

Research Article

Economic Burden of Chemotherapy in Non-Hodgkin Lymphoma Patients under Indonesia's National Health Insurance (JKN): A Cost of Illness Analysis in Samarinda

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Abstract

Non-Hodgkin lymphoma is a common hematological malignancy for which chemotherapy remains the primary treatment modality, often imposing a substantial economic burden on patients and healthcare systems. This study estimated the economic burden of chemotherapy among patients with non-Hodgkin lymphoma treated at a state referral hospital in INA-CBG Region 4 under Indonesia's National Health Insurance (JKN). A retrospective, prevalence-based cost-of-illness study was conducted from a societal perspective using 81 chemotherapy episodes recorded during July–December 2024. Clinical and cost data were obtained from medical records, hospital payment records, and structured patient interviews. Direct medical, direct non-medical, and indirect costs were estimated for each chemotherapy episode. Descriptive statistics were used to summarize the study data. The total economic burden of chemotherapy was Rp492,176,376, with a median cost of Rp3,151,375 per chemotherapy episode. Direct medical costs accounted for the largest proportion of total expenditures, primarily driven by pharmaceutical costs (Rp324,567,593). Direct non-medical costs totaled Rp56,206,760 (median Rp66,000), while indirect costs amounted to Rp7,451,631 (median Rp125,000). These findings demonstrate that the economic burden of chemotherapy extends beyond reimbursed medical services and underscore the importance of incorporating patient-incurred non-medical and productivity costs into evaluations of financial protection strategies under the JKN program.

Keywords: INA-CBG; health financing; pharmacoeconomics; societal perspective; healthcare costs.

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1 Introduction

Lymphoma encompasses a diverse spectrum of neoplasms arising from lymphocyte populations, particularly B cells, T cells, and natural killer cells, which are integral components of the lymphatic system. These malignancies are characterized by significant heterogeneity regarding their histopathological features, clinical presentations, treatment responses, and prognostic implications. Such variability underscores the complexity of lymphoma as a disease entity, necessitating a nuanced understanding for effective diagnosis and management [1].

Non-Hodgkin lymphoma (NHL) is among the most prevalent forms of lymphoma, characterized as a malignant condition arising from immune system cells. It commonly manifests as lymphadenopathy or solid tumors. The onset of this disease is often precipitated by genetic alterations in the cells, which may involve mutations, duplications, deletions, or chromosomal translocations. Additionally, various subtypes of lymphoma exhibit distinct genetic features, such as BCL2 gene expression in follicular lymphoma and MYC expression in Burkitt's lymphoma [2], [3]. The NHL classification is clinically divided into two distinct categories based on prognostic outcomes: indolent and aggressive lymphomas. Indolent lymphomas are characterized by slow progression and are associated with a favorable survival prognosis, often leading to a median survival of approximately ten years. In contrast, aggressive lymphomas progress rapidly but typically respond more effectively to intensive combination chemotherapy regimens [4], [5].

According to the 2022 Global Cancer Observatory (GLOBOCAN) data, NHL is ranked among the ten most prevalent cancers worldwide. The reported statistics indicate an incidence of 553,389 new cases and a noteworthy mortality rate, with 250,679 deaths attributed to this malignancy across the globe [6], [7]. In Indonesia, this disease ranks eighth in prevalence, with 19,826 new cases reported, representing 4.2% of the overall total. Additionally, there have been 9,367 recorded fatalities, which account for 3.3% of the total cases [8].

NHL is generally approached through two principal treatment modalities: radiotherapy and chemotherapy [9]. Chemotherapy is frequently the preferred choice for treating advanced or metastatic cancer due to its efficacy. This treatment may utilize one or more cytotoxic drugs; however, while it effectively targets cancer cells, it also negatively affects rapidly dividing normal cells, resulting in significant side effects [4], [10].

