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Original Research Article

A Retrospective Study of Hospital Admissions for Acute COPD Exacerbations

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Abstract:

Background: Acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is a leading cause of hospitalization and constitutes the principal driver of COPD-related healthcare expenditure, with prolonged hospital stay representing a major contributor to this burden.

Methods: This retrospective observational study analyzed medical records of 205 patients admitted with AECOPD at ABC Hospital over a one-year period. COPD was diagnosed per GOLD criteria and exacerbation severity classified using The Rome Proposal; prolonged length of hospital stay (LHS) was defined as ≥7 days. Clinical, demographic, and investigational parameters were extracted, and their associations with LHS were evaluated using binary and multiple logistic regression analysis with statistical significance set at $p < 0.05$.

Results: The mean LHS was 10.7 ± 5.1 days, with 144 patients (70.2%) experiencing prolonged hospitalization. The cohort was predominantly male (89.8%), with a mean age of 64.2 ± 8.4 years, and 68.3% presented with type II respiratory failure. Binary logistic regression identified advancing age ($p = 0.04$), prior AECOPD hospitalizations ($p = 0.03$), arterial hypoxemia ($p = 0.04$), NIV requirement ($p = 0.01$), and severe AECOPD ($p = 0.004$) as significantly associated with prolonged LHS. On multiple logistic regression, severe AECOPD at admission was the only independent predictor of prolonged hospitalization (OR: 5.0; 95% CI: 1.4–18.2; $p = 0.01$).

Conclusion: Severe AECOPD at admission is the strongest independent determinant of prolonged hospitalization, highlighting the importance of early severity stratification to guide timely intervention and optimize resource utilization in AECOPD management.

Keywords: Acute Exacerbation, Chronic Obstructive Pulmonary Disease, Length of Hospital Stay, Non-Invasive Ventilation, Prolonged Hospitalization.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition manifesting through a constellation of symptoms including dyspnea, chronic cough, excessive mucus secretion, and recurrent disease flare-ups. Pathologically, the condition stems from structural and functional alterations within the bronchial passages and pulmonary alveoli, culminating in sustained — and frequently worsening — restriction of airflow. Its onset and trajectory are shaped by lifelong interactions between an individual's genetic makeup and the environments they are exposed to [1,2]. On a global scale, COPD stands as the third leading contributor to mortality, with an overwhelming proportion of deaths — nearly 90% — concentrated in nations with low to middle economic standing. Within the natural history of this disease, acute hospitalizations driven by sudden deterioration, referred to as acute exacerbations of COPD (AECOPD), constitute one of the most pivotal and clinically challenging events [3,4].

Establishing a diagnosis of AECOPD relies on current COPD management frameworks, demanding a systematic appraisal of symptom aggravation — most notably worsening dyspnea, intensified coughing, and alterations in sputum quantity or consistency [5]. A thorough clinical workup encompassing the patient's prior medical history, bedside findings, and relevant investigations — including arterial blood gas (ABG) measurement, C-reactive protein (CRP) quantification, and plain chest radiography — forms the cornerstone of this evaluation. Accurate delineation of exacerbation

severity is indispensable, guiding therapeutic decisions grounded in current evidence and facilitating care that is both timely and tailored to the individual. Prompt recognition and intervention during AECOPD episodes are paramount in averting clinical deterioration, enhancing patient recovery, and alleviating pressure on healthcare resources. When inadequately addressed, these episodes hasten pulmonary function decline, erode health-related quality of life, and adversely affect long-term survival — reinforcing the imperative for swift and effective management.

