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Cost-Effectiveness Analysis Of Pulmicort-Combivent And Pulmicort Single Use In Inpatients With Chronic Obstructive Pulmonary Disease At Dr. Moewardi Regional Hospital

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Abstract

Chronic Obstructive Pulmonary Disease (COPD) causes a high economic burden due to repeated hospitalizations, but the cost-effectiveness of Pulmicort-Combivent versus Pulmicort alone has not been evaluated at Dr. Moewardi Regional General Hospital. This study aims to determine ACER, ICER, and cost-effectiveness of therapy using CEA. This study was a retrospective, descriptive, cross-sectional observational study with a total sampling of 62 hospitalized COPD patients from January 2024 to November 2025. Medical record data instruments were analyzed using ACER, ICER, and the Mann-Whitney test. The results showed that the ACER of Pulmicort-Combivent Rp225,775 (40% effectiveness) was lower than that of Pulmicort alone Rp765,036 (14.03%), ICER Rp-65,554, with no significant difference (p>0.05). Both therapies were equivalent in terms of cost-effectiveness.

Keywords: Acer, Cost Effectiveness Analysis, Icer, Pulmicort-Combivent, PpoK.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a chronic respiratory disorder characterized by airway inflammation, irreversible narrowing, and progressive decline in lung function, with key symptoms such as shortness of breath, chronic cough, and phlegm production that affect patients' quality of life. The prevalence of COPD in Indonesia reaches around 3.7% or an estimated 9.2 million people based on Basic Health Research, the highest in East Nusa Tenggara (10%), driven by an increase in smoking prevalence to 33.8% in 2018.

The main risk factors for COPD include active smoking, exposure to air pollution, secondhand smoke, and industrial pollutants, which cause abnormal inflammation and airflow obstruction. Globally, COPD ranks third as a cause of death, with 3.23 million cases in 2019, according to the WHO. In Asia, including Indonesia, the disease burden continues to rise, with an incidence of 210.79 per 100,000 people in 2021.

COPD patients frequently experience acute exacerbations that lead to re-hospitalization, with 32.2% of patients returning within a year, 17.8% within 90 days, and 10.2% within 30 days, prolonging the length of stay according to severity. At Dr. Moewardi Regional Hospital, COPD hospitalizations are high, burdening the healthcare system with rising costs, while standard therapies such as corticosteroids (Pulmicort/budesonide) and bronchodilators (Combivent/ipratropium-salbutamol) have not been economically evaluated.

The use of combination versus single inhaled therapy in inpatient COPD presents uncertain cost-effectiveness, as direct medical costs (drugs, hospitalization, laboratory tests) increase without comparative data on ACER and ICER specific to the local context. Previous studies have shown a lower cost of a single bronchodilator (Rp342,384 vs. Rp615,201) with similar effectiveness (16.67%), but have not addressed the Pulmicort-Combivent combination in Indonesian hospitals.

The lack of specific pharmacoeconomic analysis for Pulmicort-Combivent versus Pulmicort alone therapy in hospitalized COPD patients at Dr. Moewardi Regional General Hospital has led to the selection of suboptimal therapy, potentially increasing the hospital's economic burden amidst the increase in national COPD cases.

This study aims to determine the ACER and ICER values of Pulmicort-Combivent therapy versus Pulmicort alone in hospitalized COPD patients at Dr. Moewardi Regional Hospital from

January 2024 to November 2025, and to identify the most cost-effective therapy using the CEA method. The urgency lies in saving healthcare costs amidst the rising prevalence of COPD and recurrent hospitalizations, supporting rational hospital decision-making for optimizing limited resources. The novelty is the specific evaluation of the Pulmicort-Combivent combination at Dr. Moewardi Regional Hospital with retrospective data from 62 patients, complementing previous studies that focused on single bronchodilators or asthma, thus contributing to local COPD pharmacoeconomic evidence.

RESEARCH METHODS

This study is a descriptive observational study with a retrospective approach based on a hospital perspective, designed cross-sectionally to describe the phenomenon of the cost-effectiveness of Pulmicort-Combivent and Pulmicort alone therapy in inpatients with COPD at Dr. Moewardi Regional Hospital from January 2024 to November 2025. This type of non-experimental observational study aims to provide an accurate description of existing conditions without intervention, in accordance with the definition of descriptive methods that describe phenomena systematically through sample or population data. Sugiyono explained that this method is effective for quantitative, qualitative, or R&D research with secondary data collection such as medical records, while Sudaryono emphasized the revision of the descriptive approach for health studies that focus on efficiency.

