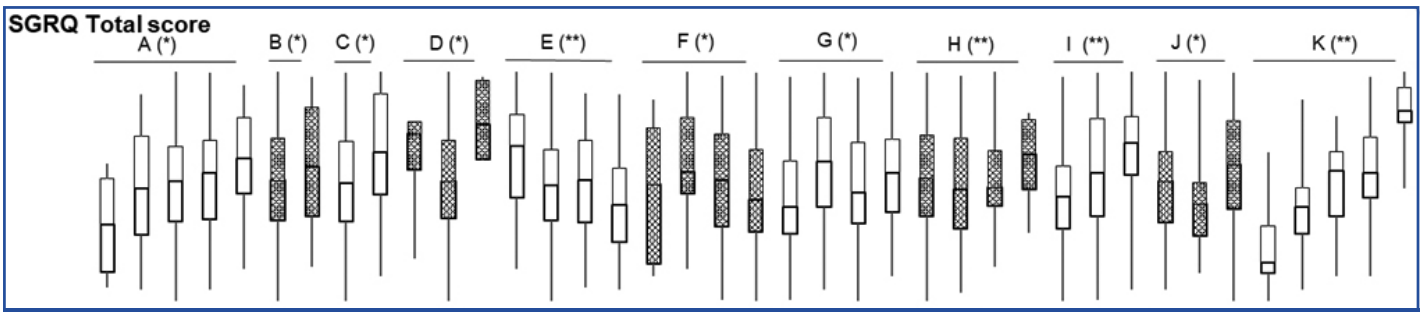
that 48% patients with COPD had cardiovascular comorbidities [15]. Furthermore, patients with multiple comorbidities did not show a significant increase in the SGRQ total score. A recent study involving a large number of patients (n=1,817) in primary care across Europe reported that patients with three or more comorbidities had significantly poor SGRQ total score compared with patients with one or two or no comorbidities [28]. These results indicate that presence of multiple physical comorbidities decreases the HRQL, which is consistent with the findings of previous studies [29,30].

The present study confirmed that demographic factors such as BMI and MMRC score influenced the HRQL. BMI was negatively associated with the HRQL (r<0, p<0.001), whereas MMRC score was positively associated with the HRQL (r>0.3, p<0.001). Moreover, the present study reported significant differences between the SGRQ total score and patient characteristics distribution, including age, gender, place of residence, marital status, BMI, education level, employment status, monthly income, exercise status, health insurance status and MMRC score (p<0.05). These findings are consistent with those of previous studies that reported a significant association between patient demographic and socioeconomic characteristics and the HRQL. Stahl E et al., showed that the SGRQ total score differed significantly among patients in different age groups (p=0.0047) [27]. Different studies have reported different results for the association between smoking status and HRQL. Prigatano GP et al., showed that patients with COPD who continued to smoke had a significantly lower HRQL than those who quit smoking [31]. In contrast, Hanneke A et al., reported that current smokers with COPD showed improved HRQL [32]. This may be because patients who did not quit smoking were those who had less severe disease.

The SGRQ symptom (r=0.43, p<0.001), activity (r=0.69, p<0.001), impact (r=0.66, p<0.001) and total scores (r=0.71, p<0.001) showed a moderate-to-strong correlation with the MMRC score. Buss AS et al., reported a correlation between the SGRQ symptom (r=0.5, p<0.001), activity (r=0.6, p<0.001) and total scores (r=0.4, p<0.05) and the MMRC score [33].

Moreover, the SGRQ total score was strongly correlated with the SGRQ domain (symptom, activity and impact) scores (r>0.5, p<0.001), indicating that COPD-associated activity exerted a higher effect on the HRQL of patients with COPD than COPD-associated in capacitation restriction and symptoms. Buss AS et al., showed that the SGRQ impact score showed the strongest correlation with the SGRQ total score [33].

