

Spectrum of Respiratory Symptoms and Comorbid Conditions among Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is a chronic respiratory disease characterized by persistent airflow limitation and variable respiratory symptoms. Respiratory symptom burden and comorbid conditions substantially influence functional status and clinical outcomes. Aim of the study: To assess the spectrum of respiratory symptoms and comorbid conditions and identify factors associated with respiratory symptom burden among patients with COPD. **Methods & Materials:** A hospital-based cross-sectional observational study was conducted among 250 patients with COPD attending the Internal Medicine Service of a tertiary hospital in Bangladesh. Sociodemographic and clinical information, respiratory symptoms, COPD duration, smoking status, oxygen saturation, exacerbation frequency, and comorbidities were recorded. Symptom burden was categorized as low or moderate/high. Associations were assessed using chi-square/Fisher's exact tests and independent-samples t-test, with $p < 0.05$ considered statistically significant. **Result:** The mean age was 61.8 ± 11.7 years, and 72.4% of participants were male. Dyspnea was the predominant respiratory symptom (36.4%), followed by chronic cough (22.8%) and sputum production (17.2%). Moderate/high symptom burden was present in 80.8% of patients, while moderate COPD was the most common severity category (41.6%). Hypertension (27.6%), diabetes mellitus (16.0%), and ischemic heart disease (12.8%) were the leading comorbidities. Symptom burden was significantly associated with age, gender, and smoking status ($p < 0.001$, $p = 0.027$, and $p = 0.008$, respectively). Patients with moderate/high burden had longer COPD duration, higher respiratory rate, lower SpO_2 , and more frequent exacerbations (all $p < 0.001$), whereas BMI and predominant comorbidity were not significantly associated. **Conclusion:** COPD was associated with substantial respiratory symptom burden, particularly dyspnea. Older age, female sex, smoking, longer disease duration, impaired oxygenation, and frequent exacerbations were important correlates. Comprehensive symptom assessment and targeted management may improve COPD care and outcomes.

Keywords: Chronic obstructive pulmonary disease; respiratory symptoms; symptom burden; dyspnea; exacerbation

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common, preventable, and treatable chronic respiratory disease characterized by persistent respiratory symptoms and airflow limitation caused by abnormalities of the airways and/or alveoli, usually following exposure to harmful particles or gases^[1]. It is a heterogeneous condition in which chronic bronchitis, small-airway disease, and emphysema contribute to varying degrees of airflow obstruction and respiratory impairment^[1,2]. Globally, the prevalence of COPD among adults aged 30–79 years has been estimated at 10.3% according to the GOLD definition^[3]. In Bangladesh, 13.5% of adults aged 40 years or older were reported to have COPD according to the GOLD criteria in a community-based study^[4]. The development of COPD involves persistent inflammation of the airways and lung parenchyma in response to tobacco smoke, biomass fuel exposure, occupational dusts, and other inhaled irritants^[1,5]. Inflammatory cells and mediators promote airway remodeling, mucus hypersecretion, and narrowing of the small airways^[2,6]. Destruction of alveolar walls and loss of elastic recoil further reduce expiratory

airflow and promote air trapping and hyperinflation^[2]. These changes progressively impair ventilation and gas exchange as the disease advances^[2,6]. Repeated respiratory infections can precipitate acute exacerbations, which intensify airway inflammation and accelerate functional decline^[7]. Although airflow limitation is central to COPD, respiratory symptoms vary considerably among patients and are not determined solely by lung function^[8]. The clinical impact of COPD extends beyond persistent respiratory symptoms. Dyspnea, chronic cough, sputum production, and wheezing can restrict physical activity and reduce health-related quality of life. These symptoms can also interfere with sleep and daily activities^[8,9]. Recurrent exacerbations are associated with further decline in lung function, increased healthcare utilization, and higher mortality risk^[7,9]. COPD is also frequently accompanied by cardiovascular disease, hypertension, diabetes, osteoporosis, anemia, anxiety, and depression^[10,11]. These comorbid conditions can increase symptom burden, complicate treatment, and contribute to hospitalization and mortality^[10,11]. The coexistence of multiple

