Comparison of the health-related quality of life of community dwelling patients with chronic obstructive pulmonary disease and the general population

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Research

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Abstract

Background

The goal of care for patients with chronic obstructive pulmonary disease (COPD) is not only diagnosis and treatment, but also improving health-related quality of life (HRQoL). This study compared the HRQoL of community dwelling patients with COPD and the general population, using the Korea National Health and Nutrition Examination Survey.

Methods

We defined COPD groups among patients with less than 70% of forced expiratory volume in 1 second value (FEV_1)/forced vital capacity (FVC) ratio in a pulmonary function test. To control for covariates that affect HRQoL, we used propensity score matching with a 1:1 ratio. Finally, 2,230 people were analyzed in both the COPD and non-COPD groups.

Results

There were no significant differences between COPD and matched non-COPD groups on the EuroQol-5 Dimensions (EQ-5D), after adjusting for clinico-socioeconomic status (e.g., age, sex, education, household income level, marital status, BMI, current smoking, drinking and comorbidities). However, according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria, as the severity of COPD increased, HRQoL decreased. In particular, this difference was prominent in the domain related to physical health.

Conclusion

Proper community support and financial stability might be important for the maintenance of HRQoL of persons with COPD, in addition to early detection and treatment.

Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic respiratory disease characterized by airflow restrictions and continuous respiratory symptoms [1]. According to the Global Burden of Disease report, the prevalence of COPD in 2015 was 174.5 million persons, up 44.7% from 1990, and the death rate was 3.2 million, making it the third most common cause of death worldwide [2]. The increase in COPD prevalence and mortality is expected to continue in the future due to the increase in the population of smokers, air pollution, and a globally aging population [3]. This is expected to be a major concern for health care costs in the future, suggesting that health managers should monitor and manage prevalence.

COPD also affects the heart function due to symptoms such as difficulty breathing, shortness of breath, chronic cough, and fatigue, and excessive expansion of the lungs, which in turn cause a reduction in daily activities [4]. Therefore, the goal of COPD patient care is not only to prevent risk factors that aggravate respiratory symptoms, but also to improve health related quality of life (HRQoL), along with providing proper diagnosis and treatment services [5]. HRQoL is a multidimensional concept that encompasses the perception of physical, emotional, cognitive, and social functions [6]. Recently, HRQoL has become increasingly important in patients with COPD, with results indicating that it is an important predictor of the effectiveness of treatment, mortality, hospitalization, and readmission rates [7].

In patients with COPD, pathophysiological changes such as reduction of maximum oxygen consumption, small airway dysfunction, and increased ventilation requirements during exercise are observed from global initiative for chronic obstructive lung disease (GOLD) stage I [8]. Even GOLD stage I patients with COPD have a greater annual reduction in FEV₁ compared to persons without COPD [9]. Thus, early diagnosis and management of patients with COPD can reduce mortality and annual decrease in FEV₁ [10]. It is very important to evaluate HRQoL in community dwelling patients with mild as well as severe COPD and to promote their HRQoL. In previous studies, assessment of the HRQoL of patients with COPD was restricted to those diagnosed with COPD at medical institutions and those with moderate-to-severe symptoms, resulting in a lower HRQoL among patients with COPD compared to that of the general population [11, 12]. Recently, Voll-Aanerud et al. [1] reported that patients with COPD had lower HRQoL and poorer mental health than persons without COPD. In addition, socioeconomic status has been found to be one of the key factors influencing individual HRQoL [13]. Therefore, it is not ascertained that this decline of HRQoL in COPD patients is related with COPD itself or other important variables affecting HRQoL. Consequently, we compared the HRQoL between COPD and non-COPD community dwelling groups, based on national survey data, and used propensity score matching (PSM) to control for the influence of diverse socioeconomic states on HRQoL.

