

COST-EFFECTIVENESS ANALYSIS OF ANTIBIOTIC USAGE IN DIABETIC FOOT ULCUS PATIENTS IN DOKTER SOEKARDJO TASIKMALAYA HOSPITAL

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ABSTRACT

Objective: Diabetic foot ulcers is sores on the skin surface until it penetrates the skin layer caused by infection, which is require high costs for treatment. This puts a considerable burden on the patient's family, health agencies and society in general. The purpose of this study was to describe the direct medical costs and cost-effective antibiotics for diabetic foot ulcer patients at Dokter Soekardjo Tasikmalaya Hospital.

Methods: The research method is retrospectively with a purposive sampling technique. The research subjects included 24 hospitalized diabetic foot ulcer patients who received antibiotic treatment ceftriaxone with metronidazole or meropenem with metronidazole. The effectiveness of therapy was determined by the Length of Stay (LOS). Direct medical costs were obtained from medical costs, treatment costs, laboratory costs, and radiology costs.

Results: The average direct medical cost for the combination of ceftriaxone and metronidazole antibiotics was Rp. 4 668 062 and for the combination of meropenem antibiotics with metronidazole was Rp. 9 093 830. The effectiveness of the antibiotic ceftriaxone with metronidazole was 47%.

Conclusion: The cost-effective antibiotic was ceftriaxone with metronidazole which has the lowest ACER value Rp. 9 932 046 and the ICER value is Rp. 22 128 840.

Keywords: Antibiotics, Cost-effectiveness analysis, Diabetic foot ulcer

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INTRODUCTION

Diabetic foot ulcers are defined as the presence of open sores on the skin surface to all layers of the skin, namely wounds that penetrate the skin layer. Diabetic foot ulcers are a manifestation of infection in the soft tissues or bones in a person with diabetes [1]. Diabetic foot ulcers are caused by complications of macroangiopathy, namely angiopathy, which will disrupt blood flow to the feet and neuropathy which can develop into infection due to the entry of bacteria and can be a strategic place for bacterial growth [2].

The prevalence of diabetic ulcers in Indonesia is 15%, amputation rates are 30%, and mortality rates are 32%. Diabetic ulcers are the most common cause of hospitalization, accounting for 80% for Diabetes Mellitus [3].

The process of the diabetic foot begins with angiopathy, neuropathy, and infection. Angiopathy will interfere with blood flow to the legs; patients can feel leg pain after walking a certain distance. Neuropathy causes sensory disturbances that can reduce or eliminate the sensation of pain in the feet, so ulcers can occur without realizing it. Infection occurs due to complications due to reduced blood flow or neuropathy [4].

To overcome the problem of infection in diabetic ulcers, appropriate treatment is needed, one of which is by using antibiotics. Antibiotics are the most widely used drugs for infections caused by bacteria [2].

Infections in diabetic foot ulcers are often caused by polymicrobials, with aerobic gram-negative and anaerobic bacilli accompanied by gram-positive cocci [5]. Diabetic foot ulcer patients with infection receive systemic antimicrobials [6]. In cases of moderate or severe infection, the empiric antibiotic therapy regimen includes gram-positive, gram-negative, and anaerobic pathogens [7].

Diabetic ulcers are the most common cause of hospitalization, accounting for 80% for Diabetes Mellitus [3]. Diabetic foot ulcers require high costs for treatment; this puts a considerable burden on the patient's family, health agencies and society in general. Cost-effectiveness can help reduce the burden of diabetic foot ulcer health care [8].

Pharmacoeconomics is defined as an analysis of the cost of treatment therapy for the health care system in the community [9].

CEA (Cost-Effectiveness Analysis) is an analytical method in pharmacoeconomics that compares two or more alternative treatments. This provides guidance to help make drug regimen decisions [10]. CEA converts cost and effectiveness in terms of ratios. The results of the CEA are described in ratios, namely ACER (Average Cost Effectiveness Ratio) or as ICER (Incremental Cost Effectiveness Ratio) [11].

