Original Article

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Differences in physical function, self-efficacy, and health-related quality of life by disease severity in community-dwelling patients with chronic obstructive pulmonary disease

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Purpose: This study investigated the differences in physical function, self-efficacy (SE), and health-related quality of life (HRQoL) categorized by disease severity in community-dwelling patients with chronic obstructive pulmonary disease (COPD).

Methods: This cross-sectional study included 182 patients with COPD selected from the pulmonology outpatient department of a tertiary hospital. Disease severity was measured using forced expiratory volume in 1 second (FEV_1). Physical function, SE, and HRQoL were measured with the six-minute walking distance, Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE), and St. George's Respiratory Questionnaire (SGRQ). Disease duration, FEV_1, and 12-month history of exacerbations were obtained from medical records. Patients were categorized by Global Initiative for Chronic Obstructive Lung Disease (GOLD) category. Data were analyzed using the χ^2 test, and one-way ANOVA.

Results: Most of the participants were male and nonsmokers. The disease duration was 10.76 ± 10.03 years, the mean FEV_1% was 62.13 ± 22.80, and 70.3% of the participants were in GOLD category 2 (moderate) or milder. Half of the participants reported modified Medical Research Council scores ≥ 2. Patients in GOLD categories 1 and 3 (mild and severe) exhibited significantly higher PRAISE scores than those in the other groups ($F = 8.23$, $p < .001$). The total SGRQ scores were highest in GOLD 4 (very severe), indicating the lowest HRQoL. Significant differences were identified among GOLD 1, GOLD 2 and 3, and GOLD 4 ($F = 9.92$, $p < .001$).

Conclusion: We identified potentially useful variables to comprehensively assess disease severity and tailor management strategies, including airflow limitation, and to determine the consequences of COPD from patients' perspectives.

Key Words: Chronic obstructive pulmonary disease; Forced expiratory volume; Self-efficacy; Quality of life

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INTRODUCTION

Since 2009, the prevalence of chronic obstructive pulmonary disease (COPD) in Korea has been increasing, and this trend is expected to continue, especially with an aging population and increased risk factors such as air pollution [1]. In Korea, the disability-adjusted life year, which represents social loss due to disease, is also increasing, contrary to the global trend of stable or declining COPD cases, indicating an underestimated social disease burden [2]. Furthermore, due to the complexity of COPD, its diagnosis is often delayed. The irreversible nature of the disease [3], which progressively worsens over time, often leads to a vicious cycle of worsening symptoms, decreased performance of daily activities, and deterioration of the overall functional status, significantly affecting patients' quality of life [4]. In this context, the Global Initiative for Chronic Obstruc-

tive Lung Disease (GOLD) guidelines [3] and Korean COPD guidelines [5], which establish the standard of care for COPD, emphasize the importance of a comprehensive assessment. This assessment includes evaluation of the patient's physical functional status and self-reported indicators of subjective symptoms, conditions, and quality of life.

In patients with COPD, dyspnea reduces their ability to engage in sustained physical activity, leading to limitations in daily life and overall functioning. Physical functioning also decreases as COPD severity increases [1]. Consequently, both domestic and international COPD guidelines [3,5] emphasize the importance of maintaining physical function in patients with COPD. This is crucial for preventing disease progression, delaying exacerbations, and assessing the extent to which patients can continue walking, as determined by the walking ability assessment. Similarly, it is crucial to keep patients actively engaged in their daily lives in order to maintain their functional status. To achieve this, significant emphasis has been placed on enhancing self-motivation [6] and treatment adherence [7] to both pharmacological and nonpharmacological interventions. Self-efficacy (SE), defined as an individual's confidence in successfully performing certain behaviors, plays a key role in COPD management [8]. Promoting SE is particularly crucial in ongoing respiratory rehabilitation, which is essential for preventing exacerbations of COPD [3,5]. Indeed, previous research on patients with COPD has demonstrated a strong association between higher SE and several positive health outcomes, such as fewer complaints related to dyspnea and fewer limitations in daily activities [9]. Additionally, higher SE has been linked to an improved overall quality of life in patients with COPD [8]. These findings suggest that SE positively affects the overall health outcomes of patients with COPD, indicating the need to explore SE and disease severity in this population.

