E-ISSN: 3025-2326
DINASTI HEALTH AND PHARMACY SCIENCE
https://dinastires.org/DHPS dinasti.info@gmail.com +62 811 7404 455

DOI: https://doi.org/10.38035/dhps.v4i1

Drug Use Evaluation of Acute Respiratory Infection (ARI) Therapy in Hospitalized Pediatric Patients: A Retrospective Study at a Hospital in Bandung, Indonesia

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Abstract: Acute respiratory infection is one of the leading causes of hospitalization among children, and inappropriate medication use may reduce treatment effectiveness while increasing the risk of adverse events and antimicrobial resistance. Although numerous studies have examined antibiotic prescribing, comprehensive evaluations of overall medication use in hospitalized pediatric patients remain limited. This study aimed to evaluate the appropriateness of medication use for children hospitalized with acute respiratory infection using a structured drug use evaluation approach. A retrospective descriptive study was conducted using medical records and prescription sheets of pediatric inpatients treated from January to June 2026. Quantitative analysis described prescribing patterns, whereas qualitative analysis assessed medication appropriateness based on established clinical standards, including drug selection, dosage, dosage form, administration route, drug combinations, and potential drug interactions. The findings showed that syrup formulations and oral administration were the most frequently prescribed, while antibiotics were prescribed in 41.6% of prescriptions. Potential drug interactions were identified in 19.89% of prescriptions, whereas clinically significant drug combinations were rare. Overall, prescribing practices generally reflected rational medication use, although several prescriptions required closer monitoring because of potential safety concerns. The novelty of this study lies in its comprehensive evaluation of pediatric medication use by integrating quantitative and qualitative drug use evaluation to support safer prescribing and improve pharmaceutical care in hospital settings.

Keywords: *Acute Respiratory Infection; Drug Use Evaluation; Pediatric Patients; Rational Drug Use; Hospital Pharmacy*

Indonesian Abstract: *Infeksi saluran pernapasan akut merupakan salah satu penyebab utama rawat inap pada anak, dan penggunaan obat yang tidak rasional dapat menurunkan efektivitas terapi serta meningkatkan risiko efek samping dan resistensi antimikroba. Meskipun banyak penelitian berfokus pada penggunaan antibiotik, evaluasi yang komprehensif terhadap keseluruhan penggunaan obat pada pasien anak yang menjalani rawat inap masih terbatas. Penelitian ini bertujuan mengevaluasi ketepatan penggunaan obat pada pasien anak rawat inap dengan infeksi saluran pernapasan akut menggunakan pendekatan evaluasi penggunaan obat. Penelitian deskriptif retrospektif dilakukan*

menggunakan data rekam medis dan lembar resep pasien anak yang dirawat pada Januari hingga Juni 2026. Analisis kuantitatif digunakan untuk menggambarkan pola peresepan, sedangkan analisis kualitatif menilai ketepatan penggunaan obat berdasarkan standar klinis meliputi pemilihan obat, dosis, bentuk sediaan, rute pemberian, kombinasi obat, dan potensi interaksi obat. Hasil penelitian menunjukkan bahwa bentuk sediaan sirup dan rute pemberian oral merupakan yang paling banyak digunakan, sedangkan antibiotik diresepkan pada 41,6% resep. Potensi interaksi obat ditemukan pada 19,89% resep, sedangkan kombinasi obat yang bermakna secara klinis sangat jarang ditemukan. Secara keseluruhan, pola peresepan telah mencerminkan penggunaan obat yang rasional, meskipun beberapa resep masih memerlukan pemantauan lebih lanjut terkait aspek keamanan. Kebaruan penelitian ini terletak pada evaluasi penggunaan obat secara menyeluruh melalui integrasi analisis kuantitatif dan kualitatif untuk mendukung peresepan yang lebih aman serta meningkatkan mutu pelayanan kefarmasian di rumah sakit..

Keywords: Infeksi Saluran Pernapasan Akut; Evaluasi Penggunaan Obat; Pasien Anak; Penggunaan Obat Rasional; Farmasi Rumah Sakit

INTRODUCTION

Acute respiratory infection (ARI) remains one of the leading causes of morbidity and hospitalization among pediatric patients worldwide, particularly in low- and middle-income countries. Despite advances in preventive and therapeutic strategies, inappropriate medication use, especially the irrational prescribing of antibiotics, continues to contribute to increased antimicrobial resistance, prolonged hospitalization, higher treatment costs, and adverse drug reactions (World Health Organization [WHO], 2023; Centers for Disease Control and Prevention [CDC], 2024). Consequently, ensuring the rational use of medicines in pediatric patients has become an essential component of healthcare quality improvement and patient safety.

