Original Article

Exploring risk factors for all-cause hospital readmissions following chronic obstructive pulmonary disease exacerbation patients discharged on steroid tapers

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Background: Chronic obstructive pulmonary disease (COPD) exacerbations often lead to hospitalizations and subsequent readmissions. Steroid therapy is a common approach in managing COPD exacerbations, yet a considerable proportion of patients experience readmissions within a short timeframe, highlighting the persistent and complex nature of COPD exacerbations. The aim of this retrospective study is to investigate risk factors for all-cause hospital readmissions in COPD patients discharged on steroid tapers following exacerbations, emphasizing the need for personalized management strategies to reduce readmission rates.

Methods: Patient demographics and treatment histories were collected in a retrospective study of electronic medical records for patients in our hospital system for the calendar year 2023. Descriptive statistics were calculated, and univariate logistic regression were conducted for potential predictors.

Results: Data analysis revealed that higher exacerbation frequency significantly increased the likelihood of readmission within a year, with patients experiencing three or more exacerbations facing 11 times and 25 times greater risks compared to those with 0 exacerbations. Early re-exacerbations within 30 days of discharge also emerged as strong predictors of long-term prognosis.

Conclusions: Existing prognostic tools lack specificity for predicting short-term readmissions, highlighting the need for comprehensive risk assessment tools tailored to individual patient needs. Proactive monitoring of exacerbation frequency and personalized management strategies are essential for optimizing care delivery and reducing readmission rates in COPD patients. Targeted interventions aimed at mitigating identified risk factors and optimizing post-discharge management can enhance patient outcomes and alleviate the overall burden of COPD on patients and healthcare systems. Further research is warranted to address limitations and refine risk assessment tools to support personalized COPD care.

Keywords: Chronic obstructive pulmonary disease exacerbations (COPD exacerbations); hospital readmissions; steroid tapers; risk factors; retrospective study

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Introduction

Background

Chronic obstructive pulmonary disease (COPD) remains a global health challenge, ranking as the third leading cause of death worldwide and among the leading causes of morbidity and healthcare expenditure worldwide (1). COPD manifests with diverse symptoms caused by varying underlying mechanisms across different patient subsets. Among these, exacerbations of COPD (ECOPD) stand out as a significant clinical phenotype, contributing to disease progression, elevated healthcare costs, and heightened morbidity and mortality (2). ECOPD represent acute episodes of respiratory deterioration in patients with COPD and are associated with poor outcomes, including higher mortality rates, accelerated disease progression, declining lung function, worsening dyspnea, impaired quality of life, and increased healthcare utilization and costs (3). Steroid therapy, including steroid tapers at discharge, is a common approach in managing ECOPD and aims to alleviate symptoms and reduce the risk of relapse (4). However, despite advancements in treatment modalities and interventions, ECOPD often lead to hospitalizations and readmissions within a short timeframe, contributing substantially to the burden of patients who suffer from COPD while also causing psychological and financial stress (5-8). In this retrospective study, we evaluated patient records to determine the factors associated with readmission for individuals with COPD receiving steroid therapy.

These exacerbations complicate disease management and strain resources due to frequent hospitalizations and the need for intensive care unit (ICU) care (9). The healthcare system faces substantial economic costs and resource allocation challenges as it deals with high rates of emergency visits and long-term care needs. A retrospective case control study examined healthcare costs 36 months prior to COPD diagnosis (10). It found that COPD patients used emergency and inpatient services 1.5–1.6 times more often and had increased outpatient visits a month before diagnosis, indicating delayed diagnosis until acute exacerbations or respiratory changes occur (10). Even after accounting for co-morbidities, a COPD diagnosis led to higher resource use and treatment costs (10). Unfortunately, the economic burden of COPD is anticipated to rise due to factors like an aging population, tobacco use, and air pollution (11). In 2010 the total estimated cost of COPD in the U.S. was $36 billion, with $32.1 billion directly related to healthcare expenses (12). A 2011 study analyzed the hospital costs of COPD in 602 U.S hospitals, finding the mean costs for COPD related visits in 2008 were $6,467 for an emergency department visit, $7,242 for a simple admission, and $20,757 for a complex admission, with ICU admission requiring intubation being the most expensive at $44,909 (13). A similar Canadian study determined the mean cost per exacerbation for moderate to severe COPD patients was $3,036 Canadian dollars, with hospitalization accounting for 80% of the total cost (14).