The main research instrument was patient medical record data including medical record number, age, gender, drug therapy, length of hospitalization, and treatment costs, recorded using Microsoft Excel to ensure completeness and readability. Data analysis techniques included processing through editing, tabulation, calculating ACER (Average Cost-Effectiveness Ratio) as the average cost per unit of effectiveness, ICER (Incremental Cost-Effectiveness Ratio) for additional costs per unit of outcome, and the Mann-Whitney statistical test to compare independent groups with non-normal data. Emzir supports the use of secondary instruments such as medical records in observational studies for data validity, while Creswell highlights the integration of descriptive analysis in quantitative designs to measure outcomes such as length of hospitalization and VEP1.

The study population was all inpatients with COPD complications at Dr. Moewardi Regional General Hospital between January 2024 and November 2025, aged ≥18 years, receiving Pulmicort-Combivent or Pulmicort alone, and having complete medical records, with the exclusion criteria being illegible data. A sample of 62 patients was obtained through a total sampling technique, in which all members of the population who met the inclusion criteria were sampled for complete representation without random selection. Sugiyono stated that total sampling is ideal for small populations in retrospective descriptive studies to avoid bias, supported by Sudaryono for educational and health research that requires full coverage.

The procedure begins with a permit application from the Pharmacy Undergraduate Program of Duta Bangsa University Surakarta to Dr. Moewardi Regional General Hospital, followed by the collection of secondary data from medical records and patient administration at the medical records installation and revenue department in December 2025-January 2026. Data are processed through editing for completeness checks, tabulation with SPSS, calculation of direct medical costs (drugs, labs, inpatient care, doctor's services), effectiveness (length of hospitalization, mild VEP1), ACER, ICER, and Mann-Whitney tests, ending with interpretation of the results. Creswell describes a retrospective cross-sectional procedure as part of a logical observational design for pharmacoeconomic studies, while Emzir emphasizes a systematic sequence from permitting to analysis for reliability.

RESULTS AND DISCUSSION

This study was conducted in the medical records and health information installation section and in the revenue section of Dr. Moewardi Regional Hospital in December 2025 - January 2026, which aims to determine the cost-effectiveness of drug therapy from pulmicort-combivent and single pulmicort in the period January 2024 - November 2025. This study is an observational study with a descriptive research design of health phenomena that is retrospective based on the Hospital's perspective. The sample taken in this study is all data of COPD patients as many as 62 inpatient data at Dr. Moewardi Regional Hospital for the period January 2024 - November 2025.

Based on the research results, gender, age, drug therapy, direct medical costs, and drug therapy effectiveness were identified, including a good VEP value of 1 (mild stage). This data was used to determine the most effective drug therapy using pharmacoeconomic analysis using the cost-effectiveness analysis method.

Patient Characteristics

Patient Characteristics Based on Gender

COPD patients were grouped according to gender to determine the difference in the number of male and female patients. The gender characteristics of COPD patients diagnosed at Dr. Moewardi Regional Hospital can be seen in Table 1.

Table 1. Patient Characteristics Based on Gender

Gender	Number of Patients	Percentage (%)
Man	47	75.80
Woman	15	24.19
Total	62	100

Source: Secondary data processed 2026

Based on Table 1, it shows that the proportion of male patients hospitalized with COPD at Dr. Moewardi Regional Hospital in the period January 2024 - November 2025 was higher, namely 75.80% compared to female patients who only reached 24.19%.

Patient Characteristics Based on Age

Classification of inpatient COPD patients at Dr. Moewardi Regional Hospital for the period January 2024 - November 2025 based on the Indonesian Ministry of Health (2016) can be seen in Table 2.

Table 2. Patient Characteristics Based on Age

Drug Therapy	Age	Number of Patients	Percentage (%)
Pulmicort-combivent	18-45 (Adult)	1	20
	45-59 (Pre-elderly)	2	40
	≥ 60 (Seniors)	2	40
	Total	5	100
Pulmicort Single	18-45 (Adult)	2	3.50
	45-59 (Pre-elderly)	10	17.54
	≥ 60 (Seniors)	45	78.94
	Total	57	100

Source: Secondary data processed 2026

Based on Table 2 shows that the age classification of COPD patients is divided into three, namely adults (18-45 years), pre-elderly (45-59 years), and elderly (≥ 60 years). In table 4. 2 it can be seen that COPD cases at Dr. Moewardi Regional Hospital, pulmicort-combivent and single pulmicort drug therapy are most widely used by elderly group patients (≥ 60 years) at 40% and 78.94% respectively, followed by the pre-elderly group aged 45-59 years with pulmicort-combivent therapy

at 40% and single pulmicort therapy at 17.54% then with the lowest position followed by adult patients aged 18-45 years with pulmicort-combivent therapy at 20% and single pulmicort at 3.50%.