Notably, although severe exacerbations warranting inpatient admission affect only a fraction of the COPD population — roughly 10–15% — the financial toll of AECOPD-related hospitalizations constitutes upwards of 70% of the entire COPD healthcare expenditure [6]. Central to this economic burden is the duration of inpatient admission, with existing literature demonstrating considerable variability in the length of hospital stay (LHS) among AECOPD patients, generally spanning anywhere from 3 to 16 days [7–9]. Research has further delineated specific admission-level clinical indicators associated with protracted hospitalization, among them elevated arterial carbon dioxide tension ($PaCO_2$), a symptomatic period exceeding one day before presentation, and preceding antibiotic exposure [10,11]. Elucidating the variables that predispose patients to extended admissions holds practical value in shaping interventions aimed at curtailing costs and refining inpatient management protocols. Motivated by these considerations, this retrospective study aims to systematically examine the clinical determinants of prolonged hospital stay among patients admitted for AECOPD, ultimately seeking to furnish healthcare providers with actionable insights for more effective and efficient patient care.

Materials and Methods

Study Design and Setting: This study employed a retrospective observational design, utilizing data retrieved from medical records of patients admitted with AECOPD at a tertiary care institution, over a one-year study period. The study aimed to identify and analyze clinical and demographic factors associated with prolonged hospitalization among AECOPD patients. COPD diagnosis was established in accordance with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria, and exacerbation severity was stratified using "The Rome Proposal" classification framework [12].

Sample Size and Population: A total of 205 patients admitted with a primary diagnosis of AECOPD during the study period were included in the analysis. This sample was considered adequate to detect a 10% prevalence of AECOPD-related hospitalization — consistent with reported rates of 10–15% in the existing literature — with a margin of error of 5% at a 95% confidence interval [6,13,14].

Inclusion Criteria: Patients aged above 40 years who had been admitted with a confirmed diagnosis of AECOPD and whose medical records were complete and available for review were included in the study.

Exclusion Criteria: Patients were excluded if their hospitalization was attributable to causes other than AECOPD, including pulmonary embolism, pneumothorax, primary lung malignancy, lower respiratory tract infections, pleural effusion, or cardiac insufficiency. Records with incomplete or missing clinical data that precluded meaningful analysis were also excluded from the study.

Data Collection and Variables: Demographic, clinical, and investigational data were systematically extracted from the hospital's medical records database. The parameters retrieved included patient age, sex, body mass index (BMI), smoking history, number of prior AECOPD-related hospitalizations, documented comorbidities such as diabetes mellitus and systemic hypertension, and recent spirometry findings. Laboratory investigations recorded at the time of admission comprised arterial blood gas (ABG) analysis, complete blood count (CBC), renal and hepatic function tests, pro-B-type natriuretic peptide (pro-BNP), and C-reactive protein (CRP) levels. Radiological and cardiac assessments including chest radiography, electrocardiography (ECG), and echocardiography were also documented.

Exacerbation severity was categorized as mild, moderate, or severe based on established classification criteria [12], and treatment approaches documented in the records were noted accordingly. Pharmacological management included inhaled bronchodilators, inhaled and systemic corticosteroids, and parenteral antibiotics. Non-pharmacological interventions such as non-invasive ventilation (NIV) and supplementary supportive care were recorded where applicable. Notably, none of the patients in the study cohort required invasive mechanical ventilation, and all patients achieved clinical recovery prior to discharge.

The primary outcome of interest was the length of hospital stay (LHS), which was categorized as either prolonged, defined as a stay of 7 or more days, or usual, defined as a stay of fewer than 7 days, in line with previously published thresholds [15]. The association between LHS and variables including patient age, exacerbation severity, comorbidity burden, and treatment-related factors was subsequently examined.

Statistical Analysis: Continuous variables were summarized using mean, median, and standard

deviation, while categorical variables were expressed as frequencies and percentages. Associations between clinical parameters and length of hospital stay were evaluated using the independent samples t-test and binary logistic regression analysis. A p-value of less than 0.05 at a 95% confidence level was considered statistically significant, and all analyses were performed using SPSS version 20.

