

## Evaluation of Antibiotic Use in Patients with Acute Appendicitis

Romauli Lumbantobing<sup>1\*</sup>, Lidwindy Morani Logo Ule<sup>2</sup>, Nur Nunu Prihantini<sup>3</sup>

<sup>1</sup>Department of Pharmacology & Therapy, Faculty of Medicine, Universitas Kristen Indonesia

<sup>2</sup>Clinical Student, Faculty of Medicine, Universitas Kristen Indonesia

<sup>3</sup>Department of Biochemistry, Faculty of Medicine, Universitas Kristen Indonesia

**Corresponding Author:** Romauli Lumbantobing

[romauli.lumbantobing@uki.ac.id](mailto:romauli.lumbantobing@uki.ac.id)

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### ABSTRACT

This activity aims to evaluate the accuracy of antibiotic use among patients with acute appendicitis at Aeramo Regional General Hospital to support rational healthcare services. The process involved observing medical records from April 2024 to April 2025. The implementation method used a qualitative descriptive analysis based on Gyssens' criteria to assess indications, dosages, routes, and timing of administration in accordance with ASHP and IDSA guidelines. Evaluation results showed that 53% of antibiotic use was rational (Category 0), though inaccuracies in indications remained at 33%, particularly in non-perforation cases. Consequently, strengthening compliance with local clinical protocols is essential to prevent the risk of antimicrobial resistance within the hospital environment.

## **INTRODUCTION**

Acute appendicitis remains one of the most frequent surgical emergencies worldwide, necessitating prompt intervention to prevent life-threatening complications such as perforation and peritonitis. In clinical practice, antibiotic therapy plays a vital role as both a prophylactic measure to minimize surgical site infections and a therapeutic necessity in complicated cases (Anggraini, W., et al 2020). However, the global escalation of antimicrobial resistance poses a significant threat to public health, often driven by irrational prescribing patterns, improper dosage, or non-compliance with established clinical guidelines. In Indonesia, specifically within regional healthcare settings like RSUD Aeramo, the challenge lies in balancing immediate clinical needs with the long-term imperative of antimicrobial stewardship. While national and international guidelines such as those from ASHP and IDSA provide a framework for treatment, local implementation often varies due to resource availability and regional clinical protocols (Bhangu et al 2015).

This study contributes to the body of knowledge by providing an empirical evaluation of antibiotic stewardship in a specific regional context in East Nusa Tenggara, offering a niche perspective on how clinical guidelines are translated into practice in decentralized healthcare facilities. By utilizing the Gyssens criteria, this research offers a systematic assessment of the quality of antibiotic use, thereby enriching the theoretical application of clinical audits in surgical cases (Bratzler, D. W., et al 2013). The novelty of this work lies in its longitudinal data capture from April 2024 to April 2025 at RSUD Aeramo, highlighting specific gaps in prescribing patterns for both non-perforated and perforated appendicitis cases. Ultimately, this research seeks to address whether the current administration of antibiotics aligns with the rational use principles regarding indication, timing, and duration. The primary objective is to evaluate the appropriateness of antibiotic use in acute appendicitis patients at RSUD Aeramo for the specified period to ensure optimized patient outcomes and the mitigation of resistance risks (Fitriani, B. S., et al, 2024).

## **LITERATURE REVIEW**

### **Acute Appendicitis and Antibiotic Therapy**

Acute appendicitis is an inflammation of the vermiform appendix, typically caused by luminal obstruction. Management involves surgical intervention (appendectomy) supported by antibiotic therapy. According to the Infectious Diseases Society of America (IDSA) and the American Society of Health-System Pharmacists (ASHP), antibiotics serve two roles: prophylaxis in non-perforated cases to prevent surgical site infections, and therapeutic treatment in perforated cases to manage intra-abdominal infection. The selection must cover common enteric gram-negative bacilli and anaerobes (Happyanto, M. R., et al, 2022).

### **Rational Use of Medicine (RUM) and Gyssens Criteria**

The World Health Organization (WHO) defines the rational use of medicine as patients receiving medications appropriate to their clinical needs, in doses that meet their individual requirements, for an adequate period. The Gyssens criteria is a validated method for auditing antibiotic use quality. It

categorizes prescriptions into six tiers (0 to VI), where Category 0 represents rational use, and higher categories indicate issues with effectiveness, toxicity, cost, or timing (Maulana, E., & Salsabila, 2022).

As this study utilizes a descriptive qualitative approach to evaluate clinical audit data, no formal statistical hypotheses (H1, H2) are tested. Instead, the review focuses on the alignment between clinical practice and established protocols. Previous studies by Harartasyahrani and Simamora (2021) indicate that prophylactic antibiotic accuracy significantly reduces postoperative morbidity, while Khaira Maulina et al. (2017) highlighted that non-compliance with hospital formularies often leads to sub-optimal therapeutic outcomes (Nadeak, B., et al, 2025).