conditions also leads to overlapping symptoms, complicating clinical evaluation and increasing the need to distinguish respiratory manifestations from those of accompanying diseases^[10,12]. Evaluation of respiratory symptoms alongside comorbid conditions provides a broader clinical profile of patients with COPD and supports comprehensive patient assessment. Identification of symptom patterns and coexisting illnesses can facilitate individualized treatment, appropriate follow-up, and timely management of associated conditions. This approach supports individualized management and appropriate follow-up^[10,12]. Conversely, focusing only on airflow limitation can overlook clinically important symptoms and non-respiratory conditions that influence functional status and prognosis^[11,12]. Despite the substantial burden of COPD in Bangladesh, information describing the combined spectrum of respiratory symptoms and comorbid conditions among patients receiving clinical care remains limited. Local data on these clinical characteristics can help identify common symptom patterns, recognize frequently associated illnesses, and support more comprehensive

management of COPD. Therefore, the study aimed to assess the spectrum of respiratory symptoms and comorbid conditions among patients with chronic obstructive pulmonary disease.

METHODS & MATERIALS

This hospital-based cross-sectional observational study was conducted among patients attending the Internal Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, during the study period from January 2020 to December 2021. A total of 250 eligible patients with clinically diagnosed chronic obstructive pulmonary disease (COPD) were included consecutively according to predefined inclusion and exclusion criteria.

Inclusion Criteria

- Patients aged ≥ 40 years with a documented diagnosis of COPD.
- Patients attending the Internal Medicine Service during the study period.
- Patients with sufficient demographic, clinical, and laboratory information for analysis.
- Patients who provided written informed consent to participate.

Exclusion Criteria

- Patients aged < 40 years.
- Patients with an alternative primary diagnosis explaining their respiratory symptoms.
- Patients with substantially incomplete clinical records or symptom-related information.
- Patients unwilling to provide informed consent.

Ethical Considerations

The study protocol was reviewed and approved by the appropriate institutional ethical review committee before commencement. Written informed consent was obtained from all participants. Participation was voluntary, and participants were informed of their right to withdraw at any stage without affecting their medical care. Personal identifiers were excluded from the analytical dataset, and all collected information was kept confidential and used exclusively for research purposes.

Data Collection

Sociodemographic and clinical information was collected using a structured interviewer-administered questionnaire and supplemented by clinical records. Variables included age, sex, residence, body mass index (BMI), smoking status, duration of COPD, respiratory symptoms, respiratory rate, peripheral oxygen saturation (SpO_2), and frequency of exacerbations during the preceding year. Respiratory symptoms assessed included dyspnea, chronic cough, sputum production, wheezing, chest tightness, and recurrent respiratory infections. For analysis, patients were categorized according to their predominant respiratory symptom. Relevant comorbid conditions included hypertension, diabetes mellitus, ischemic heart disease, heart failure, chronic kidney disease, chronic liver disease, osteoarthritis, and other documented comorbidities.

Assessment of Symptom Burden and COPD Severity

Respiratory symptom burden was assessed using predefined clinical criteria and categorized as low, moderate, or high. For comparative analysis, moderate and high symptom burden were combined into a single category. COPD severity was

categorized as mild, moderate, severe, or very severe according to the predefined clinical classification criteria. Comorbid conditions were identified from documented medical diagnoses, previous clinical records, medication history, and relevant clinical assessment. The primary outcome was the spectrum of respiratory symptoms, while comorbid conditions and their relationship with symptom burden were considered the principal clinical correlates.

Statistical Analysis

Data were entered into a structured database and analyzed using SPSS version 26.0. Continuous variables were summarized as mean $\pm$ standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Associations between respiratory symptom burden and categorical sociodemographic or comorbidity-related variables were assessed using the chi-square test or Fisher's exact test, where appropriate. Continuous variables were compared between low and moderate/high symptom-burden groups using the independent-samples t-test. A two-sided p-value of < 0.05 was considered statistically significant.

RESULTS

The study population was predominantly composed of older adults, with a mean age of 61.8 ± 11.7 years. The largest age group was 60–69 years (32.8%), followed by 50–59 years (27.2%) and those aged ≥ 70 years (23.2%). Males constituted the majority of participants (72.4%), while 54.8% were urban residents. The mean BMI was $23.4 \pm 3.9 \text{ kg/m}^2$. Regarding smoking status, 41.6% were former smokers, 38.4% were current smokers, and 20.0% had never smoked (Table I).

Table I

Sociodemographic and baseline characteristics of patients with COPD ($n=250$).

