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**EVALUATION OF BRONCHODILATOR USE IN COPD PATIENTS
USING THE ATC/DDD AND DU90% METHODS AT JEMBER
PARU HOSPITAL****Adinda Safira¹, Ayu Angger Putri M. Soleh^{2*}**^{1,2} Program of Pharmacy, Faculty of Health Sciences, Universitas dr. Soebandi. Jl. dr. Soebandi No. 99,
Jember 68111, East Java, Indonesia.Email: ayuanggerputri@gmail.com**ABSTRACT**

Bronchodilators are the primary therapy in the management of COPD; therefore, evaluating their use is crucial to ensure the rationality, safety, and effectiveness of treatment. This study aimed to evaluate bronchodilator use among hospitalized COPD patients at Jember Lung Hospital using the Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) and Drug Utilization 90% (DU90%) methods. The study employed a non-experimental, quantitative observational design with a retrospective approach. Data were obtained from the medical records of hospitalized COPD patients at Jember Lung Hospital for the period of January–December 2025. The study population consisted of 170 patients, with a sample of 120 patients selected via purposive sampling based on inclusion criteria. Data were analyzed using univariate analysis. The results showed that the patient population was predominantly male (65%) and in the >66 age group (46.67%). Bronchodilators were most frequently administered via the inhalation route (56.84%), with Meprovent being the most commonly prescribed drug (47.54%), followed by Theobron (20.21%) and aminophylline (15.30%). Evaluation using the ATC/DDD method revealed that the Meprovent inhaler had the highest utilization rate, at 59.21 DDD/100 patient-days. Based on the DU90% analysis, the bronchodilators included in the DU90% segment were Meprovent inhaler, oral Theobron, and Farbivent inhaler, whereas intravenous aminophylline, oral Teosal, Spiriva inhaler, Combivent inhaler, and Spiolto inhaler fell into the DU10% segment. The study concludes that the Meprovent inhaler had the highest utilization rate; Meprovent inhaler, oral Theobron, and Farbivent inhaler showed high usage intensity among hospitalized COPD patients.

Key words: COPD, bronchodilator, ATC/DDD, DU90%, drug utilization evaluation**INTRODUCTION**

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable lung disease characterized by persistent respiratory symptoms and airflow limitation that is generally progressive. It is associated with an enhanced chronic inflammatory response in the airways and lung parenchyma caused by noxious gases or particles. Exacerbations



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and comorbidities contribute to the overall severity of the disease. COPD often manifests in middle age as a result of long-term smoking (Ministry of Health, 2019).

Data from Indonesia indicate a COPD prevalence of 3.7%. The highest prevalence is found in East Nusa Tenggara (10.0%), followed by Central Sulawesi (8.0%), and West Sulawesi and South Sulawesi (6.7% each). On the island of Kalimantan, the highest number of cases is found in South Kalimantan (5.0%), followed by Central Kalimantan (4.3%), West Kalimantan (3.5%), and East Kalimantan (2.8%) (Najihah et al., 2023). The prevalence of COPD reaches 3.6% in East Java (Widyaningsih et al., 2024). According to a hospital in Jember Regency, the prevalence rate reaches 5.6% (Andriani et al., 2024)

The risk factors for this disease are diverse and collectively contribute to the impairment of lung function. The primary risk factor is smoking, whether through active smoking or passive exposure. Genetic factors also play a role, particularly in individuals with a deficiency of alpha-1 antitrypsin, a protein that maintains lung tissue elasticity. Long-term exposure to air pollution or harmful particles can exacerbate lung damage through oxidative stress mechanisms Agusti et al., 2022). According to the Global Initiative for Chronic Obstructive Lung Disease (Singh et al., 2025), the use of bronchodilators constitutes the primary (first-line) therapy for COPD. These drugs work by relaxing airway smooth muscles, thereby improving airflow, reducing shortness of breath, and enhancing patients' activity capacity and quality of life. Drug Utilization Evaluation (DUE) is a structured, continuous program designed to assess drug use both qualitatively (appropriateness of therapy) and quantitatively (volume of use) to ensure the rationality, safety, and effectiveness of treatment (Permenkes, 2019).