Results

The study cohort comprised 205 patients admitted with AECOPD, of whom the majority were male (89.8%) and above 60 years of age (66.3%), with a mean age of 64.2 ± 8.4 years. A high proportion were ever-smokers (94.1%), and nearly three-fifths (59.5%) had a history of prior hospitalization for AECOPD. Among documented comorbidities, cor pulmonale was the most prevalent (40.5%), followed by hypertension (32.7%), treated pulmonary tuberculosis (18.5%), and diabetes mellitus (12.2%). In terms of disease severity, the majority of patients were classified under GOLD Stage III (41.9%). Non-invasive ventilation was required in 52.2% of admissions, and the mean length of hospital stay was 10.7 ± 5.1 days, with 144 patients (70.2%) experiencing a prolonged stay of 7 or more days (Table 1).

Table 1: Clinical and Demographic Profile of AECOPD Patients at Admission (n = 205)

Parameters	Value
Age >60 years	136 (66.3%)
Mean age (years)	64.2 ± 8.4
Male gender	184 (89.8%)
Ever smokers	193 (94.1%)
Current smokers	46 (22.4%)
Never smokers	12 (5.9%)
Previous hospitalization for AECOPD	122 (59.5%)
Mean BMI (kg/m²)	24.1 ± 3.6
Hypertension	67 (32.7%)
Diabetes mellitus	25 (12.2%)
Treated PTB	38 (18.5%)
Cor pulmonale	83 (40.5%)
COPD (GOLD) Stage I	23 (11.2%)
COPD (GOLD) Stage II	64 (31.2%)
COPD (GOLD) Stage III	86 (41.9%)
COPD (GOLD) Stage IV	32 (15.6%)
NIV required	107 (52.2%)
Mean LHS (days)	10.7 ± 5.1
LHS ≥7 days	144 (70.2%)

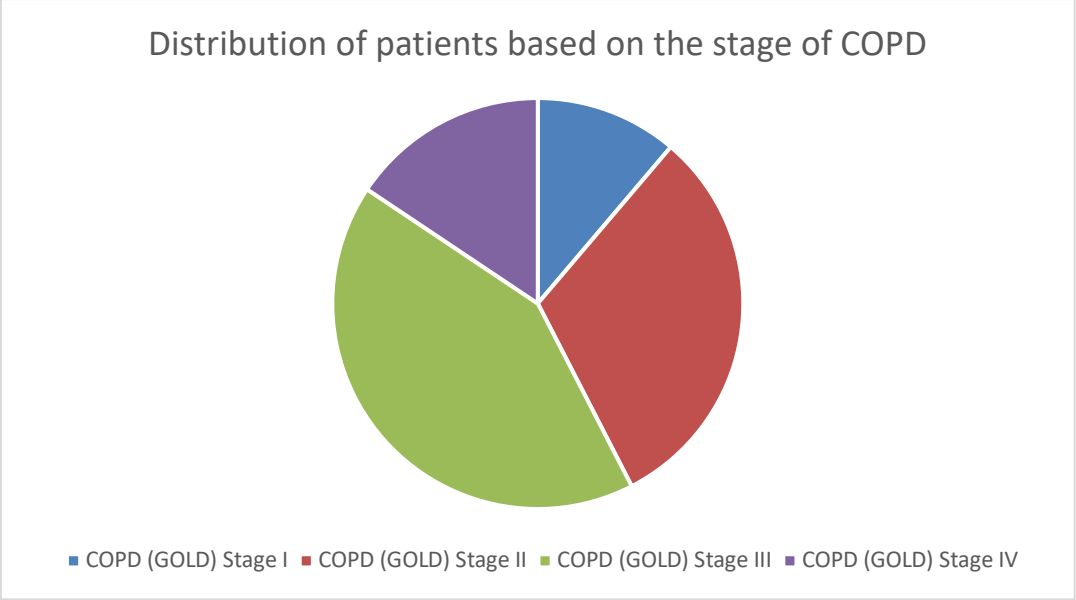

Figure 1: Patient distribution as per COPD (GOLD) Stage.