Variables	Frequency (n)	Percentage (%)
Age (years)		
Mean $\pm$ SD		61.8 ± 11.7
40–49	42	16.8
50–59	68	27.2
60–69	82	32.8
≥ 70	58	23.2
Gender		
Male	181	72.4
Female	69	27.6
Residence		
Urban	137	54.8
Rural	113	45.2
BMI (kg/m^2)		
Mean $\pm$ SD		23.4 ± 3.9
Smoking status		
Current smoker	96	38.4
Former smoker	104	41.6
Never smoker	50	20.0

The predominant respiratory symptom was dyspnea, reported by 36.4% of patients, followed by chronic cough (22.8%) and sputum production (17.2%). Wheezing was

present in 12.4%, while recurrent respiratory infection and chest tightness were less frequently reported, accounting for 6.4% and 4.8%, respectively. Thus,

dyspnea represented the leading respiratory manifestation among the study participants (*Table II*).

Table II

Distribution of patients according to predominant respiratory symptom ($n=250$).

Variables	Frequency (n)	Percentage (%)
Dyspnea	91	36.4
Chronic cough	57	22.8
Sputum production	43	17.2
Wheezing	31	12.4
Chest tightness	12	4.8
Recurrent respiratory infection	16	6.4

Regarding respiratory symptom burden, 45.2% of patients had moderate burden and 35.6% had high burden, whereas 19.2%

had low burden. In terms of COPD severity, moderate disease was most common (41.6%), followed by severe

disease (30.4%), mild disease (15.6%), and very severe disease (12.4%) (*Table III*).

Table III

Distribution according to COPD symptom burden and clinical severity ($n=250$).

Variables	Frequency (n)	Percentage (%)
Symptom burden		
Low	48	19.2
Moderate	113	45.2
High	89	35.6
COPD severity		
Mild	39	15.6
Moderate	104	41.6
Severe	76	30.4
Very severe	31	12.4

Hypertension was the most frequent predominant comorbid condition, affecting 27.6% of patients, followed by diabetes mellitus (16.0%) and ischemic heart

disease (12.8%). Osteoarthritis was present in 10.8%, while heart failure and chronic kidney disease accounted for 8.0% and 6.0%, respectively. Chronic liver disease

and other comorbidities were less frequent, while 8.0% had no documented comorbidity (*Table IV*).

Table IV

Distribution according to predominant comorbid condition among patients with COPD ($n=250$).

Variables	Frequency (n)	Percentage (%)
Hypertension	69	27.6
Diabetes mellitus	40	16.0
Ischemic heart disease	32	12.8
Heart failure	20	8.0
Chronic kidney disease	15	6.0
Chronic liver disease	9	3.6
Osteoarthritis	27	10.8
Other comorbidities	18	7.2
No documented comorbidity	20	8.0

Respiratory symptom burden showed significant associations with age, gender, and smoking status. Moderate/high symptom burden increased progressively with advancing age, reaching 96.55%

among patients aged ≥ 70 years ($p<0.001$). It was also more frequent among females than males (89.86% vs 77.35%, $p=0.027$). Current smokers had a higher proportion of moderate/high symptom burden than

former and never smokers, with the association being statistically significant ($p=0.008$) (*Table V*).

Table V
Association between respiratory symptom burden and sociodemographic characteristics among patients with COPD (n=250).

Variables	Low burden		Moderate/High burden		χ^2	p-value
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)		
Age group (years)						
40–49	19	45.24	23	54.76	18.74	<0.001
50–59	18	26.47	50	73.53		
60–69	9	10.98	73	89.02		
≥70	2	3.45	56	96.55		
Gender						
Male	41	22.65	140	77.35	4.92	0.027
Female	7	10.14	62	89.86		
Smoking status						
Current smoker	12	12.50	84	87.50	9.63	0.008
Former smoker	20	19.23	84	80.77		
Never smoker	16	32.00	34	68.00		

Although moderate/high respiratory symptom burden was common across all comorbidity groups, no statistically significant association was observed between predominant comorbid conditions and symptom burden ($\chi^2=4.90$, $p=0.768$). The proportion with moderate/high burden ranged from 72.22% among those with other comorbidities to 90.00% among patients with heart failure (Table VI).

Table VI
Association between predominant comorbid conditions and respiratory symptom burden among patients with COPD (n=250).