Rationale and knowledge gap

Identifying the risk factors associated with readmissions following COPD exacerbations is paramount for improving patient outcomes, optimizing resource utilization, and enhancing the overall quality of care. A synthesis of various studies highlights co-morbidities, such as heart failure, depression, and renal failure, as significant risk factors for readmission within 30 days (15). Each one-point increase in the comorbidity index was linked to a 24% higher risk of readmission or death (15). A history of prior COPD exacerbations and hospitalizations also correlates with an increased readmission risk, as do factors like low physical activity and alcohol use (16). Hospital-related factors, such as length of stay, may also play a role, with some studies showing higher odds of readmission for shorter stays (17), while discharge destination, like skilled nursing facilities,

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Highlight box

Key findings
- Frequent exacerbations of chronic obstructive pulmonary disease (COPD) are associated with increased likelihood of hospital readmission within one year.
- COPD exacerbations within 30 days of discharge were strong predictors of a patient's long-term prognosis.

What is known and what is new?
- COPD is commonly managed with steroid therapy, but such therapy does not prevent exacerbations.
- This retrospective analysis investigates the risk factors for all-cause hospital readmissions in patients with COPD who have been treated with steroid tapers.

What is the implication, and what should change now?
- Individualized tools need to be developed to better predict which patients will experience COPD exacerbations and better manage their disease. Improved disease management will likely reduce readmissions.

may be associated with increased readmission rates (18). Patient demographics, including age and ethnicity, and health system factors, like hospital size and outpatient visits, also influence readmission likelihood (19). While numerous studies have explored factors contributing to readmissions directly related to COPD exacerbations (15-19), there remains a notable gap in understanding the broader spectrum of all-cause readmissions within a year among COPD patients discharged on steroid tapers. This gap underscores the need for comprehensive investigations that consider diverse patient populations, treatment modalities, and temporal factors to elucidate the complex interplay of variables influencing readmission rates.

Various tools have been utilized to evaluate the severity of COPD, including the length of patient stay in the hospital, Acuity of Admission of patient in the hospital, Comorbidity and Emergency Visit (LACE) index, All Patient Refined Diagnosis Related Groups (APR-DRG), and COPD complexity tool (20). Patients with more severe disease exhibit increased odds of 30-day readmission, regardless of the method used to assess disease severity.

While scores like comorbidity, obstruction, dyspnea, and previous severe exacerbations (CODEX) (21) and Previous admission, Extended Medical Research Council dyspnea score, Age, Right-heart failure, and Left-sided heart failure (PEARL) (22) have been developed to assess readmission risk in COPD, there currently lacks a specific tool for predicting 30-day all-cause COPD readmissions. Presently, the PEARL score is the only tool available for 90-day COPD readmissions, and it focuses primarily on factors like previous admissions, extended Medical Research Council Dyspnea Scale (eMRCD) score, age, and heart failure, without considering other co-morbidities or risk factor variables (23). Recent systematic reviews indicate that existing models fall short of meeting the criteria for risk-stratified treatment in personalized COPD care (24). Personalized COPD medicine requires a more unified approach to developing and validating high-quality prediction models.

Objective

We addressed this critical gap in the literature by investigating risk factors for all-cause hospital readmissions in COPD patients discharged on steroid tapers following exacerbations. We retrospectively analyzed patient records to determine the factors associated with readmission for individuals with COPD receiving steroid therapy. We found

that exacerbation frequency could potentially serve as a valuable prognostic marker. These findings provide insights that can inform clinical practice, policy development, and future research endeavors to increase healthcare efficiency, reduce healthcare costs, and ultimately improve the quality of care for COPD patients. We present this article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-932/rc).