Cancer generally presents a significant economic burden due to elevated treatment costs, ongoing healthcare utilization, and productivity losses encountered by patients and their families [11]. In patients diagnosed with NHL, chemotherapy serves as the foundational approach to treatment; however, it is also a significant factor contributing to healthcare expenditures. This financial burden arises from the necessity of multiple cycles of treatment, the need for supportive care, and the utilization of high-cost pharmacological agents [12], [13]. Previous studies have mainly focused on quantifying chemotherapy costs within individual hospitals or particular treatment contexts. For instance, a preceding study conducted in Indonesia revealed an average chemotherapy cost of Rp5,178,146 per episode (excluding cytotoxic drugs). In this study, rituximab accounted for the highest pharmaceutical expenditure, while the R-CHOP-Bleo regimen resulted in the greatest overall treatment cost [14]. Existing studies have yielded limited insights into the broader economic burden faced by patients, particularly concerning direct non-medical and indirect costs. This limitation is especially pronounced in regions characterized by geographical barriers and diverse levels of healthcare accessibility.

In Indonesia's National Health Insurance (Jaminan Kesehatan Nasional, JKN) system, healthcare reimbursement is managed through the Indonesian Case-Based Groups (INA-CBG) framework, which categorizes hospitals into various regional groupings. INA-CBG Region 4 includes provinces in eastern Indonesia, where patients often travel long distances to obtain referral oncology services. This can lead to increased transportation expenses, productivity losses, and other non-medical costs that exceed those typically seen in more urbanized areas [15], [16]. Beyond geographical dispersion, variations in referral patterns, the availability of oncology services, medication procurement processes, and healthcare infrastructure may contribute to regional differences in treatment costs within the JKN system. While previous studies have assessed chemotherapy costs in Indonesia, there is limited evidence that

comprehensively addresses the economic burden from a societal perspective, specifically in INA-CBG Region 4. This gap in evidence hinders policymakers from fully grasping the financial implications of cancer treatment and from optimizing financial protection strategies under the JKN program [17], [18].

This study seeks to estimate the economic burden of chemotherapy for patients with NHL receiving treatment at a state referral hospital in the INA-CBG Region 4. Utilizing a prevalence-based cost-of-illness approach from a societal perspective, this research incorporates direct medical costs, direct non-medical costs, and indirect costs. By providing comprehensive evidence on the patient-level economic burden of chemotherapy in an underrepresented region of Indonesia, the findings aim to inform future resource allocation and healthcare financing policies within the JKN system.

2 Method

This research utilized a retrospective, prevalence-based cost-of-illness (COI) framework from a societal perspective to assess the financial impact of chemotherapy for individuals with NHL under Indonesia's National Health Insurance (JKN). The analysis focused on specific chemotherapy episodes instead of individual patients [16]. The study was reported, where applicable, in accordance with the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) 2022 guidelines. It was carried out at a state general hospital within INA-CBG Region 4 and focused on chemotherapy episodes that occurred during the latter half of the 2024 fiscal year (from July to December).

The study population consisted of patients diagnosed with NHL who received chemotherapy under the JKN scheme throughout the study period. Chemotherapy episodes were considered eligible for inclusion only if complete data on healthcare resource utilization and associated costs were available. Episodes with incomplete medical or financial records, patients who passed away before completing treatment, or those referred to other healthcare facilities were excluded from the analysis.

Cost estimation utilized a prevalence-based cost-of-illness approach, which involved identifying, measuring, and valuing the healthcare resources consumed during each chemotherapy episode. All costs were assessed according to the 2024 hospital tariffs and patient expenditures, and are presented in Indonesian Rupiah (IDR). No discounting was applied, as the study period was less than one year. The analysis encompassed direct medical costs, direct non-medical costs, and indirect costs. Direct medical costs were sourced from hospital payment records, while direct non-medical and indirect costs were gathered through structured interviews with patients. To enhance data consistency and reduce recall bias, information collected through patient interviews regarding transportation expenses and productivity losses was cross-verified with chemotherapy schedules and hospital visit records whenever feasible.

Secondary data derived from medical and hospital financial records were utilized to gather comprehensive clinical characteristics, chemotherapy regimens, healthcare resource utilization, and associated direct medical costs. Additionally, structured patient interviews were implemented to estimate transportation expenses and productivity losses, which were not captured in the existing hospital records.

Descriptive statistics were employed to summarize patient characteristics, chemotherapy regimens, and cost components. Categorical variables are presented as frequencies and percentages. Continuous variables related to healthcare costs are summarized as mean $\pm$ standard deviation (SD) and median (interquartile range [IQR]) to accommodate the typically right-skewed distribution of cost data. All cost estimates were calculated per chemotherapy episode, which served as the unit of analysis. Statistical analyses were conducted using Microsoft Excel version 2508 and IBM SPSS Statistics version 25.

