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Analysis of antibiotic costs for inpatients with urinary tract infection at hospital X in Kediri

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ABSTRACT

Urinary Tract Infection (UTI) is a condition where germs grow and reproduce in the urinary tract with significant amounts of bacteriuria. UTIs are treated with antibiotics. Standardization of treatment considers more effective drugs at lower costs to reduce the number of events and health costs. The aim of this research is to determine the cost-effectiveness of using antibiotics in UTI patients at the Hospital in Kediri City, to identify the most cost-effective alternatives to achieve predetermined goals or criteria that cannot be measured in monetary terms, for example several health outcomes. The study was conducted using a retrospective method that compared the direct medical cost of antibiotics for UTI patients. The population of this study was all 44 inpatient UTI patients at the Hospital X in Kediri. The data were analyzed by calculating the Average Cost Effectiveness Ratio (ACER) and Incremental Cost Effectiveness Ratio (ICER). The results of the research showed that the average total cost effectiveness of the antibiotic Levofloxacin was lower by IDR. 2.448.854 compared to ceftriaxone with an average cost of Rp. 2.474.673. The effectiveness of the antibiotic Levofloxacin is more cost effective than Ceftriaxone because it has a lower ACER value, namely Rp. 594.382.039. The calculated ICER value for both antibiotics is Rp. -58.679.55. The conclusion in this study is that to achieve cost effectiveness of a treatment, an ICER value is needed and the calculation was obtained at Rp. -58.679.55. This shows that there is a cost reduction of Rp. -58.679.55 in the use of the antibiotic Ceftriaxone to obtain lower cost effective results.

Keywords : Cost Effectiveness, Urinary Tract Infection, UTI, Antibiotics.

INTRODUCTION

Urinary Tract Infection UTI health problems increase every year. Based on data from the World Health Organization (WHO), the number of UTI sufferers in the world reaches around 8.3 million people and is estimated to continue to increase to 9.7 million people. Research in the United States, the death rate from UTI is around 13,000 people or around 2.3% of the death rate (Maulani and Siagian, 2021). The prevalence of UTI in Indonesia is very high, it is estimated. An estimated 222 million people in Indonesia are currently suffering from UTI. According to the Ministry of Health, the number of UTI sufferers in Indonesia is 90 to 100 per 100.000 population per year or around 180.000 new infections per year (Nafisah and Mubarak, 2023).

According to a preliminary study conducted by researchers at hospital X in Kediri, UTI patients hospitalized for the past 5 years amounted to 833 patients. UTI is treated with antimicrobials. Standardization of treatment considers more effective drugs with lower costs to reduce the number of incidents and welfare costs(Lestari, Citraningtyas and Edi, 2019) Based on a survey at Hospital X in Kediri, the antibiotics used for UTI patients are Levofloxacin, Ciprofloxacin, Cetriaxone and Cefixim.

In Indonesia, there is information about increasing health costs. Usually caused by various factors, including changes in infection and treatment patterns, increasing use of advanced technology in treating diseases, increasing open demand, and changes in the global economy. On the other hand, the government's ability is increasingly limited and the role of the surrounding community is still not ideal, so it is not possible to increase the cost of welfare services provided by the government (Restyana *et al*., 2019).

Pharmacoeconomic research aims to identify drugs that offer greater efficacy at lower costs, thereby making them more cost-effective and possible to use as the treatment of choice.(Rahmandani *et al*., 2021). A comprehensive method used to find the economic impact of alternative medicine and other health interventions is through pharmacoeconomic analysis in the form of cost-effectiveness analysis (CEA) or cost-effectiveness analysis.(Lestari, Citraningtyas and Edi, 2019)

The aim of this study was to analyze the use, effectiveness, and costs of antibiotic use in urinary tract infection (UTI) therapy at Hospital X, Kediri City.

