

Research Article

Assessment Of Antibiotic Use and Prescribing Practices in Hospitalized Pediatric Patients: A Retrospective, Observational Study.

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ABSTRACT

Background: Antibiotics are frequently prescribed in hospitalized pediatric patients, particularly when serious bacterial infection is suspected. However, inappropriate antibiotic selection, prolonged duration, and excessive use of broad-spectrum agents may contribute to antimicrobial resistance. This study assessed antibiotic utilization and prescribing practices among hospitalized pediatric patients.

Methods: A retrospective observational study was conducted over a period of six months, from January to June 2026 in the Department of Pediatrics at Autonomous State Medical College & Allied Pt. Ram Prasad Bismil Hospital, Shahjahanpur. Pin-24001 (U.P), Collaboration with Department of Pharmacology Autonomous State Medical College, Kanpur Dehat, (U.P), over a period of Six Months. A total of 143 eligible pediatric patients were initially enrolled, of whom 3 were excluded due to incomplete data or loss to follow-up, resulting in 140 patients for final analysis. Data regarding demographic characteristics, diagnosis, antibiotics prescribed, dose, frequency, route, duration, treatment approach, and laboratory investigations were collected using a standardized data collection form. Antibiotic prescribing was assessed for appropriateness and classified according to the WHO AWaRe framework. Descriptive statistics and chi-square tests were used for analysis, with $p < 0.05$ considered statistically significant.

Results: Among 140 patients, 58.6% were male and 41.4% were female. Children aged 6-12 years constituted the largest age group (42.9%). Respiratory tract infections were the most common diagnosis (27.1%), followed by acute gastroenteritis (17.1%) and pneumonia (15.7%). Ceftriaxone was the most frequently prescribed antibiotic (30.0%), followed by amoxicillin-clavulanic acid (17.1%) and cefotaxime (12.9%). Intravenous administration was predominant (75.0%), while monotherapy accounted for 62.9% and empirical therapy for 73.6% of prescriptions ($p < 0.001$). The mean duration of antibiotic therapy was 6.4 ± 2.3 days. According to the WHO AWaRe classification, Watch-group antibiotics accounted for 64.3% of prescriptions, followed by Access-group antibiotics (30.0%) and Reserve-group antibiotics (3.6%). Overall, 73.6% of prescriptions were considered appropriate, whereas 26.4% were inappropriate. Appropriateness was highest for route of administration (89.3%) and lowest for duration of therapy (72.1%).

Conclusion: The study demonstrated substantial use of broad-spectrum and Watch-group antibiotics among hospitalized pediatric patients, with empirical therapy being the predominant approach. Although most prescriptions were considered appropriate, considerable scope for improvement was identified, particularly regarding antibiotic duration and selection. Strengthening antimicrobial stewardship, regular prescription auditing, microbiological investigation, timely reassessment of empirical therapy, and adherence to WHO AWaRe recommendations may promote rational antibiotic use and reduce unnecessary antimicrobial exposure and antimicrobial resistance.

Keywords: Antibiotics, Pediatric Patients, Antimicrobial Stewardship, WHO Aware, Ceftriaxone, Antibiotic Prescribing, Antimicrobial Resistance.

INTRODUCTION

Children are particularly vulnerable to bacterial infections due to their immature immune systems. Therefore, timely antibiotic treatment is important to prevent complications and improve outcomes. In severe hospitalized cases, antibiotics are often started empirically before microbiological confirmation.¹ Antibiotics are commonly prescribed to hospitalized children, but excessive use may lead to unnecessary treatment, adverse effects, and antimicrobial resistance. Rational prescribing requires selecting the appropriate antibiotic, dose, route, frequency, and duration based on the child's age, weight, clinical condition, and suspected pathogen.²

