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Effectiveness of Antibiotic Use in Pediatric Diarrheal Patients Inpatient Bhina Bhakti Husada Rembang Hospital

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The author(s) declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

ABSTRACT

Purpose: This study aimed to analyze the characteristics of pediatric inpatients with diarrhea and to evaluate the relationship between the type of antibiotics used and therapeutic effectiveness at Bhina Bhakti Husada Rembang Hospital. It was hypothesized that differences in antibiotic type might influence treatment effectiveness, although other clinical factors could also contribute.

Research Method: This study used a descriptive-analytic design with a retrospective approach based on medical records of 106 pediatric inpatients diagnosed with diarrhea during June–December 2025. Data included age, sex, antibiotic type, length of hospital stay, and diarrhea frequency before and after therapy. Therapeutic effectiveness was assessed based on length of hospitalization, with ≤3 days categorized as effective and >3 days as ineffective, supported by improvement in diarrhea frequency. Data were analyzed descriptively and bivariately.

Results and Discussion: Most patients were aged 1–5 years (54.7%) and male (67.9%). Nitroimidazole was the most frequently used antibiotic (53.8%), followed by third-generation cephalosporins (34.0%). Overall, 57.5% of patients were categorized as effective and 42.5% as ineffective. No significant relationship was found between antibiotic type and therapeutic effectiveness.

Implications: These findings suggest that treatment success in pediatric diarrhea is multifactorial and not solely determined by antibiotic class. Further research should include disease severity, hydration status, nutritional condition, and local resistance patterns.

Keywords: pediatric diarrhea; antibiotic use; therapeutic effectiveness; inpatient care; hospitalization length; hospital.

1. Introduction

The high incidence of diarrhea from year to year indicates that this problem still requires serious attention, especially because of various risk factors that are still found in the surrounding environment. Diarrhea is a condition of defecating with a frequency of three or more times a day accompanied by changes in the consistency of stool that is abnormal and liquid. The cause of diarrhea can come from viruses, bacteria, or parasites as well as non-infectious factors related to nutritional status, environmental sanitation, water quality, and individual hygienic behavior. A comprehensive understanding of risk factors, management in accordance with standards, and the implementation of clean and healthy living behaviors (PHBS) are important aspects to ensure that diarrhea case control can take place optimally, effectively, and sustainably (Simadibrata et al., 2024).

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Diarrheal conditions can be triggered by a variety of factors, including infections, individual conditions, environment, and health behaviors. WHO recommends appropriate management efforts in the management strategy through the Five Steps to end Diarrhea approach, which includes the administration of oralite, zinc supplementation, accurate breastfeeding and nutrition, administration of antibiotics only for diarrhea with blood and suspected cholera, and immediately taking the child to the nearest health facility if the diarrhea does not improve within three days, if not treated quickly and appropriately. Diarrhea in children can develop into more serious conditions such as dehydration, impaired nutritional status, and even potentially lead to death (Ruth, 2024).

Data from the World Health Organization (WHO) reports that diarrhea is still one of the leading causes of death in children under five years of age and ranks second only to pneumonia. Global data shows that every year around 525,000 children under five die from this condition. The incidence of diarrhea tends to be higher in developing countries, especially in populations with low socioeconomic conditions. The highest mortality rate was recorded in the group of children under five years of age. Based on data from the 2018 Basic Health Research (Riskesdas), diarrhea most occurs in the toddler group with a prevalence of 11.5-12.8%, compared to other age groups. In Bali Province, it is reported that the prevalence of diarrhea in toddlers is in the range of 7.77-9.13%. Diarrhea needs more attention because it can cause dangerous complications. The most frequent complications caused by diarrhea are dehydration and electrolyte disorders. If not handled properly, these complications can lead to patient mortality. Medical practitioners must be able to provide appropriate treatment for patients under five with diarrhea seeing the dangers that can be caused by the disease. Diarrhea treatment generally focuses on rehydration and correction of the patient's electrolytes to prevent dehydration, while the use of antibiotics is only necessary if the patient has diarrhea caused by a bacterial infection (Krisliandi et al., 2025).

