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Analysis of Direct Medical Costs for Inpatients with Chronic Obstructive Pulmonary Disease at Jember Lung Hospital

Devi Rahayu¹, Ayu Angger Putri M. Soleh², Shinta Mayasari³, Wima Anggitasari⁴

^{1,2,3,4} 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

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disease characterized by progressive airflow limitation. The goals of COPD therapy are to reduce symptoms, decrease exacerbations, improve quality of life, and reduce mortality (Kristiningrum, 2019). Differences in patient characteristic and disease severity may affect therapeutic needs and the costs incurred by patients. Direct medical cost analysis is one of the components of the Cost Of Illness method used to determine the economic burden of a disease (Andayani, 2022). This study aimed to analyze the direct medical costs of hospitalized COPD patients at Jember Lung Hospital. This study was an observational descriptive study with a retrospective design using secondary data from medical records of COPD patients during the January-October 2025 period. The sampling technique used was total sampling with a total sample of 71 patients. Cost analysis was performed using the Cost Of Illness (COI) method. The results showed that COPD patients were predominantly male with 53 patients (74,65%), aged 60-69 years with 32 patients (45,07%), and had a length of stay of 4-6 days with 40 patients (56,33%). The average medication cost was IDR 986.697, treatment cost was IDR 1.394.451, and laboratory cost was IDR 137.242. The average direct medical cost was IDR 2.518.390, which was lower than the INA-CBG's tariff of IDR 4.888.400. Treatment cost was the largest cost component contributing to the direct medical costs of hospitalized COPD patients.

Key words: COPD; direct medical cost; Cost of Illness; pharmacoeconomics; COPD; hospitalization

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a chronic respiratory disease characterized by persistent and progressive airflow limitation, resulting in breathing difficulties. The disease is primarily caused by prolonged exposure to irritants, such as cigarette smoke, air pollution, and hazardous chemicals, and is commonly associated with symptoms including dyspnea, chronic cough, and excessive sputum production. COPD encompasses two major clinical conditions, namely chronic bronchitis and emphysema (Bălă et al., 2021).



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In Indonesia, COPD is currently the second most prevalent chronic respiratory disease after asthma, with an estimated prevalence of 3.7%. The prevalence of COPD in East Java is reported to be 3.6%, while Jember Regency has a higher prevalence of 5.6%, exceeding the provincial average (Dinkes Jatim, 2022). A preliminary study conducted at Jember Lung Hospital identified 4,120 outpatient COPD cases and 150 hospitalized COPD patients during the period of January to October 2025. Jember Lung Hospital was selected as the study site because it is a specialized healthcare facility focusing on pulmonary disease management and rehabilitation mortality (Kristiningrum, 2019).

Variations in patient characteristics and disease severity require different treatment strategies and healthcare services, which consequently influence the medical costs incurred by patients. Cost of Illness (COI) analysis is an economic evaluation approach used to estimate the financial burden of a disease by considering both its health and economic impacts. COI consists of four cost components, namely direct medical costs, direct non-medical costs, indirect costs, and intangible costs. Cost analysis has become increasingly important for COPD because it is a chronic disease with a continuously increasing prevalence. Healthcare financing plays a crucial role in supporting health system development. In Indonesia, healthcare expenditures are largely financed through out-of-pocket payments by individuals, while government funding contributes approximately 30% of total healthcare financing. The remaining costs are primarily covered by the community through direct payments and, to a lesser extent, third-party financing schemes such as the National Health Insurance (JKN) program (Silitonga et al., 2024).

A study conducted by Wulandari (2018) reported that the average direct medical cost of hospitalized COPD patients at Fatmawati General Hospital was IDR 12,155,822, with a minimum length of stay of six days. Hospital room charges represented the largest proportion of direct medical costs (33.02%), followed by medication costs (18.42%), laboratory costs (14.18%), medical service fees (16.00%), and other healthcare services (18.39%). In Europe, the direct medical costs of COPD are estimated to reach approximately €38.6 billion, representing a substantial proportion of total expenditures for respiratory diseases. In the United States, COPD-related healthcare costs are projected to increase considerably over the next two decades, reaching approximately USD 800.9 billion, or nearly USD 40 billion annually. On average, hospitalized COPD patients incur an additional USD 641 in healthcare costs due to short-term disability compared with individuals without COPD. Consequently, the combined direct and indirect economic burden of COPD is estimated to average approximately USD 7,000 per patient annually (Patel et al., 2019).