### Conceptual Framework

The conceptual framework of this study illustrates the systematic evaluation of antibiotic administration for acute appendicitis (Purnamasari, R., et al, F., 2023). It starts with patient data from medical records, which are then screened against the ASHP/IDSA guidelines and the RSUD Aeramo Antimicrobial Use Guidelines (2023). Each case is then processed through the Gyssens flow chart to determine the quality of use across parameters: indication, choice of drug, duration, dose, interval, and route of administration (Putri, D. A., et al 2022).

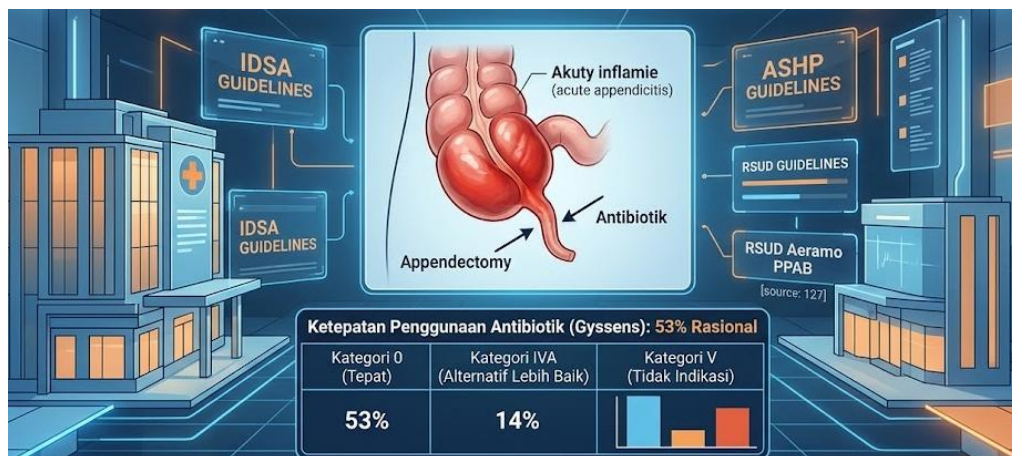


Figure 1. Coceptual Framework

## METHODOLOGY

This research employs a descriptive observational design with a retrospective approach to evaluate the quality of antibiotic administration. The study was conducted at RSUD Aeramo, focusing on clinical data spanning from April 2024 to April 2025 (Solomkin, J. S., et al, 2010). The population consists of all patients diagnosed with acute appendicitis who received antibiotic therapy during the specified period. A total sampling technique was applied to select 30 medical records that met the inclusion criteria, which required complete documentation of antibiotic type, dosage, administration route, and timing (Sophia, A., et al., 2020).

Data collection involved a systematic review of medical records to extract patient demographics, clinical diagnoses (perforated vs. non-perforated), and

detailed pharmaceutical records (Wendari, A., et al, 2025).. The evaluation was carried out using the Gyssens criteria, a standardized clinical audit tool that categorizes antibiotic use from Category 0 (rational) to Category VI (incomplete data). The analysis compares current practices against the Infectious Diseases Society of America (IDSA) guidelines, the American Society of Health-System Pharmacists (ASHP) standards, and the RSUD Aeramo Antimicrobial Use Guidelines (2023).

The data analysis tool utilized is a qualitative descriptive analysis presented through frequency distributions. Each case was processed through the Gyssens flowchart to identify specific areas of irrationality, such as improper timing, excessive duration, or incorrect drug selection. The findings are summarized in tables and charts to provide a clear overview of the percentage of rational versus irrational antibiotic use within the facility (Wendari, A., et al, 2025).

## RESULTS AND DISCUSSION

The total number of adult patients with acute appendicitis at RSUD Aeramo during the period of April 2024–April 2025 was 35 medical records. Out of this total, 25 patients met the inclusion criteria. This number will be used as the sample for this study.

Table 1. Distribution of Appendicitis Patients Based on Gender

Variable	Number of Patients	Percentage (%)
<b>Gender</b>		
Male	10	40
Female	15	60
<b>Total</b>	<b>25</b>	<b>100</b>

Table 2. Distribution of Appendicitis Patients Based on Age

Variable	Number of Patients	Percentage (%)
<b>Age</b>		
18-25 years	13	52
26-35 years	2	8
36-45 years	3	12
46-55 years	2	8
56-65 years	5	20
>65 years	0	0
<b>Total</b>	<b>25</b>	<b>100</b>

Out of the 25 respondents diagnosed with acute appendicitis, 10 patients (40%) were male, and 15 patients (60%) were female. Based on age groups, the 18–25 years category consisted of 13 respondents (52%), the 26–35 years category included two respondents (8%), the 36–45 years category comprised three respondents (12%), the 46–55 years category had two respondents (8%), and the

56-65 years category consisted of five respondents (20%). Among the collected respondents, there were no patients aged over 65 years.

