Respiratory Function and Health-Related Quality of Life among Patients with Chronic Obstructive Pulmonary Disease

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Abstract

A cross-sectional study was conducted in the National Institute of Diseases of the Chest and Hospital (NIDCH), Dhaka, Bangladesh, from January to December of 2023, to assess the correlation between respiratory function and health-related quality of life (HRQoL) among COPD patients in Bangladesh. A total of 150 patients having chronic obstructive pulmonary disease (COPD) were selected for this study. Data were collected via face-to-face interviews, with spirometry measuring FVC, FEV1, and FEV1/FVC ratio, and QoL was assessed using the St. George's Respiratory Questionnaire-C. The socio-demographic profile of COPD patients showed that 62.7% were male, with the highest proportion (35.3%) aged between 60–69 years. Additionally, 32% reported a family history of COPD, 22% were current smokers, and 15.3% had a history of tobacco product use. In terms of BMI, 54.7% had a normal weight, 41.3% were overweight, and only 2% were either underweight or obese. Pulmonary function test results revealed mean values of FVC at 1.43±0.49, FEV1 at 0.85±0.32, and an FEV1/FVC ratio of 0.61±0.13. Regarding disease severity based on FEV1/FVC ratio, 30% of patients were classified as having moderately severe COPD, while only 1.3% had very severe COPD. SGRQ-C scores indicated a high symptom burden and significantly reduced quality of life among the patients. GLM regression analysis showed a significant association between greater COPD severity and lower health-related quality of life (p<0.05). COPD has a substantial impact on health-related quality of life (HRQoL), particularly in Bangladesh, where environmental and socio-economic challenges intensify the disease burden. Improved outcomes require early diagnosis, access to pulmonary rehabilitation, and public health measures focused on smoking cessation and reducing air pollution.

Keywords: Chronic obstructive pulmonary disease, spirometry, respiratory function, quality of life, Bangladesh

Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition and a major global health concern.[1,2] It is currently the third leading cause of death worldwide and is projected to become the leading cause within the next 15 years.[3] Affecting over 212 million people and causing 3.3 million deaths annually, COPD leads to insistent respiratory symptoms and airflow restraint, resulting in reduced lung function and impaired quality of life.[3,4] The disease primarily presents as chronic bronchitis, marked by excessive mucus production and persistent cough, or emphysema, characterized by alveolar wall destruction and impaired gas exchange.[5-11] COPD's primary symptoms include chronic cough, shortness of breath (dyspnoea), wheezing, and chest tightness, which progressively worsen and severely affect health-related quality of life (QoL).[12-15] Patients often experience breathlessness, fatigue, activity limitations, and psychological distress, contributing to social isolation and diminished overall well-being.[16,17] The GOLD initiative ambitions to improve exercise tolerance, emotional well-being, and HRQoL while managing symptoms and slowing COPD progression.[13]

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COPD disproportionately impacts low- and middle-income countries (LMICs), responsible for nearly 90% of related deaths.[16-18] In Bangladesh, the estimated prevalence is 12.5%, with higher rates among rural populations, lower socioeconomic groups, and individuals exposed to biomass fuel.[19] Globally, the age-standardized rates of COPD prevalence, mortality, and disability-adjusted life years (DALY) are 2638.2, 42.5, and 926.1 per 100,000 people, respectively.[20] In 2019, Denmark, Myanmar, and Belgium had the highest prevalence, while Egypt, Georgia, and Nicaragua reported the most significant increases.[20] Nepal had the highest age-standardized death rate (182.5 per 100,000), while Japan had the lowest, at 7.4 per 100,000.[20] Despite the availability of drug therapies and pulmonary rehabilitation programs, access remains a difficulty in resource-limited environments.[21] COPD imposes a significant economic burden on healthcare systems due to frequent hospitalizations and loss of productivity.[21,22] Effective disease management requires understanding respiratory function and health-related quality of life (HRQoL) to create targeted interventions that improve patient care and outcomes.[23] This present study aims to evaluate the association of respiratory function and HRQoL in COPD patients in Bangladesh, highlighting how lung impairment impacts daily life and overall patient outcomes.

Methods

This cross-sectional study was carried out in the National Institute of Diseases of the Chest and Hospital (NIDCH), Dhaka, Bangladesh, from January to December of 2023. A total of 150 patients having chronic obstructive pulmonary disease (COPD) aged 40 and above were selected using convenience sampling. Data were collected using a structured questionnaire and clinical assessments. The St. George's Respiratory Questionnaire (SGRQ), which is specific to COPD, was employed to assess the patients' quality of life (QoL). The overall scores of all three domains covering symptom scores, activity limitations, and the overall impact of the disease on daily life, were calculated.[24] Spirometry was conducted to measure Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), and the FEV1/FVC ratio, with COPD severity classified according to GOLD criteria. BMI was measured to examine the relationship between body weight and lung function. The questionnaire was pre-tested to ensure clarity and reliability. Data were analysed using IBM SPSS version 27.0 for windows. Generalized Linear Model Regression (GLMR) was used to explore the association between lung function and health-related quality of life (HRQoL). Significance testing determined correlations between quality of life and variables such as age, gender, smoking status, and BMI. The study employed a systematic approach to ensure data accuracy and reliability, utilizing rigorous statistical methods to draw robust conclusions on the impact of COPD on HRQoL in our patients. Ethical approval was obtained from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh (Ref. No. NIPSOM/IRB/2023/06).