Cost of Illness studies provide valuable information regarding healthcare expenditures, disease-specific resource utilization, and the economic resources required for disease prevention and treatment. One of the major components evaluated in COI studies is direct medical cost, which includes expenditures for hospitalization, medications, and laboratory services (Andayani, 2022). The length of hospital stay and disease severity are among the major determinants of healthcare expenditures, particularly in patients experiencing severe complications (Abror et al., 2019).

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Based on the aforementioned considerations, this study was conducted to analyze the direct medical costs of hospitalized patients with Chronic Obstructive Pulmonary Disease at Jember Lung Hospital. This research employed a pharmacoeconomic approach using the Cost of Illness (COI) method to determine the direct medical expenditures incurred by COPD patients covered by the National Health Insurance (BPJS) during hospitalization at Jember Lung Hospital from January to October 2025.

METHODS

This study employed a quantitative descriptive design with a retrospective approach. A retrospective study was conducted using previously available data, namely patients' medical records and administrative records. The study aimed to analyze the direct medical costs of hospitalized patients with Chronic Obstructive Pulmonary Disease (COPD) at Jember Lung Hospital during the period of January to October 2025.

The study variable was direct medical cost, which included medication costs, treatment costs, and laboratory costs. The research was conducted at the Administration and Medical Records Department of Jember Lung Hospital.

The study population consisted of all hospitalized COPD patients at Jember Lung Hospital during the period of January to October 2025. The study sample comprised the medical records and administrative data of COPD patients who met the inclusion and exclusion criteria. A total sampling technique was employed by including all members of the population who fulfilled the inclusion criteria and did not meet the exclusion criteria. A total of 71 hospitalized patients met the inclusion criteria and were included in the study.

Data were analyzed using univariate analysis to describe the average direct medical costs incurred by hospitalized COPD patients at Jember Lung Hospital.

RESULT AND DISCUSSION

General Data

This study, patient characteristics included gender, age, and length of hospital stay among BPJS-insured patients with Chronic Obstructive Pulmonary Disease (COPD) who received inpatient care at Jember Lung Hospital. These characteristics were used to provide information regarding the distribution and profile of the patients included in the study sample. The patient characteristics are presented in table 1.

Based on the results of the study (Table 1), the majority of hospitalized patients with Chronic Obstructive Pulmonary Disease (COPD) at Jember Lung Hospital were male, accounting for 53 patients (74.6%), while female patients accounted for 18 patients (25.4%). Based on age group, nearly half of the total patients were aged 60–69 years, comprising 32 patients (45.1%), followed by those aged 50–59 years with 21 patients (29.6%). A smaller proportion of patients were aged ≥70 years, with 13 patients (18.3%), while only 2 patients (2.8%) were aged 40–49 years. Based on the length of hospital stay, the majority of patients were hospitalized for 4–6 days, comprising 40 patients (56.3%), whereas 31 patients (43.7%) were hospitalized for 2–3 days. No patients had a length of hospital stay of ≥7 days.

Analysis of Direct Medical Costs (Medication Costs, Treatment Costs, and Laboratory Costs) and the Average Direct Medical Costs at Jember Lung Hospital

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The analysis of direct medical costs and the average direct medical costs among hospitalized patients with Chronic Obstructive Pulmonary Disease (COPD) at Jember Lung Hospital are presented in table 2, 3, and 4. Based on the results presented in Table 2, the total medication cost for hospitalized COPD patients at Jember Lung Hospital during the period of January to October 2025 was IDR 70,055,455, with an average medication cost of IDR 986,697 per patient. Medication costs represent one of the major components of direct medical costs in the Cost of Illness (COI) analysis. The variation in medication costs observed in this study indicates that each patient required different therapeutic management. These differences were influenced by the patients' clinical conditions, the severity of COPD, the frequency of exacerbations, the presence of comorbidities, the length of hospital stay, the number of medications prescribed, and the dosage forms administered during hospitalization (Alaydrus, 2020).

Bronchodilators are the primary therapy used to dilate the airways and relieve dyspnea, whereas corticosteroids are administered to reduce airway inflammation. Inhalation therapy is frequently used in patients with Chronic Obstructive Pulmonary Disease (COPD) because it delivers medications directly to the respiratory tract, resulting in a more rapid and effective therapeutic response than systemic administration (Vogelmeier et al., 2020). The more severe the patient's clinical condition, the more complex the therapeutic regimen required, leading to higher medication costs. The implementation of treatment in accordance with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines may reduce the frequency of exacerbations and contribute to lower long-term medication costs (Matera et al., 2023).