Laboratory investigations at admission revealed a mean hemoglobin of 13.3 ± 2.1 gm/dL, with leukocytosis noted in 16.6% of patients. Eosinophil counts were below 300 cells/µL in slightly more than half the cohort (52.2%). Arterial blood gas analysis demonstrated a mean pH of 7.33 ± 0.07, with mean PaO_2 and $PaCO_2$ values of 59.1 ± 23.1 mm Hg and 51.6 ± 16.1 mm Hg, respectively. Type II respiratory failure was identified in 68.3% of patients, reflecting a significant burden of hypercapnic respiratory compromise within this cohort. Regarding exacerbation severity, patients were distributed across mild (32.2%), moderate (36.1%), and severe (31.7%) categories, with the moderate group constituting the largest proportion (Table 2).

Table 2: Blood Investigations and AECOPD Severity at Admission (n = 205)

Parameters	**Value**
Mean hemoglobin (gm/dL)	13.3 ± 2.1
Leukocytosis	34 (16.6%)
Absolute eosinophil count <300 cells/µL	107 (52.2%)
Absolute eosinophil count ≥300 cells/µL	98 (47.8%)
Mean pH (ABG)	7.33 ± 0.07
Mean PaO_2 (mm Hg)	59.1 ± 23.1
Mean $PaCO_2$ (mm Hg)	51.6 ± 16.1
Type II respiratory failure	140 (68.3%)
AECOPD Severity	
Mild	66 (32.2%)
Moderate	74 (36.1%)
Severe (pH <7.35 and $PaCO_2$ >45 mm Hg)	65 (31.7%)

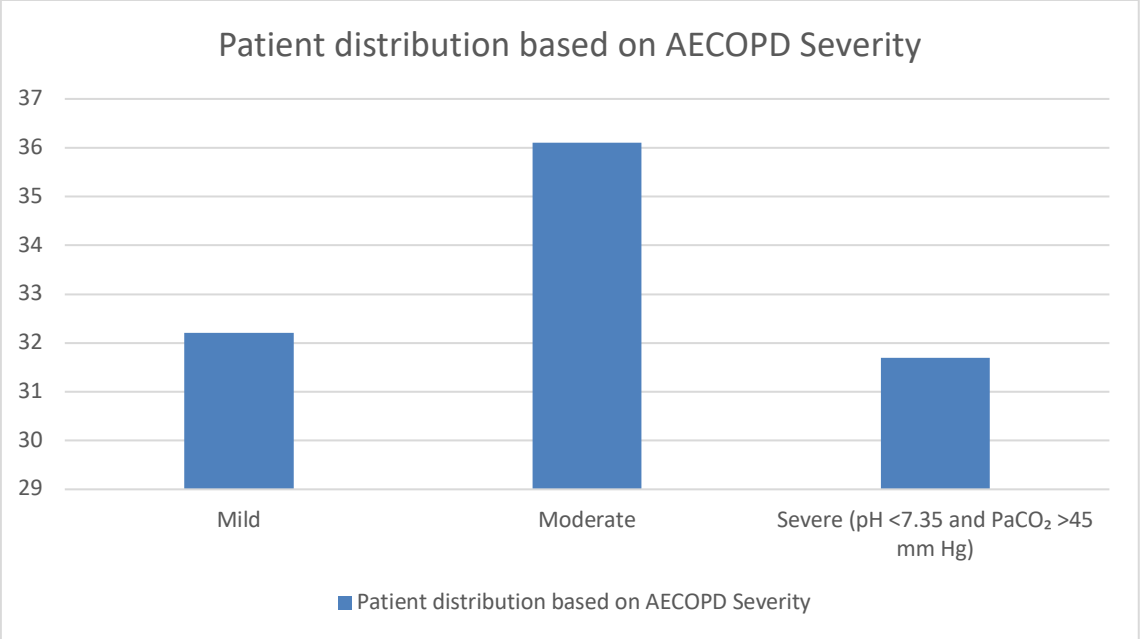

Figure 2: Patient distribution as per severity of AECOPD.