RESEARCH METHODS

The study was conducted using a retrospective method that compared the direct medical cost of antibiotics for UTI patients. Respondents were 44 inpatients with UTI using a purposive sampling technique. This study was conducted in June 2024. Research data were obtained from patient medical records. Data processing was carried out using the ICER formula and the ACER formula.

RRESULTS

SAMPLE CHARACTERISTICS

The respondents of this study were 44 inpatient UTI patients at Hospital X in Kediri.

Table 1. Characteristics of the Sample of Inpatient UTI Patients

Respondent characteristics	Pharmacist N (%)
Gender	
Man	4 (9.1 %)
Woman	40 (90.9 %)
Age	
18-29 years (teenagers)	15 (34.09%)
30-59 years (adult)	23 (52.27%)
> 60 years (elderly)	6 (13.64%)

The highest respondents were female with a percentage of 90.9% compared to males with a percentage of 9.1%. Meanwhile, the age of respondents showed that adolescent UTI patients (18-29 years) were 34.09% and adults (30-59 years) were 52.27% had a higher prevalence than the elderly (≥60) which was only 13.64%.

Table 2.Characteristics of UTI Patients Based on BPJS Class and Antibiotics

BPJS Class	Antibiotics	Number of Patients	Percentage (%)
1	Levofloxacin	1	2.27%
	Ceftriaxone	3	6.82%
2	Levofloxacin	3	6.82%
	Ceftriaxone	2	4.55%
3	Levofloxacin	21	47.73%
	Ceftriaxone	14	31.82%
Total		44	100%

Based on the table, it is known that there are more inpatient UTI patients using BPJS class 3, namely 35 patients, and the use of antibiotics using levofloxacin has a higher prevalence, namely 25 patients.

Table 3 Effectiveness of Antibiotic Therapy Based on Length of Hospitalization

Length Of Stay	Levofloxacin	Percentage	Ceftriaxone	Percentage
3	4	9.09%	10	22.73%
4	15	34.09%	7	15.91%
5	5	11.36%	-	0.00%
6	1	2.27%	2	4.55%
Total	**25**	**56.81%**	**19**	**43.19%**
Total LOS	**103**		**70**	
Average LOS	**4.12**		**3.68**	

Based on the table, it shows the effectiveness of antibiotic use on the effectiveness of therapy based on the length of hospitalization in UTI patients.

COST EFFECTIVENESS

Table 4. Average Total Cost of Antibiotics

Code Drug	Antibiotics	Amount	Total Medical Costs Direct (Rp)	Average Cost Direct Medical (Rp)
A	Levofloxacin	25	61.221.350	2.448.854
B	Ceftriaxone	19	47.018.800	2.474.673
Total		44		

The average additional cost obtained shows the viability of the antimicrobial drug Levofloxacin has a lower average price, namely the cost of coordinate therapy of Rp. 2,448,854.

Table 5. Cost Effectiveness Calculation Based on ACER

Antibiotics	Average Direct Medical Costs	Effectiveness	ACER
Levofloxacin	2.448.854	4.12	594.382.039
Ceftriaxone	2.474.673	3.68	672.465.489

Based on the table, it is known that the effectiveness of Levofloxacin antibiotics is more cost effective than Ceftriaxone because it has a lower ACER value, which is Rp. 594.382.03.

Table 6.Cost Effectiveness Calculation Based on ICER

Average Direct Medical Costs	ΔC	Effectiveness	ΔE	ICER
2.448.854 / 2.474.673	-25.819	4.12 / 3.68	0.44	-58.679.55

Based on the table above, the calculation of the ICER value for antibiotics is Rp. -58.679.55.

DISCUSSION

A. Sample Characteristics

Inpatient UTI patients at Hospital X in Kediri within a period of 5 years were 833 patients with details in 2018 of 116 patients, 2019 of 165 patients, 2020 of 159 patients, 2021 of 86 patients, 2022 of 123 patients and 2023 of 184 patients. In this study conducted in 2023, a sample of 184 patients was obtained and only 44 samples met the inclusion criteria.

