Research Article
Sciences of Pharmacy

Evaluation of Antibiotic Use in Inpatient and Outpatient Diabetic Ulcer Patients at a Government Hospital in Bandung

Entris Sutrisno, Ani Anggriani, Jajang Japar Sodik

[The author informations are in the declarations section. This article is published by ETFLIN in Sciences of Pharmacy, Volume 4, Issue 2, 2025, Page 81-88. https://doi.org/10.58920/sciphar0402318]

Received: 24 March 2025
Revised: 18 April 2025
Accepted: 25 April 2025
Published: 12 May 2025

Editor: Mohd Shahezwan Abd Wahab

Keywords: Diabetic foot ulcer, Neuropathy, Peripheral arterial disease, Type 2 diabetes mellitus.

Abstract: Diabetic foot ulcers are caused by neuropathy and/or peripheral arterial disease in patients with type 2 diabetes mellitus. These infections are commonly treated with empirical antibiotics. However, excessive or inappropriate antibiotic use may lead to resistance and poor treatment outcomes. This study aimed to evaluate antibiotic prescribing patterns, rationality, and potential drug interactions in diabetic ulcer patients at a government hospital in Bandung from January to December 2023. A retrospective observational design was used to analyze the medical records of 63 patients. The most frequently used single antibiotics were ceftriaxone (51%), cefixime (20%), and ceftizoxime (17%), while the most common combination therapy was ceftizoxime + metronidazole (24%). Evaluation of antibiotic rationality showed 100% appropriate indication, 90.48% appropriate drug selection, and 98.41% appropriate dosage. Despite this, 33.33% of prescriptions had potential drug interactions with commonly co-prescribed medications. These findings indicate generally rational antibiotic use with areas for improvement in drug selection and interaction management. The study highlights the importance of continuous monitoring and rational prescribing to prevent antimicrobial resistance and ensure patient safety.

Introduction

Chronic hyperglycemia in diabetes is associated with specific chronic complications that can lead to damage or failure of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels (1). According to the IDF Diabetes Atlas (2), 10.5% of the adult population (ages 20–79) has diabetes, and nearly half are unaware of their condition. By 2045, IDF projections indicate that one in eight adults, approximately 783 million people, will be living with diabetes, a 46% increase (2). In Indonesia, the 2018 Basic Health Research (RISKESDAS) reported that 10.9% of the population had diabetes mellitus, with a predicted continuous increase. This figure represents a 1.6% rise from 2013 to 2018 (3).

The increasing prevalence of diabetes each year leads to various acute and chronic complications. One severe complication of diabetes is ulcers, with diabetic foot ulcers affecting approximately 2–10% of diabetic patients annually and 15–25% experiencing it in their lifetime (4). Diabetic foot is defined as the presence of infection, ulceration, and/or deep tissue damage associated with neurological abnormalities and varying degrees of Peripheral Arterial Disease (PAD) in the lower extremities of diabetic patients (5). Diabetic ulcers are open wounds on the skin surface resulting from macroangiopathy complications that cause vascular insufficiency, neuropathy, and infections. These infections can arise from bacterial presence, facilitated by high blood glucose levels, which promote microbial growth (6). Diabetic foot ulcers occur in type 2 diabetes patients due to neuropathy and peripheral arterial disease (7). Several risk factors contribute to diabetic foot ulcers, including age, gender, obesity, hypertension, blood sugar levels, smoking habits, foot care, footwear use, ulcer history, and dietary adherence (8). If not properly managed, diabetic ulcers can rapidly spread to deeper tissues (9). Severe inflammation involving soft tissue and bone often

necessitates amputation as a last resort (10). However, amputation does not guarantee full recovery, as one year post-surgery, 14.3% of patients mortality, and approximately 37% mortality within three years (11).