Results

In the present study, males accounted for 62.7% of the study population, with the largest group (35.3%) in the 60-69 age range. A significant majority (84.7%) identified as Muslim. Educational levels varied, with 30% having no formal education and 28% completing secondary education. The most common occupations were labourers (28.0%) and those in service/business

(23.3%), while 19.3% were housewives. Most participants (81.3%) were married, and 60% lived in urban areas. Regarding income, 36% earned between 10,000-20,000 BDT per month. A family history of COPD was reported by 32.0% of patients. Smoking prevalence was 22.0%, and 15.3% had a history of using tobacco products (Table-I).

Table I: Sociodemographic characteristics of COPD patients (n=150)

Variables	Categories	Frequency	Percentage
Gender	Male	94	62.7
	Female	56	37.3
Age group (in years)	40-49	20	13.3
	50-59	40	26.7
	60-69	53	35.3
	70-79	19	12.7
	≥80	8	5.3
Religious view	Muslim	127	84.7
	Hindu	18	12.0
	Others	5	3.3
Educational background	No formal education	45	30.0
	Primary	38	25.3
	Secondary	42	28.0
	Higher Secondary & above	25	16.7
Occupation	Service/Business	35	23.3
	Labourer	42	28.0
	Farmer	28	18.7
	Housewife	29	19.3
	Retired/Unemployed	16	10.7
Marital status	Married	122	81.3
	Unmarried	14	9.3
	Widowed/Divorced	14	9.3
Residential area	Urban	90	60.0
	Rural	60	40.0
Average monthly income (BDT)	<10,000	47	31.3
	10,000-20,000	54	36.0
	>20,000	49	32.7
Family history of COPD	Yes	48	32.0
	No	102	68.0
Current smoking history	Smoker	33	22.0
	Non-Smoker	117	78.0
History of tobacco use	Yes	23	15.3
	No	127	84.7

According to the Body Mass Index (BMI) category, the majority of participants (54.7%) had a normal/healthy weight, while a significant proportion (41.3%) were classified as overweight, and only a small percentage (2.0%) were underweight and obese (Table-II). The mean values for FVC, FEV_1, and the FEV_1/FVC ratio were 1.43±0.49, 0.85±0.32, and 0.61±0.13 respectively (Table-III). Severity of lung conditions among participants based on their FEV_1/FVC ratio were as follows: 24% had mild, 26.7% had moderate, 30.0% had moderately severe, 18% had severe and only 1.3% had very severe COPD (Table-IV).

Table II: BMI of the patients (n=150)

BMI Categories	Frequency	Percentage
Underweight	3	2.0
Normal/Healthy Weight	82	54.7
Overweight	62	41.3
Obese	3	2.0

Table-III: Pulmonary function status of the patients (n=150)

Variables	Mean±SD	Range
FVC (L)	1.43±0.49	0.34–2.64
FEV_1 (L)	0.85±0.32	0.18–2.16
FEV_1/FVC ratio	0.61±0.13	0.32–1.00

Table-IV: Severity of the lung disease among patients (n=150)

Severity levels	Frequency	Percentage
Mild	36	24.0
Moderate	40	26.7
Moderately severe	45	30.0
Severe	27	18.0
Very severe	2	1.3

According to SGRQ-C scores that assessed the symptoms, activity limitations, and overall impact of COPD on patients' lives, the high mean scores across all categories were observed as those indicated that COPD significantly affected daily functioning and quality of life, with some patients experiencing severe limitations in their activities

(Table-V). Through Generalized Linear Model Regression (GLMR) analysis we examined the relationship between quality of life and various predictor variables in the study. The model includes factors such as sex, age group, religion, educational background, occupation, marital status, residential area, income, family history of COPD, BMI, and lung condition severity. It found a significant correlation between COPD severity and lower HRQoL ($p<0.05$) (Table-VI).