Hospitals play a central role in delivering comprehensive healthcare services, including preventive, curative, rehabilitative, educational, and research activities. Within hospitals, the Hospital Pharmacy Department is responsible for pharmaceutical services, encompassing medication procurement, storage, distribution, clinical pharmacy services, and medication-use evaluation. One of the key quality assurance activities performed by hospital pharmacy services is Drug Use Evaluation (DUE), a structured and continuous process designed to ensure that medications are prescribed, dispensed, and administered appropriately, safely, and effectively (Siregar, 2004). DUE provides an evidence-based approach for assessing prescribing patterns and identifying opportunities to optimize pharmacotherapy while minimizing medication-related problems.

Acute respiratory infection (ARI) is defined as an acute infection affecting the upper or lower respiratory tract caused by viruses, bacteria, or other microorganisms. The disease generally develops within 14 days and ranges from mild upper respiratory infections to severe lower respiratory tract infections such as bronchitis and pneumonia. Pediatric patients are particularly vulnerable because of their immature immune systems, making ARI one of the major contributors to childhood morbidity and mortality. Clinical manifestations commonly include rhinitis, sore throat, cough, fever, chest discomfort, headache, nausea, vomiting, and sleep disturbances (Alsagaff, 2005). Appropriate pharmacological management is therefore essential to improve clinical outcomes while preventing unnecessary medication exposure.

Most ARI cases in children are caused by viral infections; therefore, treatment primarily focuses on symptomatic management using antipyretics, analgesics, antitussives, bronchodilators, or corticosteroids when clinically indicated. Antibiotics should only be prescribed when bacterial infection is confirmed or strongly suspected because inappropriate

antibiotic use contributes significantly to antimicrobial resistance (Alsagaff, 2005; WHO, 2023). Ideally, antibiotic selection should be guided by microbiological culture and antimicrobial susceptibility testing. However, in routine clinical practice, microbiological examination is not always feasible because of time constraints, limited laboratory facilities, or the urgency of initiating treatment. Consequently, empirical antibiotic therapy is frequently prescribed based on clinical guidelines and physician judgment (Ministry of Health of Indonesia, 2023).

The appropriateness of medication use depends on several clinical considerations, including the accuracy of diagnosis, drug indication, contraindications, dosage, route of administration, duration of therapy, potential drug interactions, and adverse drug reactions (Siregar, 2004). In pediatric patients, dose determination is particularly complex because it is influenced by age, body weight, body surface area, sex, pathological condition, drug tolerance, concomitant medications, dosage form, and administration schedule (Siregar, 2002). Inappropriate prescribing may reduce therapeutic effectiveness and increase the risk of medication errors and adverse outcomes.

Previous studies have extensively reported prescribing patterns and antibiotic utilization in respiratory infections. However, many investigations have primarily emphasized the prevalence of antibiotic use or antimicrobial resistance, while relatively few studies have comprehensively evaluated the overall appropriateness of medication prescribing using both qualitative and quantitative drug use evaluation criteria in hospitalized pediatric ARI patients, particularly in Indonesian hospitals. Furthermore, evidence regarding the conformity of prescribing practices with rational drug use principles in pediatric inpatient settings remains limited. This gap highlights the need for a comprehensive evaluation that not only examines antibiotic prescribing but also assesses the overall appropriateness of pharmacotherapy, including drug selection, dosage accuracy, administration route, therapeutic duration, and patient-related factors.

The novelty of this study lies in its comprehensive evaluation of medication use for pediatric ARI inpatients through a structured Drug Use Evaluation (DUE) approach that integrates both qualitative and quantitative prescribing assessments. Unlike previous studies focusing mainly on antibiotic utilization, this study evaluates the appropriateness of overall pharmacotherapy based on clinical indications, dosing accuracy, safety, and treatment effectiveness, thereby providing evidence to support pharmaceutical care improvement and rational medicine use in hospital settings.

Based on these considerations, this study aims to evaluate the appropriateness of medication prescribing for pediatric inpatients diagnosed with acute respiratory infection (ARI) at a hospital in Bandung by assessing whether the prescribed medications are appropriate, safe, and effective according to established principles of rational drug use. The findings are expected to provide evidence for improving prescribing practices, strengthening medication management within hospital pharmacy services, and enhancing the quality and safety of pediatric healthcare.