Several variables are involved in disease progression of COPD patients. In particular, forced expiratory volume in one second (FEV_1) [7], which is a key indicator for diagnosing COPD and measuring the degree of airflow limitation, has been suggested by the GOLD as an important criterion for stratifying the severity of COPD [3]. However, a previous study [7] that stratified COPD patients based on their FEV_1 and examined their relationship with patient symptoms found no significant associations. In addition, a lower FEV_1 in COPD patients is associated with an increased frequency of acute exacerbations, symptoms, and physical disability [10]. Moreover, greater physical disability and psychological stress are linked to a poorer quality of life and less favorable long-term prognosis [11,12]. These findings underscore the importance of considering a comprehensive picture that includes patient-reported outcomes and psychological indicators when assessing patients with COPD and determining appropriate therapeutic approaches [13]. Relying solely on a single metric such as disease severity may not provide a complete understanding of a patient's condition. Emphasizing the significance of a comprehensive assessment is crucial because it allows the exploration of interventions that can aid in preventing exacerbations of COPD [2,7].

As mentioned above, COPD is a complex disease, and several variables are associated with a patient's condition and treatment outcomes. It is crucial to adopt a therapeutic approach based on a comprehensive assessment that includes subjective reports and the patient's physical condition. However, in Korea, there is a lack of studies that assess multiple variables along with COPD severity in patients and identify the differences between these variables based on disease severity. Therefore, this study aimed to comprehensively explore respiratory rehabilitation SE, health-related quality of life (HRQoL), and physical functioning of COPD patients, while considering the impact of airflow limitation, which is a commonly used indicator of disease severity. The goal was to provide insights into patient characteristics that should be considered in a comprehensive assessment of patients with COPD and to offer implications for nursing practice and future research.

The objectives of this study were as follows: first, to identify the characteristics of patients with COPD, and second, to determine the differences in physical function, respiratory rehabilitation SE, and HRQoL based on the severity of the condition categorized by the degree of airflow limitation.

METHODS

1. Study design

We conducted a descriptive survey to assess the characteristics of community-dwelling COPD patients.

2. Study participants

The study participants were patients diagnosed with COPD who received outpatient treatment at the Department of Respiratory Medicine of a Wonju Severance Christian Hospital. The inclusion criteria required patients to be capable of effective communication and willing to participate. An FEV_1/forced vital capacity (FVC) < 70% ratio, as per the GOLD diagnostic criteria [3], was one of the key criteria. Additionally, patients with confirmed pulmonary function test results within the previous

three months were included. Certain patients were excluded based on the following criteria: those with a psychiatric illness (e.g., schizophrenia) that could limit their ability to respond to the questionnaire, patients diagnosed with asthma only, and individuals who had difficulties performing tests to determine their exercise capacity [14].

The sample size for this study was calculated using a significance level of .05, statistical power of .80, and effect size of .25, which corresponds to the median of the f-values for one-way ANOVA of Cohen [15]. This resulted in a sample size of 180 participants. To account for potential dropouts, 190 participants were included in this study. After data collection, the final analysis included 182 fully completed questionnaires, with eight incomplete responses, indicating a dropout rate of 4.3%.

