

The Hidden Economic Burden of Hemodialysis Patients: Direct Non-medical Cost Correlation Based on Patient Characteristics

Mera Putri Pratitis*, Sintya Septa Damayanti, Hasty Martha Wijaya, Annis Rahmawaty

Institut Teknologi Kesehatan Cendekia Utama, Indonesia

*Corresponding Author: meraputripratitis@gmail.com

Abstract. Chronic Kidney Disease (CKD) patients undergoing hemodialysis is a chronic condition that requires ongoing health services and can cause economic burdens for patients and families. This study aims to analyze the economic burden of CKD patients undergoing hemodialysis based on direct non-medical costs and analyze the Correlation between these costs and patient characteristics. This study uses a non-experimental quantitative observational design with a retrospective and concurrent descriptive approach. The research sample was 48 CKD patients who underwent hemodialysis at X Kudus Hospital and was selected using purposive sampling. Non-medical cost data was directly obtained through interviews. Data analysis included Shapiro-Wilk and Chi-Square tests. The results showed that most of the patients were male (58.3%), aged 46–55 years (37.5%), working (64.6%), and undergoing hemodialysis for 1 year (47.9%). The most comorbidity was hypertension (58.3%). Based on the results of the analysis of direct non-medical costs of IDR 4,538,000 with an average of IDR 99,015.05. There was a significant correlation between direct non-medical costs and comorbidities of diabetes mellitus ($p=0.046$). This study shows that CKD patients undergoing hemodialysis face economic burdens not only from medical costs, but also from non-medical costs.

Keywords: CKD, hemodialysis, non-medical costs, economic burden.

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive condition characterized by damage or decreased kidney function so that the kidneys' ability to maintain the balance of body functions is disrupted. This condition can cause the accumulation of metabolic waste products and fluids in the body and increase the risk of various complications (Supramanian et al., 2024). CKD is one of the health problems that has a large clinical and economic impact. Globally, the prevalence of CKD continues to increase. Bikbov et al. (2020) reported that in 2017 there were around 697.5 million cases of CKD worldwide with a prevalence of around 9.1%, while the number of deaths due to CKD has also increased significantly.

In conditions of severe decline in kidney function, patients need kidney replacement therapy, one of which is through hemodialysis. Hemodialysis is a kidney function replacement therapy that aims to remove metabolic waste products and excess fluid from the body (Papadakis et al., 2020). Hemodialysis therapy is carried out repeatedly and in the long term so that it can cause an economic burden on patients and their families. This burden is not only in the form of medical costs related to health services, but also non-medical costs and loss of productivity due to the time spent undergoing treatment (Bello et al., 2022; Tania & Thabrany, 2017).

Although the financing of hemodialysis services has largely been guaranteed through the National Health Insurance program, patients are still charged other fee, such as transportation, meals, parking, and loss of income for patients and accompanying family members. This condition shows that the economic burden of the disease cannot be seen solely based on the cost of medical services. Kristina et al. (2021) also show that hemodialysis treatment in Indonesia incurs a cost burden that needs to be taken into account comprehensively.

One approach that can be used to describe the economic burden of a disease is Cost of Illness (COI). COI analysis is used to identify and measure the various resources used due to a disease, both direct costs and indirect costs (Jo, 2014). This approach can provide an overview of the amount of economic resources needed to manage a disease, although it is not used to determine the benefits or effectiveness of an intervention (Mattingly & Weathers, 2022).

Previous research has shown that patient characteristics are not always related to the amount of CKD service costs. Saputra et al. (2020) reported that patient characteristics based on gender, age, and comorbidities did not show a strong influence on total direct medical costs. However, the presence of

comorbidities and the length of time they undergo therapy can potentially increase the patient's service needs and economic burden.

X Kudus Hospital is one of the health service facilities that provides hemodialysis services for CKD patients. Based on the initial data of the study, there were 94 CKD patients undergoing hemodialysis in the period from January 2024 to May 2025. This condition is the basis for a more comprehensive analysis of the economic burden of CKD patients undergoing hemodialysis. Therefore, this study aims to analyze the economic burden of CKD patients undergoing hemodialysis using the Cost of Illness approach, which includes direct medical costs, direct non-medical costs, and indirect costs, as well as analyzing the differences and cost correlation with patient characteristics.

METHODS

This study has obtained an Ethics feasibility permit with Number: 28/KEPK/RSLH/VI/2025. This study is a non-experimental observational quantitative research with a descriptive approach using retrospective and concurrent methods conducted in March-May 2025. The retrospective approach is used to obtain patient characteristics data based on medical records from hospitals. Meanwhile, a concurrent approach is used to obtain data on non-medical costs directly through interviews with patients.