Table 3. Classification of Appendicitis Patients

No	Appendicitis Classification	Number of Patients	Percentage (%)
1	Non-perforated Acute Appendicitis	12	48
2	Perforated Acute Appendicitis	13	52
Total		25	100

Analysis results show that out of 25 respondents, 12 patients (48%) were diagnosed with non-perforated acute appendicitis, while the remaining 13 patients (52%) were diagnosed with perforated acute appendicitis.

Table 4. Distribution of Prophylactic Antibiotic Use in Acute Appendicitis Patients

No	Type of Antibiotic	Total	Percentage (%)
1	Cefazolin + Metronidazole	25	100

The results indicate that all respondents in this study received a prophylactic antibiotic combination of cefazoline and metronidazole for both non-perforated and perforated cases.

Table 5. Distribution of Pre-operative and Post-operative Antibiotic Use

No	Type of Antibiotic	Total	Percentage (%)
Pre-operative Therapy			
1	Ceftriaxone	5	20
2	Cefotaxime	19	76
3	Ceftriaxone + Metronidazole	1	4
Post-operative Therapy			
4	Cefotaxime	9	36
5	Ceftriaxone	2	8
6	Cefixime (Discharge Therapy)	25	100
7	Cefotaxime + Metronidazole	12	48
8	Ceftriaxone + Metronidazole	2	8

*Note: Cefixime was administered as take-home oral therapy.*

The study of 25 acute appendicitis respondents revealed the use of both pre-operative and post-operative antibiotics. Pre-operative therapy included single and combination regimens: five patients (20%) used ceftriaxone, 19 patients (76%) used cefotaxime, and one patient (4%) used a combination of ceftriaxone and metronidazole. Post-operative therapy also utilized single and combination regimens: nine patients (36%) used cefotaxime, two patients (8%) used ceftriaxone, 12 patients (48%) used cefotaxime and metronidazole, and two

patients (8%) used ceftriaxone and metronidazole. Cefixime was administered to all 25 respondents (100%) as follow-up therapy.

Table 6. Distribution of Antibiotic Use Appropriateness based on Gyssens Method

No.	Types of Antibiotics Amount of Giving	Category Gyssens											Total	
		0	1	II	II	II	III	III	IV	IV	IV	V		IV
				A	B	C	A	B	A	B	C			
1	Intravenous Cefotaxime	9										19		28
2	Intravenous Ceftriaxone	7												7
3	Intravenous Cefazoline + Metronidazole	11							14					25
4	Cefotaxime + Metronidazole Intravenous	9										3		12
5	Intravenous Ceftriaxone + Metronidazole	3												3
6	Oral Cefixime	14										11		25
Total		53							14			33		100
Persentase (%)		53							14			33		100

Among the 25 respondents evaluated for both non-perforated and perforated appendicitis, a total of 100 antibiotic administrations were recorded, with each respondent receiving four types of antibiotics. Based on the Gyssens criteria categorization, out of the 100% total antibiotic use, 53 (53%) were classified as Category 0 (rational/appropriate use). Meanwhile, 14 (14%) fell into Category IV A (more effective alternatives available). Finally, 33 (33%) antibiotics were classified as Category V (no indication for use).

The most frequently used antibiotic was intravenous ceftriaxone, with a total of 28 cases divided into two categories. Nineteen cases of ceftriaxone use were classified as Category V (no indication), while the other nine cases were classified as Category 0 (rational/appropriate use). Furthermore, the second most common administrations were the combination of intravenous cefazoline and metronidazole (25 cases) and oral cefixime (25 cases). The use of cefazoline and metronidazole was divided into two Gyssens categories: 11 antibiotics were in Category 0 (rational use) and 14 antibiotics were in Category IV A (inappropriate because a more effective alternative was available). For cefixime, 14 administrations were classified as Category 0 (rational use), while the other 11 cases were in Category V (no indication). The most appropriate antibiotic use was found in oral cefixime (14 cases in Category 0), whereas the highest frequency of inappropriate use was observed in intravenous cefotaxime (19 cases in Category V).

