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Analysis of Drug Costs and Types of Drugs Prescribed for Stage 5 Chronic Kidney Failure Patients on Hemodialysis at dr. R. Goeteng Taroenadibrata Regional General Hospital

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Abstract. Stage 5 Chronic Kidney Disease (CKD), particularly those undergoing haemodialysis (HD), presents a significant economic burden, especially in low- and middle-income countries where healthcare resources are limited. This condition requires frequent and costly treatments to manage, leading to high healthcare expenditures. The aim of this study was to analyse the types and costs of medications most commonly prescribed to stage 5 CKD patients undergoing HD at dr. R. Goeteng Taroenadibrata Regional General Hospital. A descriptive-analytic study was conducted with a cross-sectional approach, using retrospective data from medical records and payment documents for stage 5 CKD patients receiving HD between July and December 2023. A total of 85 patients were selected based on inclusion and exclusion criteria. Descriptive analysis was performed using SPSS software. Results showed that Heparin inj 5000 IU/mL was the most frequently prescribed medication, accounting for 17.43% of all prescriptions, primarily for the prevention and treatment of thromboembolism. Other drugs such as furosemide, folic acid, and amlodipine were also commonly prescribed. The most expensive medication was Epoetin Alfa 3000 IU/mL, with an average cost of IDR 3,112,500 over 182 prescribing episodes. This study highlights the importance of understanding drug expenditure in HD treatment, which can inform budget planning and resource allocation in hospitals.

1 Introduction

Chronic Kidney Failure (CKD) is associated with a significant economic burden in some low- and middle-income countries. This is due to the necessity for intensive renal replacement therapy, which results in considerable healthcare costs and a substantial social burden (1). CKD is a condition characterised by irreversible damage to the kidneys for a period exceeding three months. The extent of kidney damage can be quantified by measuring the Glomerular Filtration Rate (GFR), and by determining the

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urinary Albumin-to-Creatinine Ratio (uACR)(2). The prevalence of CKD in East, South and Southeast Asia is 434.4 million adults out of the total population (3). According to Basic Health Research (Riskesdas) data in 2018, the number of patients with CKD based on doctor's diagnosis in the population aged > 15 years in Indonesia was 713,783 patients, and the prevalence of CKD in Central Java province was 96,794 patients (4).

Based on the GFR category, CKD is divided into five stages (5). Stage 5 CKD requires renal replacement therapy, such as Peritoneal Disease (PD), Haemodialysis (HD), and donor kidney transplantation (6). HD is a procedure given to patients with end-stage renal failure or acutely ill patients who require short-term dialysis, the purpose of which is to cleanse the blood by collecting waste (7). HD must be undergone by patients with CKD during their lifetime, with a frequency of 2-3 times a week and a treatment duration of 3-4 hours per session (8). The prevalence of new patients undergoing HD in 2018 reached 66,433 people, with 132,142 people still undergoing it, and the number of active patients in Central Java reached 7,906 people (9).

As the prevalence of stage 5 CKD patients with HD increases, these individuals frequently encounter comorbidities that exacerbate their condition. These complications have a detrimental impact on the patient's quality of life and contribute to the complexity of managing the required therapy. The most common comorbidities in stage 5 CKD patients with HD are hypertension, diabetes mellitus, and cardiovascular disease. The treatment provided is usually focused on controlling blood pressure, managing anaemia, preventing gastrointestinal complications, and treating post-hemodialysis wounds (10)(11)(12). Therefore, an analysis of drug costs and the types of drugs prescribed is essential to identify inefficiencies in expenditure and opportunities for savings without compromising the quality-of-care patients receive.

