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Drug Utilization Pattern and Assessment of Disease Severity in Patients with Chronic Obstructive Pulmonary Disease (COPD): A Prospective Observational Study

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Abstract

Background:
Chronic obstructive pulmonary disease (COPD) continues to be one of the main causes of death and serious illness around the world, particularly in developing countries. Assessment of disease severity with prescribing patterns, is critical for providing optimal patient care and ensuring compliance with guidelines.

Objective:
To analyse drug utilization in individuals with COPD and evaluate disease severity via the mMRC dyspnea scale and the CAT.

Method:
A longitudinal observational study was conducted at Sheth H. J. Mahagujarat Hospitalover a period of six months. A total of 114 patients were enrolled (COPD alone: 92; COPD with pneumonia: 17; COPD with asthma: 5). Severity of illness and symptom burden was assessed via the mMRC and CAT scoring methods, respectively.

Result
The mean age of the participants in this study was 63.8 ± 9 years with a relatively large number of males (55.3%). The most frequently prescribed medications were antibiotics (18.01%). On average, mMRC and CAT scores were 2.19 ± 1.15 and 18.44 ± 7.89, respectively; reflecting moderate symptom burden among participants. A strong positive correlation (r = 0.76) was found between mMRC&CAT scores. Majority belonged to GOLD group E (71.9%).Male participants reported more frequent active smoking, whereas female participants reported higher passive smoking.

Conclusion:
In general, prescribing practices aligned with GOLD guidelines but there remains an opportunity to optimize the use of maintenance therapy. Additionally, increased emphasis on smoking cessation and better adherence to guideline-based therapy may help improve clinical outcomes in patients with COPD.

Keywords: COPD, Prescribing Pattern, GOLD classification, severity assessment, mMRC, CAT.

I. Introduction

Chronic obstructive pulmonary disease (COPD) is a complex and heterogeneous respiratory illness characterized by persistent symptoms and airflow limitation resulting from abnormalities created by inflammation of the airways (bronchi) and lungs (alveoli) often due to prolonged exposure of harmful substances such as chemicals or smoke. It typically follows a progressive nature and is associated with chronic inflammation of the airways, lung tissue (parenchyma) and blood vessels in the lungs. Patients typically describe having cough, phlegm production, shortness of breath, wheezing, and fatigue that get worse over time [1]. According to the World Health Organization, COPD continues to be one of the most serious problems in public health and is currently ranked third among the leading causes of death worldwide. In 2019, approximately 3.23 million deaths were attributed to COPD globally [2]. The burden of COPD is

