

Research Article

Comparing the Financial Burden of Colorectal Cancer Chemotherapy on Indonesian Healthcare Insurance (JKN) Coverage: A Study in East Kalimantan

Erfan Abdissalam^{1,*}, Rizki Nur Azmi², Bintang Dwi Putra², Afifah Puspa Anggraeni², Aulia Rahman², Muhammad Fahmi Hidayat Firdaus²

¹Faculty of Pharmacy, Universitas Mulawarman, Samarinda, Indonesia

²Faculty of Pharmacy, Universitas Muhammadiyah Kalimantan Timur, Samarinda, Indonesia

*Correspondence email : erfan.abdissalam@ff.unmul.ac.id

Abstract

Background: Colorectal cancer (CRC) constitutes a major public health burden in Indonesia. Chemotherapy remains the primary treatment for advanced CRC but creates substantial financial pressure on patients, hospitals, and the National Health Insurance (JKN) system. Although reimbursement is provided through the Indonesia Case Base Groups (INA-CBGs), differences between actual costs and tariff rates have been reported. **Objective:** This study assessed the financial burden of chemotherapy for stage III and metastatic CRC and its alignment with JKN reimbursement in a government referral hospital in Kalimantan. **Methods:** A retrospective cross-sectional study was conducted at Abdoel Wahab Sjahranie Regional General Hospital, Samarinda, using medical records from January-June 2024. A total of 129 chemotherapy visits were analyzed. Direct medical costs were compared with INA-CBG claims using descriptive statistics and the Mann-Whitney U test. **Results:** FOLFIRI was the most frequently administered regimen (71%). The total chemotherapy cost was Rp590,674,630, with a mean of Rp4,578,873 per visit. Pharmaceutical costs accounted for 56.58% of total expenditures. Actual costs were adequately covered by JKN, resulting in a positive variance of Rp1,314,544 per visit. **Conclusion:** INA-CBG reimbursement adequately covered CRC chemotherapy costs, although continued evaluation of JKN financing sustainability is warranted.

Keywords: cost burden, colorectal cancer, chemotherapy, INA-CBG, JKN

Accepted: 21 September 2025

Approved: 20 Oktober 2025

Publication: 16 November 2025

Citation : E. Abdissalam, R. N. Azmi, B. D. Putra, A. P. Anggraeni, A. Rahman, M. F. H. Firdaus, "Comparing the Financial Burden of Colorectal Cancer Chemotherapy on Indonesian Healthcare Insurance (JKN) Coverage: A Study in East Kalimantan", JTPC, vol. 9, no. 2, pp 245-255, Nov. 2025, doi : 10.30872/jtpc.v9i2.314

Copyright : © year, Journal of Tropical Pharmacy and Chemistry (JTPC). Published by Faculty of Pharmacy, Universitas Mulawarman, Samarinda, Indonesia. This is an Open Access article under the CC-BY-NC License



1. Introduction

Cancer is a pathological condition marked by the uncontrolled proliferation of abnormal cells in body tissues, which can disrupt normal physiological functions [1]. Colorectal cancer (CRC) represents a prevalent form of malignant neoplasm originating within the tissues of the large intestine. This encompasses both the colon, which constitutes the longest segment of the large intestine, and the rectum, the terminal portion preceding the anus. A comprehensive understanding of CRC involves examining its pathophysiology, risk factors, and implications for screening and treatment within the broader context of gastrointestinal oncology [2]. Colorectal cancer typically arises from an initial lesion characterized as a small polyp. Over time, this polyp undergoes a process of proliferation and subsequent transformation, ultimately evolving into a malignant tumor [3].

Colorectal cancer (CRC) is a significant health concern due to its high incidence and mortality rates worldwide. As reported by the 2022 Global Cancer Observatory (GLOBOCAN), CRC ranks as the third most common cancer globally, with an estimated 1.9 million new cases and nearly 935,000 deaths each year. In Indonesia, CRC is among the ten most prevalent cancers, and there is a concerning trend of increasing incidence year after year, especially within the productive age group [5].

A multitude of therapeutic modalities exists for the treatment of cancer, among which chemotherapy is one of the most widely employed [6]. Chemotherapy is a treatment approach that employs cytotoxic agents to achieve goals related to cure, disease control, or palliative care for cancer patients. This therapy is typically administered in a series of cycles, with patients undergoing between 4 and 8 cycles tailored to their specific treatment regimen. While not entirely curative, cytotoxic agents have demonstrated effectiveness in reducing tumor size, alleviating clinical symptoms, and extending life expectancy, particularly in cases of metastatic cancer [7].

Administering chemotherapy to patients with CRC necessitates substantial funding and a relatively extended treatment period. In Indonesia's healthcare financing framework, the National Health Insurance Program (JKN), overseen by BPJS Kesehatan (Social Security Agency for Health), is pivotal in covering cancer treatment costs, including chemotherapy. The program utilizes a claims payment mechanism based on the Indonesia Case Base Groups (INA-CBGs) tariff system, which is a bundled payment model centered around specific diagnoses and medical procedures. However, various reports indicate that the actual costs of services, particularly for cancer treatments like chemotherapy, often do not correspond with the established INA-CBG tariffs. This discrepancy can lead to additional financial burdens for both healthcare facilities and patients [8].