Consequently, antibiotics are among the most frequently prescribed medicines in hospitalized pediatric patients and are often initiated empirically when serious bacterial infection is suspected, before microbiological confirmation is available.³ However, inappropriate or excessive antibiotic use can result in adverse drug events, unnecessary healthcare costs, prolonged hospitalization, and the development of antimicrobial resistance (AMR).⁴⁻⁶ Rational antibiotic prescribing involves selecting the appropriate antimicrobial agent, dose, route of administration, frequency, and duration according to the child's age, body weight, clinical condition, site and severity of infection, and suspected or identified pathogen.^{7,8} Appropriate prescribing also requires timely microbiological investigation, reassessment of empirical therapy, and de-escalation or discontinuation when antibiotics are no longer indicated.⁹ The WHO AWaRe classification and antibiotic guidance provide a framework for promoting appropriate antibiotic selection and monitoring antibiotic consumption.^{10,11} Studies conducted in pediatric hospitals have demonstrated considerable variation in antibiotic prescribing practices. A point-prevalence survey in Indian hospitals found that 61.5% of hospitalized children received at least one antimicrobial, with third-generation cephalosporins being frequently used.¹² More recent studies have continued to identify substantial antibiotic use among hospitalized children and neonates, highlighting the need for regular assessment of prescribing practices.^{13,14} Evidence from children's hospitals has also

shown that a considerable proportion of antibiotic prescriptions may be suboptimal because of inappropriate drug selection, unnecessarily broad empirical therapy, prolonged duration, or treatment without a clear indication.¹⁵

METHODOLOGY

Study Design

A retrospective observational study will be conducted to assess antibiotic utilization and prescribing practices among hospitalized pediatric patients. This study aimed to assess antibiotic utilization and prescribing practices among hospitalized pediatric patients, including commonly used antimicrobials, indications for therapy, and antibiotic treatment patterns.

Study Duration And Setting

The study was conducted over a period of six months, from January to June 2026, in the Department of Pediatrics at Autonomous State Medical College & Allied Pt. Ram Prasad Bismil Hospital, Shahjahanpur, Uttar Pradesh (PIN: 242001), in collaboration with the Department of Pharmacology, Autonomous State Medical College, Kanpur Dehat, Uttar Pradesh. The medical records of eligible pediatric patients receiving antibiotic therapy at the hospital were systematically reviewed and analyzed.

Sample Size Calculation

The required sample size was calculated using the standard formula for estimating a single population proportion:

$$n = Z^2 \times P \times (1 - P) / d^2$$

Where:

- n = required sample size
- Z = standard normal deviate at 95% confidence level = 1.96
- P = expected prevalence of antibiotic use = 61.5% (0.615) Alosaimi HM, Alshammari M, Fetyani M, et al. Point prevalence survey of antibiotics use among hospitalised neonates and children in Saudi Arabia: findings and implications. *Infect Drug Resist.* 2024; 17:2371–2411
- $1 - P$ = 0.385
- d = allowable absolute precision = 8% (0.08)

Substituting The Values

$$\begin{aligned} n &= (1.96)^2 \times 0.615 \times 0.385 / (0.08)^2 \\ n &= 3.8416 \times 0.615 \times 0.385 / 0.0064 \\ n &= 142.2 \approx 143 \text{ patients} \end{aligned}$$

Considering the feasibility of the study, 143 eligible pediatric patients were initially enrolled. During the study period, 3 patients were excluded due to incomplete data or loss to follow-up. Therefore, a total of 140 hospitalized pediatric patients were included in the final analysis.

Inclusion Criteria

1. Pediatric patients aged >1-12 years admitted to the pediatric ward.
2. Patients who receive at least one systemic antibiotic during hospitalization.
3. Patients whose medical and medication records are sufficiently complete for data collection.

Exclusion Criteria

1. Patients admitted for less than 24 hours.
2. Patients who do not receive antibiotic therapy during hospitalization.
3. Patients with incomplete or unavailable medical records.
4. Patients discharged or referred before receiving antibiotic treatment.

Procedure

Charts of eligible pediatric patients admitted to the Department of Pediatrics were reviewed and analyzed using a standardized data collection form. Relevant information, including patient demographics, clinical diagnosis, duration of hospitalization, antibiotics prescribed,

dosage, frequency, route of administration, duration of treatment, and laboratory investigations, was systematically recorded. The prescribed antibiotics were categorized according to their pharmacological class, route of administration, and clinical indication. Antibiotic prescriptions were further evaluated to determine whether therapy was empirical or culture-guided, administered as monotherapy or combination therapy, and consistent with relevant treatment guidelines and protocols.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical methods. Descriptive statistics were used to summarize patient characteristics and antibiotic prescribing patterns. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean $\pm$ standard deviation (SD). The chi-square test was used to assess associations between categorical variables, and Fisher's exact test was applied when expected cell frequencies were small. A chi-square goodness-of-fit test was used where comparison with an equal expected distribution was appropriate. The level of statistical significance was set at $p < 0.05$, with $p < 0.001$ considered highly statistically significant.