Methods

Study design and participants

This was a cross-sectional study based on the 5th (2012), 6th (2013–2015), and 7th (2016) Korea National Health and Nutrition Examination Survey (KNHANES) conducted by the Korean Centers for Disease Control and Prevention. This study analyzed raw data from the KNHANES website (<http://knhanes.cdc.go.kr>) after obtaining an exemption approval by the Institutional Review Board/Ethics Committee (IRB No. KANGDONG 2020-05-005). The KNHANES targeted nationwide household members older than 1 year. The subjects were extracted using a complex sampling design, in which the sample districts were first extracted by a 2-stage random sample extraction method according to their cities, provinces, district, and neighborhood characteristics. A total of 39,156 people participated in the study; we excluded 23,487 people who were under 40 years of age or who did not perform the pulmonary function test (PFT). We classified individuals into two groups: (1) the COPD group (2,325 participants), which consisted of patients with less than 70% of FEV₁/FVC in the PFT (pre-bronchodilator test), and (2)

the non-COPD group (13,344 participants). Of the participants, 95 in the COPD group and 563 in the non-COPD group had missing information for the EQ-5D index and were, therefore, excluded. Accordingly, the sample available for analysis was 2,230 people with COPD and 12,781 people without COPD (Fig. 1).

Measures

Definition of COPD and severity

In this study, the PFT (Model: 1022 Digital Computed Spirometry®, Sensor Medics, USA) was measured and defined based on patients with COPD aged 40 or older whose FEV₁/FVC ratios were less than 70% [14]. In accordance with the GOLD guidelines, the patients with COPD were classified into the following 4 categories based on the ratio of measured values divided by the predicted values of FEV₁: (1) predicted FEV₁ ≥ 80% was regarded as GOLD stage I (mild); (2) 50% ≤ predicted FEV₁ < 80% was regarded as GOLD stage II (moderate); (3) 30% ≤ predicted FEV₁ < 50% was regarded as GOLD stage III (severe); and (4) predicted FEV₁ < 30% was regarded as GOLD stage IV (very severe). We combined the severe and very severe COPD groups as there were only 11 GOLD stage IV cases.

Demographic characteristics, health behavior, and status

The demographic characteristics included age, sex, years of education, household income, marital status, body mass index (BMI), and current smoking and drinking habits. Years of education was classified as less than 6 years, 7 to 9 years, 10 to 12 years, and 13 years or more. The household income levels used were based on the average monthly household equivalent incomes (total household income/the number of family members) presented in the KNHANES and were classified into quartiles. Marital status was classified as married, unmarried, and divorced. Current smoking was defined as an adult who had smoked 100 cigarettes in his or her lifetime and who currently smokes cigarettes. Regarding drinking habit, nondrinkers were defined as those who drank less than one glass of an alcohol beverage per month in the previous year, and drinkers were defined as those who drank more than one such beverage per month in the previous year. Comorbidities included hypertension, dyslipidemia, ischemic heart disease, diabetes, and depression. Respiratory symptoms defined the presence of cough or sputum production for a total of more than 3 months in a year. Subjective health perception was assessed using a 5-point Likert scale. The EQ5D is valid for measuring HRQoL in patients with COPD and the general population [15].

HRQoL

We used the Korean version of EQ-5D system as a standard measure for HRQoL [16]. The EQ-5D consists of a descriptive system and an overall self-reported score. The descriptive components consist of a five-domain questionnaire that evaluates mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The current state of each domain is assessed as “no problem,” “mild problem,” or “serious problem.”

Statistical analysis

We compared the demographic and clinical characteristics of the COPD and non-COPD groups using the χ^2 or t-test (or Mann–Whitney U test). Our data were nationally representative; however, there was a possibility of missing values due to the nature of survey data. For this reason, we performed multiple imputation (5 repetitions with 10 cycles), assuming that the missing variables were randomly distributed. Since most previous studies that compared a COPD group with a non-COPD group reported a significant difference in the baseline characteristics between groups, we compared the HRQoL indices after adjusting for important confounders, including age, sex, household income, years of education, marital status, BMI, current smoking, alcohol consumption, and comorbidities using PSM with 1:1 ratio. After PSM, the EQ-5D overall scores were compared using a t-test and the five categorical domains were compared using χ^2 tests. Statistical analyses were performed using R version 3.6.3 (the R Foundation). A p value of less than 0.05 was considered statistically significant.

