

Evaluation of Antibiotic Appropriateness in Hospitalised Pediatric Pneumonia Patients at Ar-Rasyid Islamic Hospital Palembang: A Retrospective Gyssens-Based Study

Evaluasi Rasionalitas Penggunaan Antibiotik pada Pasien Anak Rawat Inap dengan Pneumonia di Rumah Sakit Islam Ar-Rasyid Palembang: Studi Retrospektif dengan Metode Gyssens

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Abstrak

Latar Belakang: Pneumonia tetap menjadi penyebab utama morbiditas dan mortalitas pada anak-anak di seluruh dunia, khususnya di negara-negara berkembang, di mana penggunaan antibiotik yang tidak rasional berkontribusi terhadap resistensi antimikroba dan luaran klinis yang lebih buruk. **Tujuan:** Penelitian ini bertujuan untuk mengevaluasi profil dan rasionalitas penggunaan antibiotik pada pasien anak dengan pneumonia yang dirawat di Rumah Sakit Islam Ar-Rasyid, Palembang, pada periode 2023-2024. **Metode:** Penelitian observasional deskriptif dengan pendekatan retrospektif dilakukan terhadap 100 rekam medis pasien anak berusia 0-12 tahun yang memenuhi kriteria inklusi, dengan rasionalitas penggunaan antibiotik dinilai menggunakan metode Gyssens. **Hasil:** Sebagian besar pasien berjenis kelamin laki-laki (63%), dengan bayi di bawah 1 tahun sebagai kelompok usia terbanyak (76%). Antibiotik yang paling sering digunakan adalah seftazidim injeksi (49,40%). Analisis Gyssens menunjukkan bahwa hanya 35% resep antibiotik yang tergolong rasional (Kategori 0), sementara 33% menunjukkan ketidaktepatan dosis (Kategori IIa), 10% diberikan terlalu lama (Kategori IIIa), dan 22% diberikan terlalu singkat (Kategori IIIb). **Kesimpulan:** Temuan ini mengindikasikan bahwa rasionalitas penggunaan antibiotik pada pasien anak penderita pneumonia yang didapat di rumah sakit masih belum optimal, dengan ketidaktepatan dosis dan durasi terapi yang tidak sesuai sebagai permasalahan yang paling dominan. Oleh karena itu, penerapan Program Penatagunaan Antimikroba berbasis bukti sangat diperlukan untuk meningkatkan praktik persepsan dan mengurangi risiko resistensi antimikroba pada populasi yang rentan.

Kata Kunci: antibiotik; anak; metode Gyssens; pneumonia HAP; rasionalitas

Abstract

Background: Pneumonia remains a leading cause of morbidity and mortality in children worldwide, particularly in developing countries, where irrational antibiotic use contributes to antimicrobial resistance and poorer clinical outcomes. **Objective:** This study aimed to evaluate the profile and rationality of antibiotic use in pediatric patients with hospital-acquired pneumonia at Ar-Rasyid Islamic Hospital, Palembang, during 2023-2024. **Methods:** A descriptive, observational, retrospective study was conducted on 100 medical records of pediatric patients aged 0-12 years who met the inclusion criteria; rationality was assessed using the Gyssens method. **Results:** The majority of patients are male (63%), with infants under 1 year of age comprising the largest age group (76%). The most frequently used antibiotic is injectable ceftazidime (49.40%). Gyssens' analysis reveals that only 35% of antibiotic prescriptions are classified as rational (Category 0), while 33% show inappropriate dosing (Category IIa), 10% are administered for too long (Category IIIa), and 22% for too short a duration (Category IIIb). **Conclusion:** These findings indicate that the rationality of antibiotic use in pediatric hospital-acquired pneumonia patients at this institution remains suboptimal, with dosing irregularities and inappropriate duration of therapy as the predominant issues. Implementation of an evidence-based Antimicrobial Stewardship Program is therefore essential to improve prescribing practices and reduce the risk of antimicrobial resistance in this vulnerable population.

Keywords: antibiotics; children; Gyssens method; hospital-acquired pneumonia; rationality

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1. INTRODUCTION

Pneumonia is an acute infection of the lung parenchyma (alveoli) caused by viruses, bacteria, fungi, or parasites, and remains the leading infectious cause of death in children globally [1]. According to the most recent Global Burden of Disease data (GBD 2023), pneumonia claimed the lives of approximately 610,000 children under five years of age in 2023, equivalent to more than 2,000 deaths per day [2]. Among this age group, neonates accounted for approximately 186,000 deaths, underscoring that early infancy represents the most vulnerable period. The most common bacterial causes of pneumonia in children are *Streptococcus pneumoniae* and *Haemophilus influenzae* type b. However, the role of viruses, particularly respiratory syncytial virus (RSV), is increasingly recognised as a major contributor to pediatric pneumonia in low- and middle-income countries [3].

