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Association of modifiable risk factors and comorbidities with short-term outcomes in patients admitted with acute exacerbation of chronic obstructive pulmonary disease: a cohort study from Pakistan

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Availability of data and materials: the study was conducted retrospectively using patient information extracted from hard-copy medical records, as electronic medical records were not available for the study population. Data were manually extracted from individual patient files and recorded on standardized paper-based data collection forms.

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Abstract

Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) contribute substantially to morbidity, healthcare burden, and hospitalization rates worldwide. This analytical cohort study assessed the prevalence of modifiable risk factors and cardiometabolic comorbidities among patients admitted with AECOPD and their association with short-term clinical outcomes at Aga Khan University Hospital, Karachi, from March to September 2023. Medical records of 141 patients were reviewed for demographics, smoking status, physical inactivity, obesity, hypertension, and type II diabetes mellitus. The primary outcome was discharge in a hemodynamically stable condition without the need for home oxygen therapy or ventilatory support. The mean age was 57.4±11.6 years, with equal gender distribution and a mean disease duration of 2.7±2.6 years. Current smoking was present in 35.5%, physical inactivity in 48.9%, and obesity in 41.1% of patients. Hypertension and diabetes were observed in 50.4% and 41.1%, respectively. A successful discharge outcome was achieved in 24.8% of patients. No significant association was found between baseline risk factors or comorbidities and short-term outcomes. Larger longitudinal studies are recommended to evaluate long-term effects.

Key words: COPD, acute exacerbation, comorbidities, risk factors, diabetes mellitus, hypertension, Pakistan.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death globally and ranked sixth in disability-adjusted life-years (DALYs) among 369 causes of disease burden in 2019 [1]. It imposes a major economic strain on healthcare systems due to frequent hospitalizations, loss of productivity, and long-term treatment needs [2].

Acute Exacerbation of COPD (AECOPD) is characterized by a sudden worsening of respiratory symptoms, such as dyspnea, cough, or sputum production, beyond daily variation, often requiring changes in baseline therapy [3]. Exacerbations significantly worsen quality of life, accelerate decline in lung function (FEV_1), and increase morbidity, mortality, and healthcare costs [1,4].

In the Asia-Pacific region, a 2012 survey across nine territories reported a 6.2% COPD prevalence, with 46% of patients experiencing exacerbations and 19% requiring hospitalization in the prior year (1). In Pakistan, the BREATHE study found a 2.1% prevalence among adults aged ≥40 years, with rising mortality attributed to tobacco use, biomass fuel exposure, and poor air quality [5]. These findings underscore the growing disease burden and the urgent need for targeted prevention and management strategies in low- and middle-income countries [6].

Multiple modifiable risk factors and comorbidities, including smoking, diabetes mellitus, hypertension, and cardiovascular disease, contribute to COPD progression and adverse outcomes [7]. In a study by Gaude et al., 84.4% of COPD patients were current smokers, 53.9% had hypertension, and 15.6% had diabetes, with poorer treatment outcomes in those with comorbidities [8]. Similarly, a three-year study at Mayo Hospital, Lahore found that among 355 patients hospitalized with AECOPD, 76.3% were smokers, 41.7% hypertensive, and 29.3% diabetic, but the relationship between these factors and clinical outcomes was not explored [9].

Despite global evidence, regional data from South Asia, particularly Pakistan, remain limited. Understanding how modifiable risk factors and comorbidities influence outcomes in hospitalized AECOPD patients is essential to improve care and allocate healthcare resources effectively.

This study aims to determine the prevalence of modifiable risk factors and comorbidities among patients admitted with AECOPD and assess the association of modifiable risk factors and comorbidities with outcomes in patients admitted with AECOPD. Identifying such predictors may help clinicians personalize treatment, prioritize preventive interventions like smoking cessation, and inform public health strategies to reduce disease burden and hospital readmissions.

Materials and Methods

This study was a retrospective analytical cohort study. The study was conducted in the medicine inpatient department at Aga Khan University Hospital, Karachi, Pakistan. Data collection took place from March to September 2023.