Based on research conducted by Vivekanand Jha, et al, the global economic burden of chronic kidney disease was summarised from evidence across 31 countries and territories. The study compiled a library of cost methodologies and estimates of the management of chronic kidney disease (CKD) and its complications across countries in the Inside CKD programme. The results show that the annual cost of managing CKD varies based on the stage of CKD as determined by the glomerular filtration rate (GFR) value. Treatment costs for CKD in 2022, adjusted in US dollars to account for current health expenditure per capita (PPP), include: $3060 at stage 3a, $3544 at stage 3b, $5332 at stage 4, $8736 at stage 5, and $57,334 for haemodialysis (HD). On average, the cost of CKD increased about fourfold from stage 3 to stage 5 in all countries and regions estimated from a single source for 27 countries or regions (13).

The cost definitions used in the study mostly include outpatient care and medication, and may include diagnostic/examination costs, management of complications, and procedural costs. Some estimates also include inpatient costs including emergency department visits, while others specifically exclude inpatient costs, with the granularity of cost definitions varying widely (13). Although many studies have addressed the economic burden of stage 5 CKD with HD in developing countries, there is little literature that specifically addresses drug cost analysis and the types of drugs most prescribed in the management of stage 5 CKD patients with HD in Indonesia. This study aims to fill this gap by providing a cost analysis of drugs used in stage 5 CKD patients with HD, as well as providing further understanding of the role of these drugs in managing symptoms and complications that arise during treatment. As such, this study is expected to make an important contribution to the management of CKD treatment costs, while improving the quality of care that patients receive.

2 Method

2.1 Studi Design

The type of research used in this study is a cost analysis study with an analytic descriptive design. This study used a cross-sectional approach, and data collection was carried out retrospectively with secondary data from medical record documents which included patient characteristics data, treatment data, and financial data for stage 5 CKD patients undergoing HD treatment at dr.R. Goeteng Taroenadibrata Regional General Hospital during the period July - December 2023. This study has obtained ethical approval from the Health Research Ethics Committee of Universitas Harapan Bangsa (Approval Number: B.LPPM-UHB/215/03/2024), with attention to patient confidentiality and safe data handling.

2.2 Participants and Data Collection

The study population includes all CKD patients treated at dr. R. Goeteng Taroenadibrata Regional General Hospital from July to December 2024. Total sampling was used to select participants, yielding a sample of 85 outpatients based on the inclusion and exclusion criteria listed below.
Inclusion Criteria:

1. Outpatients diagnosed with stage 5 CKD who underwent HD during July to December 2023.
2. Patients with complete medical records containing demographic, medication, and financial data.
3. Patients with comorbid conditions of cardiovascular disease and diabetes mellitus (DM).

Exclusion Criteria:

1. Patients without complete medical records (no complete demographic, treatment, or financial data).
2. Stage 5 CKD patients who died or stopped HD during the study period (July to December 2023).

The data source was the patient's medical record, from which the following information was collected:

1. Patient demographics: Age, gender, the underlying cause of the main disease, the presence of comorbidities, the frequency of HD, the type of dialysis, and the type of health financing.
2. Medication Data: Type and quantity of medication prescribed during treatment.
3. Financial Data: The only direct medical costs captured were drug costs.

2.3 Measures

2.3.1 Dependent Variables

The dependent variable in this study is direct medical costs in the form of drug costs incurred by patients during HD treatment and drug costs after a doctor's examination.

2.3.2 Independent Variables

The independent variables included patient characteristics such as age, gender, the underlying cause of the main disease, the presence of comorbidities, the frequency of haemodialysis (HD), the type of dialysis, and the type of health financing. These characteristics were analysed to ascertain their potential impact on direct medical

costs. Furthermore, the types of drugs prescribed for patients with stage 5 CKD on haemodialysis, which may affect total drug costs, were also considered.

2.4 Statistical Analysis

The statistical analysis was performed using SPSS software. Descriptive statistics were used to summarize and provide an overview of the frequency distribution for each research variable. Significance levels and specific tests were applied to interpret relationships between patient characteristics and direct medical costs, ensuring clear and reliable results.