The results of the study showed that the number of female patients (90.1%) who suffered from UTI was greater than male patients (9.1%). UTI is usually caused by bacteria that colonize the lower urethra. In addition, urinary tract infections are more common in women because their urethra is shorter.This is in accordance with research showing that urinary tract infection sufferers are more (81.81%) than male patients (18.19%) (Nalang *et al*., 2018).

Based on the research results, data on urinary tract infection sufferers were collected based on age groups: 30-59 years (50.27%) and 18-29 years (34.09%). The prevalence of urinary tract infections increases between the ages of 46 and 55 years. Because, at this age, the body's immune system weakens and susceptibility to infection increases.

Similar results from previous studies have shown that patients aged between 56 and 60 years are more susceptible or at higher risk of developing urinary tract infections. (Nalang *et al*., 2018). Other studies have also shown that up to 17% of students suffer from urinary tract infections, and adolescents (21%) suffer from urinary tract infections. This is due to a lack of attention to hygiene. Rani and Mohartono 2018 stated that female employees (39.4%) suffer from urinary tract infections caused by a lack of awareness of maintaining intimate organ hygiene, late urination and irregular drinking of water. (Mutmainnah Abbas., *et al* 2023)

The treatment class that the researcher chose at the Hospital X in Kediri was divided into several classes, namely class 1, class 2 and class 3 using BPJS. Based on the class obtained, the most inpatient UTI patients were in class 3, namely 35 patients with a percentage of (79.55%), followed by class 2 patients with 5 patients with a percentage of (11.37%) and class 1 patients with 4 with a percentage of (9.09%). According to the 2023 Minister of Health Regulation, BPJS Health pays the amount of health service rates using standard capitation rates and agreements with health facility associations (PMK 2023). The INA-CBG rate for private class C inpatient hospitals based on the class of care is, BPJS class 1 is IDR 3.545.300, class 2 is IDR 4.130.300, class 1 is IDR 4.715.300 (Ministry of Health of the Republic of Indonesia, 2023)

Urinary tract infection is an inflammation of the urinary tract caused by infection with pathogens. The urinary tract itself is a system that produces, stores and regulates urination in humans, this framework consists of the kidneys, ureters, bladder, and urethra. Because the urinary tract and digestive tract are close together, it is likely that microscopic organisms will move from the tract connected to the stomach to the urinary tract. Because of this disease, patients require primary treatment with antibiotics to prevent worsening of the infection, prevent recurrence, and eradicate the infecting organisms. Therefore, rational therapeutic management of urinary tract infections is very important.

Excessive use of antibiotics can lead to irrational use of antibiotics. If antibiotic treatment is not carried out rationally, risks such as antibiotic resistance, toxicity, allergic reactions, and physiological changes may arise.(Selifiana, Irwanti and Lisni, 2023). The results of the study showed that the use of antibiotics using levofloxacin therapy was more than Ceftriaxone with details, namely, Levofloxacin 25 patients with a percentage (56.82%) and Ceftriaxone with a percentage (43.18%). The opposite was found in other studies where the use of cephalosporin antibiotics was more than the quinolone group (Acta Pharmaciae Indonesia, 2016), this study is also supported by subsequent research, where research conducted at the Jakarta Islamic Hospital Cempaka Putih showed that out of 45 patients with a

percentage (54.88%) who used ceftriaxone therapy and 37 patients with a percentage (45.12%) who used levofloxacin (Tuti Wiyat *et al*, 2024)