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expected to increase further due to population aging, continued exposure to tobacco smoke, and environmental pollutants. According to the Global Initiative for Chronic Obstructive Lung Disease, the global prevalence of COPD may reach approximately 600 million cases by 2050 [3]. India carries a substantial proportion of the global COPD burden. Data from the Global Burden of Disease Study indicate that India accounts for more than 15% of global COPD deaths, with prevalence estimates ranging between 5–10% in adults above 40 years of age [4]. Although smoking and air pollution are major causes of COPD [5], many risk factors have a role in the development of the disease [6]. Genetics, indoor and outdoor air pollution, occupational hazards, and childhood or adult respiratory infections. In developing countries, exposure to biomass fuel combustion used for cooking and heating is a major contributor to COPD among non-smoking women [4].Despite being an incurable condition, the progression of COPD can be slowed with appropriate interventions, including smoking cessation, reduction of environmental exposure, vaccination, pulmonary rehabilitation, and oxygen therapy.[5,7] The Global Initiative for Chronic Obstructive Lung Disease recommends a structured approach to disease classification based on symptom burden and exacerbation risk to guide treatment decisions. Pharmacological management of COPD is primarily based on inhaled bronchodilators, which form the cornerstone of therapy. Short acting bronchodilators generally only provide quick relief of symptoms while long-acting bronchodilators have the most significant role as maintenance therapy, especially for patients with moderate to severe disease. Inhaled Corticosteroids (ICS) are usually prescribed along with LABAs or LAMAs as dual therapy in patients with frequent exacerbations and evidence of airway inflammation [8]. Triple therapy (ICS + LABA + LAMA) is utilized in patients experiencing recurrent exacerbations to provide maximum bronchodilation and anti-inflammatory action [7]. Antibiotics are reserved for patients with acute exacerbation where bacterial infection is suspected. The current management guidelines as outlined by the Global Initiative for Chronic Obstructive Lung Disease emphasize a step-wise approach to medication management based on symptom severity as well as exacerbation risk, with long-acting bronchodilators forming the cornerstone of treatment [3]. Traditionally, COPD severity was primarily based on spirometry using measures such as forced expiratory volume in one second (FEV_1). However, it is now widely recognized that COPD is a multi-dimensional condition characterized by not only airflow limitation but also by impaired quality of life, decreased physical activity and overall functional capacity [6,9]. Current guidelines advocate a more comprehensive approach that involves using validated tools to objectively assess symptoms such as the modified Medical Research Council (mMRC) dyspnea scale and COPD Assessment Test (CAT)) as well as assessing exacerbation risk [3,10]. The mMRC is a straightforward tool that provides a practical measure of dyspnea severity and its impact on daily activities [10]. The COPD Assessment Test (CAT) provides a broader evaluation of disease offering a range of measures including cough, sputum production, chest tightness, and exertional dyspnea, and decreased activity, lack of confidence, sleep quality, and energy levels. Together with the mMRC scale, these validated tools are routinely used in clinical practice to assess the impact of COPD on each individual (e.g., determining severity of symptoms, monitoring the trajectory of disease progression, determining areas where changes in clinical care will be permitted). [3]. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2023 guidelines, patients are categorized based on symptom severity and risk of exacerbations

- Group A: Minimal symptoms (mMRC 0-1 or CAT <10) plus low exacerbation risk (≤1/year without hospitalization).
- Group B: High symptom burden (mMRC ≥2 or CAT ≥10) with low exacerbation risk.
- Group E: High risk of exacerbation (≥2/year or ≥1 hospitalization) irrespective of symptom severity.

Despite the availability of well-established international guidelines, prescribing practices vary widely across the world and incomplete adherence to recommended pharmacotherapy continues to be observed in routine clinical care. This is particularly evident in resource-limited settings, where data on drug utilization patterns and their relationship with disease severity are still relatively scarce. Understanding real-world treatment practices against standardized assessments tools for disease severity (mMRC scale and CAT) may shed light on existing gaps in the provision of care for individuals who have COPD.Therefore, the present observational study was performed to examine drug utilization patterns, assess disease severity using

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validated instruments, and examine the extent to which prescribed therapies correspond with GOLD guideline recommendations among COPD patients attending a tertiary care hospital.

II. Materials and Methods

2.1 Study Design and Setting.

This prospective observational study was carried out at Sheth H. J. Mahagujarat Hospital, Nadiad, Gujarat, India for six months (October 2024 - February 2025). Ethical approval was obtained from the Institutional Ethics Committee of CHARUSAT (Proposal ID: IEC/CHARUSAT/24/228).

Inclusion Criteria:

1. Patients aged ≥12 years with primarily COPD were included in this study.
2. Patients with or without comorbid condition

Exclusion Criteria:

1. Patients with TB (tuberculosis) or on anti-TB treatment.
2. Pregnant and/or breast-feeding women.
3. Patients with immuno-suppressed state (HIV+, Cancer or Steroid treatment).

2.3 Data Collection.

Patient data consistdemographics, medical clinical/social history, past medical and drug history, previous illness and current medications, family history, diagnosis, co-morbidities, and working environment/exposure. Relevant clinical investigations could also be obtained for use with other medical records. Some include, laboratory studies, inflammatory markers, CRP (C-Reactive Protein) and ESR, oxygen saturation (SpO2) with pulmonary function testing, Computerized Tomography scan of the thorax, and Arterial Blood gas testing. Details of prescription medications would have come from the patients' treatment charts. Severity of disease was grouped using validated tools such as the Modified Medical Research Council (mMRC) dyspnea scale (0-4) and the COPD Assessment Test (CAT), a 10-item questionnaire with scores ranging from 0 to 40. Patients were further classified based on symptoms and risk of exacerbation using the GOLD ABE classification.