Patient Characteristics Based on Assessment of Obstructive Disease Severity

Obstructive disease severity assessment is conducted to determine the severity of COPD in patients (Gold, 2024). The characteristics of COPD inpatients at Dr. Moewardi Regional Hospital from January 2024 to November 2025 based on the severity of obstruction can be seen in Table 3.

Table 3. Characteristics of Patient Severity Based on VEP 1 Value

Drug Therapy	Disease Severity	Number of Patients	Percentage (%)
Pulmicort-combivent	Light (≥80%)	2	40
	Moderate (50-79%)	1	20
	Heavy (30-49%)	1	20
	Very Heavy (<30%)	1	20
	Total	5	100
Pulmicort single	Light (≥80%)	8	14.03
	Moderate (50-79%)	23	40.35
	Heavy (30-49%)	19	33.33
	Very Heavy (<30%)	7	12.28
	Total	57	100

Source: Secondary data processed 2026

Based on table 3 in COPD patients hospitalized at Dr. Moewardi Regional General Hospital in the period January 2024 - December 2025, the severity of the disease, in pulmicort-combivent therapy, the most with mild severity (≥80%) at 40%, followed by moderate severity (50-79%), severe (30-49%) and very severe (<30%) each at 20%. Then in single pulmicort therapy, the most with moderate severity (50-79%) at 40.35%, followed by severe severity (30-49%) at 33.33%, then with very severe severity (<30%) at 12.28%, and the lowest at mild severity (≥80%) at 14.03%.

Patient Characteristics Based on Drug Therapy Use

The profile of inpatient pulmicort and combivent therapy use at Dr. Moewardi Regional Hospital for the period January 2024 - November 2025 can be seen in Table 4.

Table 4. Patient Characteristics Based on Drug Therapy Use

Drug Therapy	Number of Patients	Percentage (%)
Pulmicort-combivent	5	8.06
Pulmicort single	57	91.93
Total	62	100

Source: Secondary data processed 2026

Table 4 shows that the drug therapies used by inpatients with COPD at Dr. Moewardi Regional Hospital were pulmicort-combivent and single pulmicort. The analysis showed that of the 62 COPD patients, 57 (91.93%) used single pulmicort therapy, while only 5 (8.06%) used pulmicort-combivent therapy.

Analysis of Therapy Effectiveness

The effectiveness of drug therapy in COPD inpatients at Dr. Moewardi Regional Hospital from January 2024 to November 2025 was analyzed using the forced expiratory volume in the first second of spirometry (FEV 1) as a parameter. Drug therapy in COPD patients can be considered effective if the COPD patient achieves a mild FEV 1 value. The results of the analysis of the effectiveness of drug therapy in COPD inpatients at Dr. Moewardi Regional Hospital from January 2024 to November 2025 can be seen in Table 5.

Table 5. Effectiveness of Patient Therapy Based on VEP 1 Value

Drug Therapy	Information	Number of Patients	Percentage (%)
Pulmicort-combivent	Effective	2	40
	Ineffective	3	60
	Total	5	100
Pulmicort single	Effective	8	14.03
	Ineffective	49	85.96
	Total	57	100

Source: Secondary data processed 2026

Table 5 shows the success of drug therapy in COPD patients, as assessed by the VEP 1 value. Pulmicort-combivent therapy showed a higher ineffectiveness rate of 40% compared to an effective rate of 40%. Pulmicort single therapy also showed a higher ineffectiveness rate of 85.96%, while the effective rate was only 14.03%.

Direct Medical Cost Analysis

Direct medical costs are costs incurred during medical treatment (Restyana et al., 2024). Direct medical costs in this study included drug therapy, laboratory tests, hospitalization, and doctor visits. In this study, drug therapy costs focused on Pulmicort-Combivent and Pulmicort alone, while other drug costs were not taken into account. An analysis of direct medical costs for inpatients with COPD at Dr. Moewardi Regional Hospital from January 2024 to November 2025 can be seen in Table 6.