Methods

We conducted a retrospective analysis of electronic medical records and COPD Care Pathway records to examine variables potentially associated with readmission outcomes for patients discharged on steroid tapers after ECOPD from January 1st, 2023 to January 1st, 2024 within several nearby institutions. We collected patient demographics, medical history, steroid taper regimen, co-morbidities, provider specialties, medication prescribed, and inpatient details. To be included in the study, patients had to meet the following criteria: a confirmed diagnosis of COPD based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria, admitted to the hospital for an ECOPD and subsequently and discharged on a systemic corticosteroid taper regimen.

Patients were excluded from the study if they met any of the following criteria: presence of other significant respiratory conditions, such as asthma or interstitial lung disease, which could confound the outcomes related to COPD management, insufficient medical records, particularly those lacking details on steroid taper regimen or follow-up data, patients transferred to another facility where follow-up care could not be tracked. All patients admitted for ECOPD within the study period were initially screened. Those who met the inclusion criteria were further reviewed to ensure that none of the exclusion criteria were present. Eligible patients were then enrolled in the study for subsequent analysis. For the purposes of this study, "steroid tapers" were defined as any amount of systemic steroids prescribed at discharge. Given the variability in corticosteroid prescriptions (e.g., prednisone, methylprednisolone), we standardized the measurement of steroid dosing by calculating the cumulative dose prescribed at discharge and converting it into an equivalent dose of prednisone in milligrams. This approach allowed for consistent comparisons across patients, regardless of the specific corticosteroid used, thereby reducing potential bias

in the study.

Statistical analysis

Descriptive statistics were calculated for demographic, clinical, and treatment-related variables. Continuous variables were summarized as means and standard deviations (SDs) or medians with interquartile ranges (IQRs), depending on data distribution. Categorical variables were presented as frequencies and percentages.

A series of univariate logistic regression was conducted to identify potential predictors of readmission within one year. Variables with a P value <0.25 in univariate analysis were entered into the multivariate logistic regression model. These variables included body mass index (BMI), insurance status, pulmonary function test documentation, frequency of exacerbations, participation in pulmonary rehabilitation, provider specialty, follow-up with a provider after initial discharge, outpatient prescriptions of steroids and antibiotics, in-hospital steroid dosing, and steroid taper dosage at discharge (prednisone equivalent). Multivariate logistic regression analysis was performed to assess the independent impact of these variables on hospital readmission while controlling for confounders.

Odds ratios (ORs) and 95% confidence intervals (CIs) were reported for all significant predictors. Statistical significance was defined as a two-tailed P value <0.05. All statistical analyses were conducted under alpha level 0.05. Statistical Analysis System (SAS) 9.4 (SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses.

Ethical statement

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). It was approved by the institutional ethics board of Allegheny Health Network Research Institute (AHNRI) [No. 45 CFR 46. 102(f)], and individual consent for this retrospective analysis was waived.

Results

During the study period, 154 patients were discharged on steroid tapers after ECOPD; a total of 109 patients were used in our analysis after exclusion criteria. The mean age of the patients was 69.83 years (SD =9.92), and 64 patients were female (58.72%; *Table 1*). The majority of patients were White (87.16%, n=95). Among the entire cohort, 104

(95.41%) patients reported co-morbidities. About half of those patients with co-morbidities (50.93%, n=55) were readmitted within a year, although one patient was lost to follow up due to death and/or migration to a different facility and was excluded from the study. Hypertension was the most common comorbidity (n=87, 17.94%), along with coronary artery disease (n=52, 10.72%; *Table 2*). Dementia was the least reported comorbidity (n=1, 0.21%). The frequencies of each comorbidity can be seen in *Table 2*.