Table 1. Gender-Wise Distribution Of Pediatric Patients (N = 140)

Gender	Frequency (n)	Percentage (%)
Male	82	58.6
Female	58	41.4
Total	140	100.0

Among the 140 pediatric patients, males constituted the majority (58.6%), while females accounted for 41.4%.

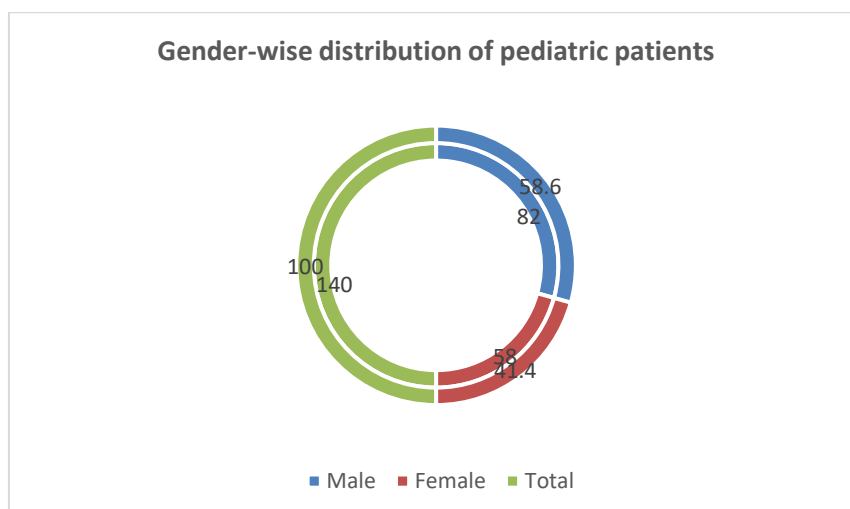


Fig: 1 Graphical Represents Gender-Wise Distribution of Pediatric Patients.

Table 2. Age-Wise Distribution of Pediatric Patients (N = 140)

Age group	Frequency (n)	Percentage (%)
1Month-1year	32	22.9
>1–5 years	48	34.3
>5–12 years	60	42.9
Total	140	100.0

The majority of patients belonged to the 6–12-year age group (42.9%), followed by 2–5 years (34.3%) and 0–1 year (22.9%).

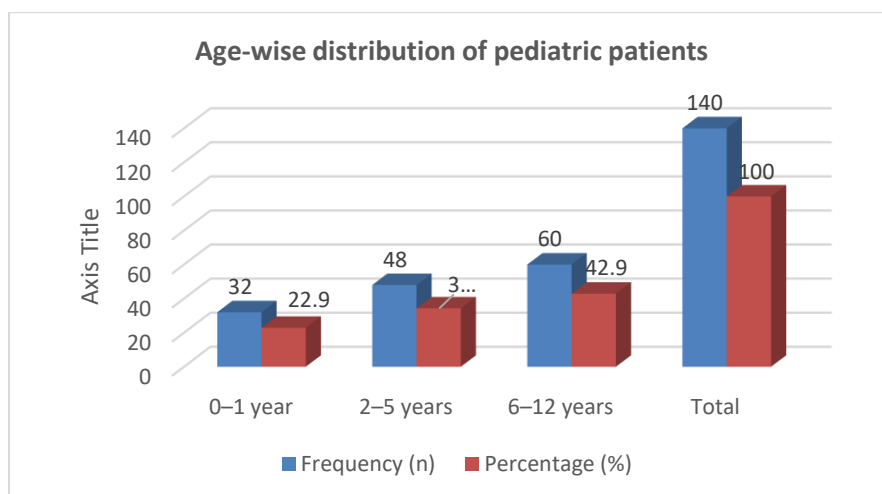


Fig: 2 Graphical Represents Age-Wise Distribution of Pediatric Patients

Table 3. Distribution According to Duration of Hospitalization (N = 140)

Duration of hospitalization	Frequency (n)	Percentage (%)
1–3 days	45	32.1
4–7 days	63	45.0
>7 days	32	22.9
Total	140	100.0

Most patients (45.0%) had a hospital stay of 4–7 days, followed by 32.1% who were hospitalized for 1–3 days and 22.9% who stayed for more than 7 days.