Bivariate analysis identified several clinical variables significantly associated with prolonged hospital stay (LHS ≥7 days). Advanced age (r = 0.25, p = 0.04), a history of prior AECOPD hospitalization (r = 0.30, p = 0.03), arterial hypoxemia reflected by lower PaO_2 (r = −0.27, p = 0.04), severe AECOPD at presentation (r = 0.40, p = 0.004), and the requirement for non-invasive ventilation (r = 0.34, p = 0.01) each demonstrated statistically significant associations with prolonged admission. On subsequent multiple logistic regression analysis, however, severe AECOPD at admission emerged as the sole independent predictor of prolonged hospitalization, with an odds ratio of 5.0 (95% CI: 1.4–18.2; p = 0.01), indicating that patients presenting with severe exacerbations were five times more likely to experience an extended hospital stay compared to those with milder disease (Table 3).

Table 3: Logistic Regression Analysis of Variables Associated with Length of Hospital Stay (n = 205)

Variable	Pearson Coefficient (r)	p-value	OR (95% CI)	Significance
Age	0.25	0.04	1.8 (1.02–3.12)	*
Male gender	0.09	0.51	1.2 (0.64–2.31)	NS
BMI	0.07	0.63	0.9 (0.74–1.18)	NS
Smoking status	−0.14	0.33	0.8 (0.52–1.43)	NS
Hypertension	−0.18	0.21	0.7 (0.41–1.34)	NS
Diabetes mellitus	−0.07	0.09	0.9 (0.43–1.72)	NS
Cor pulmonale	0.38	0.44	1.4 (0.82–2.43)	NS
Previous hospitalizations	0.30	0.03	2.1 (1.08–4.02)	*
Treated PTB	0.22	0.13	1.5 (0.78–2.94)	NS
Leukocytosis	0.12	0.41	1.3 (0.67–2.51)	NS
PaO_2	−0.27	0.04	0.6 (0.38–0.97)	*
$PaCO_2$	0.19	0.21	1.3 (0.86–1.94)	NS
Type II respiratory failure	0.18	0.20	1.6 (0.79–3.14)	NS
Severe AECOPD	0.40	0.004	**5.0 (1.4–18.2)**	*
NIV requirement	0.34	0.01	2.4 (1.21–4.73)	*

Discussion

The present retrospective study examined a range of clinical and demographic variables for their association with length of hospital stay (LHS) among 205 patients admitted with AECOPD, defining prolonged hospitalization as a stay of 7 or more days and usual stay as fewer than 7 days [15]. Among the variables assessed, advancing age ($r = 0.25$, $p = 0.04$), prior AECOPD-related admissions ($r = 0.30$, $p = 0.03$), arterial hypoxemia ($r = −0.27$, $p = 0.04$), requirement for non-invasive ventilation ($r = 0.34$, $p = 0.01$), and severe exacerbation at admission ($r = 0.40$, $p = 0.004$) demonstrated statistically significant correlations with prolonged LHS. The mean duration of hospital stay in our cohort was 10.7 ± 5.1 days, which is broadly comparable to figures reported from studies conducted in China (9.38 days), North West England (9.8 days), and Spain (11.9 days) [16–18]. Conversely, lower durations have been documented in the United States (5.9 days) and across several European nations (8.7 days), and this variability may be attributed to differences in disease severity at presentation, geographic and healthcare infrastructure differences, and heterogeneity in institutional care standards [19,20].