3. Result and Discussion

3.1. Characteristics of CKD patients with HD treatment

This study was conducted at Dr. R. Goeteng Taroenadibrata Regional General Hospital. The data were collected retrospectively through the medical records, pharmacy installation, HD installation, and finance department over the period July to December 2023. A total of 85 outpatients were obtained from the study, having met the inclusion and exclusion criteria determined by the researcher. The initial cohort comprised 107 patients with chronic kidney disease (CKD) undergoing haemodialysis (HD). However, 22 patients were excluded from the study due to either death or discontinuation of HD. Patients who lacked complete medical records, those who had died, and those who had discontinued HD between July and December 2023 were excluded from the study. This was because their data, particularly in regard to costs, was not representative of the long-term or overall costs associated with CKD treatment. The results demonstrated that 43 patients were female and 42 were male, with the majority aged 45-64 years (47 patients). The primary cause of CKD was hypertension, which was experienced by 47 patients. Furthermore, 40 patients had one comorbidity, the majority of patients utilized Social Security Administration (BPJS) financing, 76 patients underwent HD twice a week, and all patients employed elective re-use dialyzers.

Table 1. Characteristics of CKD Patients with HD Actions at dr. R. Goeteng Taroenadibrata Regional General Hospital in the July-December 2023 Period.

Characteristics	Frequency (N=85)	Percentage (%)
Gender		
Female	43	50.6%
Male	42	49.4%
Age		
>64 years	16	18.8%
45 – 64 years	47	55.3%
25 – 45 years	22	25.9%
Cause of Disease		
DM	16	18.8%
HT	47	55.3%
Other	22	25.9%
Comorbidities		
>2 Comorbidities	20	23.5%
2 Comorbidities	4	4.7%
1 Comorbidities	60	70.6%
Unknown	1	1.2%

Financing Type		
BPJS	84	98.8%
General	1	1.2%
HD Frequency		
1x/month	1	1.2%
1x/week	8	9.4%
2x/week	76	89.4%
Dialyser Type		
Re-use elective	85	100%
	85	100%

The *Global Burden of Disease Study* found that sex differences in CKD-related mortality are remarkably consistent at ages 20 to 90 years, although hormones may be particularly influential during reproductive years (14). In the case of CKD, sex differences are likely to be influenced by hormones, either due to the positive effects of oestrogen or the negative effects of testosterone (15). Urinary albumin excretion, plasma glucose, and systolic blood pressure are the main indicators of severe renal function decline in males. In addition, waist circumference and cholesterol to high-density lipoprotein ratio are positively associated with maintenance of renal function. For women, plasma glucose and systolic blood pressure are predictors of risk of kidney function decline, and triglycerides are positively associated with maintenance of kidney function, and women with CKD often do not receive dialysis immediately upon observation but tend to undergo conservative treatment only (16).

Table 1 shows that the highest cause of CKD with HD was hypertension in 47 people (55.3%). This is different from global data which shows the most common primary disease causing CKD with HD is DM (30%-50%) (17). However, the results of this study are in accordance with data from the *Indonesian Renal Registry* (IRR) in 2020, the prevalence of underlying disease of CKD with HD is hypertension (35%), followed by diabetic nephropathy at 29% (18). In addition to hypertension, this study also noted that diabetes mellitus was the cause of CKD in 16 people (18.8%) and other causes in 22 people (25.9%) such as kidney stones, gout, and *benign prostatic hyperplasia.* The results of this study are in accordance with the 2020 *Indonesian Renal Registry* (IRR) data, the second highest prevalence of CKD underlying disease after hypertension is DM or diabetic nephropathy (29%), followed by obstructive nephropathy (3%), and uric acid nephropathy (1%) (18). The results of the same study found that of the 267 DM patients studied, 31.5% experienced CKD (19).

Patients with hypertension have a 5.52 times higher risk of developing CKD compared to patients without hypertension. High blood pressure that lasts for a long period of time will change the resistance in afferent arterioles. The altered microvascular structure causes narrowing of the afferent arterioles. This results in glomerular ischaemia and an inflammatory response that results in the release of inflammatory mediators, including endothelin. Endothelin then activates angiotensin-II in the kidney, increases matrix production, and causes deposits in the glomerular microvasculature. This condition leads to hypertension-induced nephrosclerosis (20).