The findings of this study are consistent with those reported by Kirsch et al. (2019), who stated that the greater the severity of Chronic Obstructive Pulmonary Disease (COPD) and the higher the number of comorbidities experienced by patients, the greater the direct medical costs incurred due to the increased need for pharmacological therapy and healthcare services during hospitalization. The medication costs constitute one of the largest components of direct medical costs among patients with COPD. These costs are influenced by disease severity, the frequency of exacerbations, length of hospital stay, the use of combination drug therapy, and the presence of comorbidities requiring additional treatment (Yuanda et al. 2026).

In contrast, Patient No. 31 (Mrs. D) had the lowest medication cost, amounting to IDR 171,454. The therapeutic regimen administered was relatively less complex than that of the patient with the highest medication cost and consisted of codeine, acetylcysteine, Nitrokaf Retard, digoxin, omeprazole injection, ceftriaxone injection, Pulmicort® Respules, Neurosanbe injection, furosemide injection, and Santagesik injection. The results of this study demonstrated a considerable difference between patients with the highest and the lowest medication costs. Patient No. 42 (Mr. S) incurred the highest medication cost, amounting to IDR 2,381,758. The high medication cost in this patient was likely attributable to a more complex therapeutic regimen, including Meiact® (cefditoren pivoxil), erdosteine, Teosal®, SmofKabiven® Peripheral, 0.9% sodium chloride, sterile water for injection (Aquabidest), metamizole injection, Meprovent® inhalation, azithromycin injection, and acetylcysteine injection. In addition to receiving standard COPD therapy, including

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bronchodilators and mucolytics, the patient was also treated with antibiotics, analgesics, intravenous fluids, and SmofKabiven® Peripheral as parenteral nutritional support. The administration of parenteral nutrition suggests that the patient required nutritional support due to a more severe clinical condition or increased metabolic demands during hospitalization. Furthermore, the predominant use of injectable formulations, intravenous infusions, and inhalation therapy contributed to higher medication costs than oral formulations because these therapies require additional medical devices, disposable medical supplies, and healthcare professional services for administration (Collins et al., 2019).

Based on the results presented in Table 3, the total treatment cost for hospitalized patients with Chronic Obstructive Pulmonary Disease (COPD) at Jember Lung Hospital during the period of January to October 2025 was IDR 99,006,000, with an average treatment cost of IDR 1,394,451 per patient. The findings indicate that treatment costs constituted the largest component of direct medical costs. The variation in treatment costs among patients reflects differences in healthcare service utilization during hospitalization. These variations were influenced by the length of hospital stay (LOS), frequency of physician visits, medical procedures, nursing services, utilization of hospital facilities, and the need for diagnostic examinations and supportive therapies according to each patient's clinical condition. The findings of this study are consistent with those reported by Patel et al. (2018), who found that the length of hospital stay is the primary determinant of hospital service costs among patients with COPD. The longer patients remain hospitalized, the greater the utilization of hospital beds, nursing services, physician visits, oxygen therapy, and other medical interventions, resulting in higher treatment costs.

Based on the study findings, Patient No. 49 (Mr. J) incurred the highest treatment cost, amounting to IDR 2,712,500. The high treatment cost was likely attributable to the need for more complex healthcare services during hospitalization. The patient was hospitalized for five days, received five physician visits, and underwent various supportive interventions, including echocardiography, oxygen therapy, repeated nebulization, injectable medications, nutritional consultation, and nursing care. Furthermore, the use of oxygen therapy and echocardiography indicates that the patient required more intensive cardiopulmonary monitoring. The extensive healthcare services provided resulted in greater utilization of hospital resources, thereby increasing treatment costs compared with those of other patients (Farrasyifa, 2025).

In contrast, Patient No. 31 (Mrs. D) incurred the lowest treatment cost, amounting to IDR 583,000. The patient was hospitalized for only two days and required relatively less intensive healthcare services, including one specialist physician visit, hospital room charges for two days, nutritional consultation, injectable medications, nebulization therapy, and nursing care. No advanced diagnostic procedures or high-cost supportive therapies were required. The shorter length of hospital stay, together with fewer medical procedures and supportive healthcare services, resulted in lower utilization of hospital resources and consequently lower treatment costs (Sari, 2017).