METHODS

. This study employed a retrospective descriptive Drug Use Evaluation (DUE) design to assess the appropriateness of medication use for pediatric patients hospitalized with acute respiratory infection (ARI). The evaluation was conducted using both qualitative and quantitative approaches to determine whether prescribed medications were administered appropriately, safely, and effectively according to established clinical standards. The study population consisted of hospitalized pediatric patients diagnosed with ARI at a hospital in Bandung, Indonesia. An inclusive sampling approach was applied, in which all pediatric inpatients meeting the inclusion criteria during the study period were included. Retrospective

data were collected from patients who had received pharmacological treatment between January and June 2026, while data collection was conducted from April to July 2026.

The evaluation focused on medications prescribed for ARI management in pediatric patients. The criteria for appropriate medication use were established before data collection based on authoritative pharmaceutical and clinical references, including Drug Facts and Comparisons (Cada, 2000), AHFS Drug Information (McEvoy et al., 1999), Drug Information for the Health Care Professional (Halperine, 1997), the Indonesian National Drug Information (Informatorium Obat Nasional Indonesia) (Ministry of Health of Indonesia, 2000), Stockley's Drug Interactions (Stockley, 1999), Buku Ajar Ilmu Penyakit Anak (Danusantosa, 2000), and Buku Saku Penyakit Paru (Alsagaff, 2005). These references served as the standard for evaluating the appropriateness of drug selection, indication, dosage, dosage form, route of administration, duration of therapy, concomitant medications, antibiotic use, contraindications, and potential drug interactions.

Data were obtained from hospital medical records and prescription sheets. The variables collected included patient age, sex, body weight, prescribed medications, dosage, dosage form, route of administration, duration of therapy, antibiotic utilization, and concomitant medications. After data collection, all variables were systematically organized into tabular form according to patient characteristics and medication profiles to facilitate subsequent analysis. Quantitative analysis was performed by tabulating medication utilization data according to patient characteristics and prescribed ARI medications. The frequency and percentage of each variable were calculated to describe prescribing patterns and medication utilization. Qualitative analysis was conducted by comparing the prescribing data with the predetermined drug use criteria derived from the selected clinical references. This evaluation assessed the appropriateness of medication prescribing regarding indication, drug selection, dosage, route of administration, duration of therapy, dosage form, concomitant drug use, and antibiotic prescribing. The findings were subsequently used to identify prescribing patterns and determine the appropriateness of drug use in hospitalized pediatric patients with ARI.

RESULTS AND DISCUSSION

1. Quantitative Data on Drug Utilization for Acute Respiratory Infection (ARI) in Hospitalized Pediatric Patients from January to June 2026

Figure 4 illustrates the distribution of dosage forms prescribed for hospitalized pediatric patients with acute respiratory infection (ARI) from January to June 2026. Syrup was the most frequently prescribed dosage form, accounting for 210 prescriptions (57.22%), followed by injections with 99 prescriptions (27.35%) and tablets with 29 prescriptions (7.97%). Less frequently prescribed dosage forms included suppositories (2.46%), powder formulations (2.46%), and inhalation preparations (0.82%).

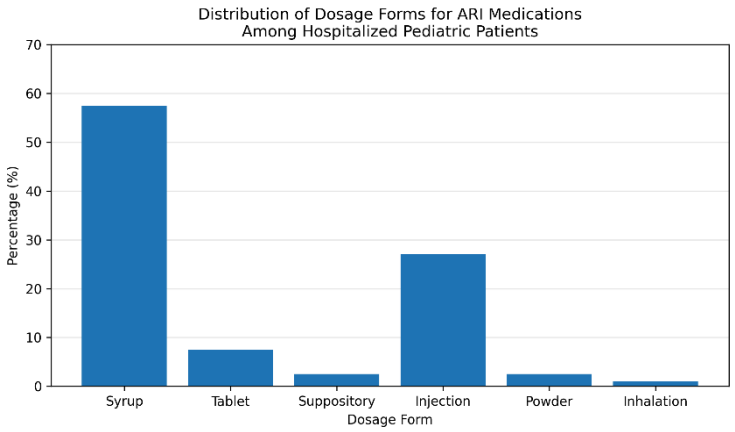

Figure 1. Distribution of Dosage Forms for ARI Medications among Hospitalized Pediatric Patients