2.4 Data Analysis.

Data were analyzed with Microsoft Excel and GraphPad Prism (Version 9.0).Demographic and clinical characteristics of the study population were summarized with descriptive statistics. Continuous variables such as age, mMRC score, and CAT score were expressed as mean ± standard deviation (SD) and median where appropriate, while categorical variables were presented as frequencies and percentages. Disease severity was evaluated using validated tools, specifically using the mMRC dyspnea scale and CAT, and results were presented to show a distribution of the study population across the severity levels. The relationship between the mMRC and CAT scores was evaluated with Pearsons's correlation coefficient (r), including 95% confidence intervals (CI), and the coefficient of determination, (R^2), was used to determine the amount of variability explained. A two-tailed p-value of <0.05 was considered statistically significant. Patients were stratified according to the GOLD ABE classification and subgroup analyses were performed to evaluate distribution across the severity groups. The association between categorical variables, including smoking status and degree of severity of the disease, were assessed using the chi-square (χ^2) test.Prescribing patterns of medications based on severity of disease were analyzed according to GOLD classifications in order to assess prescribing trends, as well as the extent of variability in pharmacologic treatment between groups of differing severity as a way to evaluate pharmacologic management between severity groups. All statistical tests were performed at a significance level of 5%, and results were interpreted accordingly.

III. Results

3.1 Demographic and Clinical Characteristics

A total of 114 patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) were included in the study. The majority of patients presented with COPD alone (n = 92, 80.7%), followed by COPD with pneumonia (n = 17, 14.9%) and COPD with asthma (n = 5, 4.4%). The mean age was 63.8 ± 9 years with median of 71 years. Male predominance was observed (55.26% male vs. 44.74% female; M:F ratio 1.235:1). The majority of patients (58.77%) were aged 61-81 years. Elevated inflammatory markers were noted in 59.64% (CRP) and 17.54% (ESR) of patients. Approximately 58.77% of patients maintained SpO_2 of 95-100%, while 26.31% had SpO_2 90-94%, indicating moderate hypoxemia in a significant proportion. Additionally, 42.10% of patients reported a previous history of respiratory disease as summarized in Table 1.

3.2 Drug Utilization Pattern

A total of 1,049 medications were prescribed among the study population.Mucolytics (17.44%) and

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antibiotics (18.01%) were the most frequently prescribed drug classes, followed by short-acting β₂-agonists (12.48%) and inhaled corticosteroids (9.34%). Systemic corticosteroids accounted for 7.91% of prescriptions. Notably, long-acting bronchodilators showed relatively lower utilization, with long-acting β₂-agonists accounting for 5.05% and long-acting muscarinic antagonists for 8.38% of prescriptions, suggesting potential underutilization of maintenance combination therapy. [Table 2]

Table 1: Demographic and clinical characteristics of patients with COPD

Parameter	N (%)	Details
Total Patients	114	100
Age (years)		
Mean ± SD	–	63.8 ± 9
Median	–	71
12-18	7	6.14
19-39	8	7.01
40-60	26	22.80
61-81	67	58.77
>81	6	5.26
Gender		
Male	63	55.26
Female	51	44.74
Male : Female ratio	–	1.235:1
Disease Distribution		
COPD alone	92	80.70
COPD + Pneumonia	17	14.90
COPD + Asthma	5	4.40
Respiratory History		
Previous respiratory disease	48	42.10
Family history of respiratory disease	18	15.78
Inflammatory Markers		
Elevated CRP	68	59.64
Elevated ESR	20	17.54
Oxygen Saturation (SpO_2)		
95-100%	67	58.77
90-94%	30	26.31

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85-89%	5	4.38
80-84%	8	7.01
<79%	4	3.50
Comorbidities		
Presence of ≥1 chronic comorbidity	63	55.26
Smoking Status		
Male smokers	37	32.46
Male non-smokers	25	21.93
Female smokers	3	2.63
Female non-smokers	29	25.44
Male passive smokers	1	0.88
Female passive smokers	16	14.04