Table 1 shows that the number of patients undergoing HD treatment tends to increase with age. Of the total 85 patients, the age group of 45-64 years accounted for the highest number, 47 patients (55.3%), while the number of patients aged over 64 years decreased to 16 people (18.8%). Similar results were obtained at Bethesda Hospital Yogyakarta, Rasyida Specialised Kidney Hospital Medan Province, and Dr

Mohammad Hoesin Government General Hospital Palembang Province, where many patients with CKD who underwent HD were in the age range of 45-64 years (11)(21).

The high percentage of CKD cases with HD in the 45-64 years age group indicates that the disease is more common in older individuals. With age, there are various physiological and pathophysiological changes that affect kidney structure and function, including increased glomerular pressure, the appearance of proteinuria, and an increased risk of kidney injury (22). In addition, the aging process is closely associated with various factors that contribute to the development and progression of CKD. Among these factors are increased susceptibility to oxidative stress, inflammation, and fibrosis, all of which can worsen the condition of the kidneys with age (23).

The presence of comorbidities or diseases other than chronic kidney disease that affect the function of other organs in the body can worsen the survival of patients with CKD undergoing HD (24). The results showed the presence of several comorbid conditions, including hypertension, anaemia, hyperuricaemia, hypercholesterolaemia and congestive heart failure. As indicated by data from the Indonesian Renal Registry, the most prevalent comorbidities in patients with chronic kidney disease (CKD) are hypertension (61%) and diabetes (23%) (18). Hypertension is associated with an elevated risk of developing chronic renal failure, whereas diabetes can precipitate kidney failure as a consequence of elevated blood sugar levels. Additionally, congestive heart failure is a comorbid disease that many CKD patients experience, with the two conditions being interrelated. Anaemia may be experienced by patients undergoing haemodialysis as a consequence of the lack of erythropoietin production by the kidneys (25)(26)(27).

The primary source of financing for CKD patients undergoing haemodialysis treatment is the Social Security Organisation (BPJS). Haemodialysis represents the primary therapeutic option for CKD patients who are not eligible for a kidney transplant. The objective of this approach is to ensure the provision of adequate and safe patient care. The recommended frequency of haemodialysis is three times a week; however, in some countries, including Indonesia, patients often undergo haemodialysis less frequently due to medical indications and limitations in financing. The frequency of haemodialysis is influenced by financing, with most coverages only supporting a maximum of two times a week. Additionally, managing uremic symptoms and controlling phosphate levels are crucial aspects of the dialysis procedure (28).

The text discusses the use of reuse dialyzers in the haemodialysis process in Indonesian hospitals. It states that in one hospital, all patients used dialyzer reuse, with a frequency of use of 7 times before replacing it with a new one. The use of reuse dialyzers in Indonesia started in 1998 due to the monetary crisis. Data from the Indonesian Renal Registry shows that 68% of dialyzers are reused 1-5 times, while 30% are reused 6-10 times. The use of reuse dialyzers is necessary in Indonesia because the national health insurance program does not provide funding for single-use dialyzers. The Indonesian Nephrology Association recommends a maximum frequency of 7 times for each dialyzer. A study at Sekarwangi Hospital found that disposable dialyzers were more efficient in improving certain values and were more cost-effective compared to reuse dialyzers. However, the quality of life for patients using both types of dialyzers showed no significant difference (18)(29)(30).

3.2. Characteristics of CKD patients with HD treatment

Drug costs include expenditures for drugs used during patient care at RSUD dr. R. Goeteng Taroenadibrata. The amount of this cost is influenced by the type of medicine,

the amount given, and the complaints experienced by CKD patients while undergoing HD treatment. Table 2 shows that every time a patient undergoes HD treatment and during the doctor's examination at the beginning or end of each month, they will be given medication. The high cost of these drugs is often due to complications or comorbidities experienced by patients with HD, such as HT, DM, congestive heart failure, hypercholesterolaemia, hyperuricaemia and anaemia.