The predominance of syrup formulations reflects the unique pharmacotherapeutic needs of pediatric patients. Liquid dosage forms are generally preferred in children because they are easier to swallow, allow flexible dose adjustments according to body weight, and are often formulated with pleasant flavors that improve treatment adherence. Compared with solid dosage forms such as tablets or capsules, syrups are more acceptable to young children who have not yet developed the ability to swallow tablets safely (Ansel, 1989). Furthermore, pediatric dosing frequently requires individualized dose calculations, making liquid formulations more practical for achieving accurate therapeutic dosing. Injection preparations represented the second most commonly prescribed dosage form. Injectable medications are typically administered to hospitalized children who are unable to take medications orally because of decreased consciousness, persistent vomiting, severe respiratory distress, poor cooperation, or critical clinical conditions requiring rapid therapeutic effects (Ansel, 1989). The relatively high proportion of injectable medications in this study is consistent with the inpatient setting, where parenteral administration is often necessary during the acute phase of illness before patients are transitioned to oral therapy once their clinical condition improves.

Tablet formulations accounted for only 7.97% of prescriptions and were primarily prescribed for older children, particularly those aged 9–12 years, who generally possess adequate swallowing ability. Tablets also offer advantages such as greater stability, convenient administration, and accurate dosing, making them suitable for older pediatric patients and adults (Ansel, 1989). The limited use of tablets among younger children reflects current pediatric pharmaceutical practice, which prioritizes age-appropriate formulations to improve medication adherence and reduce the risk of swallowing difficulties. The low utilization of suppositories, powder formulations, and inhalation preparations suggests that these dosage forms were prescribed only under specific clinical circumstances. Suppositories may be selected when oral administration is not feasible, such as in patients experiencing persistent vomiting or seizures. Powder formulations are commonly used for medications requiring reconstitution or individualized pediatric dosing, whereas inhalation therapy is reserved for respiratory conditions associated with bronchospasm or airway obstruction rather than routine management of uncomplicated ARI. Overall, the prescribing pattern demonstrates that dosage form selection was generally adapted to the physiological characteristics, age, swallowing ability, and clinical condition of pediatric patients. The predominance of syrup formulations, together with the selective use of injectable medications for severely ill patients, indicates that prescribing practices were consistent with the principles of rational pediatric pharmacotherapy, emphasizing both treatment effectiveness and patient safety.

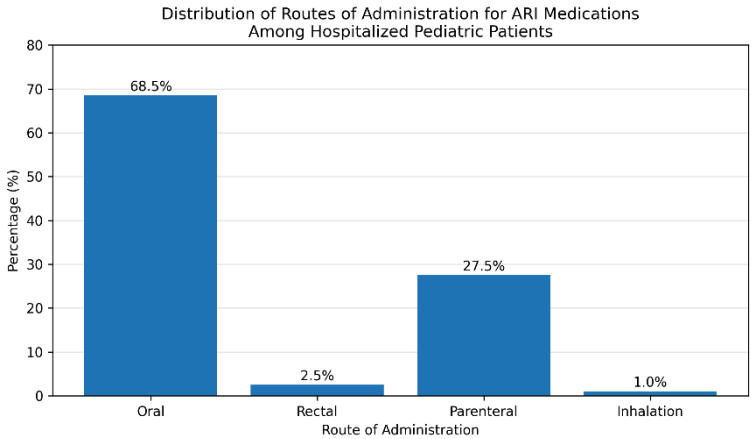

Figure 2. Distribution of Routes of Administration for ARI Medications among Hospitalized Pediatric Patients

Figure 5 presents the distribution of medication administration routes prescribed for hospitalized pediatric patients with acute respiratory infection (ARI) from January to June 2026. The oral route was the most frequently prescribed, accounting for 244 prescriptions (67.59%), followed by the parenteral route with 99 prescriptions (27.42%), the rectal route with 9 prescriptions (2.49%), and the inhalation route with 4 prescriptions (1.11%). The predominance of oral administration reflects its role as the preferred route for pediatric pharmacotherapy because it is non-invasive, convenient, cost-effective, and generally well accepted by children. Oral administration is suitable for patients who are clinically stable and capable of swallowing medications, particularly when syrup formulations are available. In addition, the oral route minimizes patient discomfort and reduces the risk of complications associated with invasive procedures while maintaining therapeutic effectiveness for most uncomplicated ARI cases (Ansel, 1989).