Results

Characteristics of the study population, EQ-5D, and subjective health perception

Of the 39,156 participants sampled from the 2012–2016 KNHANES survey, 2,325 out of 15,669 people over age 40 were diagnosed with COPD, for a prevalence of 14.8%. In accordance with the GOLD criteria, most patients with COPD were in stage I (49.5%) and stage II (45.7%) (Fig. 1). The COPD group was older ($p < 0.001$), predominantly male ($p < 0.001$), of lower education level ($p < 0.001$), and lower household income ($p < 0.001$) compared to the non-COPD group. In addition, the COPD group had significantly lower BMI ($p < 0.001$), higher prevalence of current smoking ($p < 0.001$), alcohol consumption ($p = 0.015$), hypertension, ischemic heart disease, and diabetes ($p < 0.001$) than the non-COPD group. The EQ-5D overall scores of the COPD group were lower than those of the non-COPD group (0.92 ± 0.13 vs. 0.94 ± 0.12 , $p < 0.001$), and former exhibited higher proportions of “mild-to-serious problems” in mobility, self-care, usual activities, pain/discomfort, and anxiety/depression domains than the non-COPD group (Table 1).

Table 1
Demographics, clinical characteristics, EQ-5D domain scores and subjective health perception for the complete dataset

	Non-COPD (N = 12,781)	COPD (N = 2,230)	<i>p</i>
Age, years	56.3 ± 10.5	65.8 ± 9.3	< 0.001
Male	4877 (38.2%)	1622 (72.3%)	< 0.001
Educational year			< 0.001
≤ 6 years	3364 (26.3%)	907 (40.7%)	
7–9 years	1813 (14.2%)	373 (16.7%)	
10–12 years	4234 (33.1%)	590 (26.5%)	
≥ 13 years	3370 (26.4%)	360 (16.1%)	
Household income			< 0.001
Lowest	2330 (18.2%)	725 (32.5%)	
Lower middle	3233 (25.3%)	620 (27.8%)	
Upper middle	3299 (25.8%)	455 (20.4%)	
Highest	3919 (30.7%)	430 (19.3%)	
Marital status			0.003
Married	12487 (97.7%)	2201 (98.7%)	
Unmarried/Divorced	294 (2.3%)	29 (1.3%)	
BMI, kg/m ²	24.3 ± 3.2	23.8 ± 2.9	< 0.001
Current smoking	1948 (15.2%)	607 (27.2%)	< 0.001
Drinking	2956 (23.1%)	569 (25.5%)	0.015
Hypertension	3596 (28.1%)	930 (41.7%)	< 0.001
Hyperlipidemia	2523 (19.7%)	462 (20.7%)	0.299
Ischemic heart disease	388 (3.0%)	117 (5.2%)	< 0.001
Depression	686 (5.4%)	90 (4.0%)	0.010
Diabetes mellitus	1342 (10.5%)	363 (16.3%)	< 0.001
EQ-5D index scores	0.94 ± 0.12	0.92 ± 0.13	< 0.001

BMI, body mass index; COPD, chronic obstructive pulmonary disease; EQ-5D, EuroQol-5 dimension

	Non-COPD (N = 12,781)	COPD (N = 2,230)	<i>p</i>
EQ-5D domain			
Mobility			< 0.001
No problem in walking about	10751 (84.1%)	1696 (76.1%)	
Some problem in walking about	1943 (15.2%)	516 (23.1%)	
Confined to bed	87 (0.7%)	18 (0.8%)	
Self-care			< 0.001
No problems self care	12283 (96.1%)	2095 (93.9%)	
Some problems washing or dressing myself	474 (3.7%)	132 (5.9%)	
Unable to wash or dress myself	24 (0.2%)	3 (0.1%)	
Usual activities			< 0.001
No problem with performing usual activities	11627 (91.0%)	1937 (86.9%)	
Some problem with performing usual activities	1094 (8.6%)	271 (12.2%)	
Unable to performing my usual activities	60 (0.5%)	22 (1.0%)	
Pain/discomfort			0.001
No pain or discomfort	9538 (74.6%)	1613 (72.3%)	
Moderate pain or discomfort	2945 (23.0%)	538 (24.1%)	
Extremely pain or discomfort	298 (2.3%)	79 (3.5%)	
Anxiety /depression			0.042
Not anxious or depressed	11333 (88.7%)	1938 (86.9%)	
Moderately anxious or depressed	1347 (10.5%)	275 (12.3%)	
Extremely anxious or depressed	101 (0.8%)	17 (0.8%)	
Subjective health perception			< 0.001
Very good	573 (4.5%)	110 (4.9%)	
Good	3070 (24.0%)	491 (22.0%)	
Moderate	6672 (52.2%)	1063 (47.7%)	
Bad	1986 (15.5%)	441 (19.8%)	