This study is expected to help make decisions on drug regimens and intervention costs for hospitals. This study determine the cost-effectiveness of antibiotics used in the treatment of diabetic foot ulcers.

MATERIALS AND METHODS

The research method used is Cost-Effectiveness Analysis. The study was conducted at the RSUD Soekarjo Tasikmalaya from January to April 2022. The type of research was descriptive observational with retrospective data collection. The population in the study were diabetic foot ulcer patients hospitalized in March 2020–November 2021 who received antibiotic treatment for both women and men. The sample was taken by cross-sectional purposive sampling technique, namely the sampling technique with the aim of obtaining a sampling that has the desired characteristics. Samples in this study were patients who met the inclusion criteria. Inclusion criteria were hospitalized diabetic foot ulcer patients and patients receiving antibiotic treatment for diabetic foot ulcer therapy, both women and men. And the exclusion criteria were diabetic foot ulcer patients with incomplete medical records, forced discharge status, and death.

Data taken from medical records include patient demographics, disease diagnosis and treatment history. Medical costs consist of drug costs, doctor consultations, nurse service fees, use of hospital facilities (inpatient rooms, equipment), laboratory tests, informal service fees and fees other health. Data analysis was conducted with formula:

$$ACER = \frac{\text{Average Direct Medical Cost}}{\text{Effectiveness}}$$

$$ICER = \frac{\Delta \text{Average Direct Medical Cost}}{\Delta \text{Effectiveness}}$$

RESULTS AND DISCUSSION

Demographics

Demographic data of patients in this study included gender, age, address, and payment status. The data obtained from 24 patients were grouped into several groups as shown in table 1.

The data in table 1 shows that diabetic foot ulcer patients at the RSUD Soekardjo Tasikmalaya are more woman than man. Woman have a greater chance of increasing body mass index or have a higher risk of obesity than man and as a result of hormonal processes, post-menopausal which can lead to insulin resistance [12].

Table 1: Demographic data

		Σ	%
Gender	Man	6	25
	Woman	18	75
Age	17-25	0	0
	26-35	0	0
	36-45	1	4.17
	46-55	17	70.83
	56-65	5	20.83
	>65	1	4.17
Address	Tasikmalaya City	14	58
	Tasikmalaya Regency	6	25
	Other	4	17
Payment Status	Common	1	4.17
	BPJS insurance	21	87.50
	Jamkeskinda insurance	2	8.33

The most diabetic foot ulcer patients by age at the RSUD Soekardjo Tasikmalaya are aged 46-55 y. Age factors affect the decline in all body systems, including the endocrine system. The addition of age causes insulin resistance conditions which result in unstable blood glucose levels so that the number of occurrences of diabetes mellitus is one of them due to the aging factor which degeneratively causes a decrease in body function [13]. In women with a menopausal age range of 45-65 y, it will accelerate the decrease in estrogen hormone production, which is associated with metabolic disorders, diabetes mellitus, cardiovascular disorders [14]. Skin cells also undergo structural, physiological, and functional changes. Decreased function of the skin can cause a decrease in the process of wound healing [15].

More patients with diabetic foot ulcers at the RSUD Soekardjo Tasikmalaya come from the City of Tasikmalaya. This is because the RSUD Doctor Soekardjo is located in the City of Tasikmalaya. In addition, lifestyle of urban people tends to be more irregular so that

it becomes a risk factor for diabetes mellitus. People outside the City of Tasikmalaya can maintain a good diet and exercise more often. People who live in cities are more at high risk of developing diabetes mellitus because of an instant lifestyle.

Diabetic foot ulcer patients in RSUD Soekardjo Tasikmalaya mostly make payments using BPJS insurance. RSUD Soekardjo Tasikmalaya is one of the hospitals under the auspices of the government so it has an obligation to implement payments using BPJS insurance. BPJS insurance Kesehatan is a legal entity formed to administer the health insurance program [16]. Jamkeskinda is a health service provided to destitute people in Tasikmalaya City and financed from the Tasikmalaya City Regional Revenue and Expenditure Budget (APBD) [17].