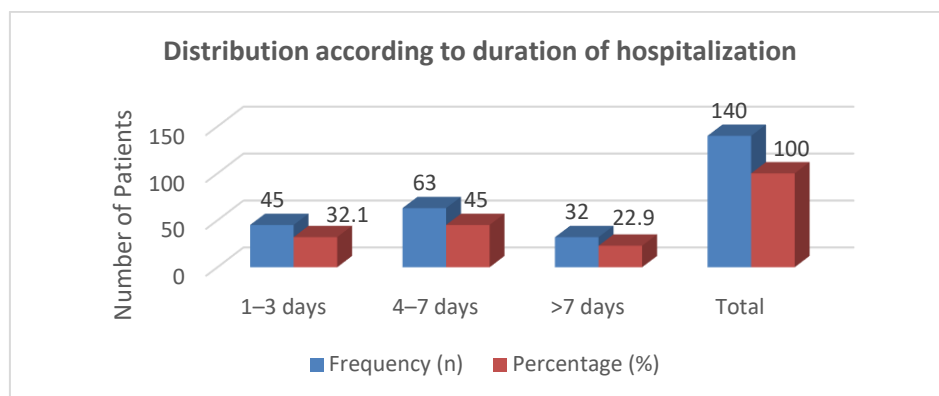


Fig: 3 Graphical Represents Distribution According to Duration Of Hospitalization.

Table 4. Distribution Of Pediatric Patients According to Primary Diagnosis (N = 140)

Primary diagnosis	Frequency (n)	Percentage (%)
Respiratory tract infection	38	27.1
Acute gastroenteritis	24	17.1
Pneumonia	22	15.7
Urinary tract infection	14	10.0
Enteric fever	10	7.1
Skin and soft-tissue infection	8	5.7
Meningitis/encephalitis	6	4.3
Sepsis	5	3.6
Dengue/viral fever	5	3.6
Other infections	8	5.7
Total	140	100.0

Respiratory tract infections were the most common primary diagnosis, accounting for 27.1% of patients, followed by acute gastroenteritis (17.1%) and pneumonia (15.7%). Urinary tract infections accounted for 10.0% of cases.

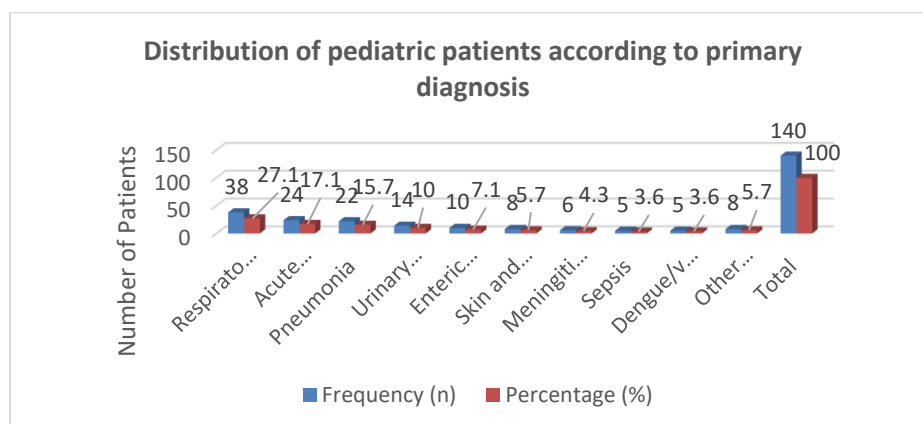


Fig: 4 Graphical Represents Distribution of Pediatric Patients According to Primary Diagnosis.