After conducting a series of univariate logistic regressions, the following variables were selected for multivariate analysis: patient's BMI (OR =0.94, 95% CI: 0.86–1.02, P=0.12), insurance status (Medicaid: OR =8.07, 95% CI: 0.45–144.5, P=0.07; pending: OR =0.02, 95% CI: 0.001–5.03, P=0.08), pulmonary function test documentation (OR =1.98, 95% CI: 0.42–9.39, P=0.38), history of ECOPD (exacerbation within one year: OR =0.12, 95% CI: 0.01–2.96, P<0.001), pulmonary rehabilitation participation (OR =2.18, 95% CI: 0.51–9.32, P=0.29), provider specialty managing the patient's COPD (pulmonologist: OR =0.32, 95% CI: 0.05–2.26, P=0.11), any post-discharge follow-up visits (OR =2.36, 95% CI: 0.49–11.30, P=0.28), steroids prescribed in the outpatient setting (OR =0.62, 95% CI: 0.11–3.31, P=0.52), antibiotics prescribed in the outpatient setting (OR =1.78, 95% CI: 0.29–10.89, P=0.55), steroid dosing while admitted to the hospital (OR =1.00, 95% CI: 1.00–1.002, P=0.66), and steroid dosing at discharge (OR =1.00, 95% CI: 1.00–1.001, P=0.51). After multivariate analysis, only ECOPD was a significant predictor of patient readmission after controlling for other predictors (*Table 3*). Compared to patients who experienced zero exacerbations, those who experienced one exacerbation within one year were 88% less likely to be readmitted (OR =0.12, 95% CI: 0.01–2.96, P<0.001). Patients who experienced three exacerbations in one year had 11.09 times higher chance of being readmitted than those with zero exacerbations (OR =11.09, 95% CI: 0.42–296.44; P=0.045). Patients who experienced more than three exacerbations were 25.78 times more likely to be readmitted than those with zero exacerbations (OR =25.78, 95% CI: 1.06–625.90, P=0.001). Other factors did not have significant correlation with the probability of being readmitted.

Discussion

Key findings

In this retrospective analysis, we found that out of 17

Table 1 Descriptive statistics of demographics and medical information of patients with COPD

Clinical variables	Value
Age, years	69.83 (9.92)
Body mass index, kg/m^2	28.10 (8.16)
Gender	
Female	64 (58.72)
Male	44 (40.37)
Other	1 (0.92)
Race	
Black	13 (11.93)
White	95 (87.16)
Native American	1 (0.92)
Smoking	
Never	4 (3.67)
Current	53 (48.62)
Former	52 (47.71)
Housing status	
Home owner	107 (98.17)
Homeless	1 (0.92)
Other	1 (0.92)
Insurance status	
Medicare	91 (83.49)
Medicaid	8 (7.34)
Uninsured	3 (2.75)
Other	7 (6.42)
Pulmonary function test documented in medical records	
Yes	81 (74.31)
No	28 (25.69)
Post-bronchodilator FEV1% predicted	
≥80%	11 (10.09)
70–79%	8 (7.34)
60–69%	12 (11.01)
50–59%	16 (14.68)
35–49%	17 (15.60)
<35%	8 (7.34)
Not present	37 (33.94)
Exacerbations within a year time frame starting after discharge (not including the initial COPD exacerbation)	
1	38 (34.86)
2	26 (23.85)

Table 1 (*continued*)

Table 1 (*continued*)

