Measuring the national tariff and patient economic burden of chemotherapy treatment for lymphoma cancer

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Abstract

Background: Chemotherapy is the most current alternative treatment that requires many resources and long-term arrangements. All stages of lymphoma cancer use this therapeutic modality. The costs become a financial burden for patients, families, service providers, and the government. **Objective:** This study aims to estimate the economic burden and measure the adequacy of national tariffs for lymphoma cancer patients' chemotherapy. **Method:** This research is a cost analysis study examining retrospective data. The analysis uses a prevalence approach and bottom-up processes. The secondary data comprises treatment and claim costs borne by lymphoma cancer patients undergoing chemotherapy at a teaching hospital in Indonesia from May 2020 to May 2021. Quantitative analysis was used to calculate the cost of illness. **Results:** The data shows that the economic burden of 55 lymphoma cancer patients receiving chemotherapy was USD 38,958.70 per year. Lymphoma patients paid USD 708.34 or about one-six GDP for each chemotherapy visit. The margin between the value of insurance claims and medical costs is from USD 8.41 to 110.51. **Conclusion:** The economic burden for lymphoma chemotherapy is unreasonable, but the revenue from the national tariffs is minimal. Hence, the government should promote prevention programmes more than curative ones to minimise lymphoma cancer.

Introduction

Lymphoma is a blood cancer caused by abnormal growth of malignant lymphocyte cells invading the lymphatic system, such as lymph nodes (National Health Commission of the PRC, 2022). In general, lymphoma cancer can be divided into Hodgkin's lymphoma (HL) and non-Hodgkin's lymphoma (NHL). This classification is based on histopathological margins. In HL, the typical histopathological picture is characterised by the presence of Reed-Sternberg cells (Stricker & Kumar, 2021). Global Cancer Observatory (GLOBOCAN) Data in 2020 shows that lymphoma has the highest number of new cases in Indonesia (Sung *et al.*, 2021). The World Health Organization (WHO) stated that lymphoma cancer had the highest number of new cases in 2020 (Sung *et al.*, 2021; The Global Cancer Observatory, 2020).

Lymphoma cancer in stages 1 to 4 can only be treated with radiation, chemotherapy, or both (Horwitz et al., 2016; Hoppe *et al.*, 2020). Chemotherapy is a cancer treatment that uses one or more drugs to stop the growth and kill cancer cells. When the cancer is in micro-metastasis, systemic chemotherapy is suitable (Crawford, 2013). However, it requires a high cost and

a long-term commitment (Puspandari *et al.*, 2015). Cancer treatment costs have increased by 10% in the last five years. Lymphoma is among the top five cancers with the most extensive national medical services (Mariotto *et al.*, 2020; National Cancer Institute, 2023). WHO argued that the increasing availability of cancer diagnosis and treatment services is directly proportional to a country's increasing income (Kementrian Kesehatan Republik Indonesia, 2012).

Sound financial planning for cancer treatment is needed to create a robust health system. However, the challenges in financing cancer therapy, especially chemotherapy over a long period, have not been defined. In addition, the insurance claim payments based on diagnosis-related groups that consider case-mix, case-base and severity levels have never been calculated. Considering this, the current study aims to 1) Discover the cost of care and economic burden (Cost of Illness) of lymphoma chemotherapy and 2) examine the adequacy of the national health insurance payment system in this context.

Methods

Research design and setting

This study used a bottom-up prevalence approach to examine the cost of illness (COI). Data was collected through non-randomisation and purposive sampling techniques to assess patient visit costs. The inclusion criterion is a chemotherapy visit for lymphoma cancer treatment at Airlangga University Hospital between May 2020 and May 2021. The data is secondary data on patient care costs. Ethical approval, numbered No. 007/KEP / 2022, was obtained through the Health Research Ethics Committee of Airlangga University Hospital.

Data sources

As mentioned previously, the inclusion criteria are hospital treatment costs for lymphoma cancer patients undergoing chemotherapy at a teaching hospital, Airlangga University Hospital, regardless of the treatment cycle. The exclusion criteria from this study are the data with missing information about the costs, such as billing data, cashier's billing, and claims of the case mix at Airlangga University Hospital.