The parenteral route represented the second most common method of administration. Injectable medications are typically indicated for hospitalized children with severe clinical conditions, including impaired consciousness, persistent vomiting, inability to tolerate oral medications, severe respiratory distress, or when rapid therapeutic drug concentrations are required. Parenteral administration also provides complete drug bioavailability and a faster onset of action, making it the preferred option for critically ill pediatric patients during the acute phase of treatment (Ansel, 1989). The relatively high proportion of parenteral prescriptions observed in this study is therefore consistent with the characteristics of inpatient care. Rectal administration accounted for only a small proportion of prescriptions and was generally reserved for children who were unable to receive medications orally because of vomiting, swallowing difficulties, or decreased consciousness. This route offers an alternative method for administering medications such as antipyretics when oral therapy is impractical. Similarly, inhalation therapy was prescribed infrequently because it is indicated only for selected patients with respiratory symptoms involving bronchospasm, airway obstruction, or excessive bronchial secretions rather than for routine treatment of uncomplicated ARI.

Non-generic medications accounted for 95.55% of all ARI prescriptions, whereas generic medications represented only 5.45%. This finding may be attributed to the limited availability of generic medicines compared with branded (non-generic) products in the pharmaceutical market. Although the prescription of generic medicines is encouraged in hospitals to promote rational and cost-effective drug use, their utilization remained low because of the limited availability of generic formulations within the hospital formulary. Furthermore, the low prescribing rate may also be influenced by the widespread perception among patients that generic medicines are less effective than branded products due to their lower cost, despite evidence demonstrating that approved generic medicines are therapeutically equivalent to their branded counterparts.

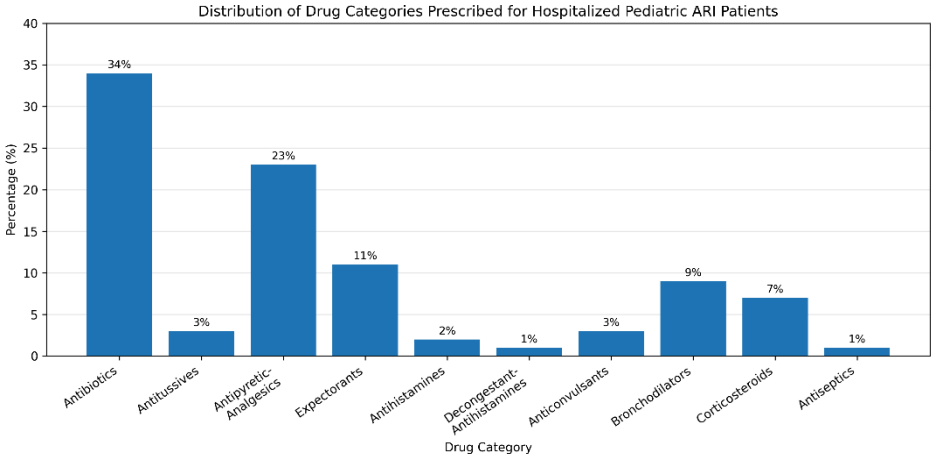

Figure 7. The distribution of drug categories prescribed for hospitalized pediatric patients diagnosed with acute respiratory infection (ARI).

Figure 7 presents the distribution of drug categories prescribed for hospitalized pediatric patients diagnosed with acute respiratory infection (ARI). Antibiotics represented the largest proportion of all prescribed medications, accounting for approximately 34% of total prescriptions. This was followed by antipyretic–analgesics (23%), expectorants (11%), bronchodilators (9%), and corticosteroids (7%). Smaller proportions of prescriptions included antitussives (3%), anticonvulsants (3%), antihistamines (2%), decongestant–antihistamine combinations (1%), and antiseptics (1%). The predominance of antibiotic prescriptions reflects the frequent clinical suspicion of bacterial infection or secondary bacterial complications among hospitalized pediatric patients with ARI. Although viral pathogens are responsible for the majority of ARI cases in children, antibiotics remain indicated for patients with confirmed or strongly suspected bacterial infections, severe disease, or complications such as bacterial pneumonia. Therefore, antibiotic prescribing should be guided by clinical assessment, microbiological findings whenever available, and antimicrobial stewardship principles to ensure appropriate drug selection, dosage, and duration of therapy while minimizing the development of antimicrobial resistance.

Antipyretic–analgesic agents were the second most commonly prescribed drug category because fever and pain are among the most common clinical manifestations of ARI. Medications such as paracetamol and ibuprofen are widely recommended to reduce fever, relieve discomfort, and improve the overall well-being of pediatric patients. Their high utilization in this study reflects the emphasis on symptomatic management as an essential component of ARI treatment. Expectorants accounted for approximately 11% of prescriptions and were used to facilitate mucus clearance in children with productive cough. Bronchodilators represented 9% of prescribed medications and were administered primarily to patients presenting with bronchospasm, wheezing, or airway obstruction, particularly in cases complicated by reactive airway disease or asthma. These medications improve airflow by relaxing bronchial smooth muscle and reducing respiratory distress.