BMI, body mass index; COPD, chronic obstructive pulmonary disease; EQ-5D, EuroQol-5 dimension

	Non-COPD (N = 12,781)	COPD (N = 2,230)	<i>p</i>
Very bad	480 (3.8%)	125 (5.6%)	
BMI, body mass index; COPD, chronic obstructive pulmonary disease; EQ-5D, EuroQol-5 dimension			

Characteristics of the study population, EQ-5D, and subjective health perception after propensity score matching

Figure 2(a) shows the distribution of missing variables in the whole dataset, in which the missing variables were randomly distributed. An exact 1:1 match between participants with and without COPD was performed using PSM (Fig. 2(b), Table 2). As a result, the final analysis samples consisted of 2,230 participants in each of the COPD and non-COPD groups.

Table 2
Demographics, clinical characteristic, EQ-5D domain scores and subjective health perception after propensity score matching

	Non-COPD (N = 2,230)	COPD (N = 2,230)	<i>p</i>
Age, years	65.3 ± 9.6	65.8 ± 9.3	0.089
Male	1618 (72.6%)	1622 (72.3%)	0.920
Educational year			0.300
≤ 6 years	878 (39.4%)	907 (40.7%)	
7–9 years	364(16.3%)	373 (16.7%)	
10–12 years	580 (26.0%)	590 (26.5%)	
≥ 13 years	408 (18.3%)	360 (16.1%)	
Household income			0.137
Lowest	662 (29.7%)	725 (32.5%)	
Lower middle	643 (28.8%)	620 (27.8%)	
Upper middle	501 (22.5%)	455 (20.4%)	
Highest	424 (19.0%)	430 (19.3%)	
Marital status			0.580
Married	2206 (98.9%)	2201 (98.7%)	
Unmarried/Divorced	24 (1.1%)	29 (1.3%)	
BMI, kg/m ²	23.9 ± 3.0	23.8 ± 2.9	0.467
Current smoking	566 (25.4%)	607 (27.2%)	0.174
Drinking	591 (26.5%)	569 (25.5%)	0.473
Hypertension	922 (41.3%)	930 (41.7%)	0.832
Hyperlipidemia	460 (20.6%)	462 (20.7%)	0.971
Ischemic heart disease	124 (5.6%)	117 (5.2%)	0.691
Depression	91 (4.1%)	90 (4.0%)	1.000
Diabetes mellitus	385(17.3%)	363 (16.3%)	0.400
EQ-5D index scores	0.923 ± 0.130	0.920 ± 0.130	0.484

BMI, body mass index; COPD, chronic obstructive pulmonary disease; EQ-5D, EuroQol-5 dimension

	Non-COPD (N = 2,230)	COPD (N = 2,230)	<i>p</i>
EQ-5D domain			
Mobility			0.969
No problem in walking about	1703 (76.4%)	1696 (76.1%)	
Some problem in walking about	509 (22.8%)	516 (23.1%)	
Confined to bed	18 (0.8%)	18 (0.8%)	
Self-care			0.600
No problems self care	2090 (93.7%)	2095 (93.9%)	
Some problems washing or dressing myself	134 (6.0%)	132 (5.9%)	
Unable to wash or dress myself	6 (0.3%)	3 (0.1%)	
Usual activities			0.724
No problem with performing unusual activities	1941 (87.0%)	1937 (86.9%)	
Some problem with performing unusualactivities	272 (12.2%)	271 (12.2%)	
Unable to performing my usual activities	17 (0.8%)	22 (1.0%)	
Pain/discomfort			0.667
No pain or discomfort	1611 (72.2%)	1613 (72.3%)	
Moderate pain or discomfort	550 (24.7%)	538 (24.1%)	
Extremely pain or discomfort	69 (3.1%)	79 (3.5%)	
Anxiety /depression			0.071
Not anxious or depressed	1977 (88.7%)	1938 (86.9%)	
Moderately anxious or depressed	230 (10.3%)	275 (12.3%)	
Extremely anxious or depressed	23 (1.0%)	17 (0.8%)	
Subjective health perception			0.076
Very good	115 (5.2%)	110 (4.9%)	
Good	495 (22.2%)	491 (22.0%)	
Moderate	1131 (50.7%)	1063 (47.7%)	
Bad	371 (16.6%)	441 (19.8%)	