COPD was defined according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria as persistent airflow limitation demonstrated by a post-bronchodilator FEV_1/FVC ratio <0.70. AECOPD was defined as an acute worsening of respiratory symptoms, particularly dyspnea, cough, and/or sputum production, beyond normal day-to-day variation that required additional treatment. successful clinical outcome was defined as clinical stabilization during hospitalization followed by discharge in a vitally stable condition on room air without any signs of dyspnea.

Patients aged between 40 and 70 years who were admitted with an AECOPD to a tertiary care hospital were included in the study.

Patients admitted with other lung pathologies such as asthma, pulmonary embolism, pulmonary tuberculosis, bronchiectasis, interstitial lung diseases, or pneumonia without any underlying chronic lung pathology were excluded. Additionally, patients with congestive heart failure and pulmonary edema were excluded.

The variables collected for each patient included age, measured in years, gender categorized as male or female, duration of COPD in years, and residence status, which was classified as either urban or rural. Additionally, physical inactivity and obesity status were recorded, both noted as either yes or no. Regarding modifiable risk factors, the presence of diabetes mellitus type II and hypertension was also documented for each patient, with responses recorded as yes or no. A successful outcome was operationally defined as discharge from the hospital in a vitally stable condition, without transfer to the intensive care unit (ICU) at any point during hospitalization, absence of in-hospital mortality, and no requirement for ventilatory support at the time of discharge.

The required sample size for the study was calculated to be 141 patients. This calculation was based on a prevalence of diabetes mellitus of 15.6%, a margin of error of 6%, and a confidence level of 95%. The sample size was determined using WHO software. Non-probability consecutive sampling was employed to select the patients.

Following approval from the Ethical Committee of Aga Khan University Hospital, medical records of patients who met the inclusion criteria were reviewed. Information regarding the aforementioned variables was extracted from the patients' files.

Data were analyzed using SPSS version 20. Continuous variables such as age and duration of COPD were presented as means and standard deviations if they were normally distributed, as assessed by the Kolmogorov–Smirnov test. For variables that were not normally distributed, median, and interquartile ranges (IQR) were reported. Categorical variables, including gender, residence status, physical inactivity, obesity status, modifiable risk factors (diabetes mellitus type II, hypertension, and current smoking status), and successful outcomes, were presented as frequencies and percentages. Effect modifiers were controlled by stratifying data according to age, gender, residence status, physical inactivity, obesity status, and duration of COPD. Post-stratification, the chi-square test or Fisher's exact test was applied, with a p-value of ≤ 0.05 considered statistically significant.

Results

A total of 141 patients admitted to the Department of Medicine, Aga Khan University Hospital, Karachi, who met the inclusion criteria, were included in this study. The mean age of the patients was 57.39 ± 11.57 years (range 40–70 years), and the mean duration of COPD was 2.72 ± 2.57 years. Most participants (95; 67.4%) were in the 51–70-year age group, while 46 (32.6%) were between 40 and 50 years. Among these, 71 (50.4%) were males and 70 (49.6%) were females. The mean duration of COPD among study participants was 2.72 ± 2.57 years. Most patients (114; 80.9%) resided in urban areas. Table 1 summarizes the demographics of participants.

Regarding lifestyle-related factors 35.5% patients were current smokers, 69 (48.9%) were physically inactive, and 58 (41.1%) were obese (Figure 1).

Among the comorbid conditions, diabetes mellitus type II was observed in 58 (41.1%) patients, while hypertension was present in 71 (50.4%) patients.

A successful outcome was achieved in 35 (24.8%) patients, whereas 106 (75.2%) did not show a successful outcome.

When stratified by potential risk factors, the success rate did not differ significantly across age groups (p = 0.28), gender (p = 0.52), duration of COPD (p = 0.29), residence (p = 0.72), diabetes mellitus (p = 0.30), hypertension (p = 0.52), smoking status (p = 0.56), physical inactivity (p =

0.96), or obesity (p = 0.34) (Table 2). Thus, no baseline characteristic demonstrated a statistically significant relationship with successful outcome among COPD patients in this study.

