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Research Article

Prescribing pattern of antibiotics among paediatric patients admitted in a tertiary care hospital: A prospective study

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Abstract

BACKGROUND: The inappropriate use of antibiotics in children for viral infections or when the infection is not clearly established is a significant global health issue. This practice contributes to the growing problem of antimicrobial resistance (AMR). Thus, understanding prescribing pattern of antibiotics is essential. **OBJECTIVE:** To analyse the antibiotic prescribing pattern in paediatric patients of a tertiary care hospital and to analyse consequences associated with the therapy. **METHODOLOGY**: This study was a six-month prospective observational study carried out in the paediatric department of a tertiary care hospital (Karnataka Medical College & Research Institute, Hubballi). **RESULTS:** A total of 251 cases were evaluated, with males comprising the majority (65.33%) and the 'childhood' age group population accounting for 73.65% of cases. Respiratory disorders represented the most prevalent diagnosis (35.05%). Overall, 541 antibiotic prescriptions were recorded, with ceftriaxone being the most frequently utilized agent (29.75%). the highest sensitivity was observed for imipenem (14.74%) and meropenem (14.34%), whereas cefuroxime (13.94%) and cefazolin (13.54%) demonstrated the highest resistance rates. **CONCLUSION:** The report finds that pediatric hospital admissions are driven mainly by respiratory infections and that antibiotics more often broad-spectrum agents are frequently started empirically with limited culture confirmation, leading to delays in targeted therapy and contributing to adverse reactions, longer stays, higher costs, and rising antimicrobial resistance.

Keywords: Paediatrics, antibiotics, prescribing pattern, antibiotic resistance, sensitivity and resistance

INTRODUCTION

Antibiotics are generally classified into two main types based on their spectrum of activity: If an antibiotic kill only a few specific bacteria, like just Gram-positive ones, it's called a narrow-spectrum antibiotic. Example: Flucloxacillin mainly works against Gram positive bacteria and the broad-spectrum antibiotics are the ones which can kill many antibiotics including both gram-positive and gram-negative bacteria. Example: Ceftriaxone works against a wide range of bacteria[5]. Conducting an assessment of antibiotic usage within the hospital wards provides us with valuable insights into the extent and types of antibiotics being consumed, as well as the appropriateness of their prescription. Pediatrics is the branch of medicine concerned with the health and medical care of individuals from birth through childhood. While childhood is classically defined as the period from birth to the onset of puberty, the scope of pediatrics often extends to include adolescent medicine[1]. Pediatric population are the most vulnerable population towards adverse drug reactions because of their unique pharmacodynamic and pharmacokinetic characteristics[2]. Infectious diseases represent a major cause of mortality and morbidity in India and pediatric population are more prone to infections due to decreased immunity[3]. Previous already

existing related works indicates that approximately 60% of hospitalized children are prescribed at least one antibiotic during their stay. This figure shows a significant prevalence of antibiotic use among the pediatric inpatients. However, it's important to note that antibiotic prescribing practices can vary widely across different hospitals and different regions. For instance, studies have shown that the percentage of children receiving antibiotics during hospitalization can range from 38% to 72%, depending on factors such as hospital policies, patient demographics, and the nature of the medical conditions being treated[4].This study helps us identify patterns of use, including any misuse or overuse, which is crucial for understanding the dynamics of antimicrobial resistance (AMR). The findings from such assessments serve as a critical resource for policymakers, offering a clear picture of current antibiotic utilization practices. By providing detailed, context specific data, these studies assist in shaping national strategies to combat AMR, ensuring that interventions are evidence-based and tailored to the specific needs of different regions and healthcare settings[6]. Natural resistance refers to the inherent ability of some microorganisms to resist the action of certain antimicrobial agents (AMAs). This occurs because the microorganism either lacks the specific target site (such as an enzyme or receptor) required for the drug to act, or it does not perform the metabolic pathway that the drug is responsible to inhibit. As a result, the mechanism of action of the drug becomes ineffective against that microbe. Acquired resistance occurs when a microorganism that was previously sensitive to an antimicrobial agent (AMA) becomes resistant after being exposed to the drug over time [7].

OBJECTIVES:

❖ To analyse the antibiotic prescribing pattern in paediatric patients of a tertiary care hospital.

❖ To analyse consequences associated with the therapy.