Clinical variables	Value
3	13 (11.93)
>3	28 (25.69)
Co-morbidities	
Yes	104 (95.41)
No	5 (4.59)
Pulmonary rehab participation	
Yes	34 (31.19)
No	75 (68.81)
Provider specialty treating COPD	
PCP	36 (33.03)
Pulmonologist	65 (59.63)
Other	8 (7.34)
Discharge follow-up	
Yes	57 (52.29)
No	52 (47.71)
Prescribed steroids outpatient between admissions	
Yes	54 (49.54)
No	43 (39.45)
Unknown	12 (11.01)
Prescribed antibiotics outpatient between admissions	
Yes	31 (28.44)
No	66 (60.55)
Unknown	12 (11.01)
Discharged on home oxygen after	
Yes	26 (23.85)
No	53 (48.62)
Not documented	1 (0.92)
Home oxygen use prior to initial admission	29 (26.61)
Readmission within a year of initial discharge	
Yes	55 (50.93)
No	53 (49.07)
Steroid dosing in hospital (prednisone equivalent in mg)	245 [143.35–450]
Steroid dosing on discharge (prednisone equivalent in mg)	200 [100–300]

Data are presented as mean (SD), n (%), or median [interquartile range]. COPD, chronic obstructive pulmonary disease; SD, standard deviation; FEV1, forced expiratory volume in one second; PCP, primary care physician.

Table 2 Frequency and percentage of each disease or medical condition that was simultaneously present in patients

Variable	Frequency (%)
Hypertension	87 (17.94)
Coronary artery disease	52 (10.72)
Heart failure	40 (8.25)
Diabetes	32 (6.60)
Obesity	40 (8.25)
Gastroesophageal reflux	36 (7.42)
Vitamin D deficiency	16 (3.30)
Asthma	18 (3.71)
Obstructive sleep apnea	31 (6.39)
Atrial fibrillation	23 (4.74)
Dementia	1 (0.21)
Osteoporosis	14 (2.89)
Major depressive disorder	32 (6.60)
Chronic kidney disease	18 (3.71)
Lung cancer	12 (2.47)
Anemia	32 (6.60)
None	1 (0.21)

potential risk factors, only frequency of ECOPD was significantly correlated with readmissions in both univariate and multivariate analyses. We found that patients with more frequent exacerbations (three or more in one year) were more likely to be readmitted for any reason within a year, whereas patients who only had one exacerbation were less likely to be readmitted than patients who had zero exacerbations. This observed association underscores the pivotal role of exacerbations in predicting long-term outcomes and healthcare utilization among COPD patients. While a majority of studies have evaluated risk factors contributing to readmissions directly due to COPD (25-28), very few have investigated all-cause readmissions within 12 months. Our study extends beyond the traditional scope of investigating readmissions solely due to COPD. By examining all-cause readmissions, we provide a more comprehensive understanding of the impact of COPD exacerbations on overall healthcare utilization and patient outcomes. This broader perspective allows providers to capture the multifaceted challenges that COPD patients face after discharge, which can include co-morbidities and

other complications not directly related to COPD but still influenced by the patient's overall health status.

Comparison with similar research and explanations of findings

Exacerbation frequency of COPD serves as a critical indicator of disease severity and prognosis in these COPD patients as evidenced by our retrospective analysis findings, offering valuable insights into the clinical course and management of the condition. Our findings align with an existing study that showed that frequent exacerbators (defined as two or more hospitalizations in the past year) had a 2.5-fold increase in odds of readmission compared to non-frequent exacerbators (25). This supports the notion that frequent exacerbations are not only markers of disease severity but also potential predictors of patient outcomes and long-term healthcare utilization. A multivariate analysis study showed ECOPD within 30 days of discharge was a significant predictor of long-term prognosis, which further highlights the profound impact of early re-exacerbation on the clinical trajectory and prognosis of COPD patients (26). More specifically, they found that re-exacerbation within 30 days of discharge was associated with a 3.85-fold increased risk of exacerbation, a 3.46-fold increased risk of severe exacerbation, and a 3.28-fold increased risk of all-cause readmissions in the following 12 months (26). This emphasizes the importance of effective management strategies aimed at preventing exacerbation recurrence, stringent post discharge monitoring, and targeted interventions to reduce the burden of hospital readmissions in this vulnerable patient population. By addressing exacerbation frequency as a key determinant of long-term outcomes, healthcare providers can optimize care delivery, enhance patient outcomes, and mitigate healthcare resource utilization associated with ECOPD.