3 Result and Discussion

3.1 Results

A total of 81 chemotherapy episodes met the established inclusion and exclusion criteria and were therefore included in the final analysis. Several episodes were excluded due to incomplete medical records, patient mortality before completion of chemotherapy, or referral to an alternative healthcare facility.

Table 1 Sample Characteristics

Characteristics	Categories	n	%
Gender	Male	58	71.60
	Female	23	28.40
Age (years old) [19]	10-19	6	7.41
	20-29	2	2.47
	30-39	3	3.70
	40-49	10	12.35
	50-59	27	33.33
	60-69	26	32.10
	70-79	7	8.64
JKN Class	Class 1	44	54.32
	Class 2	5	6.17
	Class 3	32	39.51
Length of Stay (days)	1	75	92.94
	2	5	5.88
	3	1	1.18
Regency/City of Origin	Berau Regency	3	3.70
	Bulungan Regency	5	6.17
	Kampar Regency (Riau)	3	3.70
	Kutai Barat Regency	4	4.94
	Kutai Kartanegara Regency	5	6.17
	Kutai Timur Regency	1	1.23
	Penajam Paser Utara Regency	5	6.17
	Tabalong Regency (South Kalimantan)	1	1.23
	Balikpapan City	1	1.23

Samarinda City	53	65.43
Total	81	100

The chemotherapy regimen administered to patients diagnosed with NHL at a state general hospital within INA-CBG Region 4 is detailed as follows.

Table 2 Chemotherapy Regimens

Chemotherapy Regimens	n	%
ABVD (Doxorubicin, Bleomycin, Vincristine, Dacarbazine)	3	3.70
CHOP (Cyclophosphamide, Doxorubicin, Vincristine, Prednisone)	36	44.44
CV-R (Cyclophosphamide, Vincristine, Rituximab)	1	1.23
CVP (Cyclophosphamide, Vincristine, Prednisone)	3	3.70
R-CE (Rituximab, Cyclophosphamide, Etoposide)	2	2.47
R-CHOP (Rituximab, Cyclophosphamide, Doxorubicin, Vincristine, Prednisone)	25	30.86
R-CHOP-Bleo (Rituximab, Cyclophosphamide, Doxorubicin, Vincristine, Prednisone, Bleomycin)	3	3.70
R-CVP (Rituximab, Cyclophosphamide, Vincristine, Prednisone)	6	7.41
VCR-Pred (Vincristine, Prednisone)	1	1.23
Vincristine	1	1.23
Total	81	100

As indicated in Table 2, the CHOP chemotherapy regimen emerged as the predominant treatment, encompassing 36 administration episodes, which represents 44.44% of the total. This was followed by the R-CHOP regimen, accounting for 25 episodes (30.86% of the overall chemotherapy interventions). The remaining chemotherapy regimens were administered with significantly lower frequency.

Table 3 Cost of Illness for NHL Chemotherapy

Costs	Categories	Total (Rp)	Mean $\pm$ SD (Rp)	Median (IQR) (Rp)
(n = 81)				
Direct	Pharmaceuticals	324,567,593	4,007,007 $\pm$ 4,095,487	1,126,889 (6,769,701)
Medical Cost	Inpatient	9,225,000	113,889 $\pm$ 40,942	150,000 (85,000)
	Nutrition	7,315,000	90,309 $\pm$ 15,255	100,000 (25,000)
	Nursing Care	26,182,152	323,236 $\pm$ 127,910	309,080 (26,315)

	Laboratory	1,775,650	295,942 ± 165,090	382,075 (312,250)
	Chemotherapy	53,460,000	660,000 ± 0	660,000 (0)
	Medical Records	2,835,000	35,000 ± 0	35,000 (0)
	Physician Services	2,640,000	138,947 ± 120,192	75,000 (75,000)
	Ancillary Services	517,590	172,530 ± 95,499	122,331 (85,030)
	Total	428,517,985	5,836,860 ± 4,660,374	2,960,375 (7,463,325)
Direct Non-Medical Cost	Transportation	56,206,760	693,911 ± 1,353,525	66,000 (660,240)
	Total	56,206,760	693,911 ± 1,353,525	66,000 (660,240)
Indirect Cost	Productivity Loss	7,451,631	91,995 ± 59,035	125,000 (125,545)
	Total	7,451,631	91,995 ± 59,035	125,000 (125,545)
Overall Cost		492,176,376	6,622,766 ± 6,072,935	3,151,375 (8,249,110)

Table 3 outlines the economic burden linked to chemotherapy, encompassing direct medical, direct non-medical, and indirect costs. Direct medical expenses represented the largest share of total expenditures, primarily driven by pharmaceutical costs. Following this, direct non-medical costs, which mainly included transportation expenses, constituted the second-largest component. In contrast, indirect costs accounted for the smallest portion of the overall economic burden.