Diarrheal disease is still a public health problem in Rembang Regency. Based on patient morbidity monitoring data from the Rembang Regency Health Office sourced from the SATUSEHAT Platform, during January-May 2025 there were 7,196 cases of digestive system diseases served at health facilities, where diarrhea is included as one of the main diseases in the group. Various previous studies in the Rembang Regency area show that the incidence of diarrhea is still found in a significant number, both in the toddler group and the general public, and is closely related to environmental factors such as clean water quality and sanitation. This condition is strengthened by the Rembang Regency Health Profile data which shows that environmental health problems are still a challenge in several regions. Rembang Regency is seen as a relevant and strategic location to conduct research related to diarrheal diseases to support scientific evidence-based prevention and control efforts (Rembang Regency Health Office, 2025).

The use of antibiotics in the pediatric population is still an important concern in clinical practice, especially in cases of gastrointestinal infections such as diarrhea. Some studies show that antibiotics are often prescribed although not all cases of diarrhea in children are caused by bacterial infections. One study reported that of 64 cases of acute diarrhea in hospitalized children, as many as 82.8% of patients received antibiotic therapy with ceftriaxone as the most widely used drug, although not all patients had clear clinical indications for antibiotic administration (Novita et al., 2023). A similar study stated that 75% of pediatric patients with acute diarrhea in one of the hospitals in Gianyar received antibiotics, and the most dominant pattern was the use of broad-spectrum antibiotics such as ceftriaxone (Krisliandi et al., 2025).

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Research on the rationality aspect of therapy shows that improper use of antibiotics can contribute to the risk of antimicrobial resistance and suboptimal clinical outcomes. Research on pediatric patients with acute diarrhea at Fatmawati Hospital found that only 54.29% of antibiotic use was considered rational based on the Gyssens method, while the rest were categorized as inappropriate, especially related to the indication and selection of antibiotic types (Rokhmah et al., 2022). Other studies show that although some antibiotic use is considered appropriate for medication, metronidazole is still the most widely prescribed antibiotic even though its indications are not always in accordance with the guidelines for diarrhea therapy in children (Simatupang et al., 2023). There is still the use of antibiotics in pediatric patients with diarrhea, although many cases of pediatric diarrhea are self-limiting and do not require antibiotics (Alimah et al., 2025).

There are variations in the patterns, indications, and rationality of antibiotic use in pediatric patients with diarrhea in various health facilities in Indonesia, as well as the absence of evaluations that link antibiotic use with clinical parameters such as fever or vomiting, the researcher intends to conduct a study on the profile of antibiotic use in pediatric patients with a diagnosis of diarrhea to provide a more comprehensive picture of current clinical practices, and to see if there is a relationship between patient characteristics and clinical characteristics of diarrheal patients with antibiotic use.

The remainder of this paper is organized as follows. Section 2 presents the research method and design. Section 3 provides the results and discussion. Section 4 is Concluding Remarks and Recommendations.

2. Research Method

This study is a descriptive observational study with a prospective approach that uses secondary data in the form of medical records of pediatric patients hospitalized at Bhina Bhakti Husada Hospital Rembang during the period June-December 2025. The design of this study aims to describe the profile of antibiotic use in pediatric diarrheal patients and analyze its relationship with patient characteristics and clinical characteristics as indicators of therapy effectiveness. The independent variable in this study was the use of antibiotics which included the type of antibiotic, the class of antibiotics, and the duration of administration, while the bound variable was the effectiveness of antibiotic therapy which was measured based on the frequency of initial diarrhea, the frequency of late diarrhea, and the length of hospitalization. Patient characteristics such as age and gender were also analyzed as supporting descriptive variables.

The target population of this study is all pediatric patients who are undergoing hospitalization with a diagnosis of diarrhea and potentially receiving antibiotic therapy, while the affordable population is pediatric diarrheal patients who are hospitalized at Bhina Bhakti Husada Rembang Hospital with complete medical record data during the study period. The research sample was determined using the Lemeshow formula with a confidence level of 95% and a margin of error of 10%, so that a minimum sample number of 106 patients was obtained. The sampling technique used the purposive sampling method based on inclusion criteria, namely pediatric patients aged 0–12 years who received antibiotic therapy and had complete medical record data, as well as exclusion criteria, namely patients who did not receive antibiotics and patients over 12 years old.