In the framework of the National Health Insurance (JKN) system, costs associated with cancer treatment have emerged as one of the largest expenditures for BPJS Kesehatan. Nevertheless, numerous cancer patients are still faced with additional out-of-pocket expenses that extend beyond JKN coverage, including transportation fees and lost productivity, thereby amplifying the economic burden on their families. The intricacies of treatment protocols, particularly chemotherapy, further exacerbate the overall costs of care. A study by Hamidah et al. [9] indicates that as the complexity of a patient's treatment regimen increases, there is a corresponding escalation in the financial burden incurred by both healthcare institutions and patients. This relationship holds true even within the context of non-COVID elderly patients presenting in the emergency department.

Numerous prior studies indicate that the economic burden of cancer in Indonesia is considerable. A systematic review by [10] revealed that out-of-pocket (OOP) costs, excluding medical expenses, remain notably high, particularly in low- and middle-income countries (LMIC), even as these nations begin to adopt the principles of Universal Health Coverage (UHC). Almost all studies conducted in LMIC reported non-medical expenditures surpassing 30%, with an average non-medical expenditure estimated at approximately 42% of annual income. Another study conducted by Kurniawati and Rukminingsih [3] at Hospital X Semarang revealed that the average direct medical cost for mild chemotherapy in patients with class 3 colorectal cancer was Rp2,490,615. The most significant cost components were attributed to medical personnel services, accounting for 45.17%, and medication expenses, which represented 37.22%. When compared to the applicable INA-CBGs rate of Rp2,606,500 for the mild chemotherapy

package, this finding demonstrates a positive variation. However, it is essential to note that this difference should not be interpreted as a definitive profit for the hospital, as the cost calculation does not encompass the utilization of indirect facilities and infrastructure.

In addition, various studies have highlighted a disparity between the actual costs of hospital services and the INA-CBGs rates, especially in cases involving chronic and complex illnesses. For instance, research conducted at Airlangga University Hospital concerning patients with diabetic gangrene revealed a notable difference between the actual hospital expenses and the remuneration received through INA-CBGs (Kinanti et al., 2021). Comparable observations have also been identified in the context of cardiovascular disease and cerebrovascular accidents [12]. This disparity has the potential to precipitate a budget deficit within the hospital, thereby adversely affecting the quality of services rendered.

This study aimed to analyze and compare the financial burden of CRC chemotherapy in relation to the National Health Insurance (JKN) coverage within a government hospital in Kalimantan. The findings are intended to offer valuable insights for enhancing the cancer financing system and the JKN framework, especially in regions facing geographic challenges and limited access to healthcare services.

2. Method

2.1 Materials

This study analyzes data derived from medical records to identify patient characteristics and the chemotherapy treatments administered. Additionally, it investigates the thorough documentation of patient financial management to evaluate direct medical costs. Estimates are based on the distance from the patient's residence to the hospital to assess direct non-medical costs, including transportation expenses.

2.2 Method

2.2.1 Design

This research utilized an observational design complemented by analytical methodologies. Data were retrospectively obtained through a cross-sectional approach, covering January to June 2024. This data span was selected strategically based on a delineation of half of the fiscal year.

The research was conducted at Abdoel Wahab Sjahrane Regional Hospital in Samarinda. This hospital, operated under the East Kalimantan Provincial Government, is a comprehensive referral center for cancer patients enrolled in the Health Insurance program. The hospital is classified within the INA-CBG claim rate grouping for government-owned facilities in region 4.

The population of this study comprised the number of visits by patients enrolled in the Health Insurance program who have stage III and IV (metastatic) colorectal cancer and are undergoing chemotherapy according to the treatment regimen recommended in the guidelines. A purposive sampling technique was employed, focusing on criteria suitable for inclusion as research data. Chemotherapy visits that were not fully documented in either the medical record or the patient's financial administration details were excluded. Additionally, visits were excluded if they were not covered by the Health Insurance program, as well as those for which the patient paid for chemotherapy services independently. Out of 143 potential participants, 129 were identified as meeting the inclusion criteria.

2.2.2 Data Analysis

Cost data are presented from the patient's perspective and are expressed in Indonesian Rupiah based on the 2024 exchange rate (1 USD = 16,162 IDR). A univariate descriptive analysis was conducted to evaluate sample characteristics and the costs associated with illness. Inferential statistical analysis was performed using the Mann-Whitney U test to assess the relationship between the financial burden and Health Insurance Program financing claims. For cancer chemotherapy, financing is processed through the INA-CBG service package mechanism, alongside separate claims for cytostatic drugs that fall outside the INA-CBG framework.

3. Result and Discussion

3.1 Results

A review of 142 medical records found that 129 met the established inclusion criteria. Table 1 delineates the demographic and clinical characteristics of patients with stage III and metastatic CRC who received treatment at Abdoel Wahab Sjahranie Regional General Hospital.

Table 1. Patients' Characteristics.