The results of this study are supported by a study at Dr Sardjito General Hospital Yogyakarta, which revealed that the cost of medicines or consumable medical goods was the second largest expense after HD costs for patients with CKD who were hospitalised. The increase in drug costs is due to complications or side effects of the HD procedure, which require the administration of additional drugs. The drugs administered are tailored to the patient's condition and severity, generally related to problems such as hypertension, anaemia, gastric disorders, and external wounds to manage post-HD symptoms (10)(11)(12).

Tabel 2. Analysis of drug costs for patients with CKD with HD measures for the period July-December 2023 at dr. R. Goeteng Taroenadibrata Regional General Hospital.

Type of medication	Prescribing Episode	Percent (%)	Average Total Drug Cost (IDR)	Minimum Price of Medication (IDR)	Maximum price of medication (IDR)
Amlodipine 10 Mg	193	9.63%	194.580	3.960	4.470
Asam Folat 1 Mg	212	11.59%	962.760	5.400	17.040
Cetirizine 10 Mg	176	7.87%	71.610	1.860	3.098
Furosemide	217	12.11%	354.000	6.000	9.870
Epoetin Alfa 3000 IU/mL	182	8.49%	3.112.500	75.000	81.250
Heparin inj 5000 IU/mL	373	28.26%	1.517.960	11.080	19.391
Irbesartan 300 Mg	124	2.48%	168.438	13.475	60.000
Lansoprazole	174	7.66%	558.000	12.480	14.880
Natrium Bicabonat tab	163	6.52%	106.560	3.330	6.660
Paracetamol 500 Mg	152	5.38%	81.885	3.090	4.380

Table 2 shows that the most prescribed drug was Heparin 5000 IU/mL and the least prescribed drug was Irbesartan 300 Mg. Anaemia and coagulation are the main haematological abnormalities observed in renal pathology (31). The accumulation of uremic toxins in patients with CKD promotes platelet abnormalities that may increase the risk of bleeding in most patients. However, there are many additional risk factors that can potentially lead to thrombotic events in the CKD patient group, including blood disorders, inflammation, comorbidities, and endothelial dysfunction (32). The risk of bleeding increases up to twofold if the estimated GFR falls <30 mL/min. In addition, although HD is the main renal replacement therapy used to remove toxic by-products, it is also thought to trigger venous thromboembolism (33).

Anticoagulants are the main therapy for the prevention and acute and long-term treatment of various types of thromboembolic disease (34)(35). Table 2 shows that Heparin injection 5,000 IU/mL is the most common type of drug given to HD patients. HD requires the use of anticoagulants with Unfractionated Heparin (UFH) as one of the commonly used options (36). The mean total cost of a 5 mL heparin injection was IDR

1,517,960 for 373 prescriptions, with a minimum drug price of IDR 11,080 and a maximum drug price of IDR 19,391.

Hypertension accounts for more than 50% of complications in patients with CKD (37)(18). This occurs due to impaired sodium secretion resulting in increased fluid retention and extracellular volume (38). Hypertension in patients with CKD can increase the burden of medical costs, morbidity, and mortality. Therefore, the International Society of Hypertension (ISH) in 2020 and KDIGO or Kidney Disease Outcome Quality Initiative (KDOQI), emphasise the need for antihypertensive therapy to control blood pressure in patients with GHGK and provide additional renoprotective or cardioprotective measures (39). There are several types of antihypertensives, namely Angiotensin-Converting Enzyme Inhibitor (ACE-I), Angiotensin Receptor Blockers (ARBs), Calcium Channel Blocker (CCBs), diuretics, β-blockers, and α-blockers. In this study, irbesartan is an antihypertensive drug that is rarely prescribed, which is 147 episodes of prescription. According to the ISH therapy guidelines, ARBs are used as first-line therapy in patients with CKD with hypertension (39). ARBs are renoprotective through the mechanism of efferent arteriolar vasodilation which causes a decrease in renal intraglomerular pressure (37).