The research instrument used was a data collection sheet compiled based on information in the patient's medical records. The data collected included the demographic characteristics of the patients (age and sex), the characteristics of antibiotic use (type, class, and duration of administration), and the

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indicators of therapy effectiveness (frequency of initial diarrhea, frequency of late diarrhea, and length of hospitalization). The data collection process is carried out through the stages of identifying medical records that meet the criteria, recording data into data collection sheets, and verifying the completeness and consistency of data.

Data processing is carried out through the stages of editing, coding, entry, and tabulating using the Statistical Package for the Social Sciences (SPSS) software version 27. Data analysis was carried out univariate and bivariate. Univariate analysis was used to describe the frequency and percentage distribution of each study variable, while bivariate analysis was performed using the Chi-square test to assess the relationship between antibiotic use and the effectiveness of antibiotic therapy with a significance level of 95% ($\alpha = 0.05$). The use of the Chi-square test is based on categorical data types and does not require normal distribution assumptions. The feasibility of using this test is determined based on the expected count value in the contingency table.

This research has met the ethical principles of health research, including respect for patient confidentiality and privacy, scientific honesty, and social responsibility. All data used is secondary data that has been anonymized without including the patient's personal identity. This research meets the official research ethics rules of the ethics committee and the hospital so that this research has fulfilled the principles of respect for persons, beneficence, non-maleficence, and justice.

3. Results and Discussion

4.1 Analysis Results

The analysis was carried out to determine the characteristics and distribution of the variables studied. In this study, the number of samples was obtained as many as 106 samples. The characteristics of this study are as follows:

Table 1. Sample Characteristics

Categories	Frequency n (%)
Types of antibiotics	
Cephalosporins generation I	6 (5.7%)
Cephalosporins generation III	36 (34.0%)
Nitroimidazole	57 (53.8%)
Chloramphenicol	2 (1.9%)
Nitrofuran	3 (2.8%)
Penicillin (beta-lactam)	2 (1.9%)
Age	
0 months -1 year	33 (31.1%)
1-5 years	58 (54.7%)
5-9 years	10 (9.4%)
9-12 years	5 (4.7%)
Gender	
Male	72 (67.9%)
Women	34 (32.1%)
Length of stay	
2 days	10 (9.4%)

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Categories	Frequency n (%)
3 days	51 (48.1%)
4 days	34 (32.1%)
5 days	10 (9.4%)
6 days	1 (0.9%)
Early frequency of diarrhea	
1-5 times diarrhea	96 (89.7%)
6-10 times diarrhea	10 (9.3%)
Frequency of end diarrhea	
0 (cured/no diarrhea)	92 (86.0%)
1	14 (13.1%)
Total	106 (100.0%)

Based on the results of the study in table 1, the most common use of antibiotics was found in the nitroimidazole group, which was 57 patients (53.8%), making it the most dominant antibiotic used. Age characteristics showed that the most patients were in the age group of 1–5 years with 58 patients (54.7%), followed by 33 patients (31.1%) at 0 months–1 years old, with the majority being male, namely 72 patients (67.9%). The most frequent length of hospitalization was 3 days for 51 patients (48.1%), then 4 days for 34 patients (32.1%). Most patients experienced an initial diarrhea frequency of 1–5 times per day (89.7%), and at the end of treatment the majority of patients had no diarrhea (0 times), namely 92 patients (86.0%), indicating an improvement in clinical conditions during the treatment period.

Table 2.Effectiveness of Antibiotic Use

Type antibiotics	Effectiveness		
	Effective	Ineffective	Total
Cephalosporins generation I	4 (3.8%)	2 (1.9%)	6 (5.7%)
Cephalosporins generation III	16 (15.1%)	20 (18.9%)	36 (34.0%)
Nitroimidazole	37 (34.9%)	20 (18.9%)	57 (53.8%)
Chloramphenicol	2 (1.9%)	0 (0.0%)	2 (1.9%)
Nitrofuran	1 (0.9%)	2 (1.9%)	3 (2.8%)
Penicillin (beta-lactam)	1 (0.9%)	1 (0.9%)	2 (1.9%)
Total	61 (57.5%)	45 (42.5%)	106 (100.0%)

The analysis of the relationship between the type of antibiotic used and the effectiveness of antibiotics was measured based on the length of hospitalization with the criteria of effectiveness if the length of hospitalization was ≤3 days and ineffective if the length of hospitalization was >3 days and the decrease in the frequency of diarrhea in pediatric diarrhea patients was assessed based on the comparison of the frequency of initial diarrhea when the patient was admitted to the frequency of diarrhea after receiving therapy.