3.3 Disease Severity Assessment

3.3.1 Modified Medical Research Council (mMRC) Dyspnea Scale

The mean mMRC score was 2.19 ± 1.15 (range 0-4), indicating moderate dyspnea on average. 72.7% of patients exhibited at least moderate dyspnea (Grade 2 or higher), with 42% experiencing severe dyspnea (Grade 3-4), reflecting significant functional limitation. in this population. [Table 3]

3.3.2 COPD Assessment Test (CAT) Scores

The mean CAT score was 18.44 ± 7.89 (range 3-36), reflecting moderate symptom burden on daily life. 85.09 percent of patients experienced at least moderate COPD impact (CAT score ≥10), with 36.84% reporting high to very high symptom burden (CAT ≥21).[Table 4]

Table 2: Distribution of drug classes prescribed in patients with COPD (total prescriptions = 1049)

Drug Class	Frequency (N)	Percentage (%)
Systemic Corticosteroids	83	7.91
Inhaled Corticosteroids (Budesonide)	98	9.34
Short-Acting β_2-Agonists (SABA)	131	12.48
Long-Acting β_2-Agonists (LABA)	53	5.05
Anti-Cholinergics	88	8.38
Methylxanthines	54	5.14
Leukotriene Modifiers	57	5.43
Mucolytics	183	17.44
Antihistamines	71	6.76
Expectorants	42	4.00

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Antibiotics	189	18.01
Total Medications	1049	100

Figure 1: Percentage distribution of major drug classes prescribed in COPD management

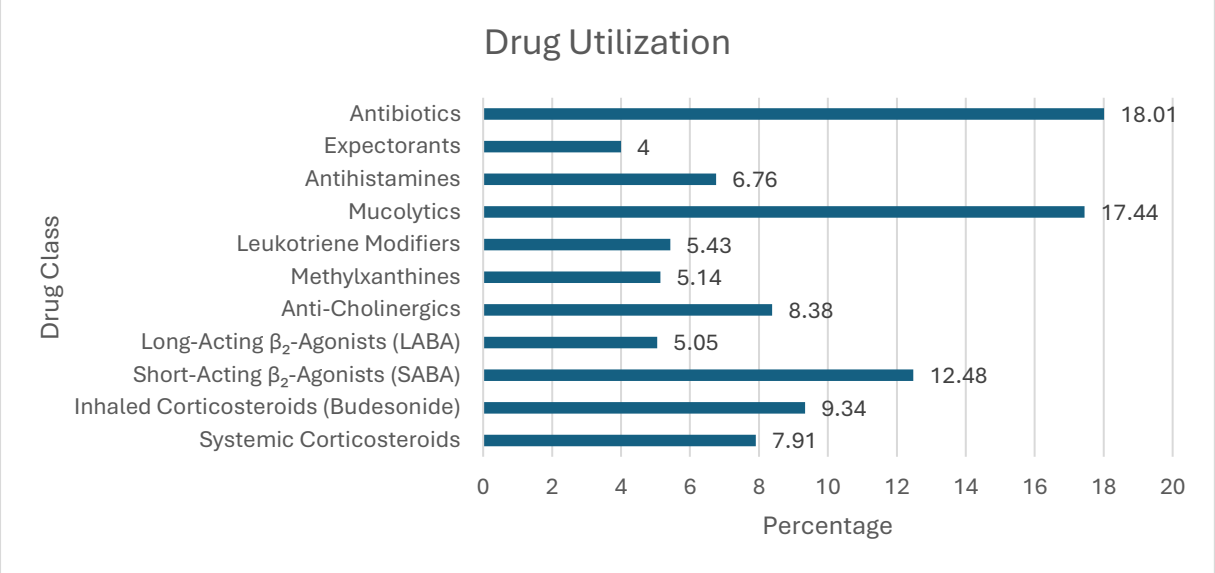

Table 3: Distribution of mMRC Dyspnea Grades

mMRC Grade	Number (N)	Percentage (%)
Grade 0 (No dyspnea)	10	8.77
Grade 1 (Dyspnea only with strenuous activity)	21	18.40
Grade 2 (Moderate dyspnea with exertion)	35	30.70
Grade 3 (Severe dyspnea with minimal activity)	32	28.00
Grade 4 (Dyspnea at rest/unable to leave home)	16	14.00
Total	114	100