Table 3 Pharmaceutical Costs Breakdown

Categories	Total (Rp)	Mean ± SD (Rp)	Median (IQR) (Rp)
(n = 81)			
Cytotoxic Agents	305,511,322	3,771,745 ± 4,072,680	896,387 (6,752,075)
Non-Cytotoxic Agents	9,229,187	113,941 ± 92,809	104,839 (33,652)
Medical Devices & Consumables	9,827,084	121,322 ± 45,979	126,307 (30,001)
Pharmaceutical Cost	324,567,593	4,007,007 ± 4,095,487	1,126,889 (6,769,701)

Table 4 presents a systematic categorization of pharmaceutical spending into three distinct groups: cytotoxic agents, non-cytotoxic agents, and medical devices and consumables. The analysis demonstrates that cytotoxic agents represented the largest segment of total pharmaceutical expenditures, while non-cytotoxic agents and medical devices comprised relatively smaller portions of the overall costs.

3.2 Discussion

3.2.1 Characteristics of the Study Population

The demographic characteristics observed in this study were generally consistent with previous reports. Most chemotherapy episodes involved male patients aged 50–59 years, reflecting the epidemiological pattern of NHL reported in Indonesia and other Asian countries [20], [21]. The JKN scheme offers three classes of service for patients, designed to align inpatient facilities with participants' financial capabilities [22]. In this study, the higher representation of patients in JKN Class 1 and Class 3 may indicate variations in socioeconomic preferences and insurance enrollment categories rather than differences in disease severity; however, these factors were not specifically examined in the current study. Additionally, the majority of chemotherapy sessions were completed within a single day, suggesting that outpatient chemotherapy continues to be the standard treatment approach for patients with NHL undergoing systemic therapy [23], [24], [25], [26].

A significant finding of this study was the extensive geographic distribution of patients receiving chemotherapy. Over one-third of chemotherapy episodes involved individuals residing outside of Samarinda, highlighting the role of the study hospital as a regional referral center for oncology services in eastern Kalimantan. This geographic trend helps to explain the considerable direct non-medical costs identified in the study, particularly the expenses related to transportation. It also demonstrates that the financial burden under the JKN scheme extends beyond the reimbursed medical services, as patients from remote districts incur substantial out-of-pocket costs to access specialized cancer treatment. This widespread distribution of patient residences emphasizes the need for more equitable access to chemotherapy referral services across various geographic regions [26].

3.2.2. Chemotherapy Regimens

Among the ten available chemotherapy regimens, the CHOP and R-CHOP protocols were the most commonly administered, representing 36 (44.44%) and 25 (30.86%) chemotherapy episodes, respectively. The CHOP regimen consists of cyclophosphamide, doxorubicin, vincristine, and prednisone, whereas R-CHOP is an adapted version that adds rituximab as a targeted therapeutic agent [27], [28]. This observation aligns with previous studies by Salma et al. [29] and Susanti et al. [30], both of which identified CHOP-based regimens as the predominant treatment for patients with NHL. The prevalence of CHOP-based regimens reflects current clinical practice, as CHOP remains the recommended first-line chemotherapy for many subtypes of NHL due to its established efficacy and safety profile [31], [32]. The widespread use of this regimen in the study may also indicate its routine availability within the tertiary referral hospitals participating in the JKN program.

3.2.3. Economic and Policy Implication

The predominant share of pharmaceutical expenditure is anticipated due to the nature of chemotherapy, which involves the repeated administration of high-cost anticancer medications over multiple treatment cycles. Unlike acute conditions that require short-term pharmacotherapy, the NHL often necessitates combination regimens lasting several months, significantly elevating cumulative medication costs. This observation aligns with prior pharmacoeconomic studies indicating that anticancer therapies are the primary contributors to direct medical expenses in hematological malignancies [12], [14], [33], [34]. Although previous Indonesian studies also identified pharmaceutical expenditure as the largest cost component, differences in absolute cost estimates may reflect variations in hospital characteristics, treatment protocols, medicine procurement, and patient referral patterns across regions.