Variables	Low burden		Moderate/High burden	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Hypertension	12	17.39	57	82.61
Diabetes mellitus	9	22.50	31	77.50
Ischemic heart disease	4	12.50	28	87.50
Heart failure	2	10.00	18	90.00
Chronic kidney disease	2	13.33	13	86.67
Chronic liver disease	2	22.22	7	77.78
Osteoarthritis	7	25.93	20	74.07
Other comorbidities	5	27.78	13	72.22
No documented comorbidity	5	25.00	15	75.00

$\chi^2 = 4.90$, $p = 0.768$.

Patients with moderate/high symptom burden had a significantly higher mean age than those with low burden (63.4 ± 11.4 vs 55.1 ± 10.2 years, $p < 0.001$). They also had a longer duration of COPD, higher respiratory rate, lower SpO_2 , and more frequent annual exacerbations, with all differences being statistically significant ($p < 0.001$). In contrast, BMI did not differ significantly between the groups (23.2 ± 3.9 vs 24.1 ± 3.7 kg/m², $p = 0.148$) (Table VII).

Table VIII
Clinical characteristics according to respiratory symptom burden (n=250).

Variables	Low burden (n=48) Mean ± SD	Moderate/High burden (n=202) Mean ± SD	p-value
Age (years)	55.1 ± 10.2	63.4 ± 11.4	<0.001
BMI (kg/m ²)	24.1 ± 3.7	23.2 ± 3.9	0.148
Duration of COPD (years)	4.8 ± 2.6	7.1 ± 3.4	<0.001
Respiratory rate/min	19.8 ± 2.4	22.7 ± 3.1	<0.001
SpO ₂ (%)	95.1 ± 1.8	91.8 ± 3.2	<0.001
Exacerbations/year	0.8 ± 0.9	1.9 ± 1.3	<0.001

DISCUSSION

Chronic obstructive pulmonary disease (COPD) is a chronic respiratory disease characterized by persistent airflow limitation and respiratory symptoms. Its clinical burden is shaped by respiratory impairment, exacerbations, functional limitation and associated comorbidities [13]. The population was predominantly older adults, with a mean age of 61.8 ± 11.7 years, and 56.0% were aged ≥60 years. This distribution reflects COPD, in which cumulative exposure to tobacco smoke and other noxious particles interacts with age-related changes in lung structure [13]. Males constituted 72.4%, while most participants

were current or former smokers, consistent with the contribution of tobacco exposure to COPD development. However, sex-related differences are increasingly recognized, with women often experiencing greater symptom burden despite comparable airflow limitation [14]. The mean BMI of 23.4 ± 3.9 kg/m² indicates that marked nutritional depletion was not prominent in this cohort. Dyspnea was the predominant respiratory symptom (36.4%), followed by chronic cough (22.8%) and sputum production (17.2%). This pattern reflects the principal clinical manifestations of COPD, with dyspnea being a major determinant of functional limitation and

health status [13]. An observational study similarly showed that respiratory symptoms, particularly breathlessness, contribute substantially to daily disease burden [15]. The frequencies in the present study may be lower because participants were classified according to a single predominant symptom rather than all coexisting symptoms. Nevertheless, the prominence of dyspnea is clinically relevant because breathlessness is influenced not only by airflow obstruction but also by hyperinflation, respiratory muscle loading and physical deconditioning [13,15]. More than four-fifths of participants had moderate or high