BMI, body mass index; COPD, chronic obstructive pulmonary disease; EQ-5D, EuroQol-5 dimension

	Non-COPD (N = 2,230)	COPD (N = 2,230)	<i>p</i>
Very bad	118 (5.3%)	125 (5.6%)	
BMI, body mass index; COPD, chronic obstructive pulmonary disease; EQ-5D, EuroQol-5 dimension			

The comparison of EQ-5D overall scores after adjusting for age, gender, educational status, household income, marital status, BMI, current smoking, alcohol consumption, and comorbidities revealed no significant difference between the COPD and matched non-COPD groups ($p = 0.484$). There were no significant differences between groups for the EQ-5D domains scores and overall subjective health perception ($p = 0.076$; Table 2).

EQ-5D and subjective health perception according to COPD GOLD criteria after propensity score matching

The GOLD stage III and IV group had the lowest EQ-5D overall subjective health perception ($p = 0.004$) and demonstrated a higher proportion of “mild-to-serious problems” in the mobility and usual activities domains than did the GOLD stage I and II groups. In addition to subjective health perception, the GOLD stage III and IV group showed higher proportion of “bad” and “very bad” ($p < 0.001$; Table 3).

Table 3

Comparison of demographics, EQ-5D domain scores and subjective health perception according to GOLD criteria

	Stage I (N=1,113)	Stage II (N = 1,019)	Stage III-IV (N = 98)	<i>p</i>
Current smoking	273 (24.5%)	307 (30%)	27(27.6%)	0.015
Respiratory symptom				
Cough that lasted for 3 months	47(4.2%)	80(7.9%)	29(29.6%)	< 0.001
Sputum that lasted for 3 months	146(13.1%)	181(17.8%)	42(42.9%)	< 0.001
EQ-5D index scores	0.92 ± 0.1	0.92 ± 0.1	0.88 ± 0.2	0.004
EQ-5D domain				
Mobility				0.002
No problem in walking about	854 (76.7%)	782 (76.7%)	60(61.2%)	
Some problem in walking about	250 (22.5%)	231 (22.7%)	35(35.7%)	
Confined to bed	9 (0.8%)	6 (0.6%)	3(3.1%)	
Self-care				0.054
No problems self care	1047 (94.1%)	960 (94.2%)	88 (89.8%)	
Some problems washing or dressing myself	64 (5.8%)	59 (5.8%)	9 (9.2%)	
Unable to wash or dress myself	2 (0.2%)	0 (0.0%)	1 (1.0%)	
Usual activities				0.027
No problem with performing unusual activities	970 (87.2%)	892 (87.5%)	75 (76.5%)	
Some problem with performing unusual activities	130 (11.7%)	120 (11.8%)	21 (21.4%)	
Unable to performing my usual activities	13 (1.2 %)	7 (0.7%)	2 (2.0%)	
Pain/discomfort				0.885

EQ-5D, EuroQol-5 dimension; GOLD, Global Initiative for Chronic Obstructive Lung Disease

	Stage I (N=1,113)	Stage II (N = 1,019)	Stage III-IV (N = 98)	<i>p</i>
No pain or discomfort	802 (72.1%)	739 (72.5%)	72 (73.5%)	
Moderate pain or discomfort	271 (24.3%)	246 (24.1%)	21 (21.4%)	
Extremely pain or discomfort	40 (3.6%)	34 (3.3%)	5 (5.1%)	
Anxiety /depression				0.394
Not anxious or depressed	976 (87.7%)	883 (86.7%)	79 (80.6%)	
Moderately anxious or depressed	129 (11.6%)	128 (12.6%)	18 (18.4%)	
Extremely anxious or depressed	8 (0.7%)	8 (0.8%)	1 (1.0%)	
Subjective health perception				< 0.001
Very good	67 (6.0%)	43 (4.2%)	0 (0.0%)	
Good	279 (25.1%)	202 (19.8%)	10 (10.2%)	
Moderate	530 (47.6%)	501 (49.2%)	32 (32.7%)	
Bad	183 (16.4%)	221 (21.7%)	37 (37.8%)	
Very bad	54 (4.9%)	52 (5.1%)	19 (19.4%)	
EQ-5D, EuroQol-5 dimension; GOLD, Global Initiative for Chronic Obstructive Lung Disease				