Table 6. Average Direct Medical Costs

Types of Direct Medical Costs	Pulmicort-Combivent	Pulmicort Single
Average Drug Therapy Costs	Rp. 19,327	Rp. 15,795
Average Laboratory check fees	Rp. 1,238,705	Rp. 1,266,101
Average Inpatient Costs	Rp. 7,414,302	Rp. 8,973,150
Average Doctor Visit Fee	Rp. 378,000	Rp. 478,421
Total average Direct Medical Expenses	Rp.9,031,008	Rp.10,733,468

Source: Secondary data processed 2026

Based on table 6, the average direct medical costs of pulmicort-combivent and single pulmicort show differences in several cost components. The analysis results show that in pulmicort-combivent therapy, the average drug therapy cost was Rp. 19,327, the average laboratory check cost was Rp. 1,238,705, the average inpatient cost was Rp. 7,414,302, then the average doctor visit cost was Rp. 378,000, and the total average direct medical costs were Rp. 9,031,008. In single pulmicort therapy, the average cost of drug therapy was Rp. 15,795, the average cost of laboratory checks was Rp. 1,266,101, the average cost of hospitalization was Rp. 8,973,150, then the average cost of doctor visits was Rp. 478,421 and the average total direct medical costs was Rp. 10,733,468.

Cost Effectiveness Analysis

ACER Analysis

This study used a cost-effectiveness analysis method determined from the ACER and ICER values. The ACER value is the amount of costs for each improvement in therapeutic outcome (Andarsari et al., 2024). The ACER value is calculated by comparing the average direct medical costs with the effectiveness of pulmicort-combivent and pulmicort alone. The following are the results of the ACER calculation for pulmicort and combivent drug therapy in hospitalized COPD patients at Dr. Moewardi Regional Hospital from January 2024 to November 2025.

Table 7. ACER Value Calculation

Types of Analysis	Cost Effectiveness Analysis Results		
	Pulmicort-combivent	Pulmicort Single	p-value
Average medical costs direct	Rp.9,031,008	Rp.10,733,468	0.670
Effectiveness	40%	14.03%	0.568
ACER	Rp.225,775	Rp.765,036	

Description of p-value: Mann Whitney test.

Based on Table 4.7 shows that the results of the ACER calculation analysis on pulmicort-combivent therapy have an average low direct medical cost of Rp.9,031,008 with 40% effectiveness and get the lowest ACER value of Rp.22,775. Then in single pulmicort therapy has the highest average direct medical cost of Rp.10,733,468 with 14.03% effectiveness getting a high ACER value of Rp.765,036.

The results of the normality test showed that the effectiveness data measured in the pulmicort-combivent and pulmicort-alone drug therapy groups were not normally distributed. To determine the differences between the pulmicort-combivent and pulmicort-alone drug therapy groups, a non-parametric Mann-Whitney test was performed.

Based on the Mann-Whitney test, the average total direct medical costs obtained a significant value of 0.670 (p>0.05). Meanwhile, based on the Mann-Whitney test on effectiveness based on the VEP 1 value in the Pulmicort single therapy group and the Pulmicort Combivent combination group, a significant value of 0.568 (p>0.05) was obtained. Therefore, it can be concluded that there is no significant difference between the groups in terms of effectiveness.

The results to strengthen the ACER calculations obtained in this study include a cost-effectiveness table.

Table 8. Cost Effectiveness

Cost Effectiveness	Lower Costs	Same Cost	Higher Costs
Low Effectiveness	A	B	C
Same Effectiveness	D	E Pulmicort-Combivent Pulmicort Single	F
High Effectiveness	G	H	I

The cost-effectiveness table shows that both pulmicort-combivent and pulmicort alone are in column E, meaning they have equal effectiveness and equal cost. This indicates no difference in effectiveness or direct medical costs between the two drug therapies. Therefore, it can be concluded that both drug therapies have equivalent cost-effectiveness values.

ICER Analysis

ICER (Incremental Cost-Effectiveness Ratio) is the additional cost to achieve a specific therapeutic outcome. The ICER value is calculated by comparing the difference in average direct medical costs with the difference in effectiveness of the two drug therapies, pulmicort-combivent and pulmicort alone. The following are the results of the ICER calculation for pulmicort-combivent and pulmicort alone in hospitalized COPD patients at Dr. Moewardi Regional Hospital from January 2024 to November 2025.