Table 5. Pattern Of Antibiotics Prescribed Among Hospitalized Pediatric Patients (N = 140)

Antibiotic	Frequency (n)	Percentage (%)
Ceftriaxone	42	30.0
Amoxicillin + Clavulanic acid	24	17.1
Cefotaxime	18	12.9
Azithromycin	14	10.0
Piperacillin + Tazobactam	12	8.6
Amikacin	10	7.1
Metronidazole	8	5.7
Meropenem	5	3.6
Vancomycin	4	2.9
Other antibiotics	3	2.1
Total	140	100.0

Among the 140 hospitalized pediatric patients, ceftriaxone was the most frequently prescribed antibiotic, accounting for 42 prescriptions (30.0%). Ceftriaxone is a third-generation cephalosporin that exerts its antibacterial effect by binding to penicillin-binding proteins (PBPs) and inhibiting bacterial cell-wall synthesis, ultimately resulting in bacterial cell lysis. Its broad spectrum of activity, once-daily dosing, and good tissue penetration may contribute to its frequent use in hospitalized pediatric patients, particularly for suspected serious bacterial infections. However, extensive use of third-generation cephalosporins may increase selection pressure for extended-spectrum β -lactamase (ESBL)-producing organisms and other resistant bacteria.

Amoxicillin Plus Clavulanic Acid was the second most commonly prescribed

antibiotic, used in 24 patients (17.1%). Amoxicillin is a β -lactam antimicrobial that inhibits bacterial cell-wall synthesis by binding to PBPs. Clavulanic acid is a β -lactamase inhibitor that protects amoxicillin from enzymatic degradation by susceptible β -lactamase-producing organisms, thereby extending its antibacterial spectrum. This combination is commonly used for respiratory, urinary, skin and soft-tissue, and other community-acquired bacterial infections. Appropriate selection remains important because unnecessary use may contribute to antimicrobial resistance and disruption of the normal microbiota.

Cefotaxime

another third-generation cephalosporin, was prescribed in 18 patients (12.9%). Similar to ceftriaxone, cefotaxime inhibits bacterial cell-wall synthesis through binding to PBPs. Its broad activity against many Gram-

negative and Gram-positive organisms makes it useful in serious infections requiring parenteral therapy. The relatively high use of cefotaxime and ceftriaxone together indicates a substantial reliance on third-generation cephalosporins in the study population.

Azithromycin was prescribed in 14 patients (10.0%). It is a macrolide antibiotic that binds to the 50S subunit of bacterial ribosomes and inhibits protein synthesis, thereby exerting predominantly bacteriostatic activity. It has activity against several atypical respiratory pathogens and is therefore useful in selected respiratory infections. Nevertheless, its use should be guided by the clinical indication because inappropriate macrolide exposure can contribute to macrolide resistance.

Piperacillin plus tazobactam was used in 12 patients (8.6%). Piperacillin is an extended-spectrum penicillin that inhibits bacterial cell-wall synthesis through interaction with PBPs, while tazobactam inhibits certain β -lactamase enzymes and thereby protects piperacillin from enzymatic degradation. The combination provides broad activity against many Gram-negative and Gram-positive organisms, including *Pseudomonas aeruginosa*. Its use is generally more appropriate for severe or complicated infections where broader antimicrobial coverage is clinically justified.

Amikacin was prescribed in 10 patients (7.1%). Amikacin is an aminoglycoside that binds to the 30S ribosomal subunit, interfering with bacterial protein synthesis and causing misreading of mRNA. It is bactericidal and has strong activity against many aerobic Gram-negative organisms. Because aminoglycosides can cause nephrotoxicity and ototoxicity, pediatric use requires appropriate dose adjustment, monitoring of renal function, and careful assessment of treatment duration.

Metronidazole was used in 8 patients (5.7%). It is particularly active against anaerobic bacteria and certain protozoa. After entering susceptible organisms, metronidazole is reduced to reactive metabolites that damage bacterial DNA, resulting in inhibition of nucleic acid synthesis and cell death. Its use may be

appropriate in selected intra-abdominal, anaerobic, or protozoal infections, but unnecessary administration should be avoided when anaerobic infection is unlikely.

Meropenem was prescribed in 5 patients (3.6%). Meropenem is a carbapenem antibiotic that inhibits bacterial cell-wall synthesis by binding to PBPs and has a very broad spectrum of activity against Gram-positive and Gram-negative bacteria. Its use is generally reserved for severe infections caused by multidrug-resistant organisms or infections in which resistant pathogens are strongly suspected. Although its frequency was relatively low in the present study, preservation of carbapenems is important because excessive use can promote carbapenem-resistant organisms.