Characteristics	n	%
n = 129		
Gender		
Female	59	46
Male	70	54
Age (years)		
30-39	4	3
40-49	36	28
50-59	50	39
60-69	13	10
70-79	26	20
Type of Patient Care		
Inpatient	129	100
Outpatient	0	0
Class of Patient Care		
I	46	36
II	32	25
III	51	40
Length of Stay (days)		
1-3	94	73
4-6	32	25
7-9	3	2
Primary Site of Cancer		
Colon	58	45
Sigmoid	63	49
Rectum	8	6
Stage of Cancer		
III	120	93
IV (Metastatic)	9	7
Site of Metastasis (in Stage IV)		
Bladder	1	1
Liver	5	4
Lung	2	2
Unspecified	1	1

In the total sample, 54% of participants were male, and 46% were female. The most significant age distribution was found in the 50-59 age group, which comprised 39% of the sample, followed by 28% in the 40-49 age group, 20% in the 70-79 age group, 10% in the 60-69 age group, and 3% in the 30-39 age group. All patients (100%) were inpatients, with the majority receiving treatment in Class III of the National Health Insurance (40%), followed by Class I (36%) and Class II (25%). A significant proportion of patients (73%) were hospitalized for 1-3 days, while 25% received care for 4-6 days, 2% for 7-9 days, and another 2% for more than 9 days. The most prevalent site for primary tumors was the sigmoid colon, accounting for 49% of cases. In terms of disease stage, 93% of patients were classified as stage III, while 7% had progressed to stage IV with metastasis. Among those with metastases, 4% had liver involvement, 2% had lung metastases, and 1% had metastases to the bladder, with another 1% experiencing metastases to unspecified sites.

In this study, chemotherapy for CRC was predominantly administered through the FOLFOX and FOLFIRI regimens, specifically targeting stage III and metastatic cases, as illustrated in Table 2.

Table 2. CRC Chemotherapy Regimens.

Stages	Regimens	n	%
III	FOLFOX	33	26
	FOLFIRI	87	67
IV (Metastatic)	FOLFOX	4	3
	FOLFIRI	5	4
Total		129	100

FOLFOX: folinic acid, fluorouracil, oxaliplatin.

FOLFIRI: folinic acid, fluorouracil, irinotecan.

The application of these treatment regimens was predominantly characterized by the FOLFIRI protocol, which constituted 71% of the total cases (n=93). In contrast, the FOLFOX regimen accounted for 29% of the cases (n=38).

This study determined that the total cost of illness for patients with stage III and metastatic colorectal cancer undergoing chemotherapy was Rp590,674,630, with an average cost of Rp4,578,873 per chemotherapy visit. The highest cost burden was observed in the pharmaceutical category, amounting to Rp330,047,348, with an average cost of Rp2,558,507. The findings of the study are presented in Table 3 below.

Table 3. Cost of Illness for CRC Chemotherapy.

Costs	Category	Total (Rp) (n = 129)	Mean ± SD (Rp)
Direct Medical Cost	Pharmacy	330,047,348	2,558,507 ± 414,848
	Chemotherapy Service	85,140,000	660,000 ± 0
	Inpatient	33,505,000	261,758 ± 202,753
	Other Medical Procedures	32,064,582	252,477 ± 180,978
	Nutrition Care	28,595,000	221,667 ± 93,534
	Nursing Care	16,100,000	125,781 ± 52,285
	Medical Documents	4,500,000	34,884 ± 1,316
	Laboratory Service	3,381,000	120,750 ± 154,247
	Physician/ Consultant Visit	2,412,500	120,625 ± 59,592
	Emergency Room Ticket	75,000	75,000 ± 0
Direct Non-Medical Cost	Transportation	54,854,200	442,373 ± 724,267
Overall Cost		590,674,630	4,578,873 ± 1,190,308

In the analysis of pharmaceutical cost components, the predominant segment is attributed to the expenses associated with cytotoxic agents, which constitute a substantial 56.58% of the overall pharmaceutical expenditures. This allocation is further elucidated in Table 4, presented below.

Table 4. Cytotoxic Agent Costs.

Drugs' Name	Frequency of Use	Total (Rp)	Mean ± SD (Rp)
Fluorouracil	129	28,012,616	217,152 ± 26,209
Leucovorin	129	40,954,786	317,479 ± 45,861
Oxaliplatin	37	26,456,850	715,050 ± 38,700
Irinotecan	92	91,317,000	992,576 ± 117,210
Overall Cost		186,741,252	1,447,607 ± 196,731

An analysis was conducted to examine the relationship between actual costs and the claimed rates in the Health Insurance Program. The calculated actual costs were specifically the direct medical expenses. For claims related to chemotherapy, the Indonesian Case-Based Group (INA-CBG) financing model was employed to cover the overall chemotherapy services, while the Non-INA-CBG model was used to claim the costs of cytostatic drugs. The Kolmogorov-Smirnov normality test revealed a p-value of 0.000

(<0.05), indicating that the data were not normally distributed. Additionally, the Mann-Whitney U inferential statistical analysis yielded a p-value of 0.000 (<0.05), suggesting that the direct medical costs aligned with both the INA-CBG and Non-INA-CBG rates. The financing of health insurance for chemotherapy in cases of stage III and metastatic colorectal cancer demonstrated a positive difference in direct medical costs, totaling Rp169,576,222, with an average of Rp1,314,544, as illustrated in Table 5 below.