3. Research tools

1) Participant characteristics

To identify participants' general characteristics, the study included four questions on age, sex, education level, and occupation. The disease-related characteristics of the participants included indicators suggested by domestic and international treatment guidelines [3,5] and previous studies [16] as the main evaluation items for the disease status of patients with COPD. First, "smoking status" was measured by the participants' self-report of "never smoked," "quit smoking," and "currently smoking." Medical histories included illness duration, presence of cardiovascular disease complications, and hospitalization for exacerbations, which were collected from the patients' medical records. Disease duration was calculated as the number of years between the year in which the patient was first diagnosed with COPD and the year of data collection. The presence of cardiovascular disease was included as a variable because it is highly associated with health status and prognosis in patients with COPD and has been suggested to be a frequent comorbidity in these patients [17]. Dyspnea as a current symptom was measured using the modified Medical Research Council (mMRC) tool proposed by the American Thoracic Society [18]. This tool, which is widely used in Korea for patients with respiratory diseases [19], assesses the level of dyspnea experienced by individuals. The scale ranges from 0, "I do not feel dyspneic except during strenuous exercise"; to 1, "I feel short of breath when walking up an inclined path or walking quickly on a flat surface"; 2, "When I am walking with a group of my peers, I would stop and rest even if I fall behind or walk alone"; 3, "I get out of breath after walking about 100 meters or a few minutes on flat ground"; and 4, "I get out of breath even if I move a little in my daily routine." There are five levels in total, with higher scores on the scale indicating more severe shortness of breath.

2) Severity

The severity of the participants' respiratory conditions was categorized based on airflow limitation (FEV_1 [% predicted]) according to the GOLD stage criteria [3]. The degree of airflow limitation was defined by FEV_1, as recorded in the last three months of the participants' medical records. This approach aligns with the existing literature [20], which indicates that lung function tests using spirometry are acceptable as long as the results are obtained within the last three months. Severity was divided into four levels based on FEV_1 values: GOLD 1 with FEV_1 (% predicted) ≥ 80 was categorized as "mild," GOLD 2 with FEV_1 (% predicted) 50-79 as "moderate," GOLD 3 with FEV_1 (% predicted) 30-49 as "severe," and GOLD 4 with FEV_1 (% predicted) < 30 as "very severe."

3) Physical function

The physical function of the participants refers to their ability to sustain the physical activities that are necessary for daily life. In this study, physical function was measured using the walking ability test, which has been suggested as an indicator of the ability to perform daily activities [3,5]. Among the available options, including the 6- and 12-minute walk tests and shuttle walk tests, the 6-minute walk test was selected as the most commonly used and reliable method. It is easy to administer, shows high patient compliance, and employs standardized instructions [21]. In this study, the 6-minute walk test was conducted indoors following standardized instructions. A 30-m long corridor with a hard floor was used, and the participants walked back and forth at a comfortable speed of their choice for 6 minutes. The total distance covered by each participant during the test was recorded. If a participant experienced shortness of breath or fatigue during the test and wished to stop, the test was immediately halted and the distance walked up to that point was recorded.

4) SE

To assess the participants' SE, we used the Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE) [22]. This tool was developed to measure the extent to which individuals with COPD perceive themselves as capable of maintaining respiratory function and controlling and self-managing their daily lives [22]. This tool has also been validated in Korean patients with COPD [23]. The PRAISE consists of 15 questions, with

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scores ranging from 15 to 60 based on a 4-point Likert scale. The responses range from 1, "not at all," to 4, "very much so," with higher scores indicating higher respiratory rehabilitation SE. In a previous study involving Korean patients with COPD [23], the tool demonstrated high reliability with a Cronbach's alpha value of .93, and in this study, the reliability was .94.

5) HRQoL

To measure participants' HRQoL, we employed the St. George's Respiratory Questionnaire (SGRQ), developed by Jones et al. [24]. This questionnaire comprises 50 items designed to assess daily functioning and the impact of lung disease on the daily lives of patients with COPD. It is organized into three domains: symptoms, activity, and impact. The symptom domain includes eight questions concerning cough frequency, expectoration, wheezing, shortness of breath, chest tightness, and the duration and frequency of chest tightness or wheezing. The activity domain consists of 16 questions focused on physical activities that cause breathlessness or are limited by breathlessness. The impact domain comprises 26 questions covering areas such as occupation, health control, embarrassment, medication needs and side effects, health expectations, and interference in daily life. In the symptom domain, multiple response options are provided for questions regarding the severity, frequency, and persistence of symptoms over a one- to four-week period. In contrast, the activity and impact domains utilize "yes" and "no" responses to assess the difficulty and impact of activities for each question. The scores for each domain were then converted to a range from 0 to 100, with higher scores indicating poorer HRQoL.