Anaemia is a common occurrence among patients with chronic kidney disease (CKD) due to the impaired renal function that results in the inadequate production of erythropoietin, the hormone responsible for the formation of erythrocytes in the bone marrow (25). The aetiology of anaemia in CKD is multifactorial, encompassing a range of underlying conditions. These include shortened erythrocyte lifespan, inflammation, infection, hypothyroidism, bone mineral disorders with hyperparathyroidism, aluminium toxicity, haemoglobinopathies, as well as iron deficiency, folate deficiency and elevated hepcidin levels (36). Anemia is classified according to the level of hemoglobin (Hb) present in the blood, with values below 13.5 g/dL in adult males and below 12 g/dL in adult females considered indicative of anemia (40). The objective of anaemia therapy in CKD is to prevent disease progression and improve patients' quality of life. This is achieved through single or combination therapy, which may include ESA (Erythropoietin Stimulating Agent), folic acid, iron, and vitamin B12 (41)(42).

The most commonly prescribed antianemia drugs were Epoetin Alfa 3000 IU/mL and folic acid 1 mg, with 232 and 262 prescription episodes, respectively. The average total cost was IDR 3,112,500 and IDR 1,517,960, respectively. A further study conducted in Yogyakarta revealed that epoetin alfa was the most efficacious anaemia therapy for reducing cardiovascular risk in patients with Hb levels between 10 and 12 g/dL. Furthermore, folic acid has been demonstrated to be effective in reducing homocysteine levels, which are known to increase in patients with CKD (18). The use of loop diuretics, such as furosemide, effectively reduces excess body fluids by increasing urine production. This study recorded 217 furosemide prescription episodes, confirming the effectiveness of this approach in managing hypervolemia (43).

Patients with chronic kidney disease (CKD) undergoing haemodialysis frequently present with uremic pruritus, a consequence of uremic toxins and systemic inflammation. The recommended treatment plan includes the use of topical emollients, optimal dialysis management, antihistamines, and neuropathic agents. The antihistamine cetirizine 10 mg was the most frequently prescribed medication (176 episodes), with an average cost of IDR 71,610. Gastrointestinal disorders in CKD frequently have their origin in decreased mucosal prostaglandin levels and hyperacidity. Lansoprazole, a proton pump inhibitor (PPI), was the most frequently prescribed drug (174 episodes), with an average cost of IDR 558,000. Proton pump

inhibitors (PPIs) have been demonstrated to effectively reduce gastric acid secretion in patients with chronic kidney disease (CKD) (44).

Metabolic acidosis, a prevalent complication in CKD, is attributable to impaired hydrogen ion excretion and is frequently accompanied by diverse adverse effects, including insulin resistance and impaired muscle function. The use of sodium bicarbonate has been demonstrated to be a more effective treatment for metabolic acidosis than sodium citrate. In this study, sodium bicarbonate was the most commonly prescribed alkalising agent (163 episodes). For pain management, acetaminophen (paracetamol) was selected as it is safe for patients with CKD and has a low potential for drug interactions. In this study, acetaminophen was prescribed in 152 episodes with an average cost of IDR 81,885.

4. Conclusion

A detailed examination of the financial implications of drug costs and the pharmacological regimens prescribed for patients with stage 5 chronic kidney disease (CKD) undergoing haemodialysis at dr. R. Goeteng Taroenadibrata Regional General Hospital study offer valuable insights into the economic burden of CKD management. The study identified heparin inj 5000 IU/mL as the most frequently prescribed medication, which is indicative of its critical role in the prevention of thromboembolic complications associated with haemodialysis. Epoetin Alfa was identified as the most expensive medication, which serves to illustrate the significant financial challenges faced by patients, particularly in low- and middle-income settings. The findings indicate that hypertension and diabetes are prevalent comorbidities among CKD patients, which further complicates their treatment and increases healthcare costs. The reliance on the Social Security Organization (BPJS) for financing underscores the importance of policy support in ensuring access to necessary treatments.

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