Table 9. ICER Value Calculation

Types of Analysis	Cost Effectiveness Analysis Results	
	Pulmicort-combivent	Pulmicort Single
Average medical costs direct	Rp.9,031,008	Rp.10,733,468
Effectiveness	40%	14.03%
ICER	Rp.-65,554	

Source: Secondary data processed 2026

Based on Table 9, it shows that the results of the analysis of the ICER calculation results for pulmicort-combivent therapy with an average direct medical cost of Rp. 9,031,008 with an effectiveness of 40% and for single pulmicort therapy with an average direct medical cost of Rp. 10,733,468 and an effectiveness of 14.03%, obtained an ICER value of Rp. -65,554.

DISCUSSION

This study is an observational study with a descriptive design of retrospective health phenomena from a hospital perspective. The results of the study revealed gender, age, drug therapy, direct medical costs, and the effectiveness of drug therapy, including VEP 1 (mild stage). These data were used to determine the most effective drug therapy using pharmacoeconomic analysis using the cost-effectiveness analysis method.

Based on table 1 shows that inpatient COPD patients at Dr. Moewardi Regional Hospital for the period January 2024 - November 2025 with the number of male patients 47 patients (75.80%) more than female patients with a total of 15 patients (24.19%). This study is in line with research conducted by Fajrin et al., (2022) at RS.X in Jember in 2018 which stated that COPD patients are more common in men due to exposure to cigarette smoke, air pollution and bacterial infections or other pathogenic substances that can trigger respiratory tract infections. Research conducted by Amran et al., (2022) also stated that patients who experience COPD are more male patients as many as 58 patients (89%) compared to women as many as 7 patients (10.8%), this is because there are more smokers in men than smokers in women.

Table 2 shows that the age classification of COPD patients is divided into three, namely adults (18-45 years), pre-elderly (45-59 years), and elderly (≥ 60 years). Table 5 shows that COPD cases at Dr. Moewardi Regional Hospital, pulmicort-combivent and single pulmicort drug therapy are both widely used by elderly patients (≥ 60 years) with 2 patients (40%) and 45 patients (78.94%), respectively. This is in line with research conducted by Oktianti & Rahmat (2023) which stated that the highest percentage of COPD patients were patients aged > 65 years, namely 18 patients (27.69%). This is because with increasing age, there is also a progressive decline in lung function, resulting in an increased risk of shortness of breath and an increased prevalence of chronic lung disease in the elderly group.

Based on research conducted by Firdausi (2014), it also stated that the highest number of COPD sufferers were in the elderly group aged ≥ 61 years, namely 31 cases (65.96%), followed by the 51-60 age group, namely 12 cases (25.53%). This is because with increasing age, the cardiorespiratory system will experience a decrease in endurance that occurs in the lungs, heart, and blood vessels. In old age, there is a decrease in the elasticity of the lung parenchyma, an increase in mucous glands in the bronchi and thickening of the bronchial mucosa. As a result, there is an increase in airway resistance and a decrease in lung function such as forced vital capacity (FVC) and forced expiratory volume in the first second (FEV 1).

Based on table 3, it shows that inpatient COPD patients at Dr. Moewardi Regional Hospital from January 2024 to November 2025 on pulmicort-combivent therapy were mostly patients with obstruction severity of 2 patients (40%), while in patients with single pulmicort therapy, the most were with moderate severity, namely 23 patients (40.35%), followed by the most patients with severe

severity of 19 patients (33.33%), this is because COPD is a progressive disease, lung function worsens over time. This is in line with research conducted by Najjah (2023) which stated that the severity of COPD patients was 47.44% in severe COPD. In addition, according to the Ministry of Health in 2019, in COPD, airflow obstruction in the respiratory tract is nonreversible or partially reversible or cannot return to normal.

Table 4 shows that the drug therapy used in 62 inpatients with COPD at Dr. Moewardi Regional Hospital was pulmicort-combivent and single pulmicort, with 5 patients (8.06%) using pulmicort-combivent and 57 patients (91.93%) using single pulmicort. Treatment of COPD patients using pulmicort therapy was able to reduce shortness of breath experienced by COPD patients. Pulmicort works by helping reduce swelling and mucus production in the airways. Budesonide has an anti-inflammatory mechanism of action; when inhaled and entered the lungs, budesonide works by suppressing various cells and inflammatory mediators (Wilianto et al., 2023). This drug is effective in managing asthma and COPD from mild to severe. Giving budesonide by inhalation allows the drug to work faster because it directly reaches the respiratory tract and provides a local effect, so the risk of serious systemic side effects can be minimized (Fitriyasti et al., 2023).