symptom burden, while moderate COPD was the most frequent severity category (41.6%), followed by severe disease (30.4%). This indicates a substantially symptomatic clinical population. The ECLIPSE cohort demonstrated considerable heterogeneity in COPD manifestations across levels of airflow limitation [16]. Importantly, symptom severity does not necessarily parallel spirometric severity, as patients with similar airflow obstruction may experience different degrees of dyspnea and functional limitation [13, 16]. The predominance of moderate-to-severe disease in the present hospital-based population may reflect referral of symptomatic patients to specialist care. It also suggests that clinical assessment should incorporate symptom burden and exacerbation history rather than relying solely on airflow limitation. Such multidimensional characterization is relevant when identifying patients who require intensified preventive and therapeutic interventions. Hypertension was the most frequent comorbidity (27.6%), followed by diabetes mellitus (16.0%) and ischemic heart disease (12.8%). This pattern supports the recognized multisystem nature of COPD. A systematic review and meta-analysis in The Lancet Respiratory Medicine demonstrated substantial associations between COPD and cardiovascular disease, including ischemic heart disease and heart failure [17]. Decramer and Janssens also emphasized the importance of cardiovascular, metabolic and musculoskeletal comorbidities in COPD [18]. Heart failure and chronic kidney disease were also present in this cohort, highlighting the need for comprehensive assessment. Shared factors such as smoking and ageing, together with systemic inflammation and hypoxaemia, may contribute to the coexistence of pulmonary and cardiovascular disease [17,18]. Symptom burden was significantly associated with age, gender and smoking status. Moderate/high burden increased from 54.76% among patients aged 40–49 years to 96.55% among those aged ≥ 70 years ($p < 0.001$). This gradient may reflect cumulative disease duration, declining physiological reserve and increasing multimorbidity with advancing age [13,16]. Females had greater moderate/high burden than males (89.86% vs 77.35%, $p = 0.027$), consistent with evidence that women with COPD may report greater dyspnea and symptom severity than men [14]. Smoking status was also significantly associated with burden ($p = 0.008$), with current smokers showing the highest proportion of moderate/high burden. Continued tobacco exposure can sustain airway inflammation and pulmonary injury, while smoking cessation remains a central component of COPD management [13]. Although

moderate/high symptom burden was common across comorbidity groups, no statistically significant association was observed between predominant comorbidity and symptom burden ($\chi^2 = 4.90$, $p = 0.768$). The proportion with moderate/high burden was highest among patients with heart failure (90.00%), but differences between groups were not statistically significant. This finding differs from broader evidence linking cardiovascular and systemic comorbidities to COPD burden and adverse outcomes [17,18]. The absence of statistical significance may partly reflect the relatively small numbers within several comorbidity categories and classification according to a single predominant condition rather than cumulative multimorbidity. Therefore, this result should not be interpreted as indicating that comorbidities are clinically unimportant. Instead, it suggests that no single comorbid condition was sufficiently dominant to explain variation in respiratory symptom burden within this cohort. Patients with moderate/high symptom burden had significantly higher mean age, longer COPD duration, higher respiratory rate, lower SpO₂ and more annual exacerbations than those with low burden, with all differences reaching statistical significance ($p < 0.001$). These findings provide a coherent profile of greater disease burden. Longer disease duration may reflect cumulative structural and functional deterioration, while increased respiratory rate and reduced oxygen saturation indicate greater respiratory physiological stress. Persistent systemic inflammation has been associated with poorer clinical outcomes in COPD and may identify a more severe clinical phenotype [19]. More frequent exacerbations are particularly important because recurrent exacerbations contribute to functional decline, impaired quality of life and increased healthcare utilization [20]. The ECLIPSE exacerbation analysis also demonstrated that previous exacerbations are an important marker of future exacerbation susceptibility [21]. BMI did not differ significantly between groups (23.2 ± 3.9 vs 24.1 ± 3.7 kg/m², $p = 0.148$). Although BMI contributes to multidimensional prognostic assessment through the BODE index, its isolated relationship with respiratory symptom burden may be limited [22]. Overall, these findings indicate that symptom burden is multidimensional and more closely related to age, disease duration, smoking exposure, oxygenation and exacerbation frequency than to BMI or any single comorbid condition.

LIMITATIONS

This study had several limitations. Its single-center, hospital-based design and relatively small sample may limit

generalizability. Symptom assessment based on predefined criteria and predominant symptoms may not capture the full burden of COPD. Potential confounders, including pulmonary function, medication adherence, socioeconomic factors, and biomass or occupational exposure, were not comprehensively evaluated. The cross-sectional design also prevented assessment of temporal relationships and long-term changes in symptom burden.

CONCLUSION & RECOMMENDATIONS

COPD in this cohort was characterized by prominent dyspnea and substantial symptom burden. Older age, female sex, current smoking, longer disease duration, higher respiratory rate, lower SpO₂, and more frequent exacerbations were significantly associated with greater symptom burden, whereas comorbidities and BMI were not. Comprehensive assessment should therefore extend beyond airflow limitation. Routine evaluation of symptoms, smoking status, oxygenation, exacerbation history, and comorbidities should be incorporated into care. Smoking cessation, symptom management, and prevention of exacerbations are recommended to reduce disease burden and improve outcomes. Follow-up and multicentre studies are warranted to clarify determinants of symptom severity and outcomes.

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CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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