Length of stay (LOS) is the length of time a patient stays in a health facility. Length of stay is one of the factors that affect the health care system. This shows that the longer a patient is hospitalized, the more resources such as medical personnel, medical supplies, and medical equipment are needed, resulting in higher medical costs.Based on the characteristics of the length of treatment of patients using Levofloxacin antibiotic therapy 3-6 days with a total LOS of 103 days and obtained a percentage of (56.81%) with an average LOS (4.12) while the length of treatment for Ceftriaxone antibiotics 3-6 days with a total LOS of 70 days and obtained a percentage of (43.19%) with an average LOS (3.68). Other studies also show the same thing regarding the average length of hospitalization of UTI patients using Levofloxacin antibiotic therapy and Ceftriaxone antibiotics, which was explained by Tuti Wiyat in 2024 at the Jakarta Islamic Hospital Cempaka Putih, the average length of hospitalization of patients using Ceftriaxone antibiotics was smaller, namely 4 days compared to Levofloxacin with an average length of hospitalization for 5 days (Tuti Wiyat, 2024)

B. Cost Effectiveness of Antibiotics

According to the Ministry of Health of the Republic of Indonesia in 2015, direct medical costs are costs directly related to health services, doctor's visit costs, drug costs, nursing service costs, and medical costs. Use of hospital facilities (hospitalization, equipment), laboratory examinations, and other medical costs (Tuti wiyati, 2024). Direct medical costs in this study were obtained from patient administration data and the total direct medical costs of inpatient urinary tract infection patients at the Hospital in Kediri. This shows that 25 patients used levofloxacin therapy and 19 patients used ceftriaxone therapy. The total direct medical costs of patients using levofloxacin therapy were IDR 61.221.350, while the direct medical costs for ceftriaxone drug therapy were known to be IDR 47.018.800.

Based on the results of the total cost, the average direct treatment cost per patient was IDR 2.488.854, lower than the average direct treatment cost of ceftriaxone drug therapy of IDR 2.478.673. The study found that the average total direct treatment cost for 45 patients treated with ceftriaxone was IDR 2.650.336, while the average total direct treatment cost for 37 patients treated with levofloxacin was IDR 3.773.985. This is contrary to other studies which stated that at Cempaka Putih Hospital 2018-2019 the average length of treatment for patients receiving levofloxacin antibiotics was five days, compared to four days for patients receiving ceftriaxone. This also has an impact on increasing the total treatment costs directly borne by patients receiving levofloxacin antibiotics. (Tuti Wiyati, 2024). Research conducted by Ruru in 2019 also found something in line that the average total cost of ciprofloxacin drug therapy with the same fluoroquinolone class as levofloxacin, the cost of drug therapy was IDR 2.741.099, - slightly more expensive than ceftriaxone drug therapy, which was IDR 2.718.567, -.

Based on the ACER results, the lowest ACER value was for the antibiotic levofloxacin with an ACER value of 594.382.039 rupiah and an average length of hospitalization of 4.12 days, while the ACER value for ceflixone antibiotic therapy was 672.246 and the cost was 5.489 rupiah and took 3.68 days. The calculation of the ACER value is used to determine the daily costs that must be borne by the patient compared to its effectiveness. In this study, effectiveness was measured by the average hospitalization rate for each treatment group. Another study stated that the ACER obtained with class II ceftriaxone was Rp. 295.028 / day, the ACER value for the antibiotic levofloxacin was Rp. 212.283 / day. Therefore, it is necessary to calculate the ICER value (Kusumaning Wardhani, 2019).

The calculation of the ICER value is intended to compare the effectiveness of two programs or interventions. The ICER value is obtained from the difference in program or intervention costs and its effectiveness (Rahayu *et al*., 2013). Based on the calculation of the ICER ratio, the direct cost ratio value for patients using levofloxacin and ceftriaxone antibiotic therapy was -58.679.55. This shows that cost reduction is needed to achieve cost-effectiveness of treatment.

CONCLUSION

ACER value with Cefrixone antibiotic therapy is Rp672.465.489 with an average length of hospitalization of 3.68 days. There is a decrease in costs of Rp. -58.679.55 in the use of Ceftriaxone antibiotics so that more cost-effective results are obtained.

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