Drug utilization evaluation can be performed using both quantitative approaches. The ATC/DDD (Anatomical Therapeutic Chemical / De-fined Daily Dose) method is a quantitative approach recommended by the WHO for evaluating drug utilization (Agung et al., 2023). The DU 90% (Drug Utilization 90%) method is the specific approach that will be used to analyze drug utilization patterns. The DU 90% method identifies the specific drugs that account for 90% of total drug utilization—calculated using Defined Daily Doses (DDD)—within prescribed regimens; the remaining 10% consists of drugs used for rare conditions or in patients with a history of drug intolerance or adverse effects (Kurniati & Indah Kurniasih, 2024).

As a hospital specializing in pulmonary and respiratory care, Jember Lung Hospital reported a total of 170 adult inpatients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) in 2025. Given this context, research is required at Jember Lung Hospital to determine the extent of drug utilization.

METHOD

Study Design

This study is a non-experimental, observational, and quantitative study. Data were obtained retrospectively from the medical records of patients diagnosed



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with COPD at the Jember Lung Hospital for the period of January to December 2025. The study was conducted from April to May 2026 in the medical records department of the Jember Lung Hospital. Ethical approval for this study was granted by the Health Research Ethics Committee (KEPK) of Dr. Soebandi University under reference number 419/KEPK/UDS/IV/2026.

Population and Sample

The study population comprised the medical records of all adult inpatients diagnosed with COPD who received treatment at Jember Lung Hospital between January and December 2025, totaling 170 patients. The sample size was determined using Slovin's formula, resulting in a sample of 120. Inclusion criteria were: inpatients diagnosed with COPD, aged ≥ 18 years, possessing complete medical records, and receiving either single or combination bronchodilator therapy suitable for analysis using ATC/DDD and DU90% methodologies.

Sampling Technique

Purposive sampling was used to select data from patient medical records. This technique involved selecting sample members from the population based on the inclusion criteria, resulting in a final sample of 120 out of the 170 eligible patients.

Data Analysis

Data from samples meeting the inclusion criteria were compiled on data collection sheets and subjected to univariate analysis. The objective was to describe the characteristics of each variable by presenting frequency distributions and percentages. The resulting data were processed using Microsoft Excel.

RESULTS AND DISCUSSION

Bronchodilator Use Profile

This study evaluates bronchodilator use among COPD patients at Jember Lung Hospital by collecting data from medical records covering the period from January to December 2025. Table 1 shows that 120 patients received bronchodilator therapy, including Meprovent, Farbivent, Combivent, Theobron, Teosal, Aminophylline, Spiolto, and Spiriva. The routes of administration included inhalation, oral, and intravenous. The most frequently used bronchodilators were Meprovent 87 (47.54%), Theobron 37 (20.21%), and Aminophylline 28 (15.30%). Administration routes comprised inhalation 104 (56.84%), oral 51 (27.86%), and



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intravenous 28(15.30%). Doses per administration were 0.5 mg/2.5 mg for Meprovent, 130 mg for Theobron, and 240 mg for Aminophylline. The average dosing frequency for bronchodilators was three times daily. The average length of hospital stay (LOS) for COPD patients ranged from 1 to 7 days.

Consistent use of bronchodilators has been shown to reduce symptoms of shortness of breath and the frequency of exacerbations, as well as to improve the functional lung capacity of COPD patients (Sari et al., 2021). Bronchodilators can be administered orally, via injection, or through aerosol or inhalation therapy. They function by dilating the bronchi and relaxing the muscles of the airways, thereby facilitating easier and smoother airflow (Wardiani *et al.*, 2026).