CEA converts cost and effectiveness in ratio form. The results of the CEA are described in ratios, namely ACER (Average Cost Effectiveness Ratio) or as ICER (Incremental Cost Effectiveness Ratio) [11].

Table 2: Average direct medical cost

Drug name	Quantity	Average direct medical cost
Ceftriaxone+Metronidazole	21	Rp 4 668 062
Meropenem+Metronidazole	3	Rp 9 093 830
Sum	24	

Direct medical costs in this study include medical costs, treatment costs, laboratory costs, and radiology costs. Direct medical costs are direct costs incurred by patients during treatment [11]. Antibiotics used for the treatment of diabetic foot ulcers at RSUD Soekardjo Tasikmalaya are a combination of ceftriaxone with metronidazole or a combination of meropenem with metronidazole. The choice of empirical antibiotic regimen for diabetic foot infections, according to The International Working Group on the Diabetic Foot, includes third-generation cephalosporins with metronidazole or carbapenems with metronidazole [7].

Effectiveness refers to the ability of a treatment or health program to provide improved health. Indicators that state the effectiveness of treatment, such as the length of treatment and the time needed to relieve symptoms [11]. The effectiveness of this study was measured based on the average length of stay for diabetic foot ulcer patients. Average length of stay for diabetic foot ulcer patients at RSUD Doctor Soekardjo is the total hospitalization days of all patients divided by the number of patients. Effective, which does not exceed

the average length of hospitalization. The length of stay for diabetic foot ulcer patients at RSUD Doctor Soekardjo is 3 to 10 d.

ACER is a value that shows the amount of costs required for each improvement in treatment outcomes. ACER is calculated from the average direct medical cost divided by effectiveness. The treatment that has the lowest ACER value is the most cost-effective treatment [11]. Based on table 7, the combination of ceftriaxone and metronidazole antibiotics has the lowest ACER value of Rp. 9 932 046. Thus, treatment using a combination of the antibiotic ceftriaxone with metronidazole is the most cost-effective treatment.

ICER is a value that shows the additional cost needed to produce each change in one unit of treatment outcome [11]. ICER is calculated based on the difference between the average direct medical costs divided by the difference in effectiveness. Based on table 5, it can be concluded that more additional costs are needed to improve outcome or effectiveness from 47% to 67%, which is Rp. 22 128 840.

Table 3: Effectiveness

Drug name	Length of stay (d)	Qty	Effectiveness	
			Effective	Percent
Ceftriaxone+Metronidazole	7	21	10	47%
	6			
	7			
	10			
	13			
	6			
	5			
	13			
	10			
	8			
	7			
	3			
	3			
	6			
	8			
	14			
Meropenem+Metronidazole	8	3	2	67%
	15			
	10			
Sum		24		

Table 4: Average cost-effectiveness ratio

Drug name	ACER
Ceftriaxone+Metronidazole	Rp 9 932 046
Meropenem+Metronidazole	Rp 13 572 880

Table 5: Incremental cost-effectiveness ratio

Drug name	ICER
Ceftriaxone+Metronidazole	Rp 22 128 840
Meropenem+Metronidazole	

CONCLUSION

Based on data from research that has been conducted on patients with diabetic foot ulcers at RSUD Soekardjo Tasikmalaya, it can be concluded that the average direct medical cost of using antibiotics in diabetic foot ulcer patients for the combination of ceftriaxone and metronidazole antibiotics is Rp. 4 668 062 and for the combination of meropenem and metronidazole antibiotics, Rp. 9 093 830. The most cost-effective antibiotic is the combination of ceftriaxone with metronidazole which has the lowest ACER value of Rp. 9 932 046. The ICER value obtained is Rp. 22 128 840.

This study is expected to help make decisions on drug regimens and intervention costs for hospitals. The advantage of this study is that it can determine the cost-effectiveness of antibiotics used in the treatment of diabetic foot ulcers. The limitation of this study is that the effectiveness measured is only the length of stay, not based on infection parameters. It is recommended to do research with infection parameters with prespective method.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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