Table 5. Comparison of Direct Medical Costs with INA-CBG and Non-INA-CBG Rates.

Costs & Claims		INA-CBGs			Overall
		C-4-13-I: Chemotherapy (Minor) (n = 109)	C-4-13-II: Chemotherapy (Moderate) (n = 6)	C-4-13-III: Chemotherapy (Major) (n = 14)	
Direct Medical Costs (Rp)	Total	429,878,550	29,434,136	76,507,744	535,820,430
	Mean	3,943,840	4,905,689	5,464,839	4,153,647
INA-CBG Claim Tariffs (Rp)	Total	362,490,400	37,552,800	118,612,200	518,655,400
	Mean	3,325,600	6,258,800	8,472,300	4,020,584
Non-INA-CBG Claim Tariffs (Rp)	Total	157,925,137	8,811,632	20,004,483	186,741,252
	Mean	1,448,854	1,468,605	1,428,892	1,447,607
Difference (Rp)	Total	90,536,987	16,930,296	62,108,939	169,576,222
	Mean	830,614	2,821,716	4,436,353	1,314,544

3.2 Discussion

Colorectal cancer affects individuals of all ages, regardless of gender. However, this study indicates that its prevalence is notably higher in men, accounting for 54% of cases. According to GLOBOCAN's global prevalence data, from 2017 to 2022, there were 3,183,756 reported cases of colorectal cancer in men, compared to 2,584,025 cases in women. It was reported that EXITS, a tumor suppressor gene that escapes X-inactivation, may play a role in the higher prevalence of colorectal cancer observed in men [13]. This study also revealed that the 50-59 age group had the highest incidence of cancer cases, which aligns with existing research indicating a significant rise in colorectal cancer diagnoses after the age of 50, attributed to an increased cancer risk. The likelihood of developing cancer sharply escalates after the age of 40, with approximately 90% of cases occurring in individuals over 50 [14].

All chemotherapy treatments were administered exclusively as inpatient services (100%), reflecting the standard treatment regimen that necessitates a duration of no less than 50 to 52 hours. This approach is consistent with the observed pattern of hospital stays, where the majority (73%) ranged from one to three days [15]. Patient care under Indonesia's National Health Insurance program operates within a tiered structure consisting of classes I, II, and III, with class I being the most comprehensive. This study reveals that the majority of patient visits occur in class III (40%), which is primarily designated for individuals receiving premium assistance. This observation is consistent with earlier research examining the financial impact of chemotherapy on National Health Insurance patients, where 64% were found to receive premium assistance [15], [16].

This study indicated a higher prevalence of stage III and IV colorectal cancer, with 49% of cases in the sigmoid. Notably, the sigmoid emerged as the most common site for this type of carcinoma, accounting for 55% of the incidences observed [17]. This predominance may be attributed to a greater incidence of p53 gene mutations, which are likely a result of prolonged carcinogenesis [18]; [19]. Among the diagnosed cases, 93% were classified as stage III colorectal cancer, while only 7% had metastases. The survival rates for different stages highlight this disparity: 90% for stage IIIA, 72% for stage IIIB, and 53% for stage IIIC, contrasted with just 12% for stage IV (metastatic) [20]. Additionally, the liver was identified

as the most frequent site of metastasis in colorectal cancer patients, with approximately 25% experiencing liver involvement at some point during their illness, which aligns with findings from this study [21].

This study demonstrated that the FOLFOX and FOLFIRI chemotherapy regimens were utilized exclusively across all stages of treatment. These regimens were preferred due to their superior response rates (RR), extended progression-free survival (PFS), and enhanced overall survival. Additionally, the integration of targeted therapies is highly recommended, especially in cases of metastatic disease. National guidelines specify various targeted therapies, including bevacizumab and panitumumab for FOLFOX and FOLFIRI, as well as cetuximab and ziv-aflibercept specifically for FOLFIRI [15]. A systematic review and meta-analysis indicate that the incorporation of bevacizumab, cetuximab, or panitumumab into treatment regimens may enhance anti-tumor efficacy and disease control in patients. However, it is important to note that these agents do not lead to a statistically significant improvement in overall survival rates [22]. Ziv-aflibercept has received regulatory approval for use in conjunction with the FOLFIRI regimen in the treatment of metastatic colorectal cancer. This approval is supported by clinical evidence demonstrating a significant survival advantage in affected patients [23]. Despite their clinical efficacy, bevacizumab, panitumumab, and ziv-aflibercept are not featured in the Indonesian National Formulary. In contrast, the application of cetuximab is restricted to its utilization as a second-line therapeutic agent, specifically for squamous cell carcinoma of the head and neck [8]. This observation may elucidate the absence of targeted therapy in the current study, despite its inclusion in national guidelines as a recommended intervention.