A total of 61 patients (57.5%) were in the category of effective therapy, while 45 patients (42.5%) were ineffective based on length of hospitalization and decreased frequency of diarrhea. Numerically, nitroimidazole had the highest number of patients with the most effective categories, but the results of

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bivariate analysis showed no significant relationship between the type of antibiotic and the effectiveness of therapy, so the difference only reflects the distribution of antibiotic use.

4.2 Discussion

All patient data used in this study were declared valid, and no missing value was found on all characteristic variables analyzed, including age, sex, type of antibiotic used, duration of antibiotic administration, length of hospitalization, and clinical response in the form of decreased diarrhea frequency. The dominance of nitroimidazole use in patients with inpatient pediatric diarrhea is likely influenced by clinical considerations of suspected protozoan or anaerobic bacterial infections that are still commonly found in the pediatric population in the study area. Pharmacologically, nitroimidazole has an effective mechanism of action against these microorganisms through inhibition of nucleic acid synthesis, so that clinically it can provide a relatively fast repair response if the indications for use are correct. Nitroimidazole is effective against both types of microorganisms because it is able to penetrate microbial cells and disrupt their genetic material thereby inhibiting growth and killing the microbes that cause antibiotic infections. The fairly high use of third-generation cephalosporins can be explained by its properties as a broad-spectrum antibiotic that is often chosen in conditions with suspicion of moderate to severe bacterial infections or when the etiology cannot be quickly ascertained. The selection of antibiotics of this class can generally be ensured quickly or in patients with certain clinical conditions that require extensive initial therapy.

The pattern of antibiotic use in this study shows a difference from a study conducted at one of the hospitals in Semarang (2023), which reported that ceftriaxone (cephalosporin generation III) is the most commonly used antibiotic in inpatient patients with diarrhea (61.95%). This difference indicates that the selection of antibiotics in inpatient pediatric diarrhea patients is greatly influenced by hospital policies, clinical considerations of doctors, and the suspected etiology of the cause of diarrhea, so that the pattern of antibiotic use can vary between health care facilities (Widiastuti et al., 2025).

The age group of toddlers is the most common group that experiences diarrhea and undergoes hospitalization. It can be explained by immunological and behavioral factors, at this age, the child's immune system is not optimally mature, making it more susceptible to enteric infections and exploratory phases, poor hygiene habits, and dietary transitions increase the risk of exposure to pathogens that cause diarrhea. The decrease in the proportion of cases in larger age groups is likely related to the maturation of the immune system and improved hygiene behaviors with age. The results of this study show that the epidemiological pattern is consistent with international research published in BMC Public Health (2021), which said that children under five years of age have the highest incidence of diarrhea and greater hospitalization needs than older age groups, especially in developing countries. The study explained that a combination of biological, environmental, and immune system limitations in early childhood is the main cause of the high burden of diarrheal disease in the age group of toddlers (Lanyero et al., 2021).

A higher proportion of male patients showed a relationship with age distribution, with most patients in the 1-5 year age group. At the age of toddlers, the child's immune system is still in the developmental stage so the response to enteric pathogens is not optimal. Boys in this age group tend to have higher levels of physical activity and intense exploratory behavior, thus increasing the likelihood of exposure to the infectious agent that causes diarrhea. Differences in parenting and parental supervision patterns also play a role, as boys are often given more freedom in daily activities than girls, which indirectly increases the chances of exposure to pathogens. In addition to behavioral factors,