Discussion

A total of 141 patients were included in the study. The mean age of participants was 57.39 years, indicating that COPD predominantly affects individuals in middle to late adulthood, consistent with previous studies reporting increasing prevalence with advancing age. The gender distribution was nearly equal (50.4% males and 49.6% females), which contrasts with earlier findings of male predominance. This shift may reflect changing smoking patterns and environmental exposures among women in urban areas. Most patients (80.9%) resided in urban settings, highlighting the possible contribution of air pollution and occupational exposures to disease burden.

Regarding lifestyle-related factors, 35.5% of patients were current smokers, 48.9% were physically inactive, and 41.1% were obese (Figure 1). These modifiable risk factors may exacerbate disease severity and impact overall outcomes. Among the comorbidities, hypertension (50.4%) and diabetes mellitus type II (41.1%) were prevalent, consistent with the high cardiometabolic overlap commonly observed in COPD patients. A successful treatment outcome was achieved in 24.8% of patients, suggesting that the presence of comorbidities and poor lifestyle factors may adversely influence prognosis (7). The relatively short mean disease duration (2.72 years) may indicate delayed diagnosis or low disease awareness. These findings emphasize the need for early identification, lifestyle modification, and integrated management strategies to improve outcomes among high-risk urban COPD populations [10].

Our results are comparable to the findings of Shafi et al. from Mayo Hospital, Lahore, who reported similar risk patterns among patients with AECOPD. In their study, smoking was the predominant risk factor, while hypertension and diabetes mellitus were the most common comorbidities. They also observed poorer outcomes among patients with multiple risk factors and longer disease duration [9]. The similarity in findings between both tertiary care centers highlights the burden of modifiable lifestyle risks and cardiometabolic comorbidities in COPD patients across Pakistan. Importantly, the absence of statistical significance in the present analysis does not negate the clinical relevance of these variables, as robust and consistent evidence from the medical literature has established strong associations between these risk factors, comorbidities, and adverse COPD-related outcomes. These findings should therefore be interpreted in the

context of existing evidence, and the observed lack of statistical significance should not be construed as evidence of no association.

The findings of our study underscore the importance of a multidisciplinary approach that combines early screening, risk factor modification, and coordinated long-term management to improve quality of life and reduce the disease burden in COPD patients. Our study highlights the high prevalence of smoking, obesity, physical inactivity, and comorbidities such as hypertension and diabetes mellitus, which are associated with worsened disease outcomes, including frequent acute exacerbations and prolonged hospitalizations [7]. As noted by Chatila et al., comorbid conditions such as hypertension and diabetes are common in COPD patients and significantly contribute to both morbidity and mortality [11]. Early identification and management of these comorbidities by primary care physicians is crucial in preventing disease progression, reducing exacerbation frequency, and shortening hospital stays [4]. However, research on the impact of comorbidities in urban tertiary care settings in Pakistan remains limited. Hence managing comorbidities in COPD not only improves clinical outcomes but also reduces healthcare utilization, underscoring the need for better diagnostic strategies and integrated management in our healthcare system [12].

This study has several limitations that must be acknowledged. We assessed the presence of comorbidities such as diabetes mellitus and hypertension but did not evaluate the degree of disease control. For example, HbA1c levels or blood pressure measurements were not documented, which could significantly influence outcomes [12,13]. Our primary outcome measure was limited to whether patients were discharged in a vitally stable condition; we did not assess longer-term morbidity, mortality, or readmission rates. Although COPD diagnosis was based on GOLD criteria, complete spirometric severity classification (GOLD 1–4) was not available for all patients. Additionally, we did not account for variations in the treatment regimens received by patients, such as differences in medication, oxygen therapy, or ventilatory support, which may have affected recovery.Additionally, the reliance on hard-copy medical records resulted in incomplete and inconsistently documented covariates, limiting our ability to perform multivariable logistic regression and adjust for potential confounding; therefore, the reported associations should be interpreted as unadjusted and with caution. The single center setting, and modest sample size further limit the generalizability of the findings and preclude causal inference. Despite these limitations, this study provides valuable baseline data on the prevalence and clinical

relevance of modifiable risk factors and comorbidities among patients hospitalized withAECOPD in Pakistan, thereby contributing context-specific evidence to the existing literature.