Indonesia is among the ten countries with the highest burden of child pneumonia mortality, with an estimated 11,000 deaths in children under five years of age in 2023 [2,4]. Nationally, pneumonia contributes to 15% of deaths in children under five and is the second leading infectious cause of child mortality in the country [5]. A prospective multicenter study conducted in several Indonesian hospitals found that nearly all hospitalised pediatric pneumonia cases received antibiotic therapy; however, appropriate antibiotic selection remained hindered by low adherence to clinical guidelines and limited access to rapid diagnostic tools [5,6].

In the management of pediatric pneumonia, antibiotics are a cornerstone of treatment when bacterial infection is suspected or when clinical conditions warrant antimicrobial therapy. Antibiotics function by killing bacteria or inhibiting their growth, but inappropriate use, whether in the choice of agent, dosage, route, or duration, can accelerate antimicrobial resistance and compromise future therapeutic success [4,7]. Differentiating bacterial from non-bacterial pneumonia in clinical practice remains challenging, often leading to empirical antibiotic prescribing decisions. This approach may result in overtreatment in cases of viral pneumonia that do not require antibiotics [3,8]. The issue of antibiotic rationality in pediatric pneumonia has become increasingly important in the context of Antimicrobial Stewardship Programs (ASP). A recent intervention study in hospitalised children with community-acquired pneumonia demonstrated that implementing clinical pathways with clinician feedback significantly improved antibiotic selection and facilitated earlier transition from intravenous to oral therapy without adverse clinical outcomes [9]. Consistent with this, a recent meta-analysis found that short-course antibiotic therapy (≤ 5 days) for non-severe pediatric pneumonia was non-inferior to longer-course regimens, underscoring the importance of evaluating treatment duration [6,10].

In Indonesia, rational antibiotic use remains a major challenge. A systematic review of antibiotic use in Indonesian inpatient settings reported that only approximately 33.5% of antibiotic prescriptions were classified as appropriate according to the Gyssens method, indicating a wide margin for improvement in clinical prescribing practices [11]. Studies across multiple Indonesian hospitals have also revealed low adherence to pediatric pneumonia management guidelines, including inaccuracies in case classification, dosing, and antibiotic treatment duration [12]. For example, a study at Roemani Muhammadiyah Hospital, Semarang, found that the main causes of antibiotic irrationality in pediatric bronchopneumonia were inappropriate antibiotic selection (Category IVa, 24.66%) and excessively short treatment duration (Category IIIb, 16.44%) [13]. A similar study at Bahteramas Hospital in 2024 reported that only 41% of antibiotic prescriptions were rational, with the primary issues being inappropriate antibiotic selection and suboptimal duration [14]. Available evidence remains heterogeneous across settings and does not adequately characterise prescribing patterns in all Indonesian hospitals, including those in South Sumatra.

A preliminary review at Ar-Rasyid Islamic Hospital in Palembang found that pediatric pneumonia cases declined from 88 in 2023 to 41 in 2024. However, antibiotic prescribing patterns and their rationality at this institution have never been comprehensively evaluated using a standardised assessment tool. Therefore, this study was conducted to evaluate the antibiotic use profile and prescribing rationality in pediatric HAP patients at Ar-Rasyid Islamic Hospital, Palembang, during the 2023-2024 period, using the Gyssens method.

2. METHODS

This was a descriptive, observational, retrospective study conducted at Ar-Rasyid Islamic Hospital, Palembang. Data collection was performed in July 2025, covering inpatient medical records from January 2023 to December 2024. The study population comprised all pediatric patients aged 0 months to 12 years hospitalised with hospital-acquired pneumonia (HAP) at Ar-Rasyid Islamic Hospital during the study period. Samples were selected using purposive sampling based on the following inclusion criteria: (1) pediatric patients aged 0 months to 12 years with a diagnosis of HAP; (2) patients who underwent inpatient care for more than 48 hours; and (3) patients with complete medical records, including antibiotic name, dose, indication, route of administration, and treatment duration. Patients referred to other hospitals and those with incomplete medical records were excluded. A total of 100 patients met the eligibility criteria. HAP was diagnosed by the attending pediatrician based on the presence of new or progressive pulmonary infiltrates on chest radiography together with clinical signs of respiratory infection (e.g., fever, cough, tachypnea, or increased work of breathing, with or without abnormal findings on auscultation) arising more than 48 hours after admission for a non-pneumonia indication, in accordance with the operational definition of hospital-acquired pneumonia adopted by the Indonesian Ministry of Health guideline and the IDSA/ATS criteria. Cases in which pulmonary infiltrates and respiratory symptoms were already present at admission or within the first 48 hours of hospitalisation were classified as community-acquired pneumonia and excluded from this study, consistent with inclusion criterion (2) above.