MATERIALS AND METHODS

This is a Prospective observational study. The study was conducted in paediatric department of the Tertiary care Hospital Karnataka Medical College and Research Institute, Hubballi, Karnataka. The study was conducted for a period of 6 months. 251 cases were collected and evaluated. Patient's case sheet and Patient's prescription chart were the sources of data required for the study.

Statistical Analysis: The collected prescriptions data were analysed for the patient demographics, diagnosis and prescribing pattern of different classes of antibiotics along with their doses. the suspected drug-drug interactions were identified by the help of Micromedex software. The appropriateness and categorization of prescribed drugs was analysed by entering collected data in Microsoft office excel 2010. This study was analysed using descriptive statistical analysis where the percentages of variables were obtained and a chi square test was performed to obtain a p value, which defines the level of significance of the considered variable. The results were presented as percentage and frequency using descriptive statistics.

STUDY CRITERIA: The study picked only, the patients admitted to Paediatric ward who were on antibiotic therapy up to the age of 18 years, Patients of either gender and Paediatric patients who had co-morbid conditions. And the study excluded the patients admitted to PICU, the patients above 18 years and the patient who were not willing to participate in the subject.

RESULTS

A total of 251 cases were analyzed in which 65.33% of the patients were male whereas female patients were 34.66% (Figure 1). All the 251 cases were also analysed for distribution of the age (table 1) between them, the results obtained indicated that there were 2.53% neonates, 13.90% infants, 73.65% of childhood stage and 8.34% belonging to adolescence stage. Among the 251 cases the highest number patients suffered from respiratory disorders (35.05%) followed by neurological disorders (16.73%) and viral infections (13.54%), others were at the lower margins (table 2). For 251 patients of our sample size, 541 antibiotics were prescribed and administered (table 3). Among them ceftriaxone (29.75%) is the highest prescribed antibiotic while the ampicillin (0.18%) is the least prescribed antibiotic. The second most prescribed antibiotic is amoxicillin-clavulanate combination (15.89%), followed by amikacin (15.52%), piperacillin-tazobactam combination (9.61%), meropenem (7.02%), doxycycline (3.69%). The distribution of antibiotics based on route of administration (figure 3) shows that 19.59% of antibiotics were administrated by oral route and 80.40% of antibiotics were administrated by parenteral route. The number of antibiotics prescribed per patient was studied, this distribution (figure 2) shows that 41.83% of total patients were prescribed with one antibiotic, 25.8 were prescribed with two antibiotics, 17.52% were prescribed with three antibiotics, 8.76% were prescribed with four antibiotics, 5.57% were prescribed with five antibiotics and 0.39% were prescribed with six antibiotics. We also observed that among 541 antibiotics, two types of combination drugs were also prescribed, which were amoxycillin-clavulanate and piperacillin-tazobactum. The first one was prescribed for 62.31% patients and latter one was prescribed for 37.68% of patients. Based on the data obtained from the laboratory reports, the highest sensitivity was observed for imipenem (14.74%) and meropenem (14.34%), whereas cefuroxime (13.94%) and cefazolin (13.54%) demonstrated the highest resistance rates.

we conducted a chi-square test on the observed data obtained after distribution between type of disorders and class of antibiotics (table 4), considering both of them as the two parameters of the chi-square test. As the result of this test, we obtained a p-value i.e., 0.0001946. This resulted p-value is lesser than the 0.05 (<0.05).

Table 1: Distribution based on age

CATEGORY	NO. OF PATIENTS	PERCENTAGE (%)
NEONATES (1week to 2months)	10	2.53%
INFANTS (3months to 11 months)	35	13.90%
CHILD-HOOD (1year to 11years)	185	73.65%
ADOLESCENCE (12years to 18years)	21	8.34%
TOTAL	251	100%