The researchers hypothesize that Meprovent is the most frequently prescribed medication—accounting for 87 prescriptions (47.54%)—due to its rapid-acting bronchodilator effect and efficacy in managing acute exacerbations of COPD. The inhalation route is the most dominant method of administration, used in 104 prescriptions (56.84%), owing to its rapid onset of action, minimal systemic effects, and alignment with GOLD recommendations as a primary therapy. Furthermore, the length of hospital stay is determined by the severity of the condition and each patient's FEV1 value.

Characteristics of COPD Patients

Respondent characteristics based on gender and age are presented in Table 2, shows that among the 120 respondents, the gender most frequently diagnosed with COPD was male, accounting for 78 individuals (65%), while females accounted for 42 (35%); furthermore, the age group most commonly affected by COPD was those aged 66 years and older. A study evaluating bronchodilator use—utilizing ATC/DDD and DU90% methods—among COPD patients at Jember Lung Hospital (involving a sample of 120 respondents) identified 78 male patients (65%) and 42 female patients (35%). While the age group most vulnerable to developing COPD is middle age (over 35 years) and the risk increases with age, the findings of this study indicate that the majority of COPD patients were aged 55–65 years (Ananda *et al.*, 2025).

COPD occurs more frequently in men than in women. This is supported by results from the Basic Health Research (Riskesdas) conducted by the Indonesian Ministry of Health, which showed a higher prevalence of COPD among men compared to women. This disparity is attributed to smoking habits and a higher risk of occupational exposure. Data from Indonesia's National Socio-Economic Survey (SUSENAS) indicate that 64% of the male population and 4.5% of the female



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population are smokers. Smoking remains the most significant risk factor for COPD. The prevalence of smoking is far higher among men than among women. Although not all smokers will develop COPD, approximately 20–25% of smokers are at risk of developing the disease (Ramadhani *et al.*, 2022).

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disorder characterized by progressive and irreversible narrowing of the airways. A lifestyle that includes smoking can increase the risk of developing COPD. Other contributing risk factors include air pollution, physical inactivity, secondhand smoke exposure, a history of childhood respiratory disease, genetic predisposition, and exposure to industrial pollution in the workplace. Smoking is the primary cause of COPD, alongside other risk factors such as air pollution, industrial exposure, a history of childhood respiratory disease, and heredity. A lack of public awareness regarding COPD risk factors and prevention can influence behavior and increase the incidence of the disease (Angel *et al.*, 2025).

Prescribing Patterns Based on Bronchodilator Class

In this study, COPD patients received therapies documented in their medical records. The distribution of bronchodilator prescribing patterns among COPD patients at Jember Lung Hospital, categorized by drug class, is presented in Table 3, shows that the most frequently prescribed class of bronchodilators in this study was the short-acting β 2-agonist (SABA) group—specifically the Meprovent inhaler—accounting for 87 prescriptions (47.54%). Inhaled short-acting β 2-agonists are used to manage shortness of breath, and an increase in their usage can serve as an indicator of an impending exacerbation. Nebulizer formulations may be used to treat acute exacerbations but are not recommended for long-term use. Meanwhile, the methylxanthine class of bronchodilators—specifically oral Theobron—accounted for 73 prescriptions (20.21%). Methylxanthines function by dilating the airways, alleviating shortness of breath, and improving respiratory muscle function; oral administration remains common in clinical practice. Intravenous administration offers a faster onset of action because the drug enters the systemic circulation directly, making it highly beneficial for acute exacerbations requiring immediate bronchodilation (Wardiani *et al.*, 2026).

Bronchodilator therapy may be administered as a monotherapy or a combination of the three bronchodilator types, tailored to the severity classification of the disease. Inhaled formulations are the preferred choice of administration. Bronchodilators are administered either on an as-needed basis or regularly to prevent or alleviate symptoms. Evidence suggests that initiating maintenance



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therapy early in the course of COPD can yield benefits regarding the clinical progression of the disease. Consequently, bronchodilators—whether used as monotherapy or in combination, and whether short-acting or long-acting—play a crucial role in managing COPD, particularly in improving lung function. Significant contributions have been made in identifying the role of bronchodilators in enhancing lung function in COPD patients (Wardiani *et al.*, 2026).