CAT Score Range	Number (N)	Percentage (%)
0-9 (Low impact)	17	14.91
10-20 (Moderate impact)	55	48.25
21-30 (High impact)	32	28.07
31-40 (Very high impact)	10	8.77
Total	114	100

Table 4: Distribution of COPD Assessment Test (CAT) Scores

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3.4 Correlation between mMRC and CAT Scores

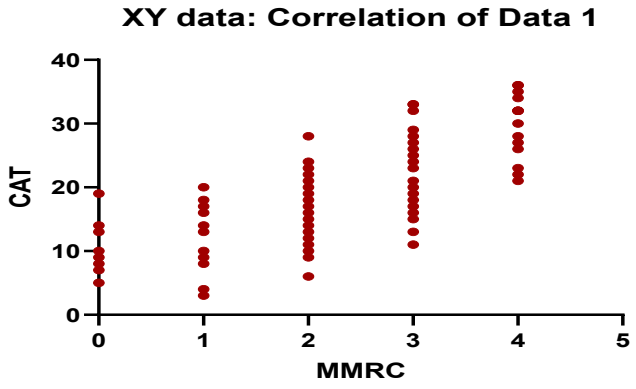
Pearson correlation analysis revealed a strong positive correlation between mMRC and CAT scores ($r = 0.7616$, 95% CI: 0.6718-0.8294, $p < 0.0001$, $R^2 = 0.5801$). There was a strong correlation ($r = 0.76$) between mMRC and CAT scores and it was in agreement with research done in past studies (11). Of the variance explained by mMRC to the CAT, 58.01% indicates that there is a significant relationship between severity of dyspnea and overall symptom burden. This supports the complementary use of both tools in clinical practice for a more comprehensive assessment of COPD. [Table 5]

Table 5: Correlation between MMRC and CAT scores.

PEARSON	MMRC v/s CAT
r	0.7616
95% confidence interval	0.6718 to 0.8294
R squared	0.5801
P value	
P (two-tailed)	<0.0001
Significant? (alpha = 0.05)	Yes
Number of XY pairs	114

Pearson correlation analysis was performed to assess the relationship between mMRC dyspnea scores and CAT scores in patients with COPD. A strong positive correlation was observed, indicating that higher dyspnea severity is associated with greater impact on health status. R^2: Coefficient of determination.

Figure 2: Correlation between MMRC and CAT scores



The scatter plot illustrates the relationship between mMRC dyspnea grades and CAT scores among patients with chronic obstructive pulmonary disease (COPD). Each data point represents an individual patient. A clear positive linear trend is observed, indicating that higher mMRC grades are associated with increasing CAT scores.

3.5 GOLD ABE Classification

The majority of the participants in this study fell into GOLD Group E (71.93%), indicating that many participants are at higher risk of exacerbations and with more advanced disease. In comparison, 22.81% and 5.26% of patients fell into GOLD groups A and B, respectively This distribution is likely due to being in a tertiary care facility, which generally sees patients with more advanced COPD than those seen in primary care facilities.[Table 6]

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GOLD Classification	Number (N)	Percentage (%)
Group A (Low symptoms, low exacerbation risk)	26	22.81
Group B (High symptoms, low exacerbation risk)	6	5.26
Group E (High risk exacerbation, ± high symptoms)	82	71.93
Total	114	100

Table 6: GOLD ABE Classification Distribution

3.6 Risk factors and Disease Severity Association

A statistically significant association between smoking exposure and increased disease severity (χ^2 = 11.23, p = 0.024 was observed. There was a higher percentage of active smokers in GOLD group E (70.73%), compared with those in GOLD groups A (21.95%) and B (7. 32%). Passive smoking exposure was also more frequently observed among patients in the higher severity group (37.50%). These findings suggest a strong link between tobacco exposure and greater disease severity in COPD.