Direct medical costs encompass expenses related to healthcare services, including pharmaceuticals, chemotherapy, hospitalization, and various other services. According to Table 3 on the cost of illness, this study found that the total cost of illness for stage III and metastatic colorectal cancer patients receiving chemotherapy amounted to Rp590,674,630, with an average cost of Rp4,578,873 per chemotherapy visit. The most significant financial burden was associated with the pharmaceutical category, which totaled Rp330,047,348, averaging Rp2,558,507 per patient. Within the pharmaceutical costs, chemotherapy drugs represented the largest portion, accounting for 56.58% of total pharmaceutical expenses. Notably, Irinotecan incurred the highest individual cost, totaling Rp91,317,000, with an average cost of Rp992,576. This finding is consistent with previous research by [24], among the various components, pharmacy costs account for the largest share, totaling Rp. 2,516,525, which represents 40.06% of the overall expenses. Additionally, another study by [25] indicates that chemotherapy costs comprise the highest percentage of direct medical costs, ranging from 27.83% to 58.11% of the total expenses.

The cost of chemotherapy ranks second, totaling Rp85,140,000, with an average expense of Rp660,000. This fixed amount adheres to the national standard rate. These findings align with previous research indicating that medical personnel costs (from medical procedures) and pharmaceutical expenses represent the two largest components of direct medical costs. For chemotherapy categorized as severe under the INA-CBGs (C-4-13-III), the average claim rate is Rp8,472,300. It's important to note that this figure does not include the cost of cytostatics [8]. The average pharmacy cost amounted to Rp 2,558,507. Consequently, the direct medical costs associated with heavy chemotherapy at Abdoel Wahab Sjahranie Regional Hospital showed a favorable variance when compared to the INA-CBGs rate. This positive difference suggests that the pharmacy costs were lower than the INA-CBGs rate, thereby yielding a profit for the hospital. However, it's important to note that this positive variance does not directly translate into profit for the hospital, as the calculation of direct medical costs excludes the expenses related to hospital facilities and infrastructure. Research conducted by [26] indicates that package-based payment systems frequently fail to capture the true costs incurred by healthcare facilities. Nonetheless, the positive difference in INA-CBGs rates signifies that the operational costs associated with patient care are adequately covered.

The data obtained clearly indicates that chemotherapy drugs are the primary drivers of total pharmaceutical costs, amounting to Rp186,741,252, which represents approximately 56.58%. This significant figure has a considerable impact on the efficiency of JKN financing in the region and aligns with earlier, more comprehensive research conducted in Indonesia. For instance, a previous study by [3] found that chemotherapy drugs contributed 37.22% to the drug costs for JKN patients. Additionally, research

has classified colorectal cancer as having the third highest cost burden in Indonesia, as evidenced by BPJS claims data from 2018 [27]. The consistency of these findings highlights the ongoing and substantial challenge of chemotherapy costs within the JKN system, underscoring the urgent need for this study to explore cost optimization strategies relevant to the JKN program.

Fluorouracil and Leucovorin were the most commonly utilized chemotherapy agents, with a usage frequency of 129 times, encompassing 100% of the patient population. This high frequency reinforces their status as the gold standard in first-line treatment regimens for colorectal cancer, akin to FOLFOX and FOLFIRI. However, a comprehensive cost analysis revealed a notable discrepancy: while both drugs were used with the same frequency, the total expenditure for Leucovorin reached Rp40,954,786, significantly surpassing the cost of Fluorouracil, which amounted to Rp28,012,616. These findings underscore that even ancillary medications in combination therapies can substantially contribute to overall pharmaceutical costs, thereby impacting the financial burden on the National Health Insurance (JKN). This conclusion aligns with the National Guidelines for Colorectal Cancer Medical Services (PNPK), which explicitly advocate for including these two agents in standard treatment protocols. The consistency of this data is further supported by previous studies by [28] in Surakarta, which similarly highlighted the significant cost implications associated with these standard chemotherapy drugs in the assessment of real costs and their compliance with INA-CBG rates for colorectal cancer patients. Although situated in Java, this study demonstrated comparable cost patterns linked to the utilization of standard treatment medications.

The data indicates that the average cost per patient for Oxaliplatin was Rp715,050, while for Irinotecan, it is as high as Rp992,576. These figures underscore the financial burden faced by patients undergoing regimens that include these drugs, which is particularly concerning within the context of JKN coverage, since their use heavily relies on the clinical response and progression of the disease. Various studies related to chemotherapy costs support these findings. Although direct data comparing the costs of Oxaliplatin and Irinotecan per session in Indonesia remains limited, a study indicated that the total cost for the FOLFOX or FOLFIRI chemotherapy regimens (which include Oxaliplatin or Irinotecan) in Indonesia reached 359 million Rupiah [29]. This clearly illustrates the high overall cost burden associated with treatments involving these drugs. Additionally, research conducted in the United States revealed that regimens based on Oxaliplatin and Irinotecan led to a substantial increase in direct medical costs compared to 5-Fluorouracil/Leucovorin alone, with costs per life-year gained amounting to \$78,181 for Oxaliplatin and \$267,938 for Irinotecan [30]. This indicates that these drugs are recognized globally as more expensive components of colorectal cancer therapy. Furthermore, the prevailing consensus among healthcare practitioners acknowledges that Oxaliplatin and Irinotecan are part of a more aggressive and costly treatment regimen, reflective of the cancer's severity and the patient's response, as corroborated by various healthcare information sources.