The study was conducted on CKD patients undergoing hemodialysis at X Kudus Hospital. The study population consisted of 94 CKD patients who underwent hemodialysis in the period from January 2024 to May 2025. The research sample amounted to 48 patients who were determined using the Slovin formula with a margin of error value of 10% and selected using purposive sampling techniques.

The inclusion criteria included CKD patients who have undergone hemodialysis for at least six months, have complete medical records, use BPJS financing, and are willing to be research respondents. The characteristic variables analyzed included gender, age, occupation, education, length of hemodialysis treatment, comorbidities, and length of hospitalization. The cost component analyzed was direct non-medical costs which included transportation, parking, and meals.

Statistical analysis began with a normality test using Shapiro-Wilk because the number of samples was less than 50 respondents, if the significance value ≥ 0.05 , then the data was normally distributed. The analysis of the correlation between patient characteristics and cost components was carried out using the Chi-Square test, if the significance value was ≤ 0.05 , then there was a significant correlation.

RESULTS AND DISCUSSION

A. Patient Characteristics

The characteristics of the patients in this study can be seen in Table 1.

Table 1. Patient Characteristics				
No	Patient Characteristics	Quantity	Percentage (%)	p-value
1	Gender			0,084
	Male	28	58.3	
	Female	20	41.7	
	Total	48	100	-
2	Age (year)			0,980
	17-25	1	2.1	
	26-35	7	14.6	
	36-45	7	14.6	
	46-55	18	37.5	
	56-65	12	25.0	
	> 65	3	6.3	
	Total	48	100	-
3	Jobs			0,312
	Work	31	64.6	
	Not Working	17	35.4	-
	Total	48	100	
4	Education			0,416
	Not finished	1	2.1	

elementary school/equivalent			
5	Graduation from elementary school/equivalent	13	27.1
	Completion of junior high school/equivalent	11	22.9
	High School Graduation/equivalent	19	39.6
	Diploma Completion	2	4.2
	Graduate Degree	2	4.2
Total		48	100
-			
Lenght of Hemodialysis (year)			
5	1	23	47.9
	2	10	20.8
	>3	15	31.3
	Total	48	100
-			
Comorbidity			
6	Hypertension	28	58.3
	Heart Disease	9	18.8
	Anemia	16	33.3
	DM	5	10.4
	Dyspneu	7	14.6
Total		65	135,4
-			
Length of Stay (day)			
7	<5	17	35.4
	5-7	26	54.2
	>7	5	10.4
Total		48	100
-			

The study involved 48 CKD patients undergoing hemodialysis. Most of the respondents were male as many as 28 patients (58.3%), while women were 20 patients (41.7%). The larger proportion of men in this study can be attributed to high exposure to several risk factors for chronic kidney disease that are epidemiologically more common in men, although gender is not the only factor determining the occurrence of CKD.

Based on age, the largest group was 46–55 years old with 18 patients (37.5%), followed by the age group of 56–65 years with 12 patients (25.0%). The dominance of the late adult to elderly age group in this study can be clinically understood because the decline in kidney function and the accumulation of risk factors for chronic diseases tend to increase with age. Older age is also often accompanied by various comorbid conditions, such as hypertension and diabetes mellitus, which are important factors in the development of chronic kidney disease. Webster et al.'s (2017) study explained that CKD is closely related to risk factors such as age, hypertension, diabetes, and cardiovascular disease. Thus, the high proportion of patients in the age groups of 46–55 years and 56–65 years can reflect the accumulation of risk factors and the course of chronic diseases in the study population.

Based on employment, 31 patients (64.6%) are still working and 17 patients (35.4%) are not working. The proportion of patients who are still working shows that CKD and hemodialysis therapy do not always cause patients to quit work activities. Some patients can continue to carry out productive activities even though they have to undergo hemodialysis therapy regularly. However, the frequency of therapy and the time required to undergo hemodialysis have the potential to affect the patient's productive time. This is important in research on economic burden because employment status is related to the possibility of loss of work time and income. In the Cost of Illness analysis, loss of productivity can be one of the components of economic costs that need to be considered in addition to the cost of health services (Jo, 2014).