This view is supported by a study conducted by Sari, Hanifah, Rosdiana, et al. (2021) involving 156 COPD patients in hospitals across the Yogyakarta region; the study revealed that patients received combination bronchodilator therapy (60.90%), with LABA-ICS/LAMA being the most common maintenance regimen (48.72%). The results demonstrated that the majority of patients achieved a "sufficiently effective" response in terms of lung function improvement (50.64%), followed by an "effective" response (47.43%), while the "ineffective" category was very low at 1.93% (Sari *et al.*, 2021).

Nebulizers can be used to manage acute exacerbations but are not recommended for long-term use (Ministry of Health Regulation, 2019). Inhaled bronchodilators are the primary treatment method because they provide rapid effects while minimizing the risk of systemic side effects. Bronchodilator use not only improves physiological lung function but also contributes significantly to enhancing the quality of life for COPD patients. By alleviating shortness of breath, patients can better perform daily activities and reduce the risk of long-term complications, such as right-sided heart failure and related metabolic issues (Sari *et al.*, 2021).

Based on the study results, the researchers infer that bronchodilator use among COPD patients is dominated by short-acting β_2 -agonists (SABA), specifically inhaled Meprovent (47.54%). The inhalation route is the most common administration method due to its rapid and effective relief of shortness of breath. SABAs can be used for initial therapy; GOLD guidelines categorize bronchodilator therapy into two types: relievers and controllers. Relievers are bronchodilators administered to alleviate symptoms, whereas controllers are used to prevent exacerbations. Methylxanthines can be used as a primary therapy because GOLD guidelines state that they work by dilating the airways, particularly in the treatment of stable COPD (Echazarreta et al., 2025).

Evaluation of Bronchodilator Usage Volume

The DU 90% (Drug Utilization 90%) method is employed to analyze drug usage patterns. This method identifies the volume of drugs accounting for 90% of



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total prescribed medications (based on DDD calculations), while the remaining 10% comprises drugs used for conditions rarely encountered or in patients with a history of drug intolerance or adverse effects (Kurniati & Indah Kurniasih, 2024). The DDD values for bronchodilators in hospitalized COPD patients are presented in Table 4, and the DU 90% profile is shown in Table 5.

Based on the data in Table 4, eight types of bronchodilators were administered to hospitalized COPD patients at Jember Lung Hospital: Meprovent, Theobron, Aminophylline, Farbivent, Teosal, Spiriva, Combivent, and Spiolto. The most frequently used bronchodilators were identified as Meprovent, Theobron, and Farbivent. The recorded DDD/100 patient-days value was 100.52. This means that, over a 100-day period, COPD patients received an average of 100.52 DDD of bronchodilators per day. DDD represents the assumed average daily maintenance dose for adults, serving as a rough estimate rather than an exact reflection of actual drug consumption (Ihsan, 2021).

Analysis of the study data revealed that Meprovent inhaler had the highest value at 59.21 DDD/100 patient-days. This implies that, on average, 59.21 out of 100 patients received the standard daily dose of Meprovent. The researchers attribute this high DDD value to the administered dosage and the duration of therapy; higher bronchodilator usage—whether through increased daily dosage or prolonged treatment duration—results in a higher DDD value. A high DDD value reflects a high quantity of bronchodilator use, whereas a low value indicates low usage. Meprovent inhaler was the most frequently used bronchodilator. The duration of inhaler use depends on the drug type and the treatment objective (symptom relief or prevention). "Reliever" inhalers are used only when symptoms occur, whereas "controller" inhalers are used routinely on a daily basis for long-term asthma management.