Table-V: St. George's Respiratory Questionnaire-C (SGRQ-C) scores

Categories	Mean±SD	Range
Symptoms	68.16±18.97	1.00–81.74
Activity	71.90±22.85	2.00–100.0
Impacts	72.05±18.54	35.79–99.24

Table-VI: Generalized Linear Model Regression between Quality of Life and other variables

Goodness of Fit

	Value	df	p-value
Deviance	551.359	1295	0.426
Scaled Deviance	551.359	1295	
Pearson Chi-Square	1408.005	1295	1.087
Scaled Pearson Chi-Square	1408.005	1295	
Log Likelihood[b]	-277.066		
Akaike's Information Criterion (AIC)	628.131		
Finite Sample Corrected AIC (AICC)	653.238		
Bayesian Information Criterion (BIC)	739.525		
Consistent AIC (CAIC)	776.525		

Parameter Estimates

Parameters	Hypothesis Test B	Std. Error	95% Wald CI Lower	95% Wald CI Upper	Hypothesis Test χ2 value	P value
Threshold [Quality of Life]	-5.459	2.3321	-10.029	-0.888	5.479	0.019
[sex=Male]	-0.828	0.6819	-2.164	0.509	1.474	0.225
[sex=Female]	0[a]	.	.	.	.	.
[family history of COPD=Yes]	-0.414	0.3824	-1.164	0.335	1.174	0.279
[family history of COPD=No]	0[a]	.	.	.	.	.
[BMI=Underweight]	0.424	1.4751	-2.467	3.315	.082	0.774
[BMI= Normal/Healthy weight]	-0.299	1.0024	-2.264	1.666	.089	0.766
[BMI= Overweight]	-0.378	1.0218	-2.381	1.625	.137	0.711
[BMI= Obese]	0[a]	.	.	.	.	.
[lung condition=Mild]	-3.618	1.6263	-6.806	-0.431	4.950	0.026
[lung condition=Moderate]	-3.121	1.5985	-6.254	0.012	3.812	0.051
[lung condition=Moderately severe]	-3.202	1.5987	-6.336	-0.069	4.013	0.045
[lung condition=Severe]	-3.136	1.6025	-6.277	0.005	3.830	0.050
[lung condition=Very severe]	0[a]	-	-	-	-	-
(Scale)	1[b]					

Dependent variable: Quality of Life (QoL)

Discussion

The findings align with existing literature, confirming a strong correlation between COPD severity and reduced HRQOL. The mean SGRQ-C scores – symptoms (68.16±18.97), activity (71.90±22.85), and impact (72.05±18.54) – together reflect substantial impairment, highlighting severe limitations in daily functioning and respiratory capacity. Similarly, a study by Stahl *et al.* in Sweden reported a significant association between COPD severity and SGRQ total scores, ranging from 25 to 53 (GOLD, p=0.005) and 25 to 45 (BTS, p<0.05).[21] The study found a significant negative correlation between lung function and HRQoL (p<0.05). Different previous research, which showed no significant differences in HRQoL by gender, smoking status, or socioeconomic group, this study observed variations based on demographic characteristics, particularly among older participants.[16,25,26]

A hospital-based study done in India reported a mean SGRQ score of 48.5±17.1, lower than the mean scores in this study, indicating a potentially higher COPD burden in the current population; that study also found worsening symptom, activity, and impact scores with increasing COPD severity, consistent with this study's findings. However, it noted a decline in scores among participants aged 56-65, a trend not observed in the current research.[27] Another study found a higher COPD prevalence among rural populations and males, with over half in stage II.

Similarly, this study observed the highest proportion (30%) in the moderately severe category, with only 1.3% in very severe COPD. While smoking is often highlighted as a major risk factor, this study found 78% of participants were non-smokers, suggesting environmental and occupational exposures play a

stronger role in disease progression.[15] Other studies have shown a significant correlation between lung function and HRQoL, with lower socioeconomic status and higher smoking rates associated with a poorer quality of life, but no correlation with BMI.[16,25,28] Another study done in China, however, noted that the activity domain was most affected in COPD patients, while the impact domain was the least; that study also found a significant burden in activity scores, with some patients reporting maximum physical limitations.[29] However, unlike the other study, no significant effect of gender or occupation on HRQoL was observed.

The findings of the present study are consistent with international research, highlighting the progressive nature of COPD and its negative impact on health-related HRQoL.[25-29] Differences in healthcare access, disease management, and socio-economic conditions may explain the variations in findings. In high-income countries, better medical interventions, pulmonary rehabilitation, and lifestyle changes help mitigate HRQoL decline, dissimilar in LMICs countries like Bangladesh.

Conclusion

This study emphasizes the substantial impact of COPD on respiratory function and HRQoL. The clear link between disease severity and diminished HRQoL highlights the need for targeted interventions, including pulmonary rehabilitation, public awareness campaigns, and improved access to healthcare services. Tackling major risk factors such as smoking and indoor air pollution is vital, especially in LMICs. Strengthening early diagnosis and expanding treatment access are crucial steps toward improving patient outcomes and overall quality of life.

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