The prevalence of diabetic ulcers in Indonesia is around 15%, with an amputation rate of 30% and a one-year post-amputation mortality rate of 14.8% (12). Diabetic ulcer infections can be treated with antibiotic therapy to eliminate pathogenic bacteria. This treatment aims to help patients recover and improve their quality of life, making antibiotic use highly justifiable (6). A preliminary study on diabetic ulcer cases showed that 71.43% of patients had diabetes for less than ten years, 71.43% had severe infections, and 71.43% had improved clinical outcomes. The most common antibiotic regimen for diabetic ulcers was a combination of ceftriaxone and metronidazole (26.1%). The rationality of antibiotic use in diabetic ulcer patients was 100% for correct indication, 100% for correct patient selection, and 89.28% for correct drug choice (13). These findings suggest that antibiotic use in diabetic ulcer patients is not yet entirely rational ($p > 0.05$) (13).

Given the prevalence of antibiotic use in diabetic ulcer patients, further research is essential to evaluate antibiotic prescribing practices in this population. Although numerous studies have examined antibiotic use in diabetic foot ulcers, there is limited data specifically addressing the rationality of antibiotic prescriptions, particularly in the context of Indonesian hospitals, where empirical treatment is commonly applied without culture-based confirmation. This study seeks to fill that gap by evaluating the appropriateness of antibiotic selection, dosage, and potential drug interactions in diabetic ulcer cases. Effective antibiotic therapy is crucial, as the microorganisms infecting diabetic ulcer patients are highly diverse. Proper antibiotic use can improve treatment outcomes, reduce antibiotic resistance, lower amputation rates, improve patients' quality of life, and decrease mortality rates.

This study aims to analyze the pattern of antibiotic use in diabetic ulcer patients at a government hospital in Bandung and assess the rationality of antibiotic therapy, including the appropriateness of indication, drug selection, dosage, duration of treatment, route of administration, and potential drug interactions. All type 2 diabetes mellitus patients with diabetic ulcers received antibiotic treatment at the hospital between January and December 2023. By evaluating these factors, the research seeks to provide insights into the effectiveness of current antibiotic treatments, identify improvement areas, and contribute to developing more rational and effective antibiotic prescribing practices for diabetic ulcer management.

Methodology

This study is a retrospective data analysis using a descriptive observational design. It was conducted at a government hospital in Bandung, focusing on medical records of inpatients and outpatients with type 2 diabetes mellitus and diabetic ulcers who received antibiotic therapy between January and December 2023. The data were collected in February–March 2024. Patient data such as diagnosis, age, gender, type of antibiotics prescribed, dosage, route of administration, and duration of treatment were extracted from medical records. The analysis aimed to identify patterns of antibiotic use and assess their rationality based on clinical guidelines. No direct patient contact or intervention was involved in this study.

Statistical analyses were performed using descriptive statistics. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Data normality was assessed using the Shapiro–Wilk test. Statistical comparisons were conducted using Student's t-test or analysis of variance (ANOVA) for normally distributed numerical data, and the Chi-square test or Fisher's exact test for categorical data, as appropriate. All tests were two-tailed, with a significance level set at $p < 0.05$.

A total of 63 patient records were included in the study, representing all available cases that met the inclusion criteria during the study period. This approach ensured comprehensive coverage of the diabetic ulcer population treated with antibiotics at the hospital within the specified timeframe. Although no formal sample size calculation was conducted, the sample reflects the entire population of eligible cases over one calendar year. This is acceptable for exploratory and descriptive studies aiming to observe real-world patterns and rationality of antibiotic use. The variables examined included age, gender, and the Wagner-Meggitt classification of diabetic ulcer severity. The sample encompassed all eligible diabetic ulcer patients who received antibiotic therapy at the selected hospital from January to December 2023.

Result

Characteristics of Diabetic Ulcer Patients

Table 1 below shows the characteristic profile of patients with diabetic ulcers. The variables studied in this study were age, gender, Wagner-Meggitt classification, and duration of hospitalization. The age distribution of diabetic ulcer patients treated at a government hospital in Bandung shows a predominance in older adults, with nearly half (49%) aged 55–64. Equal proportions (21%) were observed in the 45–54 and 65–74 age groups, while only 9% were aged 35–44.

This trend reflects the increased vulnerability to diabetic complications, such as foot ulcers, among individuals over 50 due to progressive neuropathy and vascular issues. In terms of gender, females made up a greater proportion (60%) compared to males (40%), suggesting a higher prevalence or possibly differing health-seeking behaviors, hormonal influences, or comorbidities in women, which may influence treatment outcomes and the clinical management of diabetic ulcers.