Corticosteroids constituted approximately 7% of prescriptions and were prescribed selectively for patients with significant airway inflammation or associated respiratory conditions. Their relatively limited use is consistent with current clinical recommendations, which discourage the routine administration of corticosteroids in uncomplicated ARI unless specific indications are present. The low utilization of antitussives, antihistamines, decongestant–antihistamine combinations, anticonvulsants, and antiseptics indicates that these medications were prescribed only when clinically indicated. Antitussives were used to control severe non-productive cough, antihistamines and decongestants were prescribed for allergic manifestations or nasal congestion, anticonvulsants were administered to patients experiencing febrile seizures, and antiseptics were used for supportive management of upper respiratory tract symptoms. Table 1 presents the distribution of prescription sheets according to antibiotic use among hospitalized pediatric patients with acute respiratory infection (ARI). Of the 250 prescription sheets reviewed, 104 prescriptions (41.6%) contained at least one antibiotic, whereas 146 prescriptions (58.4%) did not include any antibiotic. In total, 362 medications were prescribed across all prescription sheets, indicating that multiple medications were frequently prescribed for individual patients to manage both the underlying infection and associated clinical symptoms.

Table 1. the distribution of prescription sheets according to antibiotic use among hospitalized pediatric patients with acute respiratory infection (ARI).

Prescription Category	Number of Prescription Sheets	Percentage (%)
Prescriptions with Antibiotics	104	41.6

Prescriptions without Antibiotics	146	58.4
Total Prescription Sheets	250	100.0

The finding that more than half of the prescriptions (58.4%) did not contain antibiotics suggests that a substantial proportion of hospitalized pediatric ARI cases were managed without antimicrobial therapy. This prescribing pattern is consistent with current clinical guidelines, which recommend that most pediatric ARIs—predominantly caused by viral pathogens—should be treated with supportive and symptomatic therapy rather than antibiotics. Symptomatic treatment, including antipyretics, analgesics, expectorants, and bronchodilators when indicated, is generally sufficient for uncomplicated viral respiratory infections. Conversely, antibiotics were prescribed in 41.6% of prescription sheets, indicating that clinicians suspected bacterial infection or secondary bacterial complications in a considerable proportion of hospitalized patients. Antibiotic therapy may be clinically justified in cases of bacterial pneumonia, acute bacterial sinusitis, otitis media, or other confirmed or strongly suspected bacterial infections. In hospitalized children, the decision to prescribe antibiotics is also influenced by disease severity, laboratory findings, radiological examinations, underlying comorbidities, and the patient's overall clinical condition.

The relatively moderate proportion of antibiotic use observed in this study suggests that antibiotics were not routinely prescribed to all pediatric ARI patients but were reserved for selected cases with appropriate clinical indications. This prescribing pattern reflects adherence to the principles of rational drug use, which emphasize that antibiotics should be prescribed only when the expected clinical benefits outweigh the potential risks. Rational antibiotic prescribing is essential to improve therapeutic outcomes, reduce unnecessary healthcare costs, minimize adverse drug reactions, and prevent the emergence of antimicrobial resistance. Overall, these findings indicate that medication management for hospitalized pediatric patients with ARI was primarily based on supportive symptomatic treatment, while antibiotics were prescribed selectively according to clinical necessity. Continuous Drug Use Evaluation (DUE) and antimicrobial stewardship programs remain essential to monitor prescribing practices, ensure compliance with evidence-based treatment guidelines, and optimize the quality and safety of pediatric pharmacotherapy.

Drug Combination Analysis

The qualitative evaluation was conducted based on predefined criteria for appropriate medication use established from recognized clinical treatment guidelines and pharmaceutical references. The qualitative assessment included the evaluation of drug combinations, dosage forms, and potential drug–drug interactions among medications prescribed for hospitalized pediatric patients with acute respiratory infection (ARI). Table 2 presents the frequency of drug combinations prescribed during the study period. Among the 362 prescribed medications reviewed from 250 prescription sheets, only one prescription (0.27%) contained a documented drug combination considered clinically relevant, namely prednisone tablets combined with injectable dexamethasone (Kalmetason). This finding indicates that the use of potentially significant drug combinations was uncommon in the study population.