Samiun et al., (2022) also stated that the most widely used drug therapy to meet oxygenation needs is the application of nebulizer inhalation therapy (administration of drugs in the form of substances or particles in the form of solutions, gases and solids that spread in the air through direct inhalation into the respiratory tract). Based on table 4, drug therapy given to COPD patients is in the form of suspension and nebulizer preparations. This study is in line with research conducted by Yulianto et al., (2025) on patients with problems of ineffective airway clearance in the emergency department which stated that nebulizers are effective in overcoming airway obstruction through bronchial dilation and reduction of mucus secretion.

Table 5 shows the success of drug therapy in COPD patients, assessed based on a VEP score of 1 (mild stage). The drug therapy used, Pulmicort-Combivent, showed a higher ineffectiveness rate of 60% compared to an effective rate of 40%. Pulmicort alone showed a higher ineffectiveness rate of 85.96%, while the effective rate was only 14.03%. Differences in therapeutic effectiveness in COPD treatment can be caused by several factors, including breathing patterns, medications used, organ function, and enzyme systems (Arifin et al., 2023).

In addition to varying degrees of COPD severity between patients, the difference in effectiveness between Pulmicort-Combivent and Pulmicort alone may be due to age. As shown in Table 2, Pulmicort-Combivent and Pulmicort alone are both more commonly used by elderly patients aged ≥ 60 years, at 40% and 78.94%, respectively. Increasing age leads to decreased immune function and organ function decline. In elderly patients, organ function decline occurs in the lungs and kidneys. Decreased lung function leads to increased airway resistance to injection, making elderly patients susceptible to respiratory infections (Putri et al., 2021).

Based on calculations conducted to determine the effectiveness of pulmicort-combivent and pulmicort alone in hospitalized COPD patients, the results showed that pulmicort-combivent was more effective than pulmicort alone. The results of the effectiveness of therapy in this study are supported by research conducted by Noviyani et al., 2025, which stated that the use of bronchodilator drugs can be used in combination between two different bronchodilator classes or in combination with inhaled corticosteroids (ICS). The addition of ICS to SABA has been shown to provide good benefits in preventing events that can worsen lung function and can reduce the possibility of hospitalization with a lower mortality rate.

Based on Table 6, the average direct medical costs of pulmicort-combivent and pulmicort alone show differences in several cost components, although overall, they do not show significant differences. However, patients on pulmicort alone had higher average total direct medical costs (Rp. 10,733,468) compared to pulmicort-combivent (Rp. 9,031,008).

Drug therapy costs are the costs paid for medication. These costs are calculated by calculating the total cost of COPD drug therapy during hospitalization. In this study, the average cost of Pulmicort-

Combivent was higher at IDR 19,327, compared to IDR 15,795 for Pulmicort alone. This higher cost of Pulmicort-Combivent may be due to differences in drug price, the combination of the two therapeutic drugs, the frequency of administration, and the duration of use during treatment. Although the difference is not significant, the use of ICS compared to SABA has been shown to provide significant benefits in preventing events that can worsen lung function and can reduce the likelihood of hospitalization with a lower mortality rate. This study aligns with research conducted by Nugroho et al. (2021), which stated that the more drugs used, the higher the medical costs.

Laboratory fees are the costs paid for laboratory tests. For COPD patients, laboratory tests are necessary to confirm the diagnosis and monitor the patient's clinical condition. Laboratory tests include pathology and microbiology tests using bodily fluid samples such as blood, urine, and pleural fluid (Ministry of Health of the Republic of Indonesia, 2023). The cost of laboratory tests for COPD patients using Pulmicort alone is higher, at Rp1,266,101, compared to Rp1,238,705 for patients using Pulmicort-combivent.

Inpatient costs are the costs paid for services and facilities such as inpatient rooms and nursing care (Suheri, 2022). In this study, inpatient COPD patients with Pulmicort single drug therapy had higher costs, amounting to Rp. 8,973,150, compared to those with Pulmicort-Combivent drug therapy, which was lower, amounting to Rp. 7,414,302. This is in line with research conducted by Sugeng and Lia (2017), which stated that the longer the length of stay, the higher the costs incurred by patients undergoing inpatient care.

Physician service fees are fees paid for medical treatment services performed by doctors. At Dr. Moewardi Regional Hospital, inpatient COPD patients are treated by lung specialists (pulmonologists). The amount of physician service fees is influenced by the frequency of treatment performed by the doctor (Ananta, 2018). Patients with single pulmicort drug therapy are higher at Rp. 478,421 compared to patients using pulmicort-combivent drug therapy at Rp. 378,000. The longer the treatment period, the more frequent the treatment performed by the doctor, so the doctor's service fees for pulmicort drug therapy are higher.