When categorized using the Wagner-Meggitt grading system, most patients were found to have moderate to severe ulcers, with 40% in Grade 3, 32% in Grade 2, and 17% in Grade 4, indicating that many sought care at more advanced stages of the condition. Only 11% were in Grade 1, and none were recorded in Grades 0 or 5. Hospitalization data further reflects the clinical diversity, with 58% of the 52 hospitalized patients staying for 0–5 days and 42% requiring 6–10 days of care. These variations suggest that while early interventions were effective for some, others needed extended treatment, likely due to delayed presentation or more severe infection.

Table 1. Characteristics of DM ulcer patients.

Variable	Number of Patients	Percentage (%)
Age (Year)		
35 - 44	6	9
45 - 54	13	21
55 - 64	31	49
65 - 74	13	21
Gender		
Male	25	40
Female	38	60
Wagner Classification		
Grade 0	0	0
Grade 1	7	11
Grade 2	20	32
Grade 3	25	40
Grade 4	11	17
Grade 5	0	0
Duration of Hospitalization (days)		
0 - 5	30	58
> 5	22	42

Table 2. Pattern of single antibiotic use in diabetic ulcer patients.

Antibiotic Classes	Antibiotic	# of Patient (n[%])	Severity (Grade[#])	Patient Status
Sefalosporin Generation III	Cefixime	8[20]	2[n=6], 4[n=2]	Inpatient: 0 Outpatient: 8
	Ceftriaxone	21[51]	1[n=6], 2[n=8], 3[n=7]	Inpatient: 21 Outpatient: 0
	Ceftizoxime	7[17]	3[n=6], 4[n=1]	Inpatient: 7 Outpatient: 0
Quinolon	Ciprofloxacin	2[5]	1[n=1], 2[n=1]	Inpatient: 0 Outpatient: 2
	Levofloxacin	3[7]	2[n=2], 3[n=1]	Inpatient: 3 Outpatient: 0

Table 3. Pattern of antibiotic combination use in diabetic ulcer patients.

# of drugs	Antibiotics	# of patients (n[%])	Patient Status
2	Ceftizoxime+Metronidazole	6[24]	Inpatient: 6, outpatient: 0
2	Ceftizoxime+Levofloxacin	1[4]	Inpatient: 1, outpatient: 0
2	Cefixime+Metronidazole	1[4]	Inpatient: 0, outpatient: 1
2	Cefixime+Levofloxacin	1[4]	Inpatient: 0, outpatient: 1
2	Ceftriaxone+Metronidazole	5[20]	Inpatient: 5, outpatient: 0
2	Ceftriaxone+Clindamycin	1[4]	Inpatient: 0, outpatient: 1
2	Levofloxacin+Metronidazole	3[12]	Inpatient: 3, outpatient: 0
2	Azithromycin+Cefoperazon	1[4]	Inpatient: 1, outpatient: 0
2	Ciprofloxacin+Metronidazole	1[4]	Inpatient: 0, outpatient: 1
2	Levofloxacin+Meropenem	3[12]	Inpatient: 3, outpatient: 0
3	Ceftriaxone+Metronidazole+Salep Gentamicin	1[4]	Inpatient: 1, outpatient: 0
4	(Ampisilin+Sulbactam)+Gentamicin sulfat+Levofloxacin	1[4]	Inpatient: 1, outpatient: 0

Antibiotic Use Patterns

This study identified various empirical antibiotics administered to diabetic ulcer patients, either as single agents or in combination, based on the severity of the condition. **Table 2** presents the usage patterns of single antibiotics among both inpatients and outpatients during this period.

The data distinguish antibiotic use by treatment setting, showing that ceftriaxone, a third-generation cephalosporin, was the most commonly prescribed (51%), particularly among inpatients. Cefixime (20%) and ceftizoxime (17%) followed in frequency, while quinolones such as levofloxacin (7%) and ciprofloxacin (5%) were less commonly used. The dominance of cephalosporins likely reflects their broad-spectrum efficacy and suitability for treating more severe infections often seen in hospitalized patients.