Table 2. Distribution of Drug Combinations Prescribed for Hospitalized Pediatric Patients with Acute Respiratory Infection (ARI)

Drug Combination	**Number of Prescriptions**	**Percentage (%)**
Prednisone tablets + Dexamethasone injection	1	0.27
Total Drug Combinations	**1**	**0.27**

Total Prescribed Medications	362	–
Total Prescription Sheets	250	–

Drug combinations are frequently prescribed to enhance therapeutic efficacy through complementary mechanisms of action. Synergistic combinations may produce a greater pharmacological effect than either drug alone, whereas antagonistic combinations may reduce therapeutic effectiveness or increase the risk of treatment failure (Mutschler, 1991; Stockley, 1999). Therefore, the selection of combination therapy should be supported by clear clinical indications and careful consideration of the benefit–risk balance. The low frequency of drug combinations observed in this study suggests that clinicians generally preferred individualized pharmacotherapy rather than multiple-drug regimens, thereby minimizing unnecessary medication exposure and reducing the risk of adverse drug reactions.

Drug–Drug Interaction Analysis

Table 3 summarizes the potential drug–drug interactions identified among medications prescribed for pediatric ARI patients. A total of 73 potential interactions (19.89%) were identified from 362 prescribed medications, indicating that approximately one-fifth of prescriptions contained combinations with the potential for clinically significant interactions.

The most frequently identified interaction was the combination of injectable cephalosporins and injectable amikacin, occurring in 32 prescriptions (8.72%). This combination is associated with an increased risk of nephrotoxicity because both antimicrobial agents may exert additive nephrotoxic effects, particularly in pediatric patients receiving prolonged therapy or presenting with impaired renal function (Ministry of Health of Indonesia, 2000; Stockley, 1999). Despite this potential risk, the combination is commonly used in severe bacterial infections because of its broad-spectrum antimicrobial activity, provided that renal function is carefully monitored.

The second most common interactions involved ibuprofen syrup combined with injectable dexamethasone (12 prescriptions; 3.27%) and metamizole (Novalgin) combined with injectable dexamethasone (12 prescriptions; 3.27%). These combinations may increase the risk of gastrointestinal bleeding and peptic ulceration because both corticosteroids and nonsteroidal anti-inflammatory drugs (NSAIDs) can compromise gastrointestinal mucosal protection (Stockley, 1999).

Table 3. Distribution of Potential Drug–Drug Interactions Among Medications Prescribed for Hospitalized Pediatric Patients with Acute Respiratory Infection (ARI)

Drug Interaction	Number of Prescriptions	Percentage (%)	Interaction Type
Injectable cephalosporin – Injectable amikacin	32	8.72	Pharmacodynamic
Ibuprofen syrup – Injectable dexamethasone (Kalmetason)	12	3.27	Pharmacokinetic
Paracetamol syrup – Injectable dexamethasone (Kalmetason)	11	3.00	Pharmacokinetic
Chloramphenicol syrup – Cephalosporin syrup	2	0.54	Pharmacodynamic
Paracetamol syrup – Phenobarbital (Luminal) tablets	4	1.09	Pharmacodynamic
Metamizole (Novalgin) syrup – Injectable dexamethasone (Kalmetason)	12	3.27	Pharmacodynamic

Total Potential Drug Interactions	**73**	**19.89**	—
Total Prescribed Medications	**362**	—	—
Total Prescription Sheets	**250**	—	—

Another potential interaction identified was paracetamol syrup combined with injectable dexamethasone, observed in 11 prescriptions (3.00%). Although generally considered clinically manageable, prolonged concomitant administration may increase the risk of hepatotoxicity, particularly in patients receiving high doses or those with impaired liver function. Similarly, the combination of paracetamol and phenobarbital (Luminal), identified in four prescriptions (1.09%), may enhance hepatic metabolism of paracetamol through enzyme induction, thereby increasing the production of hepatotoxic metabolites. The combination of chloramphenicol syrup and cephalosporin syrup, identified in two prescriptions (0.54%), represents a pharmacodynamic interaction because chloramphenicol may antagonize the bactericidal activity of cephalosporins and has also been associated with bone marrow suppression. Consequently, concurrent administration should be carefully justified and monitored. Drug interactions are considered clinically significant when they reduce therapeutic efficacy or increase the risk of adverse drug reactions, particularly for medications with a narrow therapeutic index (Ganiswarna, 2001). Based on their mechanisms, drug interactions are generally classified as pharmacodynamic or pharmacokinetic. Pharmacodynamic interactions occur when one drug modifies the pharmacological effect of another at its site of action, resulting in additive, synergistic, or antagonistic effects (Stockley, 1999). In contrast, pharmacokinetic interactions occur when one drug alters the absorption, distribution, metabolism, or excretion of another drug, potentially leading to clinically significant changes in drug exposure and therapeutic response (Harkness, 1989).