Vancomycin was prescribed in 4 patients (2.9%). Vancomycin is a glycopeptide antibiotic that inhibits bacterial cell-wall synthesis by binding to the D-alanyl-D-alanine terminus of cell-wall precursors. It is primarily active against Gram-positive organisms and is commonly considered when infections caused by resistant Gram-positive pathogens, including methicillin-resistant *Staphylococcus aureus* (MRSA), are suspected. Its use should be restricted to appropriate indications, with consideration of renal function and therapeutic monitoring when clinically indicated.

The remaining other antibiotics accounted for 3 prescriptions (2.1%). The relatively small proportion suggests that prescribing was concentrated among a limited number of commonly used antimicrobial agents.

Overall, the prescribing pattern demonstrated a predominant use of broad-spectrum antibiotics, particularly third-generation cephalosporins. Ceftriaxone and cefotaxime together accounted for 60 prescriptions (42.9%), indicating substantial reliance on this antibiotic class. Although broad-spectrum agents may be justified in hospitalized children with severe or suspected serious bacterial infections, their routine or prolonged use can increase antimicrobial selection pressure and promote resistance. The use of piperacillin-tazobactam and meropenem further indicates that some patients required coverage for potentially resistant or severe

infections.

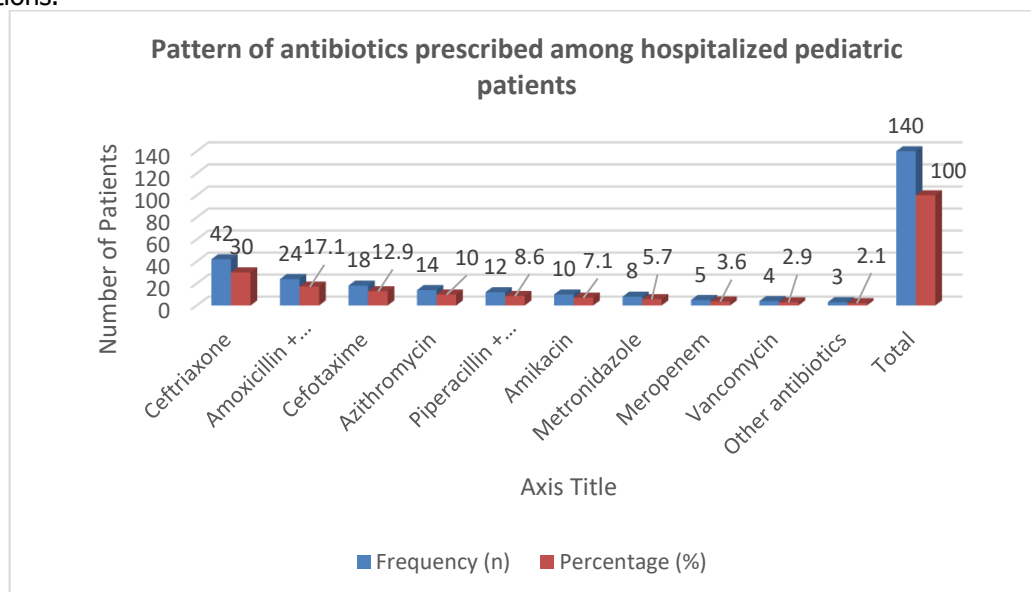


Fig: 5 Graphical Represents Pattern of Antibiotics Prescribed Among Hospitalized Pediatric Patients.

Table 6. Antibiotic Prescribing Practices Among Hospitalized Pediatric Patients (N = 140)

Parameter	Frequency (n)	Percentage (%)	p-value
Route of Administration			
Intravenous	105	75.0	<0.001
Oral	35	25.0	
Therapy Type			
Monotherapy	88	62.9	<0.001
Combination therapy	52	37.1	
Treatment Approach			
Empirical therapy	103	73.6	<0.001
Culture-guided therapy	37	26.4	
Duration of Antibiotic Therapy (days)			
Mean ± SD	6.4 ± 2.3		

Chi-square goodness-of-fit test was used for the categorical variables, assuming an equal expected distribution (50%:50%) between the two categories. A p-value <0.05 was considered statistically significant. Intravenous administration was significantly more frequent than oral administration

(75.0% vs. 25.0%, $p < 0.001$). Monotherapy was significantly more common than combination therapy (62.9% vs. 37.1%, $p < 0.001$). Similarly, empirical therapy was significantly more frequent than culture-guided therapy (73.6% vs. 26.4%, $p < 0.001$). The mean duration of antibiotic therapy was 6.4 ± 2.3 days.