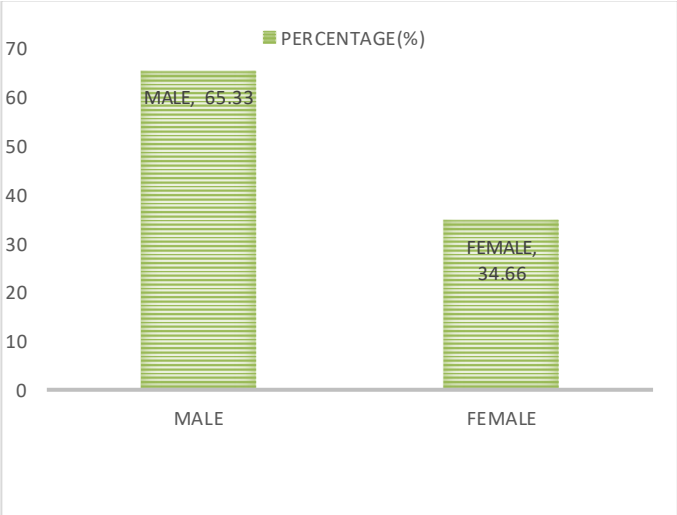

Figure 1: Distribution between the type of disorders and class of antibiotics

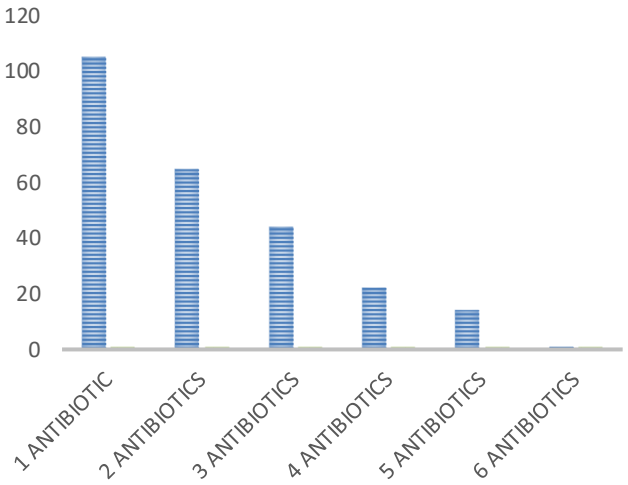

Figure 2: Distribution based on number of antibiotics prescribed per person

Table 2: Distribution based on type of disorders

TYPESOF DISORDERS	NO. OF PATIENTS	PERCENTAGE
UROLOGICAL DISORDERS	11	4.38 %
RESPIRATORY DISORDERS	88	35.05%
VIRAL INFECTIONS	34	13.54%
NEUROLOGICAL DISORDERS	42	16.73%
HAEMATOLOGICAL DISORDERS	19	7.56%
EMERGENCY CONDITIONS	11	4.38%
RENAL DISORDERS	10	3.98%
GENETIC DISORDERS	4	1.59%
GASTROINTESTINAL DISORDERS	17	6.77%
OTHERS	11	4.38%
IMMUNODEFICIENCY DISORDERS	2	0.79%
CARDIAC DISORDERS	1	0.39%
HEPATIC CONDITIONS	1	0.39%
TOTAL	251	100%

Table 3: Distribution based on antibiotics

ANTIBIOTICS	NO. OF PATIENTS	PERCENTAGE
Amoxicillin-clavulanate	86	15.89%
Ceftriaxone	161	29.75%
Piperacillin-tazobactum	52	9.61%
Meropenem	39	7.2%
Amikacin	84	15.52%
Azithromycin	3	0.55%
Ampicillin	1	0.18%
Cefpodoxime	2	0.36%
Linezolid	5	0.92%
Levofloxacin	7	1.29%
Ofloxacin	3	0.55%
Ciprofloxacin	2	0.36%
Cefotaxime	9	1.66%
Doxycycline	20	3.69%
Cefixime	10	1.84%
Imipenem	1	0.18%
Faropenem	1	0.18%
Gentamicin	1	0.18%
D-Penicillamine	1	0.18%
Penicillin G	1	0.18%
Benzathine penicillin	1	0.18%
Vancomycin	51	9.42%
SUM	541	100%