Discussion

The purpose of this study was to evaluate HRQoL in community dwelling persons with COPD using structured questionnaires and a PSM method. There was no difference in the EQ-5D overall subjective health score between COPD and non-COPD groups after adjusting for important clinical and demographic variables. In additional subgroup analysis, the EQ-5D overall subjective health score of the GOLD stage III and IV group was lower and the proportion of those with “mild-to-serious problems” in the mobility and usual activity domains was higher than the GOLD stage I and II groups. In our study, patients with COPD were likely to be male, older, and with lower body mass index, educational experience, and household income than the non-COPD group. Additionally, patients with COPD had more comorbidities, including hypertension, ischemic heart disease, and diabetes. Moreover, their EQ-5D overall subjective health scores

were low, and many respondents reported having severe problems in all EQ-5D domains (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). However, we used PSM to control for variables that can affect HRQoL, such as age [17], gender [18], education level [19], household income level [20], marital status [21], BMI [22], current smoking [23], and alcohol consumption [24]. There was no difference between the HRQoL of the COPD and non-COPD groups after adjusting for these variables. There have been many studies of HRQoL in patients with COPD, which have reported that HRQoL in persons with COPD is worse than in the general population [25].

Additionally, gender-specific HRQoL differences have been reported in patients with chronic diseases in several studies. Among chronically ill patients, HRQoL of men was better than that of women [26]. Bentsen et al. [27] demonstrated that women with COPD may have more severe impairment of HRQoL than men. The worldwide prevalence of depression in females is higher than that of males. Therefore, it is likely that the risk of depression may be associated with biological differences [28]. In this regard, vulnerability to emotional stress, such as depression or anxiety, may affect HRQoL.

The impact of BMI on HRQoL in patients with COPD is controversial. Hong et al. [25] found no association between BMI and HRQoL, while DiBonaventura et al. [29] reported that high BMI was significantly associated with better HRQoL in patients with COPD. Huber [30] found that HRQoL in patients with obesity and mild-to-severe COPD could improve after weight loss, but this association was not observed in patients with very severe COPD (GOLD stage IV). COPD patients with a lower BMI tend to have a higher mortality rate compared to normal BMI patients, while overweight or obese patients tend to have a lower mortality rate [31]. However, BMI is a value of weight divided by the square of height, which does not accurately reflect metabolism, body fat mass, and muscle mass. Patients with COPD are also at high risk of gradual loss of muscle mass, which could be as a result of physical inactivity [32]. Therefore, a careful interpretation of the obesity paradox in patients with COPD is required, and further studies are needed to assess the association between the lean body mass, waist circumference, and a waist-to-height ratio of patients with COPD and their HRQoL.

In the general population, high blood pressure significantly impairs HRQoL in terms of both physical and mental health [33]. In a study of the association between hypertension, cardiovascular disease, and HRQoL in patients with asthma and COPD, HRQoL was worse in patients with asthma and hypertension or cardiovascular disease than those without hypertension or cardiovascular disease. In addition, cardiovascular disease did not affect HRQoL, although it was an important cause of death in patients with COPD [34].

In this study, there was no difference in HRQoL between COPD and non-COPD groups after adjusting for important variables that may affect HRQoL. Early COPD patients had greater ventilator inefficiency compared with non-COPD patients during activities of daily living. However, patients with COPD did not differ significantly from non-COPD group according to physical activities such as climbing stairs and self-care [35]. In addition, HRQoL can be more affected by gender, economic status, educational status, and

comorbidities rather than by COPD itself. Similarly, there was also no difference in subjective health status between COPD and non-COPD groups.

Smoking is the most important predictor of COPD. In the current study, 24.5% of the GOLD stage I group, 30% of the stage II group, and 27.6% of the stage III-IV group were current smokers. In a randomized controlled trial study demonstrating the benefits of smoking cessation in patients with COPD, a 14.5-year follow-up of the mild COPD group showed that the successful smoking cessation group demonstrated higher pulmonary function and improved survival rate than the group that failed to stop smoking [36]. In addition, smoking cessation is the most effective intervention to stop the progression of COPD [37]; thus, healthcare personnel should encourage patients with COPD to quit smoking. However, Mun et al. [38] reported that most smokers with COPD-related symptoms, such as dyspnea, phlegm, and cough, did not take any actions to alleviate their symptoms, and Koreans had significantly lower awareness of COPD disease compared to other countries. This fact negatively affects the attempts of patients with COPD to quit smoking. In this study, a greater proportion of GOLD II and III-IV patients were current smokers compared to the GOLD I group. As individuals' understanding and awareness of COPD is an important aspect that affects their health care [39], continuing education to quit smoking and providing basic information about the disease to patients with COPD are very important.