Based on the length of hemodialysis, the largest group of 23 patients (47.9%) have undergone hemodialysis for one year, while 10 patients (20.8%) have undergone hemodialysis for two years and 15 patients (31.3%) for more than three years. The dominance of patients with a one-year

hemodialysis duration can indicate that most respondents are in the early phase of long-term hemodialysis therapy. Hemodialysis in advanced CKD patients generally requires repeated and continuous therapy, so the length of hemodialysis is an important characteristic in describing the patient's treatment burden. Therapy that is performed regularly can also increase the patient's need for transportation, family assistance time, and other fee outside of medical service costs.

The most common comorbidities were hypertension in 28 patients (58.3%), followed by anemia in 16 patients (33.3%), heart disease in 9 patients (18.8%), dyspnea in 7 patients (14.6%), and diabetes mellitus in 5 patients (10.4%). The high proportion of hypertension in this study can be explained by the close correlation between hypertension and CKD. Hypertension can be a risk factor for kidney damage as well as can appear or worsen as a consequence of decreased kidney function. Thus, the presence of hypertension in CKD patients is a common condition and important to pay attention to in patient management. In addition, anemia is a complication that is often found in CKD because decreased kidney function can interfere with the production of erythropoietin, thus contributing to the occurrence of anemia. These comorbid conditions can increase the complexity of patient management and potentially increase the need for health services.

The presence of heart disease and diabetes mellitus in some respondents also showed that CKD patients in this study had a variety of clinical conditions. Diabetes mellitus is one of the important risk factors for chronic kidney disease, while cardiovascular disease is closely related to CKD. Research by Bikbov et al. (2020) shows that CKD has a large disease burden globally and is related to various risk factors and comorbidities. Therefore, the identification of comorbidities is important in the analysis of economic burden because the patient's clinical condition can affect the needs of services and fee during treatment.

Based on the length of hospitalization, most of the patients underwent hospitalization for 5–7 days as many as 26 patients (54.2%). The dominance of the length of hospitalization of 5–7 days showed that most patients in this study required treatment for several days when inpatient services were required. The length of hospitalization can be related to the patient's clinical condition, monitoring needs, handling complications, and comorbidities. Based on a health economics perspective, the more complex the patient's condition and the more services needed, the greater the use of health service resources that can contribute to medical costs (Jo, 2014).

B. Direct Non-medical Cost

Direct non-medical costs can be seen in Table 2.

Table 2. Direct Non-Medical Costs

Components Cost	Quantity (IDR)	Average (IDR)	Max (IDR)	Min (IDR)	Percentage (%)
One-way Cost	3.100.000	65.957,45	500.000	5.000	68.09
Parking Cost	96.000	2.400	3.000	2.000	2.05
Meal Costs	1.370.000	29.148,94	150.000	10.000	29.86
Total	4.538.000	99.015,05	-	-	100.0

The total direct non-medical costs incurred by patients are IDR 4,538,000, with an average of IDR 99,015.05 per patient. The largest component comes from transportation costs of IDR 3,100,000 (68.09%), followed by food costs of IDR 1,370,000 (29.86%), and parking costs of IDR 96,000 (2.05%). The large proportion of transportation costs shows that the frequency of hemodialysis that is carried out regularly can provide an additional burden for patients, especially for patients who need repeated trips to the hospital. These non-medical costs are components that need to be taken into account in the COI analysis because they are not always reflected in the cost of health services borne by the health financing system (Jo, 2014).

Based on Table 1, there is a significant association between direct nonmedical costs and diabetes mellitus comorbidities with a significance value of $0.046 \leq 0.05$. Meanwhile, other characteristics do not show a meaningful correlation with direct nonmedical costs. Patients with comorbid diabetes mellitus have higher cost caused by clinical conditions, food consumption and mobility limitations. CKD patients with chronic comorbidities such as diabetes require more intensive assistance when undergoing hemodialysis, both in terms of logistics and consumption

costs (Hadning et al., 2022). Patients with diabetes often experience visual impairment, peripheral neuropathy, or chronic fatigue that reduces their ability to travel on their own (Harun et al., 2023). Therefore, patients require special transportation or therapeutic introductions.

Patient characteristics (age, gender, education, occupation, length of hemodialysis, length of stay and other comorbidities) do not have a significant correlation with direct non-medical costs. This shows that direct non-medical costs are influenced by external rather than individual costs, such as one-way costs, parking costs and meal costs. Research conducted by Marbun et al. (2024), stated that the direct non-medical costs incurred by hypertensive patients to undergo treatment are calculated based on the components of direct non-medical costs consisting of transportation costs and parking costs.