Figure 3: Smoking Status and COPD severity

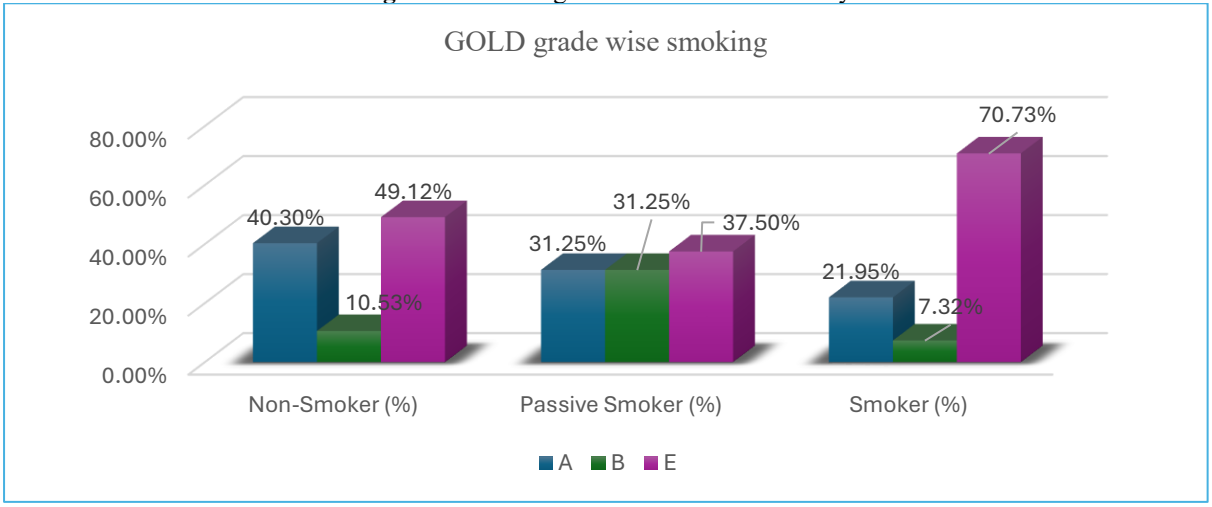

Table 7: Distribution of GOLD classification across different age groups

AGE GROUP	GOLD A	GOLD B	GOLD E	Total
>12-18	0 (0.0%)	1(14.2%)	6 (85.7%)	7
19-39	2 (25.0%)	0 (0.0%)	6 (75%)	8
40-60	12(46.1%)	0(0.0%)	14(53.8%)	26
61-81	11(16.4%)	5 (7.4%)	51 (76.1%)	67
>81	1 (16.6%)	0 (0.0%)	5 (83.3%)	6
Total	26	6	82	114

Advancing age was associated with greater disease severity, with the highest percentage of patients in GOLD group E were among those aged 61–81 years. In younger groups of patients (< 61 Years Old), disease representation was generally less Severe as represented in table 7.

3.7 Severity-Dependent Drug Utilization

Drug utilization showed variation across GOLD groups as it demonstrated a stepwise approach to therapy based on disease severity. Systemic corticosteroids utilization increased with advancing severity. Among patients in GOLD group