Overall, the relatively low prevalence of clinically relevant drug combinations and the moderate frequency of potential drug–drug interactions suggest that prescribing practices were generally consistent with rational pharmacotherapy principles. Nevertheless, the identification of several interactions associated with nephrotoxicity, hepatotoxicity, and gastrointestinal toxicity underscores the importance of continuous Drug Use Evaluation (DUE), pharmacist-led medication review, and antimicrobial stewardship programs to optimize medication safety and therapeutic outcomes in hospitalized pediatric patients with ARI.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study evaluated the appropriateness of medication use for hospitalized pediatric patients with acute respiratory infection (ARI) through a comprehensive Drug Use Evaluation (DUE) using both quantitative and qualitative approaches. The findings indicate that pharmacotherapy was predominantly based on symptomatic management, with syrup formulations and oral administration being the most frequently prescribed because of their suitability for pediatric patients. Antibiotics were prescribed in 41.6% of prescriptions, suggesting that antimicrobial therapy was generally reserved for patients with suspected or confirmed bacterial infections rather than being routinely administered to all ARI cases. The qualitative evaluation demonstrated a very low prevalence of clinically significant drug combinations, indicating that unnecessary polypharmacy was largely avoided. Although several potential drug–drug interactions were identified, particularly combinations associated with nephrotoxicity, hepatotoxicity, and gastrointestinal toxicity, most prescriptions reflected rational medication selection based on patients' clinical conditions. Nevertheless, these potential interactions emphasize the importance of careful medication review and clinical monitoring during pharmacotherapy.

Overall, the study demonstrates that Drug Use Evaluation provides an effective framework for assessing prescribing quality, identifying opportunities to improve medication safety, and promoting rational drug use in hospitalized pediatric patients with ARI. The findings contribute to hospital pharmacy practice by supporting evidence-based prescribing, strengthening antimicrobial stewardship programs, and encouraging continuous monitoring of prescribing patterns to optimize therapeutic outcomes and minimize medication-related risks.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the study was conducted retrospectively using medical records and prescription sheets from a single hospital, which may limit the completeness and accuracy of the available clinical information and reduce the generalizability of the findings to other healthcare settings. Second, the evaluation was based on prescribing data collected over a six-month period and therefore may not reflect changes in prescribing practices or seasonal variations in the incidence and management of acute respiratory infection (ARI). Third, the assessment focused primarily on the appropriateness of medication prescribing, dosage forms, administration routes, drug combinations, and potential drug–drug interactions without evaluating microbiological culture results, antimicrobial susceptibility testing, treatment adherence, clinical outcomes, or adverse drug reactions. Finally, the identification of drug–drug interactions was based on established reference sources and represented potential rather than confirmed clinically significant interactions. Consequently, the findings should be interpreted within the context of the study design and available data, and further prospective, multicenter studies incorporating clinical outcomes and antimicrobial resistance data are warranted to provide a more comprehensive evaluation of rational drug use in pediatric ARI management.

Recommendations

Future studies should include multicenter investigations involving a larger and more diverse pediatric population to improve the generalizability of the findings. Prospective study designs are recommended to enable real-time assessment of prescribing practices, treatment adherence, clinical outcomes, adverse drug reactions, and the actual clinical significance of identified drug–drug interactions. In addition, future research should incorporate microbiological culture results, antimicrobial susceptibility testing, and antimicrobial resistance surveillance to better evaluate the appropriateness of antibiotic prescribing. From a clinical perspective, hospitals should strengthen Drug Use Evaluation (DUE) and Antimicrobial Stewardship Programs (ASP) through regular prescription audits, pharmacist-led medication reviews, and continuous education for healthcare professionals on evidence-based prescribing practices. Enhancing the availability of essential generic medicines and implementing computerized clinical decision support systems with drug interaction alerts may further improve medication safety, optimize rational drug use, and enhance the quality of pharmaceutical care for hospitalized pediatric patients with acute respiratory infection (ARI).

Author Contributions

All authors made significant contributions to this study. These contributions included research conceptualization, development of the theoretical framework, data collection, data analysis, interpretation of results, manuscript preparation, scholarly revision, and final approval of the manuscript for publication. All authors confirm that they have read and approved the final version of the article.

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