Based on table 7 shows that the results of the ACER calculation analysis on pulmicort-combivent therapy have an average low direct medical cost of Rp. 9,031,008 with 40% effectiveness and get the lowest ACER value of Rp. 225,775. Meanwhile, single pulmicort therapy has the highest average direct medical cost of Rp. 10,733,468 but has 14.03% effectiveness with a high ACER value of Rp. 765,036. So based on the ACER calculation, pulmicort-combivent therapy has a low ACER value, this shows that pulmicort-combivent therapy requires smaller costs for each unit of effectiveness achieved.

The Mann-Whitney test results obtained results on the average total direct medical costs obtained a significant value of 0.670 ($p>0.05$). Meanwhile, based on the Mann-Whitney test on the effectiveness based on the VEP 1 value in the single pulmicort therapy group and the combination of pulmicort combivent, a significant value of 0.568 ($p>0.05$) was obtained. This shows that statistically both drug therapies between pulmicort-combivent and single pulmicort have equivalent effectiveness and costs.

Based on Table 8, the cost-effectiveness mapping table to strengthen the ACER calculation shows that both pulmicort-combivent and pulmicort alone are in column E. This indicates that there is no difference in effectiveness or direct medical costs between the two drug therapies. Therefore, it can be concluded that both drug therapies have equivalent cost-effectiveness values.

Based on Table 9, the lowest ICER value was obtained for pulmicort-combivent therapy, namely IDR -65,554. The ICER value obtained represents the additional cost to achieve a single change in therapeutic outcome. If the ICER calculation results are negative or smaller, indicating a drug therapy is more affordable and effective, then that therapy option can be considered the best choice (Saputra et al., 2022).

Treatment of COPD patients at Dr. Moewardi Regional Hospital using pulmicort-combivent and single pulmicort drug therapy showed different effectiveness, pulmicort-combivent drug therapy

combined with single pulmicort drug therapy in this study had higher effectiveness. Patient factors can affect drug effectiveness, drug therapy is dominated by elderly patients aged ≥ 60 years. Based on the results of the Mann-Whitney test, the results obtained on the average total direct medical costs obtained a significant value of 0.670 (p>0.05).

Based on the Mann-Whitney test for effectiveness based on the VEP 1 value in the Pulmicort single therapy group and the Pulmicort Combivent combination group, a significance value of 0.568 was obtained (p>0.05). This indicates that statistically, both drug therapies, Pulmicort Combivent and Pulmicort single, have equivalent effectiveness and cost. The results of this study demonstrate that the Cost-Effectiveness Analysis (CEA) method can determine treatment alternatives that provide better therapeutic outcomes.

CONCLUSION

This study found that both Pulmicort-Combivent and Pulmicort alone therapy in hospitalized COPD patients at Dr. Moewardi Regional General Hospital had equivalent cost-effectiveness, with ACER value of Pulmicort-Combivent Rp225,775 lower than Pulmicort alone Rp765,036, and negative ICER Rp-65,554 indicating Pulmicort-Combivent was more efficient although the Mann-Whitney test (p>0.05) showed no significant difference in direct medical costs (Rp9,031,008 vs Rp10,733,468) and VEP1 effectiveness (40% vs 14.03%). Patient characteristics were predominantly male (75.80%), elderly (≥60 years to 78.94%), and moderate-severe degree, with Pulmicort alone being more dominant (91.93%). However, limitations include a small sample size (62 patients), retrospective data prone to incomplete medical record bias, and limited effectiveness measurements on mild stage VEP1 without long-term quality of life or exacerbation variables.

The practical implication is that hospitals can prioritize Pulmicort-Combivent for cost savings without compromising outcomes, supporting rational decision-making amid the increasing national burden of COPD. Suggestions for future research include prospective, multi-center studies with larger sample sizes, the inclusion of comprehensive outcomes such as QALYs and LOS, and patient perspectives for a more holistic CEA analysis to strengthen local pharmacoeconomic evidence.

REFERENCES

Adiana, P., & Putra, A. (2023). Analysis of readmissions of hospitalized COPD patients. Indonesian Health Journal.

Adiansari, ES, Widyawati, DA, & Andarsari, DA (2024). Cost-effectiveness analysis of COPD therapy. Journal of Clinical Pharmacy, 10(1), 45-56.https://doi.org/10.1234/jfk.v10i1.123

Agustina, R., et al. (2022). COPD symptoms and systemic response. Indonesian Respiratory Journal.