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A, dexamethasone and methylprednisolone were prescribed in 10.34% and 5.74% of cases, respectively, whereas GOLD group B had only 3.44% of patients receiving dexamethasone and 1.14% receiving methylprednisolone. Conversely, GOLD group E patients showed significantly greater administration of systemic corticosteroids with dexamethasone prescribed in 41.37% and methylprednisolone in 19.54% of cases suggesting an association between the increased use of these medications and the higher degree of inflammatory disease burden and exacerbation frequency observed in GOLD Group E patients. The results from this cohort of patients also support the guidelines suggesting an increase in anti-inflammatory treatment for more severe disease, while avoiding unnecessary corticosteroid use in milder stages [7]. Use of bronchodilators differed according to severity. Short-acting β_2-agonists (e.g. salbutamol and terbutaline) were most commonly prescribed among GOLD Group E patients (39.28% and 30.30%, respectively) and with relatively limited use in GOLD groups A and B indicating greater reliance on rescue therapy in severe disease. Long-acting β_2-agonists were used less frequently than short-acting β_2-agonists. Indacaterol predominated in GOLD Group A (25%), while use of formoterol predominated in GOLD Group E (25%). Their comparatively lower use in GOLD group B may indicate a tendency toward combination therapy rather than monotherapy in routine clinical practice. Out of the long-acting muscarinic antagonists, glycopyrrolate was most commonly prescribed among patients in GOLD group E (68.70%), followed by those in GOLD group A (25%), and least among those in GOLD group B (6.25%). This is consistent with the recommendations for the use of LAMAs for exacerbation prevention among patients with more severe COPD. A similar trend was seen for inhaled corticosteroids. The use of budesonide also showed a similar increasing trend for patients in GOLD group A (23.40%), those in GOLD group B (6.38%), and those in GOLD group E (65.90%). This is consistent with the recommendations for ICS use among patients experiencing frequent exacerbations and a higher inflammatory burden. The patterns of combination therapy were consistent with the severity-based approach to treatment. For patients in the GOLD A category, combinations involving SAMA + SABA and ICS + LABA regimens were commonly prescribed. For patients in the GOLD B category, combinations involving SAMA were more common, with fewer patients receiving ICS-based combinations. In contrast, patients in the GOLD E category had higher rates of SAMA + SABA (43.30%) and ICS + LABA (25.98%) combinations, indicating a more severe treatment approach. The use of dual bronchodilator therapy, involving LABA and LAMA, was low among patients in all GOLD groups, indicating a possible underuse of this treatment, even though guidelines support the use of this therapy to enhance bronchodilation in patients with moderate to severe COPD.

IV. Discussion

4.1 Disease burden and patient demographics.

The purpose of this study is to assess the clinical characteristics and pharmacological treatment of COPD patients in a tertiary care hospital. The majority of the patients were elderly due to the progressive nature of the disease. COPD is a condition that occurs after prolonged exposure to risk factors in the environment and behavior. The age group of the patients in this study is consistent with several epidemiological studies in which a significant rise in COPD prevalence is seen after the age of 60 years. Studies among the Asian population have shown that COPD is seen among elderly patients due to prolonged exposure to cigarette smoke and environmental pollutants (Salvi et al. [13]; Halpin et al. [14]).

This predominance among males is in keeping with the findings of previous studies done in India, which showed that the prevalence of smoking is higher among males compared to females (Jindal et al. [15]). However, recent global reports indicate that the gender gap in the prevalence of COPD is gradually narrowing because of the increased exposure to tobacco among women and the exposure to indoor biomass fuels (Vogelmeier et al. [16]). The high proportion of severe disease among the patients included in the current study (GOLD group E) is probably because the current study is a hospital-based study.

4.2 Inflammatory Markers

Elevated levels of inflammatory markers such as CRP and ESR in the present study are consistent with the role of systemic inflammation in the development of COPD. The chronic inhalational exposure of noxious particles such as cigarette smoke induces inflammatory cells such as macrophages and neutrophils, which cause airway remodeling and lead to airflow limitation (Agusti et al. [17]). The present study is consistent with previous clinical studies that have shown elevated levels of CRP are associated with an increased

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severity of the disease and risk of exacerbations (Sin et al. [18]).

4.3 Severity assessment tool validation.

The strong positive correlation between mMRC and CAT score results, as found in the present study ($r = 0.7616$, $p < 0.0001$). This correlation was also found in previous studies by Rhee et al. [10] who found a moderate correlation between the CAT score and mMRC score results ($r \approx 0.49$). This indicates that both tools provide complementary information regarding the severity and quality of symptoms experienced by COPD patients.The correlation found in the present study is stronger than the correlation found in the previous studies this is possibly because the population used in the present study is more homogeneous and severe, as the population was recruited from the hospital setting.