The tool used in this study has been validated in patients with COPD in the United States and Europe [24]. The Korean version of the SGRQ has been validated in a study involving patients with chronic respiratory diseases [25]. The Korean version demonstrated a significant inverse correlation with FEV_1 and FVC in pulmonary function tests and the 6-minute walk test as well as a significant normal correlation with the dyspnea scale. In another study involving Korean patients with COPD [26], the reliability of the SGRQ was evaluated and Cronbach's alpha values were .93 for the entire tool, .94 for the symptom domain, .89 for the activity domain, and .88 for the impact domain. In the current study, the overall reliability of the tool was .94, with individual domain reliabilities of .87, .89, and .93 for the symptom, activity, and impact domains, respectively.

4. Data collection

Patients were selected for this study by explaining the purpose and details of the study to respiratory physicians at the university hospital and seeking their cooperation in identifying eligible patients. The research assistant explained the purpose and procedures of the study to patients during outpatient visits. Data collection dates were agreed upon by the patients who consented to participate. Participants were then met on the scheduled data collection day to confirm their willingness to participate in the study. Data were collected in a private patient consultation room in the Department of Respiratory Medicine after participants signed an informed consent form. The general characteristics, smoking status, mMRC dyspnea scale score, respiratory rehabilitation SE, and HRQoL of the participants were self-reported. A research assistant recorded the responses to the questionnaire, or the participants completed the questionnaire if they preferred. Additional information such as disease duration, presence of cardiovascular disease complications, history of hospitalization for exacerbations, and FEV_1 test results to identify airflow limitations was obtained from the participants' medical records. The 6-minute walk test was conducted using a standardized approach in a designated hallway area within the department.

5. Data analysis

The collected data were analyzed using PASW Statistics 28.0 (IBM SPSS Inc., Chicago, USA). Descriptive statistics were used to analyze the participants' characteristics (both general and disease-related), severity, physical functioning, respiratory rehabilitation SE, and HRQoL. The differences in general characteristics, disease-related characteristics, physical functioning, respiratory rehabilitation SE, and HRQoL were examined based on severity using the χ^2 test and one-way ANOVA. Post hoc testing was conducted using Scheffe's test. The significance level was set at .05. The reliability of the instrument was assessed using an internal consistency index (Cronbach's alpha).

6. Ethical considerations

Prior to this study, approval was obtained from the Institutional Review Board (CR 317118) of Wonju Severance Christian Hospital. Before data collection, the research participants were fully informed of the study's purpose, voluntary participation, and protection of their rights, including confidentiality. They were also informed about the benefits, risks, and rewards associated with participating in the study, and that they would receive a small reward for completing the questionnaire. Fur-

thermore, the participants were informed of their right to withdraw their consent at any time without penalty. They were assured that all the information provided and the questionnaire responses would be encrypted and used solely for study purposes. Additionally, participants were informed that all data would be securely stored for a period of three years and then destroyed. After receiving all necessary explanations, the participants who agreed to participate in the study were asked to sign a consent form before the commencement of data collection.

RESULTS

1. Participant characteristics

The mean age of the participants was 70.02 ± 9.54 years and 87.2% were male. Approximately 56.0% of the participants had a junior high school diploma or lower education level, and 60.1% had no occupation. In terms of disease-related characteristics, 89.9% of the participants were not current smokers. The mean duration of the disease was 10.76 ± 10.03 years, with 31.0% of the participants having a disease duration of more than 10 years. Additionally, 35.1% of the participants had cardiovascular complications and 38.5% had been hospitalized at least once in the past year because of worsening symptoms. The mMRC dyspnea scale was used to assess the severity of breathlessness. The findings showed that 49.3% of the participants were at or below Stage 1 on the mMRC scale, indicating that they were out of breath while walking quickly. In contrast, 50.7% were at or above Stage 2, as they experienced breathlessness and had to stop and breathe even when walking behind their peers or alone. According to GOLD stage criteria, 32.4% of the participants were categorized as 'mild,' 37.9% were 'moderate,' and 22.1% and 7.6% were 'severe' and 'very severe,' respectively (Table 1).