This shows that there is no correlation between patient characteristics and direct non-medical costs. Direct non-medical costs are not covered by BPJS, so these costs are the responsibility of the patient without any cost standardization. Patients must manage cost for transportation and consumption costs according to their abilities and needs, so that there is no meaningful correlation with patient characteristics. In line with the research of Marbun et al. (2024) that there are variations in the way patients reach health facilities, these costs remain a general burden that is not directly related to individual status or patient characteristics. These findings show that direct non-medical costs are an important component of economic burden to be taken into account in the treatment of CKD patients with hemodialysis. Although these costs are relatively small compared to medical costs, the frequency of hemodialysis performed repeatedly causes transportation, meals, and other needs to accumulate during the treatment period. Therefore, the analysis of the economic burden of CKD patients should not only focus on the cost of medical services, but also consider the direct cost that patients must bear outside of health care facilities.

CONCLUSION

CKD patients undergoing hemodialysis at X Kudus Hospital experienced an economic burden that included direct non-medical costs. The total direct non-medical costs amounted to IDR 4,538,000 with an average of IDR 99,015.05. Direct non-medical costs showed a significant correlation with diabetes mellitus comorbidities ($p=0.046$). These results show that the analysis of the economic burden of CKD patients with hemodialysis needs to consider not only the cost of medical services, but also non-medical cost.

REFERENCES

- Bello, A. K., Okpechi, I. G., Osman, M. A., Cho, Y., Htay, H., Jha, V., Wainstein, M., & Johnson, D. W. (2022). Epidemiology of haemodialysis outcomes. *Nature Reviews Nephrology*, 18(6), 378–395.
- Bikbov, B., Purcell, C. A., Levey, A. S., Smith, M., Abdoli, A., Abebe, M., Adebayo, O. M., Afarideh, M., Agarwal, S. K., Agudelo-Botero, M., Ahmadian, E., Aly, Z., Alipour, V., Almasi-Hashiani, A., Al-Raddadi, R., Alvis, N., Amini, S., Andrei, T., Andrei, C. L., & Vos, T. (2020). Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, 395(10225), 709–733.
- Hadning, I., Wirakarsa, M.H. dan Tandah, M.R.T.. 2022. Cost of illness for chronic kidney disease treatment with hemodialysis in yogyakarta. *Berkala Kedokteran*, 18(1): 53-60.
- Harun, L. 2024. Analisis penderita hipertensi terhadap laju filtrasi glomerulus (LFG) pada pasien yang menjalani hemodialisis di RS banjarماسin. *Journal of Nursing Invention*, 5(1): 42–52.
- Harun, L., Nurhikmah. dan Riyadi, M. 2023. Hubungan penderita diabetes militus terhadap tingkat keparahan gagal ginjal kronik pada pasien yang menjalani hemodialisis di rs banjarماسin. *Journal of Nursing Invention*, 4(1): 25–34.
- Jo, C. (2014). Cost-of-illness studies: Concepts, scopes, and methods. *Clinical and Molecular Hepatology*, 20(4), 327–337.
- Kristina, S. A., Endarti, D., Andayani, T. M., & Aditama, H. (2021). Cost of illness of hemodialysis in Indonesia: A survey from eight hospitals in Indonesia. *International Journal of Pharmaceutical Research*, 13(1), 2815–2820.

- Marbun, M., Solida, A. dan Wardiah, R.. 2024. Gambaran cost of illness dari perspektif pasien hipertensi rawat jalan. *Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal*, 12(1): 75–82.
- Mattingly, T.J. dan Weathers, S.. 2022. Drug costs in context: assessing drug costs in cost-of-illness analyses. *Drugs In Context*, 5(4): 1-7.
- Papadakis, Maxine, A., Mcphee, Stephen, J., Rabow. dan Michael, W. 2020. *Current medical diagnosis dan treatment*. Amerika Serikat: McGraw-Hill Education.
- Saputra, W. C., Sulistiyanto, F. X., Advistasari, Y. D., & Munisih, S. (2020). Cost of illness perawatan pasien gagal ginjal kronik di instalasi rawat inap RSI Sultan Agung Semarang. *Jurnal Kesehatan Masyarakat*, 19(2), 441–447.
- Supramanian, K., Sekar, M. dan Afendi, N.S.H.N.. 2024. *Chronic kidney disease: etiology, pathophysiology, and management strategies to increase quality of life*. Italia: InTechOpen.
- Tania, F. dan Thabrany, H.. 2017. Biaya dan outcome hemodialisis di rumah sakit kelas b dan c. *Jurnal Ekonomi Kesehatan Indonesia*, 1(1): 54-65.
- Webster, A. C., Nagler, E. V., Morton, R. L., & Masson, P. (2017). Chronic kidney disease. *The Lancet*, 389(10075), 1238–1252.