A strong correlation was observed between CAT and SGRQ scores (symptom, activity, impact and total scores; r>0.5, p<0.001; [Table/Fig-5]). Tsiligianni IG et al., reported that the CAT score was correlated with the SGRQ total score (r=0.646, p<0.001) [34]. The discrepancy in correlation between the SGRQ and CAT scores



[Table/Fig-5]: SGRQ total score according to the demographic characteristics of the study patients (N = 317).
A: Age; B: Gender; C: Residence; D: Marital status; E: BMI (kg/m2); F: Education level; G: Employment; H: Monthly income (USD); I: Exercise; J: Health insurance status (%); K: MMRC-Modified Medical Research Council. p-value based on Kruskal-Wallis test and Mann-Whitney U; *p-value<0.05, ** p-value<0.001

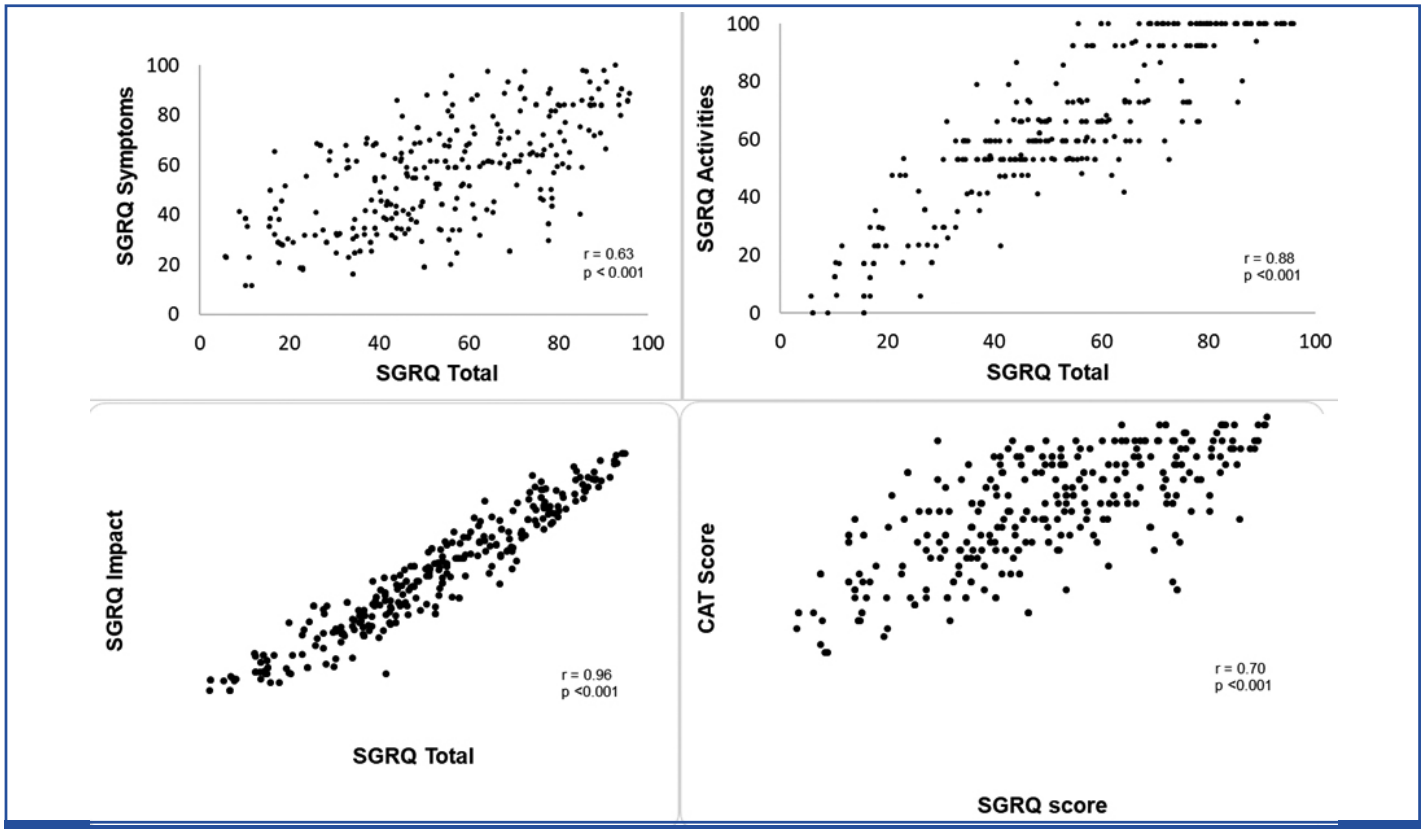
In the present study, 22.1% patients had no comorbidities and 4.1% had three or more comorbidities. Moreover, 47.0% patients had at least one cardiovascular comorbidity {defined as essential (primary) hypertension, hypertensive heart disease with (congestive) heart failure and atherosclerotic heart disease}. Burgel PR et al. reported

between this study and the present study may be because of differences in patients with respect to COPD severity, gender and nationality. Therefore, additional studies, including studies involving different clinical settings, are needed to confirm the exact magnitude of the correlation of the CAT score and SGRQ score.

