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ORIGINAL ARTICLE

Frequency of patients classified as Pre–Chronic Obstructive Pulmonary Disease (Pre-COPD) in tertiary care chest clinic.

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ABSTRACT… Objective: To determine the frequency of pre-COPD among patients attending a tertiary chest clinic. **Study Design:** Cross-sectional study. **Setting:** The Chest Clinic of Ojha Institute of Chest Disease (OICD), Dow University of Health Sciences Karachi, Pakistan. **Period:** December 2024 to March 2025. **Methods:** A total of 185 patients aged ≥ 18 years, having history of smoking and/or exposure to biomass fumes, and presenting with cough, sputum production, and/or shortness of breath were analyzed. Demographic information, along with cough, sputum production, and shortness of breath, were documented. Smoking status, and history of biomass exposure were noted. Spirometry of each patient was performed and pre-COPD was diagnosed. Data analysis was done using IBM-SPSS Statistics, version 26.0. **Results:** In a total of 185 patients, the mean age was 45.3±14.3 years, and 115 (62.2%) were male. Cough, shortness of breath, and sputum production were reported in 151 (81.6%), 109 (58.9%), and 36 (19.5%) patients, respectively. History of biomass exposure, and smoking were reported in 96 (51.9%), and 94 (50.8%) patients, respectively. Pre-COPD was identified in 47 patients (25.4%). There was a statistically significant difference in the prevalence of pre-COPD by increasing age ($p<0.001$). Patients with pre-COPD more frequently reported sputum production (40.4% vs. 12.3%, $p<0.001$). All patients with pre-COPD demonstrated abnormal chest radiographs (100% vs. 21.0%, $p<0.001$). **Conclusion:** This study revealed a substantial prevalence of pre-COPD (25.4%) among patients at risk in a tertiary chest clinic setting. Pre-COPD was found to have significant associations with middle-aged groups, presenting with sputum production, and abnormal radiological findings.

Key words: Biomass, Chronic Obstructive Pulmonary Disease, Cough, Shortness of Breath, Smoking, Sputum.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable disease. COPD is characterized by persistent respiratory symptoms and persistent airflow limitation due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development.[1] COPD is a major public health problem with extensive healthcare and economic costs due to its morbidity, disability, and mortality worldwide.[2,3] According to global burden of disease report, the prevalence of COPD among people aged 30-79 years in 2019 was 391.9 million, with a majority of 315.5 million living in low- and low-middle-income countries (LMICs),[3] and the third leading cause of mortality worldwide.[4] A meta-analysis reveals that Pakistan has the highest prevalence of COPD (13.8%), among the Eastern Mediterranean countries.[5]

Research on pre-COPD hold importance due to the evolving understanding of chronic respiratory diseases and the need for early detection as patients with pre-COPD are at risk of progressing to COPD.[6] the Global Initiative for Chronic Obstructive Lung Diseases (GOLD) initially led to the concept of “GOLD 0” or “COPD at risk” and defined it on the presence of risk factors and symptoms in the absence of persistent airflow obstruction.[7] The concept of pre-COPD has evolved with a broader and more comprehensive approach by addressing the individuals with or without structural lung lesions too.

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The findings of this study may help in identification of early signs of pre-COPD, enabling timely diagnosis that could potentially alter disease trajectories and help slow or prevent disease progression. Studying pre-COPD cases can allow researchers to highlight their contribution to the overall disease burden and identify opportunities for timely interventions, such as smoking cessation or reducing exposure to harmful substances like biomass. Identifying pre-COPD is essential to bridging gaps in our understanding of early respiratory abnormalities, their progression to COPD, and the opportunities for early intervention. This research was thought to provide a significant foundation for improved patient outcomes and help to shape the respiratory future outcomes. This study aims to determine the frequency of pre-COPD among patients attending a tertiary chest clinic.