Conclusions

While modifiable risk factors and cardiometabolic comorbidities were highly prevalent, their impact on short-term in-hospital outcomes could not be demonstrated, highlighting the need for better outcome definitions and longitudinal follow-up.

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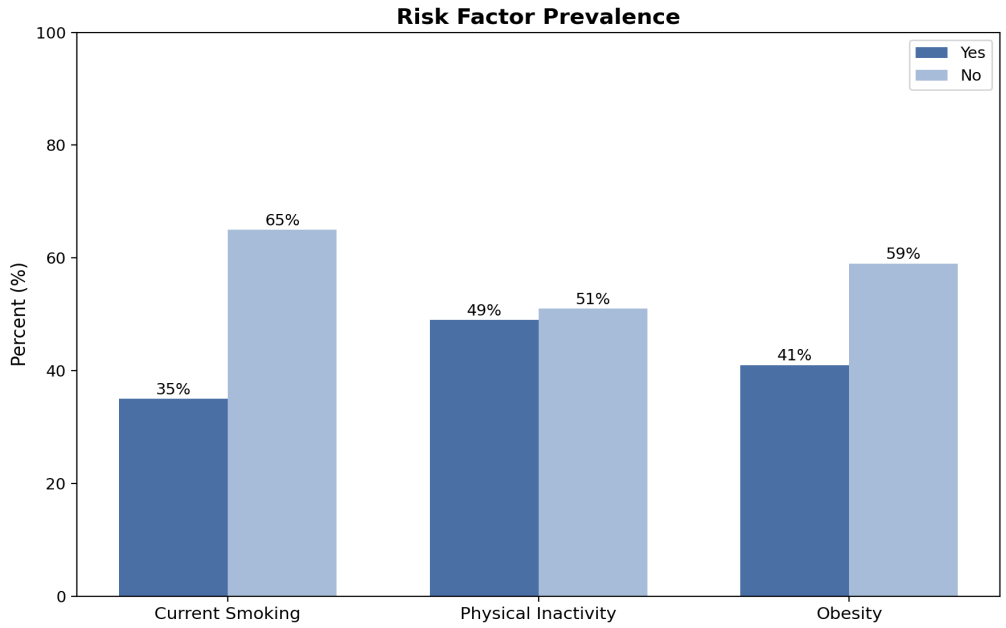

Figure 1. Frequency distribution of lifestyle-related risk factors among COPD patients (n=141).

Table 1. Baseline characteristics of study participants (n=141).

Variable	n (%) or Mean ± SD
Age (years)	57.39±11.57 (40-70)
Gender (male/female)	71 (50.4)/70 (49.6)
Duration of COPD (years)	2.72±2.57
Residence (urban/rural)	114 (80.9)/27 (19.1)

Table 2. Stratification of successful outcome by baseline variables.

Variable	Category	Successful Outcome n (%)	Unsuccessful outcome n (%)	p
Age (years)	40–50	14 (30.4)	32 (69.6)	0.28
	51–70	21 (22.1)	74 (77.9)	
Gender	Male	16 (22.5)	55 (77.5)	0.52
	Female	19 (27.1)	51 (72.9)	
Duration of COPD	≤ 3 years	15 (30)	30 (70)	0.29
	> 3 years	20 (22)	71 (78)	
Residence	Urban	29 (25.4)	85 (74.6)	0.72
	Rural	6 (22.2)	21 (77.8)	
Diabetes Mellitus II	Yes	17 (29.3)	41 (70.7)	0.30
	No	18 (21.7)	65 (78.3)	
Hypertension	Yes	16 (22.5)	55 (77.5)	0.52
	No	19 (27.1)	51 (72.9)	
Smoking	Yes	11 (22)	39 (78)	0.56
	No	24 (26.4)	67 (73.6)	
Physical Inactivity	Yes	17 (24.6)	52 (75.4)	0.96
	No	18 (25)	54 (75)	
Obesity	Yes	12 (20.7)	46 (79.3)	0.34
	No	23 (27.7)	60 (72.3)	