Advancing age emerged as a significant correlate of prolonged hospitalization in our study, a finding that aligns with observations from earlier investigations and is likely reflective of the diminished physiological reserve and slower clinical recovery trajectories characteristic of older individuals [17,21,22]. In the management of elderly AECOPD patients, a holistic approach encompassing respiratory therapy, guided physical activity, and psychosocial support is therefore warranted, with family involvement in care planning proving particularly valuable. Additionally, a history of prior AECOPD hospitalization was identified as a meaningful predictor of extended stay, consistent with the GOLD guidelines' recognition of exacerbation history as a marker of disease severity [12]. This is further corroborated by a Spanish investigation by Crisafulli et al., which similarly demonstrated that patients with prolonged admissions had a greater burden of preceding AECOPD-related hospitalizations [23]. Repeated exacerbations are thought to accelerate deterioration in lung function and hasten volumetric decline, thereby increasing both the frequency and duration of subsequent admissions.

Contrary to what several other studies have reported, elevated $PaCO_2$ did not emerge as a significant predictor of prolonged stay in our cohort, unlike findings from prior investigations which identified hypercapnia as strongly indicative of stays exceeding 11 days [9,24]. This discrepancy may partly reflect differences in study design, the specific LHS cutoff employed, and the presence of compensated type II respiratory failure in a considerable subset of our patients at the time of admission. Arterial hypoxemia, on the other hand, demonstrated a significant inverse association with LHS ($r = −0.27$, $p = 0.04$) in our study, underscoring its value as a prognostic indicator during AECOPD, a relationship that has been corroborated by prior work documenting longer stays among hypoxemic patients breathing ambient air [23,25]. These findings collectively highlight the importance of early and aggressive management of hypoxemia as a means of potentially curtailing hospitalization duration. Furthermore, NIV requirement ($r = 0.34$, $p = 0.01$) and severe AECOPD at admission ($r = 0.40$, $p = 0.004$) were both significantly correlated with prolonged LHS on binary logistic regression, consistent with prior literature [18,23,26]. Importantly, on multiple logistic regression analysis, severe AECOPD at admission was the sole independent predictor of prolonged hospitalization (OR: 5.0; 95% CI: 1.4–18.2; $p = 0.01$), with severely exacerbating patients recording a mean stay of 10.5

days compared to 5.3 days among those with mild or moderate exacerbations (p = 0.001).

Several variables failed to demonstrate any significant association with prolonged LHS in our cohort, including gender, heart rate, respiratory rate, comorbidities, GOLD disease stage, leukocytosis, and eosinophil counts — findings that are largely consistent with previously published data [18,23,25]. While certain studies have linked comorbidity burden to extended hospitalization, potentially through pathophysiological mechanisms that compromise pulmonary function and heighten the risk of secondary complications [26,27], no such association was identified in our study. The near-universal smoking history in our cohort (94.1%) precluded a meaningful evaluation of smoking as an independent determinant of LHS, and there remains a paucity of data regarding the relationship between cumulative pack-years and hospitalization duration in AECOPD. Similarly, the small number of underweight patients (BMI <18.5 kg/m²) in our sample limited the exploration of BMI as a predictor, though prior work by Jo et al. has suggested that underweight status is associated with more frequent hospitalizations, whereas higher BMI does not appear to significantly influence COPD-related healthcare utilization [28,29]. Taken together, the findings of this study draw attention to severe exacerbation at admission as the most actionable and independent determinant of prolonged hospitalization, with important implications for early risk stratification, resource planning, and the development of targeted management strategies for patients admitted with AECOPD.

Conclusion

This retrospective study of 205 patients hospitalized with AECOPD identified severe exacerbation at admission as the sole independent predictor of prolonged hospital stay (LHS ≥7 days), with affected patients remaining admitted nearly twice as long as those presenting with mild or moderate exacerbations (10.5 vs 5.3 days). While advancing age, prior AECOPD hospitalizations, arterial hypoxemia, and the need for non-invasive ventilation demonstrated significant univariate associations with extended stay, these did not retain independent significance on multivariate analysis. These findings underscore the critical importance of early and accurate severity assessment at the time of admission, as timely identification of severe exacerbations can guide targeted therapeutic interventions, facilitate optimal allocation of healthcare resources, and ultimately reduce the clinical and economic burden associated with prolonged hospitalization in AECOPD patients.

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