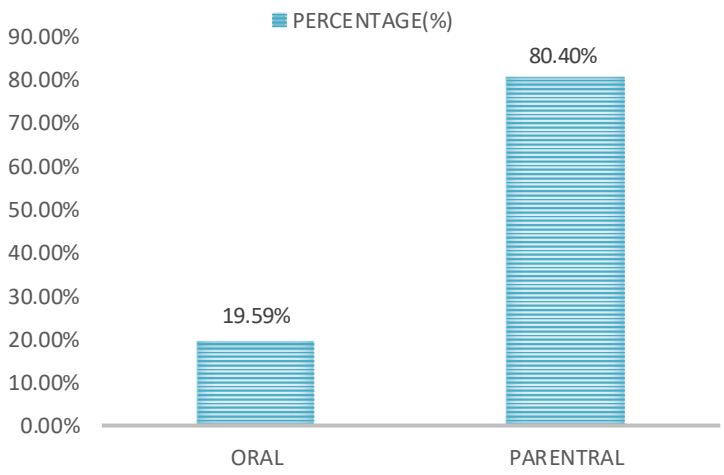

Figure 3: Distribution based on antibiotic route of administration

Table 4: Distribution between the type of disorders and class of antibiotics

TYPES OF DISORDERS	penicillins	glycopeptides	aminoglycosides	carbapenems	cephalosporins	tetracyclines	oxazolidinones	flouroquinolones	macrolides	TOTAL	PERCENTAGES
EMERGENCY CONDITIONS	6	0	4	2	6	0	0	0	0	18	3.60%
GASTRO-INTESTINAL DISORDERS	5	0	2	1	14	0	0	0	0	22	4.40%
GENETIC DISORDERS	2	0	1	0	3	0	0	0	0	6	1.20%
HEMATOLOGICAL DISORDERS	11	1	4	3	11	3	0	2	0	35	7.01%
IMMUNODEFICIENCY CONDITIONS	2	0	1	0	0	0	0	0	0	3	0.60%
NUEROLOGICAL DISORDERS	13	1	10	5	31	4	0	0	0	64	12.82%
OTHERS	7	1	2	0	7	0	0	1	0	18	3.60%
RESPIRATORY DISORDERS	42	46	46	23	67	2	4	3	2	235	47.09%
RENAL CONDITIONS	8	1	2	1	6	2	1	1	0	22	4.40%
UROLOGICAL DISORDERS	6	1	4	3	6	1	0	2	0	23	4.60%
VIRAL INFECTIONS	12	0	7	1	21	10	0	0	0	51	10.22%
CARDIAC DISORDERS	0	0	0	0	2	0	0	0	0	2	0.40%
TOTAL	114	51	83	39	174	22	5	9	2	499	100