Based on the data analysis from Table 5 regarding bronchodilator use among hospitalized COPD patients at Jember Lung Hospital (January–December 2025), the drugs falling within the DU90% segment are Meprovent inhaler, Theobron oral, and Farbivent inhaler. The consumption pattern for bronchodilators classified in the DU10% segment includes intravenous aminophylline, Teosal oral, Spiriva inhaler, Combivent inhaler, and Spiolto inhaler. Drugs falling into the 10% segment can also be evaluated for usage efficiency, particularly when there is a high number of drug variations in the DU10% segment compared to the DU90% segment (Ihsan, 2021).

Based on the resulting cumulative DU values, it can be concluded that as the number of drug types consumed increases, the drugs tend to fall into the 10%



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segment. This occurs because the cumulative percentage is calculated sequentially—starting from the first, second, and third drugs—until total usage reaches the 90% threshold; as shown in Table 5, the calculation proceeds as $58.90 + 18.39 = 77.29$, followed by the next drug ($77.29 + 9.45 = 86.79$). Consequently, Meprovent inhaler, Theobron oral, and Farbivent inhaler are included in the 90% segment, while other drugs fall into the 10% segment because the cumulative DU has already reached the 90% limit; bronchodilators exceeding this 90% threshold are categorized into the 10% segment.

The researcher posits that the large number of drugs falling into the DU90% segment indicates a lack of selective drug prescribing. The underlying factor is the variation in clinical judgment among physicians regarding therapy selection based on patient response; there is no difference in treatment between BPJS patients and self-paying patients, as all receive therapy tailored to the severity of their COPD symptoms. A favorable DU90% result is achieved when the number of drug types in the 90% segment is lower than in the 10% segment, allowing procurement efforts to focus on the smaller group of drugs comprising the 90% segment. The DU90% analysis offers guidance on bronchodilator control and procurement by taking into account COPD prescribing patterns, thereby ensuring drug availability and preventing stockouts. The study findings confirm that the number of drugs falling into the 90% segment is indeed lower than the number in the 10% segment.

CONCLUSIONS

Among COPD patients hospitalized at Jember Lung Hospital between January and December 2025, bronchodilators were most frequently administered via inhalation (56.84%); Meprovent was the most commonly prescribed medication (47.54%), followed by Theobron (20.21%) and aminophylline (15.30%). Evaluation using the ATC/DDD method revealed that Meprovent inhalers had the highest usage rate, at 59.21 DDD/100 patient-days. Based on the DU90% analysis, the bronchodilators included in the DU90% segment were Meprovent inhalers, oral Theobron, and Farbivent inhalers, whereas intravenous aminophylline, oral Teosal, Spiriva inhalers, Combivent inhalers, and Spiolto inhalers fell into the DU10% segment.

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TABLE

Table 1. Bronchodilator Use Profile Based on Medical Record Data

Names of Bronchodilators	Route of Administration	Dose per Administration	How to use	Duration of use Bronchodilator (grams) 1 day	Amount	Percentage(%)	LOS
Meprovent	Inhaler	0,5 mg/2,5 mg	3x1	0,009	87	47,54	456
Theobront	Oral	130 mg	3x1	0,39	37	20,21	
Aminophylline	Intra vena	240 mg	1x1	0,24	28	15,30	
Farbivent	Inhaler	0,5 mg/2,5 mg	3x1	0,009	14	7,65	
Teosal	Oral	150 mg	3x1	0,15	14	7,65	
Combivent	Inhaler	0,5 mg/2,5 mg	3x1	0,009	1	0,55	
Spiriva	Inhaler	18 mcg	2x1	0,000036	1	0,55	
Spiolto	inhaler	2,5 mcg/2,5 mcg	2x1	0,00001	1	0,55	
Total					183	100	
Route of Administration			Amount		Percentage(%)		
inhalation			104		56,84		
Oral			51		27,86		
intravenous			28		15,30		
Total			183		100		



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Table 2. Respondent Characteristics Based on Gender and Age