Table 7. Distribution Of Antibiotics According to WHO Aware Classification (N = 140)

WHO AWaRe category	Antibiotic	Frequency (n)	Percentage (%)
Access	Amoxicillin + clavulanic acid	24	17.1
	Amikacin	10	7.1
	Metronidazole	8	5.7
Total Access		42	30.0
Watch	Ceftriaxone	42	30.0
	Cefotaxime	18	12.9
	Azithromycin	14	10.0
	Piperacillin + tazobactam	12	8.6
	Vancomycin	4	2.9
Total Watch		90	64.3
Reserve Other Total	Meropenem	5	3.6
	Other antibiotics	3	2.1
		140	100.0

Watch-group antibiotics were the most frequently used category, accounting for 64.3% of antibiotic prescriptions, followed by Access-group antibiotics (30.0%). Reserve antibiotic use accounted for 3.6%, represented by meropenem. Ceftriaxone

was the most frequently used Watch antibiotic (30.0%). The high proportion of Watch-group antibiotics indicates the need for careful antibiotic selection, regular prescription review, and adherence to antimicrobial stewardship principles.

Table 8. Assessment Of Appropriateness of Antibiotic Prescribing Among Hospitalized Pediatric Patients (N = 140)

Prescribing parameter	Appropriate n (N)	(%)	Inappropriate (N)	(%)	Total (N) (%)
Indication for antibiotic therapy	119	85.0	21	15.0	140 (100)
Selection of antibiotic	108	77.1	32	22.9	
Dose according to age/body weight	112	80.0	28	20.0	
Frequency of administration	120	85.7	20	14.3	
Route of administration	125	89.3	15	10.7	
Duration of therapy	101	72.1	39	27.9	
Overall appropriateness	103	73.6	37	26.4	

The route of administration showed the highest level of appropriateness (89.3%), followed by frequency of administration (85.7%) and indication for antibiotic therapy

(85.0%). Appropriate antibiotic selection and dose were observed in 77.1% and 80.0% of prescriptions, respectively. Duration of therapy had the lowest

proportion of appropriate prescribing (72.1%). Overall, 73.6% of antibiotic prescriptions were considered appropriate, while 26.4% were classified as inappropriate.

DISCUSSION

The present retrospective observational study assessed antibiotic utilization and prescribing practices among 140 hospitalized pediatric patients. Males constituted 58.6% of the study population, while children aged 6-12 years represented the largest age group (42.9%). Respiratory tract infection was the most common diagnosis (27.1%), followed by acute gastroenteritis (17.1%) and pneumonia (15.7%). Ceftriaxone was the most frequently prescribed antibiotic (30.0%), followed by amoxicillin-clavulanic acid (17.1%) and cefotaxime (12.9%). The frequent use of third-generation cephalosporins was comparable with findings reported by Gandra et al., who observed substantial use of these agents among hospitalized children in India.¹⁶ Intravenous administration (75.0%), monotherapy (62.9%), and empirical therapy (73.6%) were predominant prescribing practices.¹⁷

Overall, 73.6% of prescriptions were considered appropriate, while 26.4% were inappropriate. Appropriateness was highest for route of administration (89.3%) and lowest for duration of therapy (72.1%). Hersh et al. reported suboptimal antibiotic prescribing in 25.9% of hospitalized children, particularly involving unnecessary or overly broad therapy.¹⁸ Similar variation in antibiotic appropriateness has been reported across pediatric clinical settings, emphasizing the need for regular prescription review and antimicrobial stewardship interventions.¹⁹ The frequent use of broad-spectrum antibiotics in the present study highlights the importance of appropriate antibiotic selection, microbiological investigation, reassessment of empirical therapy, and adherence to WHO AWaRe recommendations.²⁰

CONCLUSION:

The present retrospective observational study demonstrated substantial antibiotic use among hospitalized pediatric patients, with ceftriaxone being the most frequently prescribed antibiotic and empirical therapy

being the predominant treatment approach. Intravenous administration and monotherapy were commonly observed, and the mean duration of antibiotic therapy was 6.4 ± 2.3 days. Overall, 73.6% of antibiotic prescriptions were considered appropriate, while 26.4% were inappropriate, with duration of therapy showing the greatest scope for improvement.