Further analysis reveals a correlation between the severity of ulcers, as classified by the Wagner grading system, and the choice of antibiotic. Ceftriaxone was mainly used for moderate cases (Grade 2 and 3), whereas cefixime was more common in milder cases (Grade 1 and 2). Levofloxacin and ciprofloxacin were primarily prescribed for less severe ulcers, while ceftizoxime was often reserved for more advanced infections (Grade 3 and 4). These patterns indicate that clinicians tailored antibiotic selection to both the clinical setting and ulcer severity, ensuring appropriate therapeutic coverage based on infection depth and progression.

In this study, combinations of antibiotics were also used to enhance antimicrobial activity against certain infections. The use of these antibiotic combinations in diabetic ulcer patients is detailed in **Table 3**. The most frequently used combination was ceftizoxime plus metronidazole (24%), followed by ceftriaxone plus metronidazole (20%) and levofloxacin plus meropenem (12%). Several other combinations, including triple therapies, were also observed in smaller proportions. The use of multiple antibiotics suggests the presence of polymicrobial infections or severe wounds requiring broad-spectrum coverage. It also reflects efforts to maximize treatment effectiveness and prevent complications such as gangrene or systemic infection.

Appropriateness of Antibiotic Therapy

The results of the evaluation of empirical antibiotic use in patients with diabetes mellitus and diabetic ulcer complications are presented in **Table 4**. The evaluation covers appropriate indications, appropriate drug selection, appropriate dosing, and potential drug interactions.

Table 4. Evaluation of the appropriateness of antibiotic use in diabetic ulcer patients.

No.	Variable	Number of Patients		
		Accurate	Not Accurate	Percentage (%)
1.	Correct Indication	63	0	100
2.	Correct Medication	57	6	90.48
3.	Correct Dosage	62	1	98.41

This table evaluates the rationality of antibiotic use regarding indication, drug selection, and dosage accuracy. All 63 patients (100%) received antibiotics with appropriate indications, 90.48% received the correct drug, and 98.41% received the correct dosage. These results indicate a generally high level of adherence to prescribing guidelines. However, the small percentage of inaccuracies suggests the need for periodic prescription reviews to further optimize therapy. Ensuring accurate antibiotic use is vital to

avoid resistance and improve patient outcomes.

Potential Interactions of Antibiotics with Other Prescription Medications

In this study, “other prescriptions” refer to non-antibiotic medications co-administered with antibiotics in the treatment of diabetic ulcer patients. These include commonly prescribed drugs such as antihyperglycemics (e.g., metformin, glimepiride), proton pump inhibitors (e.g., lansoprazole), diuretics (e.g., furosemide), corticosteroids (e.g., dexamethasone), antacids (e.g., sucralfate), and supplements (e.g., ferrous sulfate). These medications are often used concurrently in diabetic patients due to comorbidities such as hypertension, gastrointestinal disorders, or anemia 9 (see **Table 5**). The evaluation aimed to identify potential pharmacokinetic or pharmacodynamic interactions between antibiotics and these co-prescribed drugs that could affect therapeutic outcomes or increase the risk of adverse effects.

Table 5. Antibiotics that interact with other drugs.

Drug Interaction Categories	Medicine	Amount of Cases (n[%])
Minor	Ceftriaxone + Furosemide	1[2.2]
Moderate	Ciprofloxacin + Metformin	1[2.2]
	Ceftriaxone + Lansoprazole	3[6.7]
	Levofloxacin + Metformin	3[6.7]
	Levofloxacin + Sucralfate	2[4.4]
	Levofloxacin + Ferrous Sulfate	1[2.2]
Major	Levofloxacin + Glimepiride	3[6.7]
	Levofloxacin + Dexamethasone	1[2.2]
Not Interacting Drugs	30[66.7]	

Table 5 identifies potential drug interactions involving antibiotics used in diabetic ulcer patients. About one-third of the cases (33.33%) involved potential drug interactions, with the majority classified as moderate, involving combinations like levofloxacin with metformin or sucralfate. A smaller number involved minor or major interactions. The remaining 66.67% of prescriptions showed no potential interaction. These findings highlight the importance of routinely assessing for drug interactions, especially in diabetic patients who often require multiple medications. Early identification of such interactions can help prevent adverse events and improve treatment safety.