Table 5: Distribution based on antibiotic combinations

COMBINATIONS	NO. OF PATIENTS	PERCENTAGE (%)
AMOXICLAV	86	62.31%
PIPZO	52	37.68%
TOTAL	138	100%

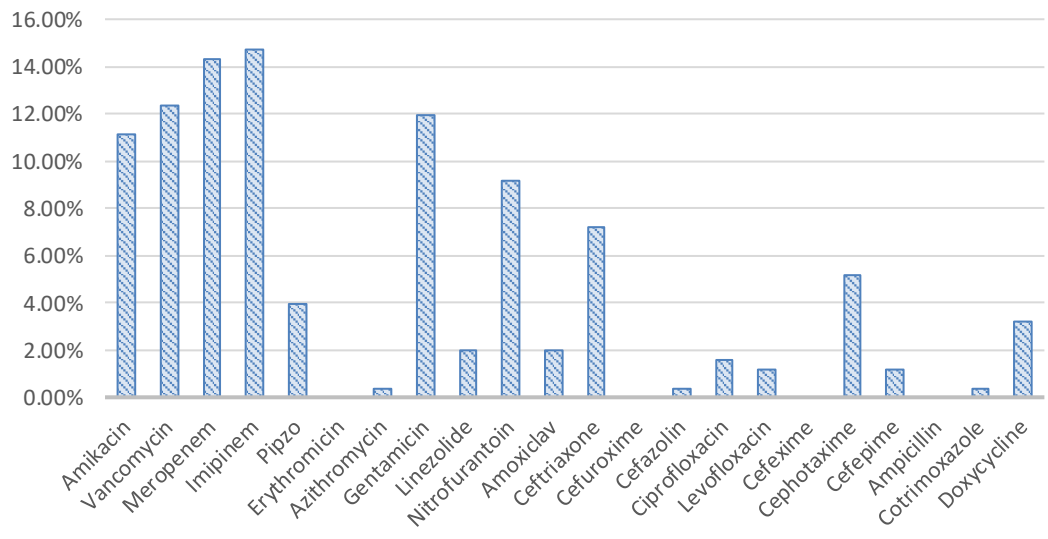

Figure 4: Distribution based on antibiotic sensitivity

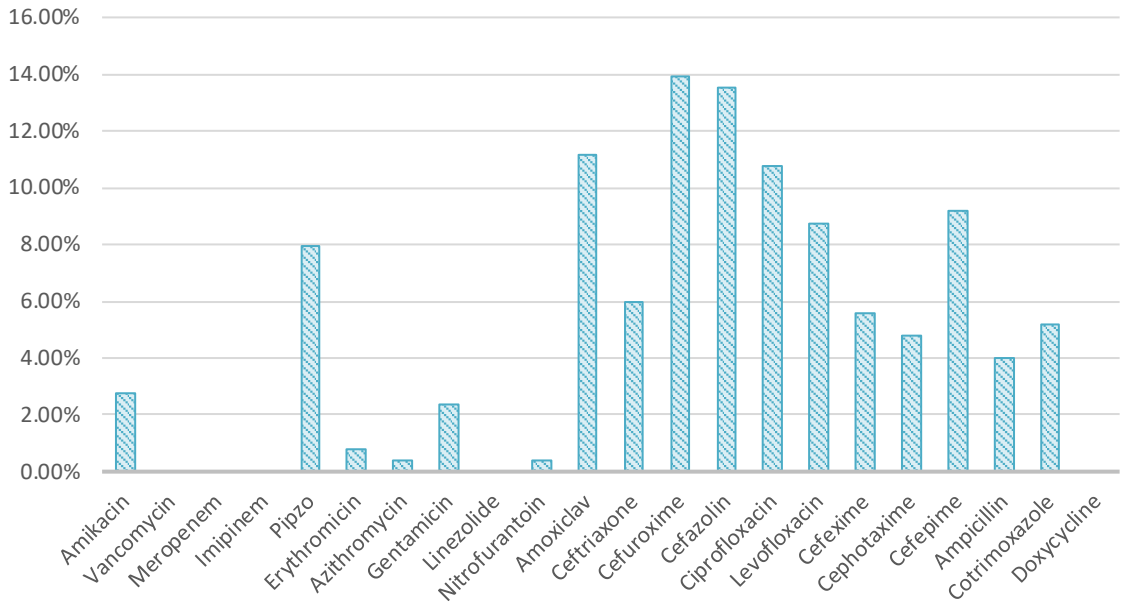

Figure 5: Distribution based on antibiotic resistance

DISCUSSIONS:

Firstly, the distribution based on the gender was obtained where the results obtained were similar to the observations by similar to the observations by Rinta Mathew, et al[8] (64.56% males) and Mukherjee S, et al[9] showcasing the higher susceptibility of the male pediatric patients to the illness mostly respiratory disorders indicating the difference in environmental exposure of both genders at the younger age itself. Our distribution based on age results were parallel to the observations by Mukherjee S, et al[9] (8.87% were lesser than 12months, 20.16% were 12-24months, 66.94% were 2-14y, 4.03% were 14-18y) and malpani, et al[10] (7.75% less than a year, 60.4% were 1-4yrs, 15.5% were 4-8yrs, 13.1% were 8-12yrs, 3.1% were 12-16yrs). We can see that the maximum number of patients are from childhood stage and number of patients in the adolescence and neonatal stage is the lowest, this emphasizes the fact that the neonates (less than 1year old) have the strong and fast immune response as they are still feeding on the mother's breast milk which is packed with the immunoglobulins required of their basic immunity (passive immunity). The patients belonging to the childhood stage are higher in number because of their higher rate of susceptibility towards pathogens, because once they are off the breast milk they are on their own in terms of immunity.

Distribution based on the type of the disorders (table 2) gives us the percentage share of each type of the disorder in our total sample (251 cases). The data obtained by us is comparable to the observations by Rinta Mathew, et al[8] (37% respiratory system related) and Mukherjee S, et al[9] (respiratory disorders25.81%). These above observations could be explained by the fact that the pediatric patients have an immature immune system as the innate immunity and the adaptive immunity are not fully developed at their age and the memory of immune system is also limited, and another explanation may be derived as the airways of the children are narrow and small compared to adults, even a mild inflammation or mucous build-up could obstruct airflow at higher margins. We observed the over reliance over the ceftriaxone which is a broad-spectrum antibiotic, like wise Rinta Mathew, et al[8] (cephalosporins 45%) also observed the prescription of cephalosporins as the highest among total antibiotics in her observations. The fact that ceftriaxone is a broad-spectrum antibiotic makes it a most overly employed antibiotic.