METHODS

This cross-sectional study was conducted at the chest clinic of Chest Unit 1, Ojha Institute of Chest Disease (OICD), Dow University of Health Sciences Karachi, Pakistan from December 2024 to March 2025. A sample size of 185 was calculated using the online OpenEPI software considering the anticipated proportion of pre-COPD as 22.3%, with a confidential interval of 95% and a margin of error of 6%.[8] The inclusion criteria were patients of any gender, aged ≥ 18 years, having history of smoking and/or exposure to biomass fumes, and presenting with cough, sputum production, and/or shortness of breath. The exclusion criteria were patients with interstitial lung disease (as per computed tomography), known cases of COPD, history of serologically positive pulmonary tuberculosis or COVID-19, or patients unable to undergo spirometry evaluation. Non-probability consecutive sampling technique was adopted.

This study commenced after the approval of Institutional Review Board (IRB-3720/DUHS/Approval/2024/372, dated: 20th December, 2024). Informed and written consents from parents/caregivers were obtained. Demographic data like gender, age, and body mass index (BMI), were documented. Height and weight were measured by using a calibrated stadiometer available at the chest clinic, and BMI was calculated (weight (kg)/height [meter]^2). Signs and symptoms, including cough, sputum production, and shortness of breath were noted. Smoking status (smoker/ex-smoker/non-smoker) and history of biomass exposure were noted. Biomass exposure was labeled when a person was exposed to smoke that came from burning organic material such as plants, wood and waste for at least 6 months. Spirometry of each patient was performed by a trained spirometry technician having at least 3 years of experience. Interpretation was performed by a consultant pulmonologist having experience post-fellowship experience of at least 3 years. Pre-COPD was labeled as individuals who had respiratory symptoms and/or other detectable structural (emphysema >5%, bronchial thickening) and/or functional abnormalities (including low FEV1 [forced expiratory volume in 1 second], gas trapping, hyperinflation, reduced lung diffusion capacity <80% of predicted, and/or accelerated FEV1 decline) in the absence of airflow obstruction (FEV1/FVC [forced vital capacity] >0.70) on forced spirometry. Normal post-bronchodilator spirometry was defined as patient presented with FEV_1 ≥ 80% predicted and an FEV_1/FVC ratio ≥ 0.70.

Data analysis was done using IBM-SPSS Statistics, version 26.0. The quantitative data were shown as mean and standard deviation. Qualitative data were shown as frequency and percentages. Chi-square test or Fischer's exact test was applied to see the impact of effect modifiers on outcome (frequency of pre-COPD), taking $p<0.05$ as significant.

RESULTS

In a total of 185 patients, the mean age, and BMI were 45.3±14.3 years (ranging from 21 to 85 years), and 24.8±4.5 kg/m^2, respectively. Among these, 115 (62.2%) were male, and 70 (37.8%) were female. Cough, shortness of breath, and sputum production were reported in 151 (81.6%), 109 (58.9%), and 36 (19.5%) patients, respectively. History of biomass exposure was noted in 96 (51.9%) patients, and history of smoking was documented in 94 (50.8%) patients. Table-I is

showing demographic and clinical characteristics of patient.

Characteristics		Frequency (%)
Gender	Male	115 (62.2%)
	Female	70 (37.8%)
Age (years)	18-45	95 (51.4%)
	46-60	69 (37.3%)
	>60	21 (11.4%)
Body mass index (kg/m^2)	<18.5	21 (11.4%)
	18.5-24.9	82 (44.3%)
	25.0-29.9	56 (30.3%)
	≥30	26 (14.1%)
History of smoking		94 (50.8%)
History of biomass exposure		96 (51.9%)
Presenting symptoms	Cough	151 (81.6%)
	Shortness of breath	109 (58.9%)
	Sputum production	36 (19.5%)
Abnormal chest x-ray		76 (41.1%)

Table-1. Demographic and clinical characteristics of patients (n=185)