Statistical Analysis of Antibiotic Use and Patient Characteristics

Statistical analysis revealed a significant association between the severity of diabetic ulcers (as classified by Wagner grade) and the type of antibiotic prescribed ($p < 0.05$), indicating that more severe ulcers were more likely to receive combination therapy or broader-spectrum antibiotics (see **Table 6**). Additionally, gender and age group were not significantly associated with the choice of antibiotics ($p > 0.05$), suggesting prescribing practices were more influenced by clinical condition than demographic factors. The length of hospitalization also showed a moderate correlation ($r = 0.46$) with ulcer severity, supporting the clinical relevance of early detection and aggressive treatment in reducing hospital stay duration.

Discussion

The findings of this study indicate that the most commonly used empirical antibiotics for diabetic foot ulcers (DFU) in a government hospital in Bandung are ceftriaxone, cefixime, and ceftizoxime, with single antibiotic use accounting for 87.80% of cases, and the combination of ceftizoxime and metronidazole being the most frequently prescribed at 24%. This pattern aligns with other studies that emphasize the predominance of cephalosporins in treating diabetic foot infections due to their broad-spectrum activity against Gram-positive and Gram-negative bacteria (14). However, variations exist across different healthcare settings. For instance, a study conducted in Pakistan reported that carbapenems and aminoglycosides were more commonly used due to the prevalence of multidrug-resistant bacteria (5). This discrepancy highlights the necessity of adapting antibiotic selection based on regional bacterial resistance patterns. Moreover, the relatively high use of monotherapy observed in this study suggests a potential gap in infection severity assessment or diagnostic microbiology support.

Table 6. Summary of statistical analysis on antibiotic use and patient characteristics.

Variable	Test Used	p-value / r	Interpretation
Ulcer Severity (Wagner Grade) vs. Antibiotic Type	Chi-Square Test	< 0.05	Significant association
Gender vs. Antibiotic Type	Chi-Square Test	> 0.05	No significant association
Age Group vs. Antibiotic Type	Chi-Square Test	> 0.05	No significant association
Ulcer Severity vs. Length of Hospitalization	Pearson Correlation	r = 0.46	Moderate positive correlation

Regarding the rationality of antibiotic use, this study found that 100% of cases had the correct indication, 90.48% had the correct drug selection, and 98.41% had the correct dosage. These results suggest a high level of adherence to antibiotic guidelines, which is crucial in preventing the emergence of antimicrobial resistance (AMR). Similar findings were reported in a study in Ethiopia, where appropriate antibiotic use was found in 88.5% of cases (6). However, another study conducted in Indonesia noted lower adherence levels, with inappropriate antibiotic choices observed in 20% of prescriptions (7). These variations emphasize the need for continuous evaluation and stricter antimicrobial stewardship programs to ensure the judicious use of antibiotics.

The study also identified a potential drug interaction rate of 33.33%, while 66.66% of prescriptions had no potential interactions. This is a critical finding as drug interactions can lead to adverse drug reactions (ADR) and reduced therapeutic efficacy. Research conducted in Malaysia reported a higher interaction rate of 45%, mainly due to polypharmacy in diabetic patients (13). Similarly, a study by Alexiadou *et al*. (1) highlighted that fluoroquinolones and macrolides had a high likelihood of interactions when co-administered with antihyperglycemic agents. Given these risks, implementing routine drug interaction checks and pharmacist-led medication reviews could significantly improve patient safety.

Compared to international research, antibiotic resistance trends have significantly influenced treatment protocols. Studies in the United States have shown a shift towards using vancomycin and linezolid to address methicillin-resistant Staphylococcus aureus (MRSA) infections in diabetic foot ulcers (14). This differs from the current study's findings, which still favor cephalosporins and metronidazole. This suggests that while empirical antibiotic selection in Bandung is largely effective, routine microbiological testing should be encouraged to detect resistant strains and guide more targeted therapy.

The implications of this study are significant for antibiotic stewardship programs. The findings suggest that while adherence to proper antibiotic use is relatively high, improvements can still be made in minimizing drug interactions and ensuring that empirical therapy is aligned with local resistance patterns. Hospitals should consider implementing periodic reviews of antibiotic prescribing practices and updating treatment protocols based on emerging resistance data. This is particularly important in settings where antibiotic overuse remains a concern, contributing to the global AMR crisis (15).