Table 7. Evaluation of Antibiotic Administration Appropriateness

No	Accuracy Category	Appropriate		Not exactly	
		Amount	Persentase (%)	Jumlah	Persentase (%)
1	Exact Indication	67	67	33	33
2	Correct type/class of drug	53	53	14	14

3	Right Dosage	67	67	-	-
4	Exact Route of Administration	67	67	-	-
5	On-time delivery	67	67	-	-

### Gender Distribution in Acute Appendicitis Cases

Demographic data from Aeramo Regional General Hospital between April 2024 and April 2025 shows that female patients dominated the acute appendicitis cases with 15 respondents (60%). This finding differs from previous research by Wendari et al. (2025), which reported a male dominance of 60%. Differences in results may stem from lifestyle factors, low fiber intake among women in the study area, and variations in sample size. Anatomically, the appendix structure is identical in both males and females. Therefore, gender is not a primary determinant for acute appendicitis in this study location.

### Age Distribution in Acute Appendicitis Cases

Research results show that the 18-to-25-year age group experienced the highest frequency of acute appendicitis with 13 patients (52%). This age range represents the peak period for lymphoid tissue growth. Lymphoid tissue hyperplasia can increase intraluminal pressure and trigger inflammation. The risk tends to decrease with age as lymphoid tissue begins to shrink after age 25 and disappears above age 60. High activity levels and low fiber diets in the productive age group also contribute to the high prevalence in this category.

### Number of Cases Based on Appendicitis Classification

This study found that perforated acute appendicitis cases were slightly more frequent (52%) than non-perforated cases (48%). A difference of only one case indicates highly dynamic occurrence patterns. The relatively high proportion of perforation likely relates to delays in seeking medical assistance. Low public awareness regarding early symptoms such as lower right abdominal pain and nausea often leads to late treatment. Rapid diagnosis is crucial to reduce the risk of perforation.

### Distribution of Prophylactic Antibiotic Administration

All patients (100%) in this study received a combination of cefazoline and metronidazole as prophylactic antibiotics. Prophylactic administration aims to prevent surgical site infections (SSI). This combination aligns with ASHP guidelines and the Aeramo Regional General Hospital Antibiotic Guidelines (PPAB). However, international guidelines suggest using ceftriaxone and metronidazole as empirical therapy for perforated cases because the infection falls into the complex intra-abdominal category.

### Pre-operative and Post-operative Antibiotic Distribution

Initial therapy for patients was dominated by single-dose cefotaxime (76%). For outpatient therapy, almost the entire sample (99.33%) received cefixime. The selection of cephalosporins and metronidazole is based on the need to cover both Gram-negative and anaerobic bacteria during inflammation. Although hospital policy provides antibiotics at all surgical stages, IDSA 2010 guidelines emphasize that non-perforated cases should only receive prophylaxis without additional post-operative antibiotics unless complications occur.

### **Antibiotic Use Appropriateness Based on Gyssens Criteria**

Evaluation using the Gyssens method shows that 53% of antibiotic use at Aeramo Regional General Hospital falls into Category 0, meaning it is rational. However, 14% of use was classified as Category IV A (more effective alternatives available) and 33% as Category V (no indication). Inappropriateness in Category IV A occurred due to the use of cefazoline in perforated cases which should ideally use ceftriaxone. Category V results from post-operative antibiotic administration in non-perforated cases that is not clinically required by international standards.

### **Recapitulation of Administration Appropriateness**

Final analysis shows that appropriateness in terms of indication, dose, route, and interval stands at 67%. While the majority of practices align with national standards, inaccuracies remain in drug selection (14%) and indication (33%). The use of cefotaxime and cefixime in non-perforated cases is the main contributor to the lack of indication. These findings highlight the need for stronger adherence to clinical protocols to optimize antibiotic use in the hospital.

## **CONCLUSIONS AND RECOMMENDATIONS**

This study concludes that the quality of antibiotic use for acute appendicitis at RSUD Aeramo from April 2024 to April 2025 is 53% rational according to the Gyssens criteria. While clinical practices regarding dosage, administration routes, and timing are largely appropriate, significant gaps remain in drug selection and indication, particularly for non-perforated cases. The high frequency of Category V (no indication) findings suggests that post-operative antibiotic administration for uncomplicated appendicitis is often unnecessary. To improve healthcare quality, the hospital must strictly implement Antimicrobial Stewardship Programs (ASP) and ensure clinical staff adhere to the updated local Antimicrobial Use Guidelines (PPAB) to prevent the escalation of antimicrobial resistance.

## **FURTHER STUDY**

This research has limitations due to its retrospective design and relatively small sample size, which may not capture the full clinical nuance behind individual prescribing decisions. Furthermore, this study does not correlate antibiotic rationality with specific patient clinical outcomes, such as surgical site infection (SSI) rates or length of hospital stay. Future research should utilize a prospective approach with a larger multicenter cohort to evaluate the impact of rational antibiotic use on patient recovery. Additionally, studies focusing on the economic impact of irrational antibiotic prescribing would provide valuable insights for hospital resource management.

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