Variables and data measurement

The economic burden or cost of illness (COI) is obtained by summing the direct medical costs, non-direct medical costs and indirect costs in patient care (Jo, 2014)*.* The economic burden in this research is from the

patient's perspective. In this study, direct medical costs include treatment costs and supporting costs such as administrative costs, drug costs, cost of medical services, cost of medical devices, the cost of medical procedures, and laboratory and hospitalisation costs (Kementrian Kesehatan Republik Indonesia, 2020). Meanwhile, non-direct medical costs include travelling from home to the hospital for chemotherapy. These are calculated by multiplying the round-trip distance, i.e., a car's fuel consumption (0.083 L/km). Indirect cost is calculated from the decreased productivity of patients and families of patients who had to leave work for treatment. The decreased productivity is calculated using a multiplication formula between two (person), the value of the patient's income per day according to the average regional minimum wages and the days spent for treatment.

Furthermore, this study assesses the margins in hospital income between the value of insurance claims and the variable medical costs. Medical costs are direct medical costs without the cost of services, while non-package rates of chemotherapy services are chemotherapy drugs (Kementrian Kesehatan Republik Indonesia, 2023a). In the package system implemented by the state, the margin in hospital income is used to pay for services and other needs.

Data analysis

All data obtained was totalled and grouped according to the cost type. The data analysis also considers the direct medical costs the hospital must incur and the margin between these costs and the national health insurance claims. A statistical analysis of the different medical variables and claims was done using the Wilcoxon signed-rank method.

Results

Data was collected from Airlangga University Hospital, involving 59 patients. Four participants were excluded from the process because they did not have a list of drugs or the cost of chemotherapy drugs in the hospital cashier's billing. Therefore, the final data consists of 55 visits by lymphoma cancer patients to receive chemotherapy (Table I). Based on the total visits, it is known that the age range undergoing chemotherapy treatment in lymphoma cancer patients was 15-64 years (productive age). Most patients (61.8%) came from Surabaya, where the study was conducted.

Table I: Demographic data of lymphoma cancer patients receiving chemotherapy

Criteria	Total n(%)
Gender	
Men	37 (67.3)
Women	18 (32.7)
Age*	
Adult (19-44 years old)	23 (41.8)
Pre-elderly (45-59 years old)	13 (23.6)
Elderly (> 60 years old)	19 (34.5)
National insurance class	
Class 1	33 (60.0)
Class 2	4 (7.3)
Class 3	20 (36.4)
Treatment type	
One-day care	30 (54.5)
Inpatient	26 (47.3)
Domicile	
Blitar	2 (3.6)
Madiun	2 (3.6)
Sampang	8 (14.5)
Sidoarjo	11 (20.0)
Surabaya	34 (61.8)

*Age groups by the Ministry of Health of the Republic of Indonesia

Patients with lymphoma cancer at Airlangga University Hospital receive seven chemotherapy regimens. Two of the seven chemotherapy regimens use a combination of rituximab monoclonal antibodies. Table II shows that the total cost incurred by the hospital to perform chemotherapy in lymphoma cancer patients amounted to USD 37,824.04. The margin in total billing is influenced by the margin in each type of chemotherapy drug and the number of drugs used in each chemotherapy regimen. Based on the hospital cashier's billing, the price of rituximab chemotherapy drug with a dose of 500 mg/500 ml is the most expensive chemotherapy drug in lymphoma cancer regimen compared to drugs. The value is USD 543.33.

The range of costs incurred by each patient who does chemotherapy needs to be calculated in more detail, including direct, non-medical, and indirect costs. The direct cost is the cost of hospital billing for each regimen deducted from the cost of chemotherapy drugs and the cost of services (services, medical services, and medical support). This is because the system of government insurance claims for chemotherapy drugs has a different system than other drugs. The other drugs use the Indonesian Case Base Group rates, so the chemotherapy drug claimed separately can't be issued in calculating the Indonesian Case Base Group claims (Kementrian Kesehatan Republik Indonesia, 2023b).

Based on Table II, the combination therapy of Rituximab, Cyclophosphamide, Vincristine, and Doxorubicin had the highest total COI, with a value of USD 14,975.0. This means, on average, all patients who use the regimen spent USD 1,018.17 for each chemotherapy visit.

Direct medical costs become the most crucial component in patients' total costs because this is the most significant expenditure compared to other costs. In line with the value of COI, direct medical cost is the largest in the Therapeutic regimen Rituximab, Cyclophosphamide, Vincristine and Doxorubicin, with an average of USD 998.33. Meanwhile, direct medical cost is the lowest in the therapeutic regimen of Cyclophosphamide, Vincristine, and Epirubicin, with a value of USD 358.12.