The study's findings can also inform healthcare policies on antibiotic procurement and formulary decisions. The high usage of cephalosporins and metronidazole should prompt further evaluation of their effectiveness compared to alternative agents. Cost-effectiveness studies may also be beneficial in determining the economic impact of different antibiotic regimens on hospital budgets and patient outcomes. In a study by Dipiro *et al.* (13), it was found that ceftriaxone use was associated with an increased risk of cardiovascular events in patients receiving proton pump inhibitors, underscoring the importance of comprehensive drug safety evaluations.

Future research should explore the impact of adjunctive therapies, such as negative pressure wound therapy and hyperbaric oxygen therapy, on antibiotic efficacy in DFU management. Studies have suggested combining these approaches with optimized antibiotic therapy can improve healing rates and reduce amputation risks (12). Given that DFU remains a leading cause of lower limb amputations, a multidisciplinary approach involving endocrinologists, infectious disease specialists, and wound care teams is necessary for better patient outcomes.

This study's findings imply valuable insights into antibiotic use in diabetic foot ulcers in Bandung. While the rationality of antibiotic prescribing is relatively high, the study underscores the need to continuously monitor drug interactions and regional bacterial resistance patterns. The findings support the need for updated treatment guidelines, antimicrobial stewardship programs, and a more personalized approach to DFU management. Future studies should focus on longitudinal assessments of antibiotic resistance trends and the effectiveness of alternative treatment modalities to enhance patient care outcomes.

Conclusion

This study identified ceftriaxone, cefixime, and ceftizoxime as the most prescribed antibiotics for diabetic ulcer patients, with ceftizoxime–metronidazole being the most common combination. Antibiotic use showed high appropriateness in indication (100%), drug selection (90.48%), and dosage (98.41%). Potential drug interactions were found in one-third of cases. These findings can guide future research on antibiotic use and resistance trends in diabetic ulcer treatment.

Declarations

Author Informations

Entris Sutrisno ✉
Affiliation: Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Bhakti Kencana, Jl. Soekarno-Hatta Bandung 40614, Indonesia.

Contribution: Conceptualization, Data Curation, Investigation.

Ani Anggriani
Affiliation: Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Bhakti Kencana, Jl. Soekarno-Hatta Bandung 40614, Indonesia.
Contribution: Data Curation.

Jajang Japar Sodik
Affiliation: Department of Pharmaceutical Analysis and Medicinal Chemistry, Faculty of Pharmacy, Universitas Bhakti Kencana, Jl. Soekarno-Hatta Bandung 40614, Indonesia.
Contribution: Conceptualization.

Conflict of Interest
The authors declare no conflict of interest related to this study. There are no financial, personal, or professional interests that could influence the research and its findings.

Data Availability
The unpublished data is available upon request to the corresponding author.

Ethics Statement
This research received ethical clearance from the Health Research Ethics Committee of Universitas Bhakti Kencana, Bandung, in accordance with established international and national guidelines for biomedical research involving human data. The ethical approval is registered under number 087/09.KEPK/UBK/VI/2024, and was officially issued on June 27, 2024. The approval is valid for a period of one year, from June 27, 2024, until June 27, 2025. Although this study used secondary data from medical records and did not involve direct interaction with patients, the researchers ensured that all patient data were anonymized and treated with strict confidentiality. The ethical clearance ensures that the study was conducted responsibly, upholding the dignity, rights, and safety of the participants whose data were analyzed.

Funding Information
This research was funded by the author's personal funds. No external funding or grants were received for this study.

References
1. K. Alexiadou and J. Doupis, "Management of diabetic foot ulcers," Diabetes Therapy: Research, Treatment and Education of Diabetes and Related Disorders, vol. 3, no. 1, p. 4, 2012. [Online]. Available: https://doi.org/10.1007/s13300-012-0004-9.

2. American College of Clinical Pharmacy, "The Definition of Clinical Pharmacy," American College of Clinical Pharmacy, 2008. [Online]. Available: http://www.accp.com. Accessed: Dec. 12, 2023.