4.4 Drug Utilization Trends and adherence to Guidelines

The prescription patterns observed in the current study were in general agreement with those of the GOLD guidelines. In addition, other studies that have assessed prescription patterns in the management of COPD in the "real world" have shown that bronchodilators, corticosteroids, and antibiotics are commonly used in the management of COPD exacerbations (Sharafkhaneh et al. [19]). Mucolytics and expectorants were widely used in conjunction for airway clearance in obstructive disease. Antibiotics were commonly used in the management of COPD + pneumonia and acute exacerbation. Escalated corticosteroid use was observed with progression of disease severity and Greater bronchodilator dependency in GOLD E than GOLD A/B. The lower use of long-acting bronchodilators in the current study does not agree with the recommendations of the GOLD guidelines, which recommend the use of LABA and LAMA in the management of moderate to severe COPD (Vogelmeier et al. [16]).Some possible explanations for the lower rates in this study could be the availability of certain inhaler formulations in the hospital setting, the cost of combination inhalers, and the tendency of physicians to prescribe short-acting bronchodilators during acute exacerbations. Similar prescribing gaps have been reported in real-world studies carried out in developing countries (Gupta et al. [20]).

4.5 GOLD Classification and Treatment Alignment

The majority of patients in GOLD group E suggests a high risk of exacerbations and symptom burden in this patient group. Escalation of therapy according to severity of disease was seen, although the use of dual bronchodilator therapy with LABA and LAMA was not high, which indicates a potential opportunity for optimization of management in patients with COPD, as dual bronchodilators have a superior bronchodilator effect with a sustained action, which may result in improved control of symptoms and reduction in frequency of exacerbations [7, 21].

4.6 Smoking and the Progression of Disease

This direct and indirect association of active and passive smoking with the severity of COPD is a strong indicator of the role of smoking as a major risk factor.70.73% of patients in GOLD E were smokers compared to 21.95% in GOLD A patients; however, it is obvious that smoking increases the severity of the disease regardless of age. Further, 37.50% of GOLD E patients were exposed to passive smoking, which is a cause of damage in the development of severe COPD. These results emphasize the importance of establishing complete smoking cessation programs and developing environmental programs in high-risk patients [7]. Previous epidemiological studies have shown that patients who are smokers are at a greater risk of developing severe COPD compared to non-smokers (Salvi et al. [13]).

4.8 Limitations and Benefits of the Study

Strengths:

The prospective observational nature of this study also helped to minimize the potential for recall bias. Disease severity was also measured through the use of validated clinical instruments, such as the mMRC dyspnea scale and the COPD Assessment Test (CAT), both of which are recommended for routine use by the Global Initiative for Chronic Obstructive Lung Disease. The use of such instruments also increased the reliability of the evaluation of symptoms and provided a clear correlation for the level of dyspnea and disease burden.The detailed evaluation of the pattern of drug use, including bronchodilators, steroids, antibiotics, and combination therapies, is also a positive attribute of this study. In addition, the study incorporated statistical analyses such as correlation analysis and GOLD classification to

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provide deeper insights into relationships between symptom burden, disease severity, and pharmacological management

Limitations:

The study was carried out in one tertiary care hospital. Therefore, the applicability of the study to community or primary healthcare settings might be limited. Tertiary care hospital patients are more likely to have more severe disease or exacerbations of the disease. This could have contributed to the higher number of individuals with GOLD group E disease in the study. Secondly, the observational nature of the study does not allow us to establish any cause-effect relationship between treatment and outcome. Thirdly, the study period of six months might have been too short to capture any seasonal variations in exacerbations or long-term progression of the disease. Finally, patient compliance with inhaler therapy and long-term treatment outcomes were not evaluated. These factors might have an impact on the effectiveness of the pharmacotherapy used.

V. Conclusion

This prospective observational study shows a considerable disease burden in patients with COPD, where most patients fall into the high-risk group according to the GOLD guidelines. The prescription patterns, in general, seem to be in accordance with current recommendations, showing an appropriate increase in pharmacologic treatment according to disease severity. Nevertheless, the relatively low use of dual bronchodilator therapy (LABA + LAMA) might be a target for optimization in maintenance therapy. The strong correlation between mMRC dyspnea and CAT scores supports the use of both tools, which have been proven to be effective, for a more detailed evaluation of disease severity. Furthermore, the strong correlation between smoking exposure and disease severity underlines the importance of effective anti-smoking strategies. Clinically, this study supports the use of guideline-directed therapy and standardized disease severity assessment, which should be part of daily routine in order to improve patient outcomes. It also emphasizes the significance of using evidence-based pharmacologic treatment, combined with preventive measures and symptom-based evaluation, in order to manage patients with COPD optimally.

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