Direct non-medical cost calculation was done by calculating the estimated cost of transportation needed by the patient and the patient's family from home to the hospital. The transportation cost is calculated using the distance (in kilometres) and fuel needed for a car. Because the patient has less mobility and needs assistance from the family, it is estimated that all patients are transported to the hospital using four-wheeled vehicles. The calculation of direct non-medical costs varies because the house locations of the patients are different even though they have the same chemotherapy regimen. The lowest average direct non-medical cost is at the nearest domicile, with a distance of 2.9 km, and the highest is at the farthest domicile, 166 km from the research site.

Indirect cost is obtained from the decreased productivity of patients and their families and then converted into monetary value. The amount of productivity lost due to treatment depends on the length of stay (in days) and the amount of regional minimum wage. The lowest Indirect cost is in patients with Cyclophosphamide, Vincristine, and Doxorubicin therapy regimens with one-day treatment.

Table II shows that the difference between total variable medical costs and hospital claims is USD 3,977.44, which is paid by insurance and is greater than the expenditure on treatment costs incurred by the hospital. The most significant margin in the total cost and claims was in the Cyclophosphamide, Vincristine-Epirubicin, and bleomycin regimens, with a margin of USD 110.51 for each chemotherapy visit. Meanwhile, the regimentation with the smallest margin value is Cyclophosphamide, Vincristine, and Doxorubicin, which has a cost value greater than the claims. However, this study also found that the margin has not been used to support the examination of blood laboratory and health services.

Table II: Total cost of treatment and national tariff for lymphoma patients with chemotherapy

Chemotherapy regimen	Patient	Total hospital billing ($)	Mean direct medical cost[1]($)	Mean direct non-medical cost[2]($)	Mean indirect cost[3]($)	Total cost of illness[4] ($)	Total services and chemotherapy[5] ($)	Total variable medical cost[6]($)	Total insurance claim[7]($)	Δ Insurance claims - variable medical costs($)	Δ Claim/ chemothe rapy[8]	P value [9]	Z value [9]
Cyclophosphamide Vincristine Doxorubicin	3	1,245.14	415.05	6.03	12.50	433.58	1,077.81	167.33	142.11	(-) 25.22	(-) 8.41	-	-
Cyclophosphamide Vincristine Epirubicin	12	4,297.41	358.12	5.31	16.36	379.79	3,387.57	909.84	1,550.92	641.08	53.42	0.081	-1.569[b]
Cyclophosphamide Vincristine Epirubicin Bleomycin	7	2,720.30	388.61	2.36	19.59	410.57	2,343.45	376.85	1,150.38	773.54	110.51	0.063	-1.859[b]
Dacarbazine Epirubicin Bleomycin	2	796.11	402.76	2.36	19.59	424.71	720.53	75.58	94.74	19.16	9.58	-	-
Dacarbazine Bleomycin Vincristine Doxorubicin	3	1,208.29	398.05	0.29	20.09	418.44	1,043.26	165.03	469.63	304.60	101.53	-	
Rituximab Cyclophosphamide Vincristine Doxorubicin	15	14,975.00	998.33	3.73	16.10	1,018.17	14,095.43	879.57	2,046.53	1,166.97	77.80	0.011	-2.556[b]
Rituximab Cyclophosphamide Vincristine Epirubicin	13	12,581.80	967.83	0.48	20.09	988.40	11,934.20	647.59	1,744.92	1,097.32	84.41	0.033	-2.132[b]
Total	**55**	**37,824.04**	**3,928.76**	**20.57**	**124.33**	**4,073.66**	**34,602.26**	**3,221.78**	**7,199.22**	**3,977.44**	**428.84**		

[1]The average from the total hospital billing is divided by the number of patients on the chemotherapy regimen. Direct medical costs include the cost of treatment and supporting the treatment of patients, which includes administrative costs, the cost of drugs obtained by patients, medical service costs, medical device costs, medical procedure costs, laboratory costs, and discharge costs