Table 1. Participant Characteristics (N = 182)

Characteristic	Category	n (%)	M ± SD
Age (yr)	≤ 60	32 (17.6)	70.02 ± 9.54
	61–70	56 (31.0)	(Range: 42–90)
	71–80	68 (37.2)	
	≥ 81	26 (14.2)	
Sex	Male	157 (87.2)	
	Female	25 (12.8)	
Education	≤ Middle school	102 (56.0)	
	≤ High school	54 (30.0)	
	≥ College	26 (14.0)	
Occupation	None	109 (60.1)	
	Self-employed	65 (35.6)	
	Office worker	8 (4.3)	
Smoking	Never	47 (25.7)	
	Ex-smoker	117 (64.2)	
	Current smoker	18 (10.1)	
Duration of the disease (yr)	< 10	126 (69.0)	10.76 ± 10.03
	≥ 10	56 (31.0)	
Cardiovascular comorbidities	Yes	64 (35.1)	
	No	118 (64.9)	
Exacerbation history	None	112 (61.5)	
	≥ 1	70 (38.5)	
mMRC	0–1	90 (49.3)	
	≥ 2	92 (50.7)	
Disease severity			
GOLD1 (mild)	FEV_1 (% predicted) ≥ 80	59 (32.4)	62.13 ± 22.80
GOLD2 (moderate)	FEV_1 (% predicted) 50 – 79	69 (37.9)	
GOLD3 (severe)	FEV_1 (% predicted) 30 – 49	40 (22.1)	
GOLD4 (very severe)	FEV_1 (% predicted) < 30	14 (7.6)	

M = mean; SD = standard deviation; mMRC = modified Medical Research Council; GOLD = Global Initiative for Chronic Obstructive Lung Disease; FEV_1 = forced expiratory volume in 1 second.

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2. Participant characteristics according to disease severity

A comparison of the general and disease-related characteristics of the participants by disease severity is shown in Table 2. First, the differences in general characteristics were significantly lower in terms of age (F = 5.77, p = .001), in the order of the moderate, severe, and very severe groups. However, the groups did not differ significantly in terms of sex, education, or occupational distribution.

Among the disease-related characteristics, the duration of illness was the shortest in the mild group (7.76 ± 8.26 years) and the longest in the very severe group (13.84 ± 9.37 years); however, the disease duration did not differ significantly between groups. Similarly, the distribution of cardiovascular comorbidities and hospitalizations for exacerbations did not differ significantly between groups. However, for the mMRC dyspnea scale, the distribution differed significantly between groups (χ^2 = 17.97, p < .001).

3. Physical function, respiratory rehabilitation SE, and HRQoL

Regarding the 6-minute walk test results, there was no statistically significant difference between the mild, moderate, severe, and very severe groups (F = 1.18, p = .332). Respiratory rehabilitation SE was significantly higher in the mild and moderate groups than in the very severe group (F = 8.23, p < .001). For the SGRQ scores, which measured HRQoL, the very severe group had a significantly lower HRQoL than the other three groups, and the highest scores overall and in the symptom, activity, and impact domains. Specifically, the overall score was significantly different among the mild, moderate, severe, and very severe groups (F = 9.92, p < .001). Symptom domain scores were significantly lower in the mild and moderate groups than in the very severe group (F = 5.59, p < .001). The activity domain score was significantly lower in the mild group than in the other groups (F = 13.32, p < .001), and the impact domain score was significantly higher in the very severe group than in the other groups (F = 5.70, p = .001) (Table 3).