Transportation accounted for the largest portion of direct non-medical costs. This observation is likely related to the hospital's function as a referral center, catering to patients from various districts

throughout East Kalimantan and neighboring provinces. The geographical features of INA-CBG Region 4, such as extended travel distances and the limited availability of oncology services outside major urban areas, likely contribute to the relatively high transportation costs noted in this study [35].

Although indirect costs accounted for the smallest proportion of total expenditures, they should not be overlooked. Productivity losses reflect the opportunity costs experienced by patients and accompanying family members during repeated chemotherapy episodes [36]. Their relatively low contribution in this study may partly reflect the predominance of older patients, many of whom were no longer engaged in full-time employment, thereby reducing measurable income loss.

From a health policy perspective, these findings underscore the need for evaluations of cancer financing under the JKN program to extend beyond just reimbursed medical expenditures. Patient-incurred transportation costs and productivity losses are significant components of the overall economic burden, especially in geographically diverse areas like INA-CBG Region 4. Consequently, policies aimed at improving geographical access to oncology services, enhancing referral coordination, and implementing supportive measures to alleviate transportation-related financial challenges may bolster financial protection while ensuring equitable access to chemotherapy under the JKN program.

3.2.4. Study Limitations

This study has several limitations worth noting. First, it was conducted at a single referral hospital, which may restrict the generalizability of the findings to other healthcare settings. Second, the retrospective design relied on the completeness of hospital records and patients' recall for non-medical and indirect costs. Third, this study assessed the economic burden without evaluating clinical outcomes or cost-effectiveness; consequently, the findings should not be interpreted as evidence regarding the value of specific chemotherapy regimens.

Despite its limitations, this study presents several significant strengths. Firstly, it adopts a societal perspective, enabling estimation of patient-incurred costs that extend beyond reimbursed medical expenses. Secondly, by integrating direct medical, direct non-medical, and indirect costs, this study offers a more comprehensive evaluation of the economic burden than analyses that focus solely on healthcare provider costs. Finally, this research contributes valuable evidence from the INA-CBG Region 4, an area where information regarding the economic burden of cancer chemotherapy remains limited.

Future multicenter studies employing extended observation periods, diverse healthcare settings, and comprehensive patient outcome measures are necessary to enhance the evidence base for economic evaluations of cancer care within the framework of the Jaminan Kesehatan Nasional (JKN) system.

4 Conclusion

This study reveals that chemotherapy for patients with NHL under Indonesia's National Health Insurance (JKN) creates a significant economic burden, with direct medical costs accounting for the largest portion of total expenditures. Moreover, direct non-medical costs, especially transportation expenses, also represent a considerable financial strain for patients undergoing repeated chemotherapy. In contrast, indirect costs associated with productivity loss contribute a comparatively smaller share. These findings underscore that the financial impact of cancer treatment extends beyond merely hospital-based medical expenses.

From a policy standpoint, the findings provide valuable evidence that could inform the evaluation of financial protection strategies and the allocation of resources for oncology services within the JKN system. This is particularly pertinent in regions with extensive geographical coverage and limited access to referral healthcare facilities. Future studies should include larger multicenter populations, extend

observation periods, and analyze factors related to healthcare costs to produce more robust evidence supporting cancer financing policies in Indonesia.

5 Declarations

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5.2 Author contributions

EA served as the principal investigator, conceptualized and designed the study, and provided overall supervision of the research process and manuscript preparation. SY was primarily responsible for conducting the research, including study implementation, data collection, and data analysis, and drafted the initial version of the manuscript. BN, FAY, and SDH contributed to the critical revision of the manuscript, refinement of the report, and verification of the data. All authors reviewed and approved the final version of the manuscript.

5.3 Ethics

Ethical clearance was granted by the Health Research Ethics Committee of Abdoel Wahab Sjahranie Regional General Hospital (KEPK AWS) under approval number 27/KEPK-AWS/IV/2025.

5.4 Conflict of Interest

The authors declare no conflicts of interest related to this study.

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