Variable	Category	amount	Percentage(%)
Gender	Woman	42	35
	Man	78	65
	Total	120	100
Age	18 – 25	0	0
	26 – 35	2	1,66
	36 – 45	6	5
	46 – 55	12	10
	56 – 65	44	36,67
	>66	56	46,67
	Total	120	100

Table 3. Prescribing Patterns Based on Bronchodilator Class

Category	Class Bronchodilator	Active Ingredient Bronchodilator	Name Bronchodilator	Route of Administration	Frequency	Percentage
Single	Metilxantin	Teofilin	Theobron	Oral	37	20,21
			Teosal	Oral	14	7,65
	LAMA	Aminophylline Tiotropium	Aminophylline	Intra vena	28	15,30
			Spiriva	Inhaler	1	0,55
Combination	SABA + SAMA	Salbutamol Ipratropium	Meprovent	Inhaler	87	47,54
			Farbivent	Inhaler	14	7,65
			Combivent	inhaler	1	0,55
	LAMA + LAMA	Tiotropium Olodaterol	Spiolto	Inhaler	1	0,55
Total					183	100

Table 4. Defined Daily Dose values of bronchodilators for hospitalized COPD patients.

Name of Bronchodilator	Route	DDD Standard WHO (grams)	Quantity of Bronchodilator Used (Grams)	Total LOS (days)	Calculation	DDD/100 Patient-days
Meprovent	Inhaler	0,0090	2,43		$\frac{2,43}{0,0090} \times \frac{100}{456}$	59,21



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Name of Bronchodilator	Route	DDD Standard WHO (grams)	Quantity of Bronchodilator Used (Grams)	Total LOS (days)	Calculation	DDD/100 <i>Patient-days</i>
Theobron	Oral	0,4	33,74	456	$\frac{33,74}{0,4} \times \frac{100}{456}$	18,49
Farbivent	Inhaler	0,0090	0,39		$\frac{0,39}{0,0090} \times \frac{100}{456}$	9,50
Aminophylline	Intra vena	0,6	17,08		$\frac{17,08}{0,6} \times \frac{100}{456}$	6,24
Teosal	Oral	0,6	16,41		$\frac{16,41}{0,6} \times \frac{100}{456}$	5,99
Spiriva	Inhaler	0,00001	0,000036		$\frac{0,000036}{0,00001} \times \frac{100}{456}$	0,78
Combivent	Inhaler	0,0090	0,009		$\frac{0,009}{0,0090} \times \frac{100}{456}$	0,21
Spiolto	Inhaler	0,00001	0,05		$\frac{0,000005}{0,00001} \times \frac{100}{456}$	0,10
Total						100,52

Table 5. Drug utilization profile of 90% of hospitalized COPD patients.

Name of Bronchodilator	Route of administration	DDD/100- Patient-days	Calculation DU	DU (%)	DU Cumulative	Segment DU
Meprovent	Inhaler	59,21	$\frac{59,21}{100,52} \times 100$	58,90	58,90	90%
Theobron	Oral	18,49	$\frac{18,49}{100,52} \times 100$	18,39	77,29	
Farbivent	Inhaler	9,50	$\frac{9,50}{100,52} \times 100$	9,45	86,74	
Aminophylline	Intra vena	6,24	$\frac{6,24}{100,52} \times 100$	6,20	92,94	10%
Teosal	Oral	5,99	$\frac{5,99}{100,52} \times 100$	5,95	98,89	
Spiriva	Inhaler	0,78	$\frac{0,78}{100,52} \times 100$	0,77	99,66	
Combivent	Inhaler	0,21	$\frac{0,21}{100,52} \times 100$	0,20	99,86	





RESEARCH ARTICLE				OPEN ACCESS		
Name of Bronchodilator	Route of administration	DDD/100- <i>Patient-days</i>	Calculation DU	DU (%)	DU Cumulative	Segment DU
Spolto	Inhaler	0,10	$\frac{0,10}{100,52} \times 100$	0,09	99,95	
Total						100%