DISCUSSION

This study evaluated physical functioning, SE, and HRQoL and revealed differences in these variables depending on disease severity categorized by the degree of airflow limitation, a critical criterion in the GOLD guidelines. A noteworthy contri-

Table 2. Comparing Participant Characteristics by Disease Severity (N = 182)

Characteristic		Disease Severity				χ^2 or F (p)
		Mild[a] (n = 59)	Moderate[b] (n = 69)	Severe[c] (n = 40)	Very Severe[d] (n = 14)	
Age (yr)		72.68 ± 9.01	73.00 ± 8.62	66.84 ± 8.28	64.10 ± 8.61	5.77 (.001) b > c > d
Sex	Male	56 (94.3)	62 (89.8)	33 (83.3)	11 (80.0)	2.64 (.450)
	Female	3 (5.7)	7 (10.2)	7 (16.7)	3 (20.0)	
Education	≤ Middle school	28 (46.8)	45 (66.2)	21 (52.5)	8 (57.1)	
	≤ High school	17 (29.0)	20 (29.1)	13 (32.5)	4 (28.6)	17.51 (.289)
	≥ College	14 (24.2)	4 (5.7)	6 (15.0)	2 (14.3)	
Occupation	No	30 (57.1)	56 (81.2)	21 (51.6)	12 (85.7)	4.87 (.561)
	Yes	29 (42.9)	13 (18.8)	19 (48.4)	2 (14.3)	
Smoking	Never	10 (17.1)	16 (22.4)	13 (32.3)	2 (14.3)	4.68 (.587)
	Ex-smoker	41 (68.6)	47 (67.4)	22 (54.8)	11 (78.6)	
	Current smoker	8 (14.3)	6 (8.2)	5 (12.9)	1 (7.1)	
Duration of the disease (yr)		7.76 ± 8.26	10.89 ± 11.37	12.84 ± 10.88	13.84 ± 9.37	1.99 (.118)
Cardiovascular comorbidities	Yes	23 (47.1)	27 (38.8)	6 (16.1)	3 (21.4)	21.56 (.120)
	No	36 (52.9)	42 (61.1)	34 (83.9)	11 (78.6)	
Exacerbation history	None	39 (65.7)	44 (63.3)	24 (60.0)	5 (39.1)	2.38 (.498)
	≥ 1	20 (34.3)	25 (36.7)	16 (40.0)	9 (60.9)	
mMRC	0–1	42 (71.2)	34 (49.0)	15 (38.7)	1 (0.7)	17.97 (< .001)
	≥ 2	17 (28.8)	35 (51.0)	25 (61.3)	13 (99.3)	

Values are presented as the mean ± standard deviation or n (%).
mMRC = modified Medical Research Council.

Table 3. Comparing Study Variables by Disease Severity (N = 182)

Variable	Total	Disease Severity				F (*p*)
		Mild[a] (n = 59)	Moderate[b] (n = 69)	Severe[c] (n = 40)	Very Severe[d] (n = 14)	
Physical function						
6-minute walking distance (meter)	206.21 ± 102.35	251.78 ± 200.55	185.65 ± 105.55	245.24 ± 122.92	182.78 ± 112.28	1.18 (.332)
Self-efficacy (PRAISE) (Range: 15–60)	42.69 ± 7.89	45.38 ± 6.06	41.17 ± 7.68	45.61 ± 8.87	37.15 ± 9.09	8.23 (< .001) a, c > d
Health-related quality of life (SGRQ) (Range: 0–100)						
Total	40.11 ± 20.22	31.53 ± 17.53	39.53 ± 19.82	45.57 ± 17.63	62.92 ± 19.11	9.92 (< .001) a < b, c < d
Symptom	49.42 ± 21.14	43.5 ± 20.19	47.81 ± 20.88	54.01 ± 17.00	69.38 ± 25.11	5.59 (< .001) a, b < d
Activity	52.05 ± 25.82	38.56 ± 23.27	52.50 ± 25.41	60.57 ± 20.01	82.67 ± 16.15	13.32 (< .001) a < b, c < d
Impact	30.43 ± 20.84	23.79 ± 18.31	29.61 ± 20.33	35.00 ± 20.40	49.63 ± 23.79	5.70 (.001) a, b, c < d

Values are presented as the mean ± standard deviation.
PRAISE = Pulmonary Rehabilitation Adapted Index of Self-Efficacy; SGRQ = Saint George Respiratory Questionnaire.

bution of this finding lies in the application of these variables, which have been emphasized as crucial indicators for comprehensively assessing the conditions of COPD patients in previous international studies in the context of community-dwelling Korean patients.