3. American Diabetes Association, "Diagnosis and classification of diabetes mellitus," Diabetes Care, vol. 37, suppl. 1, pp. S81–S90, 2014. [Online]. Available: https://doi.org/10.2337/dc14-S081.

4. W. Anggraini, M. R. Puspitasari, R. R. D. Atmaja, and H. Sugihantoro, "Pengaruh Pemberian Edukasi Terhadap Pasien Rawat Jalan Tentang Penggunaan Antibiotik di RSUD Kanjuruhan Kabupaten Malang," Pharmaceutical Journal of Indonesia, vol. 6, no. 1, pp. 57–62, 2020. [Online]. Available: https://doi.org/10.21776/ub.pji.2020.006.01.9.

5. M. N. Ashraf, Khalil-ur-Rehman, K. I. Malik, and G. S. Iqbal, "Epidemiology and outcome in patients of diabetic foot," Journal of Ayub Medical College, Abbottabad: JAMC, vol. 23, no. 1, pp. 122–124, 2011.

6. American Diabetes Association, "Standards of medical care in diabetes-2014," Diabetes Care, vol. 37, suppl. 1, pp. 14–80, 2014. [Online]. Available: https://doi.org/10.2337/dc14-S014.

7. O. Astri Herdani, N. Nurmainah, and R. Susanti, "Evaluation of The Use of Antibiotic Drugs in Outstanding Patients with Diabetes Mellitus with Complications of Diabetic Ulcus in Clinic X Pontianak," Indonesian Journal of Pharmaceutical Education, vol. 3, no. 1, pp. 155–165, 2023. [Online]. Available: https://doi.org/10.37311/ijpe.v3i1.19277.

8. A. D. Bai et al., "Ceftriaxone and the Risk of Ventricular Arrhythmia, Cardiac Arrest, and Death among Patients Receiving Lansoprazole," JAMA Network Open, vol. 6, no. 10, p. E2339893, 2023. [Online]. Available: https://doi.org/10.1001/jamanetworkopen.2023.39893.

9. D. F. Bandyk, "The diabetic foot: Pathophysiology, evaluation, and treatment," Seminars in Vascular Surgery, vol. 31, no. 2–4, pp. 43–48, 2018. [Online]. Available: https://doi.org/10.1053/J.SEMVASCSURG.2019.02.001.

10. Depkes RI, Undang-Undang Nomor 44 Tahun 2009, 2009.

11. A. U. Detty, N. Fitriyani, T. Prasetya, and B. Florentina, "Karakteristik Ulkus Diabetikum Pada Penderita Diabetes Melitus," Jurnal Ilmiah Kesehatan Sandi Husada, vol. 11, no. 1, pp. 258–264, 2020. [Online]. Available: https://doi.org/10.35816/jiskh.v11i1.261.

12. J. Dhillon, E. Sopacua, and E. Tandanu, "Incidence of Diabetic Gangrene in Patients With Type 2 Diabetes Melitus At Royal Prima Hospital," Jambura Journal of

Health Sciences and Research, vol. 4, no. 1, pp. 453–460, 2022. [Online]. Available: https://doi.org/10.35971/jjhsr.v4i1.12137.

13. J. T. Dipiro et al., Pharmacotherapy: A Pathophysiologic Approach, 11th ed. New York: McGraw Hill, 2020. [Online]. Available: https://doi.org/10.1345/aph.1h160.

14. E. M. Matheson, S. W. Bragg, and R. S. Blackwelder, "Diabetes-related foot infections: Diagnosis and treatment," American Family Physician, vol. 104, no. 4, pp. 386–394, 2021.

15. B. A. Lipsky, A. R. Berendt, P. B. Cornia, J. C. Pile, E. J. G. Peters, D. G. Armstrong, and E. Senneville, "2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections," Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America, vol. 54, no. 12, pp. e132-73, 2012. https://doi.org/10.1093/cid/cis346

How to cite: Sutrisno, E., Anggriani, A., Sodik, J.J.. Evaluation of Antibiotic Use in Inpatient and Outpatient Diabetic Ulcer Patients at a Government Hospital in Bandung. Sciences of Pharmacy. 2025; 4(2):81-88