The results of the present study should be interpreted by considering its methodological limitations. First, this was a cross-sectional study; therefore, the causal relationship between HRQL and the examined variables could not be established. Second, the present study did not include patients with GOLD stage I and II COPD; therefore, HRQL determined in the present study may be overestimated. Third, the patients included in the present study were recruited from a provincial hospital; therefore, they may not represent the complete COPD population in Vietnam. Finally, HRQL was measured using only the SGRQ without using any generic HRQL questionnaire. A recent study suggested that the SGRQ cannot capture all the aspects of the health status of patients with COPD and that the use

Characteristic	Age	BMI	Income	Duration of COPD	Smoking (years)	No.com	MMRC	SGRQ Symptom	SGRQ Activities	SGRQ Impact	SGRQ Total
Age (years)	1										
BMI (kg/m^2)	-0.10	1									
Income (USD)	0.10	0.02	1								
Duration of COPD (years)	0.03	-0.06	0.07	1							
Smoking (years)	-0.01	-0.04	0.06	-0.06	1						
No. of comorbidities	0.14*	0.22**	-0.03	0.12*	-0.07	1					
MMRC	0.17**	-0.22**	0.03	-0.05	-0.03	-0.05	1				
SGRQ Symptoms	0.16**	-0.18**	0.04	0.08	0.02	0.02	0.43**	1			
SGRQ Activities	0.12*	-0.23**	-0.03	0.13*	0.05	0.01	0.69**	0.45**	1		
SGRQ Impacts	0.13*	-0.24**	-0.01	0.11	-0.01	0.05	0.66**	0.53**	0.76**	1	
SGRQ Total	0.15**	-0.26**	-0.01	0.12*	0.01	0.03	0.71**	0.63**	0.88**	0.96**	1
CAT	0.14*	-0.23**	0.03	0.06	0.02	0.00	0.67**	0.81**	0.58**	0.62**	0.70**

[Table/Fig-6]: Spearman 's correlation between patient characteristic and HRQL measures.
SGRQ: The St. George's Respiratory Questionnaire. BMI, Body Mass Index; MMRC, Modified Medical Research Council; GOLD, The Global Initiative for Chronic Obstructive Lung Disease; CAT: the COPD Assessment Test; Spearman correlation coefficient; *p-value <0.05; ** p-value <0.001



[Table/Fig-7]: Correlation among SGRQ total score; SGRQ symptom, activity and impact scores and CAT score.
SGRQ= the St. George's Respiratory Questionnaire; CAT= the COPD Assessment Test.

of a generic questionnaire may provide different results. Therefore, additional studies involving multiple questionnaires, including a generic HRQL questionnaire and a newly developed short COPD-specific questionnaire {e.g., Clinical Questionnaire (CCQ); EQ-5D, SF-36}, should be performed to completely understand the impact of COPD on the quality of life of patients.

CONCLUSION

In conclusion, the results of the present study indicate that the HRQL of patients with COPD deteriorates considerably with an increase in disease severity. Moreover, the HRQL of patients with COPD is significantly affected by BMI and MMRC score but is not significantly affected by age, gender, smoking status and socioeconomic status. The number of patients with COPD is expected to increase because of ageing, environmental changes and air pollution. Considering the extremely low awareness of, low early detection rate of and lack of preventive measures for this disease, the present study is expected to have implications on establishing policies for improving the health status and quality of life of patients with COPD.

DISCLOSURE

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Author Contributions

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Abbreviation

SGRQ: St. George's Respiratory Questionnaire; CAT: the COPD Assessment Test; SD: Standard deviation; BMI: Body Mass Index; COPD: Chronic Obstructive Pulmonary Disease; MMRC: Modified Medical Research Council; GOLD: The Global Initiative for Chronic Obstructive Lung Disease; ICD-10 International Classification of Diseases version 10- N188: Chronic kidney disease; N189: Chronic kidney disease, unspecified; I10: Essential (primary) hypertension; I110: Hypertensive heart disease with (congestive) heart failure; I251: Atherosclerotic heart disease; D648: Other specified anaemias; D649: Anaemia, unspecified; E119: Non-insulin-dependent diabetes mellitus: Without complication; K219: Gastro-oesophageal reflux disease without oesophagitis; M814: Drug-induced osteoporosis; M819: Osteoporosis, unspecified.

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