These findings indicate that cost variation among colorectal cancer patients is significantly influenced by the type of chemotherapy drug administered, which is determined by the clinical stage and response to initial therapy. Patients with metastatic or relapsed disease typically require more aggressive and costly chemotherapy regimens, such as Irinotecan, leading to disparities in treatment costs among patients. Consequently, this study underscores the importance of selecting efficient chemotherapy regimens and highlights the necessity for regular assessment of drug coverage within the National Cancer Institute (Fornas) to ensure it aligns with the clinical needs of colorectal cancer patients. Moreover, it is essential to implement affirmative policies that address areas with limited access, such as Kalimantan, to ensure that patients are not economically or clinically disadvantaged.

In terms of compliance with JKN claim coverage, this study revealed that the direct medical costs associated with chemotherapy for colorectal cancer patients were consistently covered by both INA-CBG and non-INA-CBG rates. Notably, there was a positive variance between the actual costs and the JKN claim rates. To put it differently, the budget allocated for JKN claims received by the hospital surpassed Rp1,314,544 for each chemotherapy session. A study conducted by Satibi et al. (2018) in Bali Province, examining cancer incidence, also revealed that the actual costs were lower than the claim value stipulated

by INA-CBG. However, it is worth noting that this study did not factor in the costs associated with chemotherapy. A recent study by [31] highlights that the component of chemotherapy drugs significantly influences the total cost of cancer treatment, particularly in complex and intensive regimens. While many of these expenses can be addressed through the JKN framework via the INA-CBG's claim mechanism, there remains a potential discrepancy between actual costs and the claim ceiling, varying based on the specific types and combinations of treatment regimens. When actual costs surpass the claim ceiling, healthcare facilities may encounter financial difficulties, leading to operational deficits or imposing the cost difference on patients. This scenario raises important questions about the adequacy of JKN rates. It underscores the urgent need to revise or update therapy-based reimbursement rates to ensure the continued provision of adequate and affordable cancer care services [32].

A study highlighted the significant impact of incorporating targeted therapies, such as cetuximab, in treating metastatic colorectal cancer (mCRC). While introducing these therapies led to a substantial increase in costs, their cost-effectiveness was deemed acceptable, with an Incremental Cost-Effectiveness Ratio (ICER) of approximately IDR 3 billion per QALY. This figure notably exceeds the acceptable cost-efficiency threshold established by the National Health Insurance (JKN) system. If these innovative targeted therapies remain within the JKN benefit package, the projected national cost burden could surpass IDR 1 trillion over five years—twice that of a standard chemotherapy scenario. These findings underscore the necessity for thorough evaluations of effectiveness and efficiency for each innovative, high-cost therapy to ensure the sustainability of the JKN system. Consequently, regular assessments of the benefit package and the price negotiation mechanism for innovative drugs are essential to guarantee that each JKN-covered therapy delivers benefits that are commensurate with associated costs [33].

4. Conclusion

This study identified the FOLFOX and FOLFIRI regimens as the chemotherapy options for colorectal cancer in both stage III and metastatic phases. The total financial impact for 129 chemotherapy sessions amounted to Rp590,674,630, resulting in an average cost of Rp4,578,873 per visit. The most significant cost component was pharmaceutical expenses, averaging Rp2,558,507 per session. Among the cytostatic agents, Irinotecan was the most costly, averaging Rp992,576 per dose. The analysis indicated that direct medical costs were closely linked to the JKN rate, revealing a positive average difference of Rp1,314,544. This underscores the need for a thorough evaluation of the efficiency of the JKN claim budget. However, from the hospital's perspective as the provider, this presents a favorable aspect concerning the benefits received.

5. Declarations

5.1 Acknowledgements

The authors acknowledge the Directorate of Research, Technology, and Community Service of the Directorate General of Higher Education, Ministry of Education, Culture, Research and Technology of the Republic of Indonesia. Appreciation is also extended to Abdoel Wahab Sjahranie Regional General Hospital, Universitas Mulawarman, and Universitas Muhammadiyah Kalimantan Timur.

5.2 Author Contributions

EA and RNA were primarily responsible for conducting the literature review, formulating the research protocol, and preparing the first draft of the manuscript. BDP, APA, AR, and MFHF led the design of the data collection process and oversaw licensing procedures and ethical clearance. All authors contributed to data analysis and reviewed and approved the final manuscript.

5.3 Ethics

The Health Research Ethics Committee of Abdoel Wahab Sjahranie Regional General Hospital has formally granted ethical approval for this research, as documented under reference number 508/KEPK-AWS/VIII/2024.

5.4 Conflict of Interest

The authors declare that there are no conflicts of interest associated with this research.