Data extracted from medical records included sex, age, antibiotic type, dose, route of administration, and treatment duration. Data were processed using Microsoft Excel and analysed descriptively. The rationality of antibiotic use was evaluated using the Gyssens method, which hierarchically categorises each antibiotic prescription as follows: Category 0 (rational use); Category I (inappropriate timing); Categories IIa–IIc (inappropriate dose, interval, or route); Categories IIIa–IIIb (excessively long or short duration); Categories IVa–IVd (more effective, safer, less expensive, or narrower-spectrum alternatives available); Category V (no indication); and Category VI (incomplete data) (15). The primary references used for evaluation were the Indonesian Ministry of Health National Clinical Practice Guidelines for Pneumonia Management (2021) and the IDSA/ATS guidelines (2023).

3. RESULTS

This study included 100 pediatric patients who met the inclusion criteria. Patient demographic characteristics, antibiotic dosing accuracy, treatment duration, and the rationality of antibiotic use are presented in Table 1. The distribution of antibiotic types prescribed is presented in Table 2. The complete Gyssens categorisation profile is presented in Table 3.

Table 1. Patient Characteristics, Dosing Accuracy, Treatment Duration, and Antibiotic Use Appropriateness

No.	Variable	Frequency (n)	Percentage (%)
Sex			
1	Male	63	63%
	Female	37	37%
Age Group			
2	Infants (<1 year)	76	76%
	Toddlers (1-5 years)	20	20%
	Children (>6 years)	4	4%
Antibiotic Treatment Duration			
3	1-6 days	49	49%
	7-14 days	35	35%
	>14 days	16	16%
Dosing Accuracy			
4	Appropriate dose	67	67%
	Inappropriate dose	33	33%
Antibiotic Use Appropriateness			
5	Rational (Category 0)	35	35%

No.	Variable	Frequency (n)	Percentage (%)
	Irrational	65	65%

Table 2. Distribution of Antibiotic Types Used

Antibiotic Name	Frequency (n)	Percentage (%)
Oral		
Amoxicillin 100 mg drops	3	1.20%
Azithromycin 200 mg/5 ml syrup	9	3.59%
Cefadroxyl 125 mg dry syrup	7	2.79%
Cefixime dry syrup	21	8.37%
Renasistin drops (Cefadroxyl 150 mg/ml)	25	9.96%
Lapicef drops (Cefadroxyl 150 mg/ml)	3	1.20%
Injectable		
Ceftazidime injection	124	49.40%
Ceftriaxone injection 1 g	23	9.16%
Cefotaxime injection	14	5.58%
Ampicillin 1 g injection	9	3.59%
Picyn 750 mg (Ampicillin-Sulbactam)	12	4.78%
Gentamicin injection	1	0.40%

Table 3. Antibiotic Use Profile Based on the Gyssens Method

Gyssens Category	Frequency (n)	Percentage (%)
Category 0 – Appropriate (rational) antibiotic use	35	35%
Category I – Inappropriate timing of administration	0	0%
Category IIa – Inappropriate dose	33	33%
Category IIb – Inappropriate interval	0	0%
Category IIc – Inappropriate route	0	0%
Category IIIa – Duration too long	10	10%
Category IIIb – Duration too short	22	22%
Category IVa – More effective alternative available	0	0%
Category IVb – Less toxic alternative available	0	0%
Category IVc – Less expensive alternative available	0	0%
Category IVd – Narrower-spectrum alternative available	0	0%
Category V – No indication	0	0%
Category VI – Incomplete data	0	0%

The study population was predominantly male (63%) and comprised largely infants under 1 year of age (76%). Injectable ceftazidime was the most frequently prescribed antibiotic, accounting for 124 of 251 total antibiotic prescriptions (49.40%), followed by Renasistin drops, a cefadroxyl formulation (9.96%), and injectable ceftriaxone (9.16%). Regarding treatment duration, 49% of patients received antibiotics for 1-6 days, 35% for 7-14 days, and 16% for more than 14 days. Dosing accuracy assessment revealed that 67% of prescriptions had appropriate doses, while 33% were classified as inappropriate. Overall, Gyssen's analysis classified only 35% of prescriptions as rational (Category 0), with the predominant sources of irrationality being inappropriate dosing

(Category IIa, 33%), excessively short duration (Category IIIb, 22%), and excessively long duration (Category IIIa, 10%).