Since exacerbation frequency is a valuable prognostic marker, patients with COPD can receive better treatment if they are proactively monitored for exacerbation frequency. Early, targeted interventions may help mitigate the risk of readmission, reduce disease burden, and improve overall patient outcomes. Targeted interventions include individualized medication management, focus on individual exacerbation patterns, and improved coordination between inpatient and outpatient care settings. Using ECOPD as a marker will also help guide resource allocation, and patient education efforts. This comprehensive yet individualized approach may help prevent exacerbation recurrence and

Table 3 Univariate and multivariate logistic regression results of the impacts of patients' demographics and medical information on the probability of being readmitted

Demographics and clinical variables	Univariate		Multivariate	
	OR (95% CI)	P value	OR (95% CI)	P value
Age	1.01 (0.97, 1.05)	0.67	N/A	N/A
Body mass index	0.94 (0.90, 0.99)	0.02	0.94 (0.86, 1.02)	0.12
Gender				
Male	Reference	N/A	N/A	N/A
Female	1.30 (0.60, 2.81)	0.51	N/A	N/A
Other	3.44 (0.04, 331)	0.59	N/A	N/A
Race				
White	Reference	N/A	N/A	N/A
Black	3.40 (0.91,12.73)	0.06	N/A	N/A
Natives	3.40 (0.04, 320)	0.59	N/A	N/A
Smoking history				
Never	Reference	N/A	N/A	N/A
Current	1.21 (0.16, 9.23)	0.85	N/A	N/A
Former	0.89 (0.12, 6.81)	0.90	N/A	N/A
Housing status				
Home	Reference	N/A	N/A	N/A
Homeless	0.31 (0.003, 29)	0.61	N/A	N/A
Other	0.31 (0.003, 29)	0.61	N/A	N/A
Insurance status				
Medicare	Reference	N/A	N/A	N/A
Medicaid	4.58 (0.68, 30.76)	0.11	8.07 (0.45, 144.5)	0.07
Pending	0.13 (0.004, 4.11)	0.24	0.02 (0.001, 5.03)	0.08
Other	0.21 (0.03, 1.47)	0.11	2.16 (0.16, 28.85)	0.41
Pulmonary function test documented in medical records				
No	Reference	N/A	N/A	N/A
Yes	1.89 (0.79, 4.54)	0.15	1.98 (0.42, 9.39)	0.38
Post-bronchodilator FEV1% predicted				
≥80%	Reference	N/A	N/A	N/A
70–79%	0.40 (0.06, 2.93)	0.36	N/A	N/A
60–69%	1.68 (0.32, 8.76)	0.53	N/A	N/A
50–59%	3.30 (0.64, 17.16)	0.15	N/A	N/A
35–49%	1.35 (0.30, 6.18)	0.69	N/A	N/A
<35%	1.20 (0.19, 7.44)	0.84	N/A	N/A
Not present	1.02 (0.26, 3.94)	0.97	N/A	N/A

Table 3 (*continued*)

Table 3 (*continued*)