The predominance of broad-spectrum and Watch-group antibiotics highlights the need for strengthened antimicrobial stewardship in pediatric practice. Regular prescription auditing, appropriate dose and duration selection, microbiological investigation where indicated, timely reassessment of empirical therapy, and adherence to WHO AWaRe recommendations can promote rational antibiotic use and help reduce unnecessary antimicrobial exposure and the risk of antimicrobial resistance.

Conflict Of Interest

The authors declare that there is no conflict of interest regarding the publication of this study.

REFERENCES

1. Alekaw H, Derebe D, Melese WM, Yismaw MB. Antibiotic prescription pattern, appropriateness, and associated factors in patients admitted to pediatric wards of Tibebe Ghion Specialized Hospital, Bahir Dar, Northwest Ethiopia. *Infect Drug Resist.* 2022;15:6659-6669.
2. Venkata Naveen Kumar P, Antony LJ, Maharani B, Jaikumar S, Somasundaram G. Prescription pattern of drugs used in pediatric patients of a tertiary care hospital in Puducherry. *Natl J Physiol Pharm Pharmacol.* 2021;11(4):380-4.
3. World Health Organization. WHO AWaRe Antibiotic Book: Infographics for Children and Adults. Geneva: WHO; 2022.
4. Aricò MO, Valletta E, Caselli D. Appropriate use of antibiotic and principles of antimicrobial stewardship in children. *Children (Basel).* 2023;10(4):740.
5. World Health Organization. AWaRe Classification of Antibiotics for Evaluation and Monitoring of Use, 2023. Geneva: WHO; 2023.
6. World Health Organization. Antimicrobial Resistance: Fact Sheet. Geneva: WHO; 2025/2026.

7. World Health Organization. The WHO AWaRe Antibiotic Book. Geneva: WHO; 2022.
8. Aricò MO, Valletta E, Caselli D. Appropriate use of antibiotic and principles of antimicrobial stewardship in children. *Children* (Basel). 2023;10(4):740.
9. Donà D, Barbieri E, Daverio M, et al. Multinational consensus antimicrobial stewardship recommendations for children managed in hospital settings. *Lancet Child Adolesc Health*. 2023.
10. World Health Organization. AWaRe Classification of Antibiotics for Evaluation and Monitoring of Use, 2023. Geneva: WHO; 2023.
11. World Health Organization. The WHO AWaRe Antibiotic Book. Geneva: WHO; 2022.
12. Gandra S, et al. Point prevalence surveys of antimicrobial use among hospitalized children in six hospitals in India in 2016. *Antibiotics* (Basel). 2017;6(3):19.
13. Alosaimi HM, Alshammari M, Fetyani M, et al. Point prevalence survey of antibiotics use among hospitalised neonates and children in Saudi Arabia: findings and implications. *Infect Drug Resist*. 2024;17:2371411.
14. Sumon SA, et al. Antibiotic use in tertiary care hospitals in Bangladesh: revealing the extent through a point prevalence survey. *Am J Infect Control*. 2024;52(9):1052-1059.
15. Hersh AL, et al. Appropriateness of antibiotic prescribing in US children's hospitals: a national point prevalence survey. *JAMA Pediatr*. 2020.
16. Gandra S, Singh SK, Jinka DR, et al. Point prevalence surveys of antimicrobial use among hospitalized children in six hospitals in India in 2016. *Antibiotics* (Basel). 2017;6(3):19.
17. World Health Organization. The WHO AWaRe antibiotic book: infographics for children and adults. Geneva: World Health Organization; 2022.
18. Hersh AL, Shapiro DJ, Pavia AT, Shah SS. Antibiotic prescribing in ambulatory children: a systematic review. *Pediatrics*. 2020;145(1):e20193127.
19. Donà D, Barbieri E, Daverio M, et al. Multinational consensus antimicrobial stewardship recommendations for children managed in hospital settings. *Lancet Child Adolesc Health*. 2023;7(6):422-433.
20. World Health Organization. AWaRe classification of antibiotics for evaluation and monitoring of use, 2023. Geneva: World Health Organization; 2023.