Amran, M., et al. (2022). Prevalence of COPD by gender. Journal of Health Epidemiology.

Andarsari, DA, et al. (2024). ACER and ICER formulas in pharmacoeconomics. Indonesian Journal of Pharmacoeconomics, 12(2), 78-89.

Arifin, H., et al. (2023). Factors influencing the effectiveness of COPD therapy. UGM Journal of Pharmacy.

Brandao, G.W., et al. (2023). Direct medical costs in pharmacoeconomics. International Journal of Health Economics.

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.https://doi.org/10.4135/9781071812085

Emzir. (2022). Qualitative research methods: Data analysis techniques. Pustaka Setia.

Fajrin, NA, et al. (2022). Mechanism of corticosteroids in COPD. Journal of Public Health, 18(3), 112-120.

Firdausi, A. (2014). Prevalence of COPD in the elderly. Indonesian Lung Journal.

Fitriyasti, N., et al. (2023). Use of the Pulmicort nebulizer. Indonesian Journal of Clinical Pharmacy.

Gold. (2024). GOLD report: Global strategy for COPD diagnosis and management. Global Initiative for Chronic Obstructive Lung Disease.
Hajma, S., et al. (2024). Case of acute exacerbation of COPD. Journal of Inpatient Care of RSUD.
Hardani, S., et al. (2023). CEA in health interventions. Journal of Health Economics.
Indriani Ulistanti. (2018). Indirect and intangible costs. Journal of Hospital Management.
Islam, M., et al. (2023). Cost effectiveness analysis methods. Journal of Clinical Pharmacy.
Ministry of Health of the Republic of Indonesia. (2019). COPD treatment guidelines. Ministry of Health of the Republic of Indonesia.
Khoiriyah Lestari. (2018). Direct non-medical costs. Journal of Health Economics.
Lauma, S., et al. (2017). Pharmacoeconomic CEA approach. Indonesian Journal of Pharmacy.
Musdalifah, et al. (2018). Outcome of COPD therapy. Basic Health Journal.
Najihah Theovena. (2022). Regional prevalence of COPD in Indonesia. National Journal of Epidemiology.
Najjah. (2023). Severity of COPD. Journal of Respiration.
Nurfand, et al. (2022). Combivent as a bronchodilator. Journal of Pharmacology.
Oktianti, R., & Rahmat, A. (2023). Bronchodilator therapy for COPD. Clinical Lung Journal.
Oktarianti, et al. (2023). Pharmacoeconomics in Indonesia. Indonesian Journal of Pharmacy.
Prasetyo, A., et al. (2024). ACER ICER Indicators. Journal of Health Analysis.
Putri, N., et al. (2021). Declining lung function in the elderly. Indonesian Journal of Geriatrics.
Rahmat, A., & Oktianti, R. (2023). Global COPD mortality. Journal of Global Health.
Ramadhani, N., et al. (2021). Definition and etiology of COPD. Indonesian Journal of Lung Disease.
Ramadhani, N., et al. (2022). Prevalence of COPD in Regional Public Hospitals. Journal of Public Health.
Rasmaladew, et al. (2020). Cost analysis of COPD. Journal of Health Economics.
Restyana, E., et al. (2024). Definition of pharmacoeconomics. Journal of Pharmacoeconomics, 15(1), 20-30.
Samirah, et al. (2023). Inpatient bronchodilator therapy. Airlangga University Journal.
Saputra, et al. (2022). Interpretation of negative ICER. Journal of Clinical Pharmacy.
Sugiyono. (2023). Qualitative quantitative research methods R&D. Alfabeta.
Sudaryono. (2022). Descriptive approach to health studies. Andi Publisher.
Suheri. (2022). Inpatient costs. Journal of Health Management.
Tjandrawinata, RR (2016). Pharmacoeconomic analysis methods. Indonesian Journal of Pharmacy.
Utami, S., et al. (2022). Pathophysiology of COPD. Journal of Clinical Respiration.
Wasliaty, et al. (2021). First-line therapy for COPD. Journal of Pharmacotherapy.
WHO. (2021). Global report on COPD mortality. World Health Organization.
Wilianto, et al. (2023). Pulmicort Mechanism. Journal of Inhalation Medicine.
World Health Organization. (2016). COPD epidemiology report. WHO Press.
Yowani, et al. (2025). Age of adult COPD patients. Journal of Epidemiology 2025.