The mean age of the study participants was 70.02 years, with many (68.2%) in the age range of 60s and 70s. The study included a higher proportion of male participants (87.2%), and 14.0% had a college degree or higher. These demographic characteristics are similar to those of a previous study that examined 1,092 patients with COPD from the sixth National Health and Nutrition Examination Survey [1], in which 75.6% of the participants were in their 60s and 70s, 76.1% were male, and 15.3% had a college degree or higher. These similarities indicate that the current study sample was representative of a larger COPD patient population. However, the distribution of the severity categories in this study differed from that reported by Mok and Jo [1]. In the current study, disease severity of 70.3% of participants were categorized as mild or moderate, whereas 29.7% were categorized as severe or very severe. However, Mok and Jo reported that 95.7% of their participants belonged to the mild or moderate category. Upon further analysis of the differences in demographic characteristics according to severity, we found that age was significantly lower in the moderate, severe, and very severe groups. This finding is consistent with that of a previous international study that analyzed demographic characteristics based on FEV_1 in patients with COPD [13], which also reported that patients in the very severe group tended to be younger. However, this observation differs from that of another study that examined the general characteristics of patients with COPD in the Korean National Health and Nutrition Examination Survey [1] and found that higher severity was associated with older age. The observed differences in the characteristics of the participants in this study compared with those in previous studies may be attributed to several factors. First, this and the aforementioned studies from outside Korea [13] were conducted on patients registered and treated at a tertiary general hospital. However, a Korean study analyzed data collected from a large sample of the Korean National Health and Nutrition Examination Survey, which included patients from various medical institutions of different sizes and service scopes in the community. Consequently, the Korean study may have included a more diverse range of patients with various characteristics, which may have influenced the outcomes. It is crucial to acknowledge the limitations of the current study, particularly the relatively small number of participants. This may have affected the generalizability of the findings. Therefore, future research should include a larger number of participants to enhance the exploration of this topic.

Among the disease-related characteristics of the participants, subjective dyspnea based on mMRC 2, "When I am walking with a group of my peers, I would stop and rest even if I fall be-

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hind or walk alone," showed a significant difference in the distribution of mMRC levels 2 and above versus levels 1 and below depending on severity. This contrasts with a study of Asian patients with COPD, in which the degree of dyspnea did not differ significantly as severity worsened [13]. This study analyzed the distribution of mMRC scores of 2 or more and 1 or less by severity, whereas a previous overseas study [13] analyzed the mean mMRC score by severity, leading to limitations in directly comparing the results. In this study, the proportion of patients reporting an mMRC ≥ 2 increased dramatically, from 28.8% in the mild group to 51.0% and 61.3% in the moderate and severe groups, respectively. Notably, 99.3% of the very severe group reported dyspnea with an mMRC ≥ 2. This finding underscores the importance of preventing exacerbations, as the proportion of patients with severe dyspnea increases sharply as COPD progresses from mild to moderate and then to severe. It has been consistently recognized that applying effective interventions to improve the physical and psychological conditions of patients with early stage COPD before their lung function declines is crucial, along with supporting long-term health-promoting behaviors [27]. However, the prevention of exacerbations in patients with advanced disease has received little attention. Interventions such as respiratory rehabilitation programs [27], which have proven effective in preventing exacerbations in patients with early-stage COPD, should also be implemented for patients with advanced disease. These interventions should include strategies to identify and tailor respiratory rehabilitation according to specific conditions and characteristics.