Demographics and clinical variables	Univariate		Multivariate	
	OR (95% CI)	P value	OR (95% CI)	P value
Exacerbations within a year time frame after discharge				
0	Reference	N/A	N/A	N/A
1	0.11 (0.01, 1.81)	0.12	0.12 (0.01, 2.96)	P<0.001
2	2.33 (0.19, 29.04)	0.51	1.51 (0.09, 25.86)	0.48
3	11 (0.65, 187.17)	0.09	11.09 (0.42, 296.44)	0.045
>3	54 (2.38, 999.99)	0.01	25.78 (1.06, 625.90)	0.001
Co-morbidities				
No	Reference	N/A	N/A	N/A
Yes	1.59 (0.26, 9.92)	0.61	N/A	N/A
Pulmonary rehab participation				
No	Reference	N/A	N/A	N/A
Yes	3.79 (1.55, 9.25)	0.003	2.18 (0.51, 9.32)	0.29
Provider specialty treating chronic obstructive pulmonary disease				
Primary care physician	Reference	N/A	N/A	N/A
Pulmonologist	3.33 (1.41, 7.86)	0.006	0.32 (0.05, 2.26)	0.11
Other	1.20 (0.25, 5.89)	0.82	3.32 (0.33, 33.87)	0.15
Follow-up with a provider after initial discharge				
No	Reference	N/A	N/A	N/A
Yes	2.47 (1.14, 5.35)	0.02	2.36 (0.49, 11.30)	0.28
Prescribed steroids as outpatient between admissions				
No	Reference	N/A	N/A	N/A
Yes	2.49 (1.09, 5.68)	0.03	0.62 (0.11, 3.31)	0.52
Unknown	0.46 (0.11, 1.96)	0.29	0.05 (0.001, 7.76)	0.29
Prescribed antibiotics as outpatient between admissions				
No	Reference	N/A	N/A	N/A
Yes	4.46 (1.68, 11.84)	0.002	1.78 (0.29, 10.89)	0.55
Unknown	0.68 (0.19, 2.48)	0.55	20.49 (0.18, 999.99)	0.27
Discharged on home oxygen after initial admission				
No	Reference	N/A	N/A	N/A
Yes	1.26 (0.49, 3.23)	0.63	N/A	N/A
Not documented	0.42 (0.004, 39.97)	0.70	N/A	N/A
Home oxygen use prior to initial admission	2.33 (0.91, 5.96)	0.07	N/A	N/A
Steroids administered in hospital	1.002 (1.00, 1.003)	0.02	1.00 (1.00, 1.002)	0.66
Steroids prescribed on discharge	1.002 (1.00, 1.003)	0.02	1.00 (1.00, 1.001)	0.51

OR, odds ratio; CI, confidence interval; N/A, not applicable; FEV1, forced expiratory volume in one second.

subsequent hospital readmissions, and thus improve care efficiency, reduce overall costs, and ultimately improve the quality of care for COPD patients.

Given these findings, it is crucial to personalize care for patients who receive steroid tapers after ECOPD, particularly for those who are more symptomatic or exacerbation prone. These patients may benefit from tailored interventions that go beyond standard treatment protocols. For example, individualized tapering regimens that consider patient-specific factors such as prior exacerbation history, co-morbidities, and pulmonary function may help in optimizing outcomes.

In addition, incorporating close follow-up and monitoring can help detect early signs of exacerbation, allowing for prompt intervention. Such an approach may include scheduled tele-health check-ins, personalized action plans, and enhanced patient education on recognizing and managing exacerbation triggers. Furthermore, these patients might benefit from a multidisciplinary approach, involving not just pulmonologists but also primary care physicians, pharmacists, and possibly case managers who can ensure comprehensive care coordination. The goal of personalized care should be to reduce the frequency and severity of exacerbations, thereby lowering the risk of readmission and improving overall quality of life. Implementing these personalized strategies can lead to more effective management of COPD, ultimately improving patient outcomes and reducing the burden on healthcare systems.

ECOPD not only predict readmission rates, but also have detrimental effects on pulmonary function as patients experiencing frequent exacerbations often exhibit more severe airflow limitation, increased respiratory symptoms, and greater impairment in lung function (27). Moreover, high exacerbation rates are associated with accelerated disease progression, decline in quality of life, and heightened risk of hospitalizations and mortality (28). Additionally, frequent COPD exacerbations have been reported as a distinct susceptibility phenotype, which could support the targeting of such patients with effective preventive strategies (29). Recognizing the significance of exacerbation frequency allows healthcare providers to tailor treatment strategies and interventions to mitigate exacerbation risk, optimize symptom control, and improve long-term outcomes for COPD patients. By addressing exacerbations proactively, clinicians can enhance patient care, reduce healthcare resource utilization, and ultimately, enhance the overall management of COPD.