[2]Direct non-medical cost include travel costs from the patient's domicile to the hospital (calculation of travel costs by multiplying the round-trip distance, a car's fuel consumption of 0.083 L/km and fuel prices in 2020-2021 around USD 0.53 / litre); [3]Indirect cost is the decreased productivity of patients and their families as they leave work for treatment; [4]The total cost of the disease consists of direct medical costs, direct non-medical costs, and indirect costs; [5]Total services include medical services, medical support, and other service; [6]Total variable medical costs are obtained from the margin in total hospital billing and (total cost of services + chemotherapy drugs)

[7]Total claim is the cost of chemotherapy paid by the insurance, with a separate claim reimbursing 100% of the cost of purchasing chemotherapy drugs according to the amount of insurance claim application

[8]The margin in total claims is obtained from the margin in total claims and total cost divided by the number of patients in each regimen; [9]p-values and z-values based on total claims and total costs

*Statistically significant difference (*p*-value <0.05); Conversion of IDR to USD using Bank Indonesia data in 2021, the conversion value per unit of USD is Rp 14,269

The Wilcoxon test was then performed to determine the margin between total costs and claims. Of the seven regimens, only four had a sample of more than five. The results showed that there were two significantly different regimens with a p-value of < 0.05, namely Rituximab-Cyclophosphamide, Vincristine, and Doxorubicin (p = 0.011; z value= -2.556[b]; p < 0.05) and Rituximab, Cyclophosphamide, Vincristine, and Epirubicin (p = 0.033; z value= -2.132[b]; p < 0.05). The other two regimens are not significantly different, so it can be said that the margin between the total costs and the claims is not significant. However, the four regimens have a claim value greater than the cost value at the Z value.

Discussion

This study performs a cost analysis using the central insurance database of the government of Indonesia. In implementing health insurance in Indonesia, the payment pattern to advanced health facilities is related to the insurance method called the Indonesian Case Base Group (INA-CBG) (Kementrian Kesehatan Republik Indonesia, 2023b). Each chemotherapy regimen has a different total billing. Similar studies have not been conducted in Indonesia to assess the economic burden of lymphoma cancer. Eastern Asia has the largest number of lymphoma cancer cases in the Asian region. Japan, a country in the Eastern Asian region, has researched the disease cost of follicular lymphoma cancer, where higher severity of the disease will affect the choice of therapy related to medical economics (Muneishi *et al.*, 2017). The previous study in France 2020 showed a similar trend to this research. A significant amount of the total costs is allocated for different types of lymphoma cancer (Mounié *et al.*, 2020). The total direct costs significantly increased depending on the disease's severity.

Several factors cause price differences in the two combinations of therapy. The first is from the number of drugs used. The most expensive regimen uses four combinations of drugs. Meanwhile, the regimen with lower prices uses three combinations of drugs. The most expensive chemotherapy drug in the lymphoma cancer regimen is rituximab, which is a monoclonal antibody drug formulated to work on a specific targeted therapy, CD20, in the lymphoma cancer (Pavlasova & Mraz, 2020). The development of monoclonal antibodies costs much more than conventional chemotherapy (Painschab *et al.*, 2021).

The choice of chemotherapy drugs and services prescribed influences the cost margin. The hospital management sets the cost of services for medical personnel (Kementrian Kesehatan Republik Indonesia, 2023b). Similar to other chronic diseases, the differences or margins in cost are limited (Negara et al., 2021). The capitation method decreases the value of expensive services (Paul III *et al.*,2014). Furthermore, it lowers the healthcare providers' performance, which leads to suboptimal services (Adida *et al.*, 2016). This study reveals that the margin is small, which may affect the income per room. When room admissions decrease, hospitals may experience losses (Foroughi *et al.*, 2022; Ly & Cutler, 2018). Due to this, hospital management should develop careful calculations for expenditure detail according to clinical pathway. After that, the managers of a hospital should establish a local legal umbrella for alert notification systems when treatment patterns deviate and review tariffs continuously. In this study, retrospective data retrieval provides limitations to access data on indirect costs other than transportation costs and limited data related to the severity of the disease. As expected in future research, data retrieval should analyse the severity, and indirect cost data can be obtained in detail.

Conclusion

Management of lymphoma cancer therapy requires excessive funding, depending on the therapy regimen and the severity of the disease. With the high COI and the limited coverage from the national health insurance claims, an alternative solution to minimise costs is needed. One way is by early detection of the disease so that the therapy regimen provided can use a first-line therapy with minimal costs.

Acknowledgement

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