5.5 Funding Statement

This study was funded by the Directorate of Research, Technology, and Community Service, Directorate General of Higher Education, Ministry of Education, Culture, Research and Technology of the Republic of Indonesia (Contract No. 113/E5/PG.02.00.PL/2024).

6. Bibliography

- [1] T. Agustin, "Potential of Active Metabolites in Cruciferous Vegetables to Inhibit Cancer Cell Growth," *Journal of Professional Nursing Research*, vol. 1, no. November, pp. 89–94, 2020.
- [2] K. P. Pratama and A. A. Adrianto, "Factors Affecting the Incidence of Stage III Colorectal Cancer at Dr. Kariadi Hospital Semarang," *Diponegoro Medical Journal*, vol. 8, no. 2, pp. 768–784, 2019.
- [3] F. T. Kurniawati and F. Rukminingsih, "Direct Medical Costs For Chemotherapy For Colorectal Cancer Patients Class 3 Treatment Room For JKN Participants at Hospital "X" In Semarang City," *Indonesian Journal of Pharmaceutical Research*, vol. 7, no. 2, pp. 292–302, 2025, doi: 10.33759/jrki.v7i2.738.
- [4] GLOBOCAN, "Cancer statistics for the year 2020: An overview," *International Journal of Cancer*, vol. 149, no. 4, pp. 778–789, 2022, doi: 10.1002/ijc.33588.
- [5] H. Sung *et al.*, "Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries," *CA: A Cancer Journal for Clinicians*, vol. 71, no. 3, pp. 209–249, 2021, doi: 10.3322/caac.21660.
- [6] A. B. Manalu, "Literature Review Study: Factors Affecting Nurses' Knowledge Level About Cytotoxic Effects in the Management of Chemotherapy Drug Administration on the Environment in 2020," *Health Journal*, vol. 10, no. 2, pp. 19–30, 2021, doi: 10.37048/kesehatan.v10i2.357.
- [7] K. Banga Allo, "Factors Associated with Cancer Patients' Motivation to Undergo Chemotherapy at Hospital X," *Health Journal*, vol. 9, no. 1, pp. 1–10, 2021, doi: 10.35913/jk.v9i1.224.
- [8] Indonesian Ministry of Health, "Minister of Health Decree Number HK.01.07/MENKES/2197/2023 on National Formularium."
- [9] K. F. Hamidah, M. Rahmadi, E. Abdissalam, I. Septiani, F. N. Utomo, and W. R. Batubara, "Medication complexity and COVID-19 pandemic impact on the cost burden in non-COVID elderly patients at the emergency department," *Pharmacy Education*, vol. 23, no. 4, pp. 264–268, 2023, doi: 10.46542/pe.2023.234.264268.
- [10] N. Iragorri, C. de Oliveira, N. Fitzgerald, and B. Essue, "The out-of-pocket cost burden of cancer care—a systematic literature review," *Current Oncology*, vol. 28, no. 2, pp. 1216–1248, 2021, doi: 10.3390/curroncol28020117.
- [11] D. Kinanti, Putri, U. Athiyah, Y. Nita, and M. Diansyah, Noor, "Comparative Analysis of Actual Cost and INA CBG Rate in Diabetic Gangrene Inpatients Diajeng," vol. 8, no. 3, pp. 250–258, 2021.
- [12] B. Suprapti, M. Yusuf, M. D. Saraswati, S. F. Astuti, and D. Damayanti, "The ABC Analysis of Drug Use and Cost in Cardiology Outpatients -National Health Insurance," *Jurnal Farmasi Dan Ilmu Kefarmasian Indonesia*, vol. 9, no. 2, pp. 193–199, 2022, doi: 10.20473/jfiki.v9i2.2022.193-199.
- [13] I. Baraibar *et al.*, "Sex and Gender Perspectives in Colorectal Cancer," *ESMO Open*, vol. 8, no. 2, p. 101204, 2023, doi: 10.1016/j.esmoop.2023.101204.
- [14] S. J. Zannah, I. S. Murti, and S. Sulistiawati, "Relationship Between Age and Stage at Diagnosis of Colorectal Cancer Patients at Abdul Wahab Sjahrane Hospital Samarinda," *Journal of Science and Health*, vol. 3, no. 5, pp. 701–705, 2021, doi: 10.25026/jsk.v3i5.629.