The findings of this study underscore the critical importance of exacerbation frequency as a prognostic marker for COPD readmissions, which aligns with and extends existing literature. However, beyond corroborating previous research, these results raise important considerations about the underlying mechanisms driving this association. Frequent exacerbations may reflect a distinct biological phenotype, characterized by heightened airway inflammation, systemic effects, and a more aggressive disease course, which could predispose patients to a vicious cycle of exacerbation and readmission (29-31). Moreover, the data suggest that exacerbation-prone patients may experience accelerated disease progression, with cumulative negative effects on lung function, quality of life, and overall prognosis (31). This insight compels a reevaluation of current management strategies, emphasizing the need for early, proactive interventions tailored to the individual's exacerbation history. This could include personalized medication regimens, such as optimizing inhaled corticosteroid and bronchodilator therapy, and enhancing patient education on self-management techniques to mitigate exacerbation triggers. By adopting a more holistic and personalized approach, healthcare providers can aim not only to reduce readmission rates but also to slow disease progression, ultimately improving the long-term outcomes for COPD patients.

Limitations

While this study provides valuable insights, several limitations should be considered. First, the data extrapolation was limited to our hospital's electronic medical record system, potentially limiting the generalizability of our findings to other healthcare settings. Second, the sample size of 154 patients may have constrained the statistical power of the analysis. Third, incomplete pulmonary function test data may have influenced the accuracy of our results, particularly regarding post-bronchodilator forced expiratory volume in the first second percent predicted. The exclusion of emergency department visits from the readmission count and the reliance on ECOPD codes for case identification may have introduced bias into our analysis. Fourth, while blood eosinophil counts are known predictors of COPD exacerbations, this variable was not included in our study due to the influence of steroid treatment across our patient population. Another limitation of this study is the lack of assessment of activities of daily living upon discharge, which could have provided additional insights into patient functional status and its potential

impact on readmission risk.

Moreover, our study only included patients discharged on steroids, potentially excluding those managed with alternative treatments. Our investigation of co-morbidities was limited to those commonly seen in our local hospitals, possibly overlooking less prevalent but clinically significant conditions. Lastly, the inability to calculate a BMI, airflow obstruction, dyspnea, and exercise capacity score due to a lack of documented dyspnea scale scores may have limited our ability to fully assess disease severity and prognosis.

Despite the noted limitations, this research remains clinically significant by focusing on an understudied population of patients with ECOPD who were discharged on steroid tapers. By identifying key predictors of readmission within this specific cohort, our study provides valuable insights into the potential impact of steroid tapering on outcomes, which could guide more personalized and effective treatment strategies for COPD patients. These limitations underscore the importance of future research to address these gaps in knowledge.

Conclusions

In conclusion, this study highlights the critical role of ECOPD in predicting adverse outcomes and healthcare utilization within a year among patients discharged on steroid tapers following exacerbations. Our findings highlight the association between exacerbation frequency and all-cause hospital readmissions within a year. We found exacerbations within 30 days of discharge emerged as a strong predictor of long-term prognosis, emphasizing the importance of proactive monitoring and early intervention strategies. Despite the identification of exacerbation frequency as a key determinant of COPD outcomes, existing prognostic tools lack specificity for predicting short-term readmissions, underscoring the need for the development of individualized and comprehensive risk assessment tools. By addressing exacerbation frequency as a prognostic marker and incorporating personalized management strategies, healthcare providers can enhance care delivery, reduce hospital readmissions, and alleviate the overall burden of COPD on patients and healthcare systems.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-932/rc

Data Sharing Statement: Available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-932/dss

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-932/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). It was approved by the institutional ethics board of Allegheny Health Network Research Institute (AHNRI) [No. 45 CFR 46. 102(f)], and individual consent for this retrospective analysis was waived.

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