One variable emphasized for tailoring respiratory rehabilitation is SE [22]. Previous research [9] has shown that COPD patients with high SE report fewer dyspnea complaints and limitations in daily life, indicating a positive effect on their overall condition. In this study, although the difference was not significant, the severe group had higher respiratory rehabilitation SE scores and longer walking distances in the 6-minute walk test than the moderate group. This finding suggests that patients with severe disease and high respiratory rehabilitation SE may perform well in self-management, maintain physical function, and experience fewer daily life restrictions. This highlights that SE may play a significant role in influencing daily life restrictions and physical function decline, even in patients with advanced disease. This interpretation is also supported by the results of Kang et al. [28], who found that patients with COPD in the severe group had a higher degree of self-management than those in the moderate group. However, the study did not measure SE, which limits the interpretation. In addition, this study did not investigate the degree of self-management with other factors that may affect the participants' walking ability, and the number of participants in some moderate groups was insufficient; therefore, the interpretation should be made with caution. Future studies with larger numbers of participants and more variables should be conducted to explore the relationship between SE and physical function by disease severity.

In this study, the participants' HRQoL tended to decrease with increasing severity, which is consistent with previous studies [1,13,28,29] and supports the interpretation that worsening airflow limitation interferes with daily activities and worsens quality of life [4,30]. In addition, the "activity" domain of HRQoL was the lowest in this study, which is consistent with the findings of previous studies that used the same instrument [13,29]. Furthermore, the significant difference in the total quality of life scores and scores in the activity and impact domains between the severe and very severe groups highlights the need to manage the severe group to prevent deterioration. As mentioned earlier, respiratory rehabilitation strategies tailored to the characteristics of the population are important to prevent deterioration in the severe group.

This study effectively categorized the severity of COPD based on FEV_1, an indicator of airflow limitation, and examined the patient characteristics, physical functioning, SE, and HRQoL. The findings indicated that subjective dyspnea, respiratory rehabilitation SE, and HRQoL tended to decline as the severity of COPD worsened, with notable differences between the severe and very severe COPD groups, particularly in terms of respiratory rehabilitation SE and quality of life. These results emphasize the importance of managing COPD not only in the early stages after diagnosis, but also in the severe group to prevent further exacerbations. To achieve this, disease severity must be assessed by evaluating the degree of airflow limitation, which reflects changes in disease status, and by comprehensively evaluating meaningful variables subjectively reported by patients during condition assessment and management. The patient-reported variables utilized in this study, including dyspnea, respiratory rehabilitation SE, and HRQoL, should be assessed during follow-up according to domestic and international guidelines [3,5]. These comprehensive assessment indicators hold great significance, as they empower nurses to independently assess COPD patients and develop individualized nursing interventions based on the severity and unique characteristics of each patient.

CONCLUSION

This study focused on patients diagnosed with COPD, a relatively under-recognized disease with a growing societal burden owing to delays in diagnosis and treatment caused by its complex characteristics. This study examined COPD severity, physical functional status, and patient-reported subjective characteristics. The results of this study have significant implications for nursing practice as they identify key variables that serve as indicators for the comprehensive assessment of COPD patients in Korea. This information is crucial for establishing nursing care tailored to the specific characteristics and needs of patients with COPD, thus ensuring effective follow-up and management. However, our results should be interpreted with caution primarily because of the cross-sectional collection of outpatient data at a local tertiary general hospital, which limits the representativeness of the sample. Additionally, the study did not investigate chronic diseases or psychological health problems such as depression, which may influence the severity of the disease. To address these limitations, future studies should adopt a prospective approach to monitor changes in the identified variables, and include a larger and more diverse participant pool.

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CONFLICT OF INTEREST

The authors declared that no conflict of interest.

AUTHORSHIP

HYS and KAN contributed to the conception and design of this study; HYS collected data; HYS and KAN performed the statistical analysis and interpretation; HYS and KAN drafted the manuscript; HYS and KAN critically revised the manuscript; HYS supervised the whole study process. All authors read and approved the final manuscript.

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