Wacker [40] observed the effect of COPD on HRQoL in a middle-aged population-based cohort. GOLD II, III, and IV groups had lower SF-12 physiological component scores compared to non-COPD groups, but the GOLD I group did not differ from persons without COPD. Furthermore, mental component scores did not differ between a non-COPD group and COPD groups (GOLD I, II). In addition, another study reported that the physical health SF-12 score differed according to GOLD stage, but there were no differences in the mental health score [1]. A direct comparison between EQ5D and SF-12 is not possible, but differences in physical health items such as mobility and usual activity according to the severity of COPD are consistent with previous studies.

This study has the following limitations. First, this was a retrospective cross-sectional study using data from KNHANES; as such, certain health aspects were not addressed. For example, factors such as the exercise capacity and treatment status of patients with COPD may affect their HRQoL, but these parameters were not investigated in this study. Second, patients with severe COPD are more likely to be admitted to a hospital rather than remain at home, and thus the possibility of selective bias of the subjects according to disease severity cannot be excluded. Third, we used mild COPD patients with less than 0.7 of FEV₁/FVC in the PFT, therefore, patients with bronchial asthma or with asthma and COPD overlap could be included in early COPD group. Finally, because the PSM method focuses on matching observed variables, this could worsen selection bias in terms of unobserved variables. Therefore, the possibility of hidden, unobserved but important factors must be recognized when evaluating results that used PSM. Nevertheless, the strength of this study lies in its use of national population data rather than data from a single hospital or community. In addition, this study presented a comparative analysis of HRQoL between COPD and non-COPD groups, controlling key confounders that may affect HRQoL such as age, gender, household income, and marital status.

Conclusions

In this study, a comparative analysis of the HRQoL of participants with and without COPD was performed, while PSM was used to control for confounders that may affect HRQoL. There was no significant difference between COPD and non-COPD groups; however, according to the GOLD criteria, as the severity of COPD increased, HRQoL decreased. In particular, this difference was prominent in the domain related to physical health. Therefore, proper community support and financial stability might be important to maintain the HRQoL of patients with COPD, in addition to early detection and treatment.

Abbreviations

BMI

body mass index

COPD

chronic obstructive pulmonary disease

EQ-5D

EuroQol-5 Dimensions

GOLD

Global Initiative for Chronic Obstructive Lung Disease

FEV₁

forced expiratory volume in 1 second value

FVC

forced vital capacity

HRQoL

health-related quality of life

KNHANES

Korea National Health and Nutrition Examination Survey

PFT

pulmonary function test

PSM

propensity score matching.

Abbreviations

BMI: body mass index; COPD: chronic obstructive pulmonary disease; EQ-5D: EuroQol-5 Dimensions; GOLD: Global Initiative for Chronic Obstructive Lung Disease; FEV₁: forced expiratory volume in 1 second value; FVC: forced vital capacity; HRQoL: health-related quality of life; KNHANES: Korea National Health and Nutrition Examination Survey; PFT: pulmonary function test; PSM: propensity score matching.

Declarations

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Author's contributions

Conceptualization: S.J.L; Data curation: S.J.L; Formal analysis: S.J.L; Methodology: S.J.L; Project administration: H.S.J; Supervision: S.J.L; Writing-original draft: H.S.J and S.J.L; Writing-review and editing: H.S.J. and S.J.L. All authors read and agreed to the published version of the manuscript.

Availability of data and materials

Our datasets are available from the corresponding author on reasonable request.

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Declarations

Ethics approval and consent to participate

The study was conducted according to the guidelines of the Declaration of Helsinki, with an exemption approval from the Institutional Review Board of Kangdong Sacred Heart Hospital (IRB No. 2020-05-005).

Consent for publication

Not applicable.

Competing Interests

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

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Figures

Figure 1

Flow chart for selection of study participants

(a)

(b)

Figure 2

(a) Processing of the missing data and result of the multiple imputation of the participants; (b) Distribution of the propensity score matched and unmatched participants