4. DISCUSSION

This study evaluated the profile and rationality of antibiotic use in 100 pediatric patients with HAP at Ar-Rasyid Islamic Hospital, Palembang, during 2023-2024, using the Gyssens method. The study population was predominantly male (63%), which is consistent with reports from other Indonesian hospitals. A study at Dustira Hospital found a male proportion of 61.11% among pediatric pneumonia patients in 2022, while a study at Hospital X in Bekasi (2023) reported male predominance at 62.61% [16,17]. Comparable patterns have been reported in *Jurnal Farmasimed*: a quantitative evaluation of antibiotic use in hospitalised pediatric diarrhea patients found a male predominance of 62.54% with children under five years accounting for 65.63% of cases, while a retrospective evaluation of antibiotic-related problems in hospitalised pediatric pneumonia patients at a regional hospital in Deli Serdang likewise identified young children as the predominant group requiring antibiotic therapy [18,19]. Research at Roemani Muhammadiyah Hospital, Semarang, similarly found a male predominance, attributed to the anatomically narrower airway diameter in boys compared with girls, rendering them more susceptible to respiratory tract infections [13]. From an immunological standpoint, estrogen in females exerts a favourable immunomodulatory effect by enhancing humoral immune responses and dendritic cell activation. In contrast, testosterone in males is associated with partial immunosuppression, contributing to differential susceptibility [20]. In addition to biological factors, male children tend to be more physically active, increasing their environmental exposure to pathogenic microorganisms.

Infants under one year of age constituted the dominant age group in this study (76%), followed by toddlers aged 1-5 years (20%) and older children aged 6+ (4%). This pattern mirrors findings from Dustira Hospital (2022), where 77.78% of patients were aged 0-4 years, and Hospital X Bekasi (2023), where 77.39% were aged 0-5 years [16,17]. The disproportionately high burden in infancy can be explained by three interacting pathophysiological mechanisms. First, immune system immaturity: neonates and young infants have fundamentally different immune responses compared with older children, including limited T-cell memory, suboptimal secretory immunoglobulin A (sIgA) production, and incomplete follicular dendritic cell development in germinal centres [21]. Viral respiratory infections, which frequently precede bacterial pneumonia, can damage airway epithelium, enhance bacterial adhesion, and disrupt host immune defences, thereby facilitating nosocomial bacterial colonisation; a recent prospective cohort study confirmed these bidirectional viral-bacterial co-infection dynamics in infants with acute respiratory illness [22]. Second, narrow airway diameter: in accordance with Poiseuille's law, airway resistance is inversely proportional to the fourth power of the radius; thus, even minimal mucosal oedema can dramatically increase airway resistance in infants, compounding respiratory compromise [23]. Third, the inability to independently clear respiratory secretions: the absence of an effective cough reflex and suboptimal surfactant function impair alveolar defence mechanisms, predisposing infants to lower respiratory tract infections. A prospective multicentre study in Indonesia reported that a large proportion of pneumonia-related deaths occurred in young infants (<1 year), frequently accompanied by comorbidities such as congenital heart disease and malnutrition [5].

Injectable ceftazidime was the most frequently prescribed antibiotic (124 prescriptions, 49.40%), followed by Renasistin drops (cefadroxyl, 9.96%) and injectable ceftriaxone (9.16%). Ceftazidime is a third-generation cephalosporin with potent activity against Gram-negative bacteria, including *Pseudomonas aeruginosa*. Its selection as the primary empirical agent for pediatric HAP likely reflects clinical consideration of the risk of nosocomial Gram-negative pathogens, a profile distinct from community-acquired pneumonia, where *Streptococcus pneumoniae* predominates [24]. The predominance of third-generation cephalosporins (cefotaxime, ceftriaxone, ceftazidime) in this study is consistent with findings from the Indonesian multicentre prospective study by Lokida et al., which identified cefotaxime (17.0%) and ceftriaxone (14.4%) as the most common regimens in hospitalised pediatric pneumonia, and with a study at Bahteramas Hospital (2024) similarly reporting third-generation cephalosporins as the predominant empirical choice [5,25]. While empirical cephalosporin use is clinically justifiable for HAP, the absence of microbiological culture data to guide definitive

therapy raises concern about the selection of extended-spectrum beta-lactamase (ESBL)-producing organisms, a growing challenge in Indonesian hospitals [26].