In a study by Sweta Shrestha, et al[12] it was seen that oral medications (94.96%) were prescribed in higher quantity than parenteral (5.03%). But in contrast to that, according to our observations, parenteral route was the most preferred route of administration in the chosen health facility by us, parallel to the observations done by Christy T. Chacko, et al[11] (3% by oral route and 97% by parenteral route). This shows us that, the preferred route of administration for the pediatric population is conflicted among the health community. The observations obtained by us for the number of antibiotics prescribed per person are similar to study carried by Kumar R, et al[13] (66% were prescribed with one antibiotic, 32% were prescribed with two antibiotics and 2% were prescribed with three antibiotics) and Adebola Tolulope Olayinka, et al[2] (48.6% were prescribed with one antimicrobial, 46.2% were given two antibiotics, 4-5% were given three antibiotics and 1.2% were given four antibiotics). it was observed that meropenem has the highest sensitivity share (14.34%) followed by vancomycin (12.35%) and others. Cefuroxime was the resistant antibiotic (13.94%). While the ceftriaxone was highest prescribed antibiotic, its sensitivity percentage was 7.17% and the resistance rate of 5.97%.

After conducting a chi-square test between type of disorders and the class of antibiotics, the result obtained

was statistically significant. It was also concluded that there was a statistically significant association between the type of disorders and the class of antibiotics. This means the distribution of antibiotic classes varies significantly across different types of disorders, and the observed relationship is unlikely to be established by chance.

CONCLUSION:

According to the analysed data, respiratory infections were prominent cause of hospital admissions in pediatrics where the frequent empirical use of antibiotics was observed which could be due to various unavoidable factors. and this reflects in the common use of broad-spectrum antibiotics. Such practices, if not tried to rectify or minimize, would heighten the risk of antimicrobial resistance, adverse drug reactions and other complications. But even the health care professional's hands are tied when the patient and their family expect short term and low cost/economical instant relief therapy. To curb this problem, implementation of a hospital specific stewardship program along with encouraging the patient and its family to opt for evidence-based therapy would help. And involvement of a clinical pharmacist whose sole duty is to vigilantly observe and optimize the therapy will further ease the process.

Respiratory tract infections were the predominant cause of pediatric admissions, with antibiotics frequently prescribed empirically and often without microbiological confirmation. The common use of broad-spectrum agents reflects gaps in diagnostic support and standardized protocols. Such practices heighten the risks of adverse drug reactions, increased healthcare costs, prolonged hospitalization, and antimicrobial resistance. Implementation of a structured, hospital-specific Antibiotic Stewardship Program emphasizing evidence-based prescribing, improved diagnostics, timely de-escalation, and clinical pharmacist involvement is essential to optimize therapy and safeguard patient outcomes.

HIGHLIGHTS:

The study evaluated prescribing pattern of antibiotics among the pediatric patients admitted in a tertiary care hospital which involved 251 patients who were given antibiotic therapy. The study determined that ceftriaxone and the amoxiclav where the most frequently prescribed antibiotics. Highest number of the patients where suffering from respiratory disorders. Most antibiotics were prescribed orally.

Some of the patients were identified experiencing some suspected drug-drug interactions as other non-antibiotic drugs were also prescribed along with the antibiotic therapy. Among them most of the interactions were moderate in nature. This evaluation highlighted the importance of continuous prescription monitoring and culture-guided antibiotic use to reduce resistance. Even minor adjustments in prescribing practices can significantly enhance patient outcomes and lower the incidence of inappropriate antibiotic use in pediatric care.

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ETHICS STATEMENT:

The institutional ethics committee (IEC) of the SET'S college of pharmacy headed by Dr Preeti v Kulkarni approved the project (SET/CPD/IEC/101A) on 04/03/2025.

CONFLICT OF INTEREST:

There was no conflict of interest among the authors.

ABBREVIATIONS:

ADR(s): Adverse Drug Reaction(s); Amoxiclav: Amoxicillin-clavulanate; AMR: Antimicrobial Resistance; p-value: Probability value

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