Pre-COPD was identified in 47 patients (25.4%). Gender was not found to have any significant association with pre-COPD (p=0.940). There was a statistically significant difference in the prevalence of pre-COPD by age, with the highest frequency observed in patients aged 46-60 years (28 [40.6%]) compared with those aged 18-45 years (11 [11.6%]) and those older than 60 years (8 [38.1%], p<0.001). Patients with pre-COPD more frequently reported sputum production (19 [40.4%]) compared with those without pre-COPD (17 [12.3%]; p<0.001). All patients with pre-COPD demonstrated abnormal chest radiographs (47 [100%]) compared to 29 (21.0%) without pre-COPD (p<0.001). Table-2 is showing details about the association of pre-COPS with various demographic and clinical characteristics of patients.

DISCUSSION

This study found a prevalence of pre–COPD of 25.4% among patients attending a tertiary chest clinic in Karachi, Pakistan. Fan et al.[9], reported a prevalence of pre-COPD ranging from 9.5% to 13.4% depending on the definition applied, while Shirtcliffe et al.[10], highlighted how prevalence rates varied significantly (14.2% to 9.0%) depending on whether a fixed ratio or lower limit of normal was utilized for airflow obstruction definition.

Characteristics		Pre-COPD		P-Value
		Yes (n=47)	No (n=138)	
Gender	Male	29 (61.7%)	86 (62.3%)	0.940
	Female	18 (38.3%)	52 (37.7%)	
Age (years)	18-45	11 (23.4%)	84 (60.9%)	<0.001
	46-60	28 (59.6%)	41 (29.7%)	
	>60	8 (17.0%)	13 (9.4%)	
Body mass index (kg/m^2)	<18.5	9 (19.1%)	12 (8.7%)	0.174
	18.5-24.9	16 (34.0%)	66 (47.8%)	
	25.0-29.9	15 (31.9%)	41 (29.7%)	
	≥30	7 (14.9%)	19 (13.8%)	
History of smoking		19 (40.4%)	75 (54.3%)	0.099
History of biomass exposure		28 (59.6%)	68 (49.3%)	0.222
Presenting symptoms	Cough	39 (83.0%)	112 (81.2%)	0.781
	Shortness of breath	29 (61.7%)	80 (58.0%)	0.653
	Sputum production	19 (40.4%)	17 (12.3%)	<0.001
Abnormal chest x-ray		47 (100%)	29 (21.0%)	<0.001

Table-II. Association of pre-COPD with demographic and clinical characteristics of patients

This study's slightly higher prevalence of pre-COPD (25.4%) likely reflects differences in the study population, specifically due to the selection of patients with significant exposure to tobacco smoke or biomass fumes, coupled with symptomatic respiratory presentation.

A noteworthy finding from the present study is the significant association of pre-COPD with age. The highest prevalence (40.6%) was found among patients aged 46-60 years, substantially higher than younger (18-45 years, 11.6%) and older age groups (>60 years, 38.1%). These findings resonate with the observation by Terzikhan et al.[11], and Naser et al.[12], where increased age significantly elevated the likelihood of COPD-related morbidity. The increased frequency of pre-COPD in middle-aged individuals may reflect cumulative exposure to risk factors, particularly biomass smoke and tobacco, both prevalent in the studied population.

This study showed no statistically significant association between pre-COPD and BMI categories (P=0.174), although a higher percentage of underweight patients were noted among those with pre-COPD (19.1%) compared to those without pre-COPD (8.7%). Published literature demonstrates variable associations between BMI and COPD or its precursor stages. Lei et al.[13=,] and Fan et al.[9], indicated that low BMI could reflect increased systemic inflammation or nutritional depletion related to chronic respiratory illnesses, which may precede airflow limitation. In this study, the lack of a significant association might be attributed to limited statistical power given the sample size, or possibly because BMI alone may not accurately reflect muscle mass or body composition, important considerations in respiratory disease.