Based on the results presented in Table 4, among the total of 71 hospitalized patients with Chronic Obstructive Pulmonary Disease (COPD), 29 patients underwent laboratory examinations, with a total laboratory cost of IDR 3,980,000 and an average laboratory cost of IDR 137,242 per patient. Laboratory costs represent one of the components of direct medical costs, which are incurred to support disease diagnosis, monitor patients' clinical



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conditions, and evaluate treatment outcomes among hospitalized COPD patients. The results of this study showed that Patient No. 41 (Mr. S) incurred the highest laboratory cost, amounting to IDR 595,000. The high laboratory cost was likely attributable to the large number of laboratory examinations performed, including a complete blood count with five-part differential, electrolyte analysis, random blood glucose, serum creatinine, blood urea nitrogen (BUN), AST (SGOT), ALT (SGPT), Troponin I fluorescence immunoassay (FIA), and venous blood sampling. According to the Infectious Diseases Society of America, microbiological examinations such as Gram staining are recommended when bacterial respiratory tract infection is suspected; however, they are not routinely required for all patients with COPD. Therefore, patients who required only a single laboratory examination incurred substantially lower laboratory costs than those requiring comprehensive laboratory evaluations (Wulandari, 2020).

Based on the results presented in Table 5, the average direct medical cost for hospitalized patients with Chronic Obstructive Pulmonary Disease (COPD) at Jember Lung Hospital during the period of January to October 2025 was IDR 2,518,390 per patient. This cost consisted of an average medication cost of IDR 986,697, an average treatment cost of IDR 1,394,451, and an average laboratory cost of IDR 137,242. The findings indicate that treatment costs contributed the largest proportion of the total average direct medical costs, followed by medication costs and laboratory costs. Furthermore, the INA-CBGs tariff of IDR 4,888,400 was higher than the average direct medical cost identified in this study. In the Cost of Illness (COI) analysis, direct medical costs comprise all healthcare expenditures directly associated with disease management, including medication costs, hospitalization costs, diagnostic examination costs, medical procedures, and healthcare professional services. Estimating direct medical costs provides an overview of the healthcare resources utilized in disease management and can be used to evaluate the economic burden of a disease as well as the efficiency of healthcare services (Firman et al, 2024).

CONCLUSION

The total medication cost among patients with COPD was IDR 70,055,455, with an average medication cost of IDR 986,697 per patient. The total treatment cost was IDR 99,006,000, with an average treatment cost of IDR 1,394,451 per patient, making it the largest component of direct medical costs. Meanwhile, the total laboratory cost was IDR 3,980,000, with an average laboratory cost of IDR 137,242 among the 29 patients who underwent laboratory examinations. Based on the sum of all cost components, the average direct medical cost for hospitalized patients with COPD was IDR 2,518,390 per patient. The findings also showed that this average direct medical cost was lower than the INA-CBGs tariff of IDR 4,888,400, indicating that the actual healthcare costs incurred for hospitalized COPD patients at Jember Lung Hospital during the study period remained below the applicable INA-CBGs reimbursement rate.

ACKNOWLEDGEMENT

The author would like to express his sincere thanks to the head and all staff. Praise be to God Almighty for the grace and strength to complete this research work. Special thanks



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go to the Director and medical records staff at Jember Lung Hospital for granting research permission and data access. Deep appreciation goes to university advisors and reviewers for their valuable feedback and constant supervision.

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TABLE

Table 1. Characteristics of Hospitalized COPD Patients Based on Gender, Age, and Length of Hospital Stay

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	53	74,6%
	Female	18	25,4%
Total		71	100%
Age	40-49 tahun	2	2,8%
	50-59 tahun	21	29,6%
	60-69 tahun	32	45,1%
	≥ 70 tahun	13	22,5%
Total		71	100%
Long of Hospital Stay	2-3 hari	31	43,7%
	4-6 hari	40	56,3%
	≥ 7 hari	0	0,0%
Total		71	100%

Table 2. Medication Costs

Component	Patients (n)	Total Cost (IDR)
Medications Costs	71	Rp 70.055.455
Average Cost (Rp)		Rp 986.697

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Table 3. Treatment Costs

Component	Patients (n)	Total Cost (IDR)
Treatment Costs	71	Rp 99.006.000
Average Cost (IDR)		Rp 1.394.451

Table 4. Laboratory Costs

Componen	Patients (n)	Total Cost (IDR)
Laboratory Costs	29	Rp 3.980.000
Average Cost (IDR)		Rp 137.242

Table 5. Average Direct Medical Costs

Component	Patients (n)	Average Cost (IDR)
Medications Costs	71	Rp 986.697
Treatment Costs	71	Rp 1.394.451
Laboratory Costs	29	Rp 137.242
Total Average Direct Medical Cost:		Rp 2.518.390
INA-CBGs Tariff:		Rp 4.888.400