Regarding antibiotic treatment duration, 49% of patients received antibiotics for only 1-6 days, 35% for 7-14 days, and 16% for more than 14 days. The Indonesian Ministry of Health National Clinical Practice Guidelines (2021) recommend a treatment duration of 7-14 days for pneumonia, while the Infectious Diseases Society of America (IDSA) recommends a minimum of 7 days for HAP. The substantial proportion of prescriptions with excessively short duration (<7 days) carries the risk of therapeutic failure and the emergence of antibiotic resistance. From a pharmacodynamic perspective, cephalosporins are time-dependent antibiotics whose bactericidal efficacy depends on the proportion of time that free drug concentrations exceed the minimum inhibitory concentration ($fT > MIC$); an inadequate duration therefore fails to achieve complete eradication. A meta-analysis published in *JAMA Pediatrics* found that short-course therapy (≤ 5 days) was non-inferior to longer regimens in non-severe community-acquired pneumonia [6]; however, this evidence does not extend to HAP, where the minimum 7-day duration remains the standard recommendation. A review in *Paediatric Drugs* (2025) reinforced that the key advantages of appropriately shortened antibiotic courses include reduced resistance selection, improved adherence, fewer adverse events, and lower costs, while emphasising that unduly shortened courses, particularly in young children, carry risks of treatment failure and impaired lung development [8]. Conversely, the 16% of patients receiving antibiotics for more than 14 days were at increased risk of adverse effects, microbiome disruption, and prolonged nosocomial exposure.

Of all prescriptions evaluated, 67% had appropriate antibiotic doses, while 33% were classified as incorrect (Gyssens Category IIa). Dosing inaccuracies were most likely attributable to the absence of accurate body weight documentation in medical records, which precluded weight-based dose calculation (mg/kg). This finding is consistent with reports from multiple Indonesian studies demonstrating that incomplete body weight documentation constitutes a primary barrier to accurate pediatric dosing [25]. The clinical implications of dosing inaccuracies are substantial: underdosing increases the risk of therapeutic failure and selects for antimicrobial resistance, particularly relevant for cephalosporins, where sub-MIC exposures promote selection of resistant mutants, while overdosing elevates the risk of drug toxicity, including nephrotoxicity in the case of aminoglycosides and potential neurotoxicity with certain beta-lactams at high doses [27]. In pediatric patients, the pharmacokinetic variability attributable to age and body weight further amplifies the consequences of dosing errors.

Overall, Gyssen's analysis classified only 35% of antibiotic prescriptions as rational (Category 0). This proportion is lower than that reported at RSUP Dr Wahidin Sudirohusodo, where 58% of antibiotic use was deemed rational using the same method. Still, it is consistent with findings from Bhayangkara Hospital, Banda Aceh (35.1%) [27] and with the national systematic review and meta-analysis by Limato et al. (2022), which reported a pooled appropriateness rate of 33.5% (95% CI 18.1-53.4%) across Indonesian inpatient facilities using the Gyssens method [11]. A more recent Gyssens-based evaluation published in *Jurnal Farmasimed*, conducted among adult patients with chronic kidney disease, reported a substantially higher rationality rate of 63.74%, with narrower-spectrum alternative availability (Category IVd) rather than dosing or duration errors as the leading source of irrationality, suggesting that the specific deficiencies identified in the present pediatric HAP population may be population- and setting-dependent rather than a uniform national pattern [28]. The predominant categories of irrationality were Category IIa (inappropriate dose, 33%), Category IIIb (excessively short duration, 22%), and Category IIIa (excessively long duration, 10%). Importantly, no prescriptions were classified in Categories Iva-IVd (more effective, safer, cheaper, or narrower-spectrum alternatives available), indicating that antibiotic selection itself was relatively appropriate relative to institutional guidelines; the core deficiencies resided in dose calibration and duration determination.