The significant relationship between pre-COPD and sputum production identified in this study (40.4% in pre-COPD vs. 12.3% without pre-COPD, p<0.001) aligns closely with findings by Lei et al.[13], who reported symptomatic burden, including productive cough, as an early indicator of airway inflammation prior to airflow obstruction. Dona et al.[14=,] emphasized the diagnostic importance of symptoms such as cough and sputum production in defining pre-COPD. Persistent sputum production could be an early marker reflecting airway inflammation and mucus hypersecretion, possibly preceding structural airway damage detectable by imaging or functional abnormalities observed through spirometry.[15,16]

This study notably reported abnormal chest radiographs in all (100%) patients diagnosed with pre-COPD, a highly significant association compared to only 21.0% among those without pre-COPD (p<0.001). This aligns with contemporary studies such as that by Fan et al.[9], highlighting the importance of structural abnormalities detectable by imaging in the pre-COPD stage. Early structural changes on imaging appear critical in the identification and characterization of pre-COPD, supporting the inclusion of chest imaging in diagnostic protocols for early disease detection.[17,18]

The lack of significant association between pre-COPD and smoking (40.4% vs 54.3%; p=0.099) or biomass exposure (59.6% vs 49.3%; P=0.222) in this study contrasts somewhat with Lei et al.[13], who found significant relationships between these risk factors and early or established COPD. One plausible explanation is the relatively homogeneous exposure profiles within the studied population, limiting the discriminatory power of these variables. It remains clinically important to recognize that even in the absence of statistically significant findings, smoking and biomass exposure are well-established risk factors, underscoring their continued clinical relevance.[19,20]

An essential implication of this study is the recognition of pre-COPD as a clinically identifiable and significant entity among patients attending tertiary chest clinics. With one-fourth (25.4%) of patients exhibiting pre-COPD, routine screening through structured clinical assessment, chest imaging, and spirometry is indicated. This aligns with the recent emphasis by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) to define and manage early disease stages, highlighting the importance of early intervention

strategies to delay disease progression.[21] As highlighted by Dona et al.[14], the identification of pre-COPD allows targeted preventive measures, including smoking cessation, biomass smoke exposure reduction, and regular monitoring, potentially improving long-term respiratory outcomes.

This study has several strengths. It employed rigorous diagnostic criteria for pre-COPD, combining symptom assessment with spirometry and imaging. Spirometry interpretations by trained pulmonologists ensured reliability. Adopting objective diagnostic criteria consistent with contemporary guidelines (GOLD 2023) enhances external validity and clinical relevance.

However, limitations of this study warrant consideration. The cross-sectional design precludes the assessment of longitudinal outcomes. Longitudinal data are necessary to evaluate progression rates accurately and confirm the predictive value of pre-COPD identification. Another limitation includes potential selection bias introduced by non-probability consecutive sampling, restricting generalizability. Future research should include prospective longitudinal studies focusing on patients with pre-COPD to elucidate the natural history of disease progression, identifying predictive biomarkers and potential therapeutic targets. Further investigation into the role of chest imaging and advanced pulmonary function tests, including diffusion capacity measurements and small airway assessments, would enhance early diagnostic accuracy and inform targeted clinical interventions.

CONCLUSION

This study revealed a substantial prevalence of pre-COPD (25.4%) among patients at risk in a tertiary chest clinic setting. Pre-COPD was found to have significant associations with middle-aged groups, presenting with sputum production, and abnormal radiological findings. These findings reinforce the clinical importance of recognizing pre-COPD as a distinct entity warranting timely intervention to prevent disease progression. Given the substantial burden of COPD globally, early detection of pre-COPD may significantly impact patient outcomes and healthcare resource utilization.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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1	**Raj Kumar:** Critical revisions drafting, responsible for data, approved for publication.
2	**Faisal Faiyaz Zuberi:** Concept and designing, proof reading, critical revisions, approved for publication.
3	**Arif ul Islam:** Literature review, data analysis, discussion, approved for publication.