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biological factors also contribute, some studies show that boys have a slightly greater immune susceptibility to certain infections than girls. Exploratory behaviors, immature immune conditions, and environmental factors that support exposure to infection explain why boys under five are the group most likely to experience diarrhea and hospitalization. The results of this study are in line with the results of a pediatric diarrhea epidemiology study published in BMC Pediatrics (2020), which said that the proportion of inpatient pediatric diarrhea patients was more found in boys than women. The study explained that differences in distribution by sex are more influenced by behavioral factors and environmental exposure than purely biological factors, and can vary between regions and cultures. (Amanda et al., 2022)

The relatively short duration of hospitalization in most patients can be explained by a good response to standard management of acute diarrhea, especially rehydration and supportive therapy. In pediatric diarrhea, the success of therapy is determined more by the correction of dehydration and electrolyte balance than by the antibiotics themselves. Cases with longer length of stay are generally associated with more severe initial conditions, moderate to severe dehydration, comorbidities, or a slow response to initial therapy. The results of this study have similarities with the study conducted at Bali Mandara Hospital, which also reported that the length of hospitalization of patients under five with acute diarrhea is generally in the range of 2-4 days, especially in patients without severe complications or significant comorbidities. The study explained that the duration of hospitalization was influenced by the severity of dehydration, response to rehydration therapy, and the presence of comorbidities or failure of initial response to supportive therapy. Patients with moderate or severe dehydration who require more intensive therapy generally show a longer duration of hospitalization than patients with mild dehydration (Nandini, 2024).

Most patients come with mild to moderate degrees of diarrhea, so primary management focuses on stabilizing the condition and preventing complications. A decrease in the frequency of diarrhea at the end of treatment indicates a good clinical response to the therapy given. The improvement is not only affected by antibiotics, but also depends on comprehensive supportive therapy, especially rehydration according to the degree of dehydration, nutritional fulfillment, electrolyte balance correction, and periodic clinical monitoring. Adequate supportive management plays a major role in accelerating the recovery of the intestinal mucosa and preventing the deterioration of the condition. Other research also says that successful recovery in acute diarrhea does not depend solely on the administration of antibiotics, but is strongly influenced by supportive therapies such as oral rehydration and micronutrient supplementation such as zinc that have been shown to reduce the duration and severity of diarrhea in various pediatric populations. Some studies have shown that zinc supplementation with ORS can significantly shorten the duration of diarrhea and improve recovery rates, even without specific antibiotics for certain bacterial infections (George et al ., 2025).

The difference in the percentage of effectiveness between groups of antibiotics is influenced more by the patient's initial clinical condition than by the type of antibiotic itself. Nitroimidazole shows more effective results as it is generally used at appropriate indications so that a clinical response can occur faster. In contrast, generation III cephalosporins are often given in patients with more severe conditions or suspicions of invasive bacterial infections, so recovery times tend to be longer and do not always meet the effective criteria based on length of hospitalization. In other classes of antibiotics, the small number of samples and the variation in the patient's clinical condition also affect the results obtained. The absence of a significant relationship between the type of antibiotic and the effectiveness of therapy was found, suggesting that the success of pediatric diarrhea treatment is more multifactorial.

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Factors such as initial severity, hydration status, nutritional status, individual immune response, therapy adherence, as well as possible local bacterial resistance can affect the length of hospitalization. The type of antibiotic is not the only major determining factor in determining the rapid or slow clinical improvement in patients with inpatient pediatric diarrhea.

4. Concluding Remarks and Recommendation

Inpatient pediatric diarrhea patients at Bhina Bhakti Husada Rembang Hospital are dominated by children aged 1–5 years and are male. The pattern of antibiotic use shows that the nitroimidazole group is the most widely used, followed by third-generation cephalosporins, while the other group is used in relatively small amounts. An assessment of the effectiveness of therapy based on length of stay showed that more than half of patients met the effective criteria, although some patients still needed more than three days of treatment. Overall, no relationship was found between the type of antibiotic class and the effectiveness of therapy, so the success of pediatric diarrhea treatment in this study was not determined by the difference in antibiotic classes or the demographic characteristics of the patients.

Statement of Use of Generative AI

During the preparation of this work, the author used generative artificial intelligence tools to support the scientific writing process. Grammarly was used to check grammar, refine writing style, and improve clarity in scientific writing. All interpretations, analyses, and conclusions presented in this study are the sole responsibility of the author.

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