These findings are concordant with the study at Roemani Muhammadiyah Hospital, Semarang, which similarly identified inappropriate antibiotic selection (Category IVa, 24.66%) and excessively short duration (Category IIIb, 16.44%) as the main sources of irrationality in pediatric bronchopneumonia, [13] and with a study at Bahteramas Hospital (2024), which reported a rationality rate of 41% with primary issues in antibiotic selection and duration [25]. A multicentre intervention study evaluating an antimicrobial stewardship (AMS) clinical

pathway for non-severe pediatric pneumonia at Meyer Children's Hospital IRCCS, Italy, demonstrated that structured pathway implementation significantly increased the proportion of patients receiving short-course intravenous therapy (≤ 48 hours IV) and first-line antibiotic agents, without worsening clinical outcomes [9], providing direct evidence that the deficiencies identified in the present study are amenable to systematic intervention. Similarly, a pre- and post-intervention study at an academic medical centre in the United States found that an AMS intervention significantly reduced broad-spectrum antibiotic prescribing and decreased the median antibiotic duration from 10 to 8 days in hospitalised patients with pediatric pneumonia, without adverse clinical outcomes [29]. Furthermore, an AMS study in Indonesia demonstrated a 10% improvement in antibiotic rationality and a 30.61% reduction in antimicrobial costs following program implementation in a tertiary pediatric ward [25].

The findings of this study must be contextualised within the broader landscape of antimicrobial stewardship in Indonesia. A nationwide mixed-methods study published in the *Journal of Hospital Infection* (2024), which surveyed 575 hospitals across all 34 provinces, found that while 89.7% had a formal ASP, only 11.4% had reached an advanced level of development (score $>75\%$), with the median ASP implementation score at 48.4% [26]. Key barriers identified included limited access to microbiology services, insufficient human resources, hierarchical hospital structures, and inadequate interdisciplinary collaboration. These structural challenges are directly relevant to the dosing inaccuracies and duration problems identified in the present study, as both require coordinated action across clinicians, pharmacists, and microbiologists to resolve. These findings strongly support the urgent need for a structured Antimicrobial Stewardship Program at Ar-Rasyid Islamic Hospital, Palembang. Collectively, these findings confirm that the rationality of antibiotic prescribing at Ar-Rasyid Islamic Hospital, Palembang, remains suboptimal and is consistent with the broader national pattern of irrational antibiotic use described in the introduction. Periodic quantitative evaluation of antibiotic use patterns in hospitalised patients using validated methods such as the Gyssens or ATC/DDD approach has been demonstrated to be essential for identifying prescribing deficiencies and directing stewardship interventions; a recent retrospective study in Indonesian inpatient settings similarly confirmed that systematic antibiotic use evaluation is critical to prevent resistance and optimise therapeutic outcomes [30]. These findings therefore validate the urgent need to implement a structured, evidence-based Antimicrobial Stewardship Program at this institution, specifically targeting dose calibration, standardising treatment duration, and ensuring comprehensive medical record documentation.

Study Limitations. This study has several limitations that should be considered when interpreting the findings. First, its retrospective, single-centre design relying on secondary medical record data is subject to information bias arising from incomplete or inconsistent documentation, particularly the absence of accurate body weight records, which likely contributed to the dosing inaccuracies identified. Second, although the Gyssens method is a widely validated qualitative tool, its application involves an element of subjective clinical judgement, and inter-rater reliability among evaluators was not formally assessed in this study. Third, the absence of microbiological culture and antimicrobial susceptibility data precluded evaluation of pathogen-directed therapy and the true burden of antibiotic resistance at this institution, so antibiotic appropriateness could only be assessed against empirical guideline criteria. Fourth, clinical outcomes such as length of stay, treatment response, and mortality were not analysed, limiting inference about the clinical consequences of irrational antibiotic use. Finally, the use of purposive sampling at a single hospital over two years, together with the relatively small sample size ($n=100$), may limit the generalizability of these findings to other healthcare settings in Indonesia. Future prospective, multicenter studies incorporating microbiological and clinical outcome data are warranted to validate and extend these findings.

5. CONCLUSION

The most frequently prescribed antibiotic in pediatric HAP patients at Ar-Rasyid Islamic Hospital, Palembang, during 2023-2024, was injectable ceftazidime (49.40%), followed by Renasistin drops/cefadroxyl (9.96%) and injectable ceftriaxone (9.16%). Gyssens analysis classified only 35% of prescriptions as rational (Category 0). The primary sources of irrationality were inappropriate dosing (Category IIa, 33%), excessively short treatment duration (Category IIb, 22%), and excessively long treatment duration (Category IIIa, 10%). These findings highlight the urgent need for evidence-based Antimicrobial Stewardship Programs and improved medical record

documentation systems to enhance the rationality of antibiotic prescribing for pediatric pneumonia patients at this institution.

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