- [15] Indonesian Ministry of Health, *National Guidelines for Medical Services Management of Colorectal Cancer*. 2019.
- [16] Y. Yulistiani, E. Abdissalam, A. Rahem, N. F. Hamidi, and F. N. Utomo, "Cost burden of chemotherapy for Indonesian healthcare insurance and social security/Jaminan Kesehatan Nasional (JKN) patients with non-Hodgkin lymphoma," *Journal of Oncology Pharmacy Practice*, Jun. 2024, doi: 10.1177/10781552241261250.
- [17] Z. Liu, *Gastrointestinal Cancers*. 2019. doi: 10.1201/9781351208277-17.
- [18] G. Menon and B. Cagir, *Colon Cancer*. 2025.
- [19] S. Akash *et al.*, "In silico evaluation of anti-colorectal cancer inhibitors by Resveratrol derivatives targeting Armadillo repeats domain of APC: molecular docking and molecular dynamics simulation," *Frontiers in Oncology*, vol. 14, Apr. 2024, doi: 10.3389/fonc.2024.1360745.
- [20] P. Rawla, T. Sunkara, and A. Barsouk, "Epidemiology of colorectal cancer: incidence, mortality, survival, and risk factors.," *Przeglad gastroenterologiczny*, vol. 14, no. 2, pp. 89–103, 2019, doi: 10.5114/pg.2018.81072.
- [21] J. Gao, L. Zhuang, C. He, X. Xu, Z. Zhu, and W. Chen, "Risk and prognostic factors in patients with colon cancer with liver metastasis.," *The Journal of international medical research*, vol. 51, no. 9, p. 3000605231191580, Sep. 2023, doi: 10.1177/03000605231191580.
- [22] Y. Song, Q. Mao, M. Zhou, C. J. Liu, L. Kong, and T. Hu, "Effectiveness of bevacizumab in the treatment of metastatic colorectal cancer: a systematic review and meta-analysis," *BMC Gastroenterology*, vol. 24, no. 1, pp. 1–12, 2024, doi: 10.1186/s12876-024-03134-w.
- [23] A. Patel and W. Sun, "Ziv-afibercept in metastatic colorectal cancer," *Biologics: Targets and Therapy*, vol. 8, pp. 13–25, 2013, doi: 10.2147/BTT.S39360.
- [24] N. Aisyah and S. P. Dina, "Cost of Illness in Breast Cancer Patients at Ulin Hospital Banjarmasin," *Journal of Pharmaceutical Sciences and Health*, vol. 5, no. 2, pp. 407–415, 2020, doi: 10.36387/jiis.v5i2.573.
- [25] S. Giatna, W. Supadmi, and E. Yuniarti, "Direct Medical Costs and Side Effects of Chemotherapy in Colorectal Cancer Patients in Class 3 Hospital Rooms Participants of JKN in Semarang City," *Indonesian Journal of Clinical Pharmacy*, vol. 12, no. 2, pp. 118–128, 2025, doi: 10.15416/ijcp.2023.12.2.47215.
- [26] Y. Nilmawati, A. Yanie, and M. M. A. Saputera, "Analysis of the Difference Between Real Costs and INA-CBG Tariffs with Factors Affecting Costs in Inpatient JKN Patients at Setara Clinic Barito Kuala," *Syifa Pharmacy Journal*, vol. 3, no. 1, pp. 17–21, 2025, doi: 10.63004/jfs.v3i1.604.
- [27] Y. Andriani, S. A. Kristina, and C. Wiedyaningsih, "Estimated Direct Medical Costs for Cancer Treatment in Indonesia: Estimated Direct Medical Costs (DMC)," *Pharmaceutical Journal*, vol. 17, no. 3, pp. 251–255, 2021, doi: 10.22146/farmaseutik.v1i1.49823.
- [28] A. R. Amalia, "Analysis of Medical Costs and Compliance with INA-CBG Tariffs in Colorectal Cancer Patients at Dr. Moewardi Hospital Surakarta in 2018," *Indonesian Journal of Pharmacy*, vol. 18, no. 2, pp. 121–132, 2021, doi: 10.31001/jfi.v18i2.823.
- [29] E. Kristin *et al.*, "Economic Evaluation of Adding Bevacizumab to Chemotherapy for Metastatic Colorectal Cancer (mCRC) Patients in Indonesia," *Asian Pacific Journal of Cancer Prevention*, vol. 22, no. 6, pp. 1921–1926, Jun. 2021, doi: 10.31557/APJCP.2021.22.6.1921.
- [30] C. D. Mullins, F.-Y. Hsiao, E. Onukwugha, N. B. Pandya, and N. Hanna, "Comparative and cost-effectiveness of oxaliplatin-based or irinotecan-based regimens compared with 5-fluorouracil/leucovorin alone among US elderly stage IV colon cancer patients.," *Cancer*, vol. 118, no. 12, pp. 3173–81, Jun. 2012, doi: 10.1002/cncr.26613.
- [31] Y. Yulistiani, E. Abdissalam, A. Rahem, N. F. Hamidi, and F. N. Utomo, "Cost burden of chemotherapy for Indonesian healthcare insurance and social security/Jaminan Kesehatan

Nasional (JKN) patients with non-Hodgkin lymphoma," *Journal of Oncology Pharmacy Practice*, vol. 30, no. 6, pp. 1096–1100, Oct. 2024, doi: 10.1177/10781552241261250.

[32] E. Abdissalam, *Health Financing and The Development of Health Financing Through Health Insurance In Indoensian*. CV. Eureka Media Aksara, 2025.

[33] S. Putri *et al.*, "Cetuximab as first-line treatment for metastatic colorectal cancer (mCRC): a model-based economic evaluation in Indonesia setting," *BMC Cancer*, vol. 23, no. 1, pp. 1–12, 2023, doi: 10.1186/s12885-023-11253-y.