Original Article

Assessment of Antibiotic Prescribing Patterns in Pediatric Patients at a Tertiary Care Hospital

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Abstract

Background: Irrational use of antibiotics in pediatric populations is a major contributor to the growing problem of antimicrobial resistance worldwide. Evaluating antibiotic prescribing patterns is essential to promote rational drug use and improve clinical outcomes, especially in tertiary care settings. The objective is to assess the antibiotic prescribing pattern among pediatric patients attending a tertiary care hospital and to evaluate the rationality of prescriptions using World Health Organisation (WHO) prescribing indicators. **Material and Methods:** A prospective observational study was conducted in the Department of Paediatrics of a tertiary care hospital. A total of 580 prescriptions of pediatric patients aged 0–14 years were analysed. Data on demographic details, clinical diagnosis, and drug prescriptions were collected using a pre-designed pro forma. Prescribing patterns were evaluated using WHO core prescribing indicators and AWaRe classification of antibiotics. **Results:** Out of 580 patients, 342 (58.97%) were males, and 238 (41.03%) were females. The majority of patients belonged to the 5–10-year age group. A total of 1070 drugs were prescribed, with an average of 1.84 drugs per encounter. Antibiotics were prescribed in 122 (21.03%) encounters. **Conclusion:** The study demonstrates relatively rational antibiotic prescribing practices with adherence to WHO recommendations. However, improvements are needed to increase generic prescribing and optimise the use of essential medicines.

Keywords: Antibiotics, Paediatric patients, Prescribing pattern, WHO indicators, Antimicrobial resistance, AWaRe classification.

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Introduction

Antibiotics have transformed the treatment of infectious diseases and are among the most commonly prescribed drug groups in paediatric practice. Children are more susceptible to infections because their immune defence mechanisms are still in their infancy; hence, they are more likely to attend healthcare facilities and be prescribed antibiotics than adults. Nonetheless, the ever-present and, in many cases, inappropriate use of antibiotics has played a role in the problem of antimicrobial resistance (AMR), which is currently being seen as a severe international public health issue.[1]

The ages of paediatric populations pose challenges in prescribing antibiotics due to physiological differences, pharmacokinetics, pharmacodynamics, and weight-based dosing. Moreover, the clinical manifestations of children can be nonspecific and often lead to diagnostic confusion and empirical antibiotic treatment.[2] In most situations, viral diseases like upper respiratory tract diseases are wrongly prescribed antibiotics, which further benefit the irrational prescribing habits.[3] It is also not only exposing children to unnecessary unfavourable drug reactions but also promoting the evolution of resistant microbial strains.

The trend in antibiotic prescribing varies widely by geographic availability, healthcare services, and access to diagnostic centres and expertise among prescribers worldwide. Research in both developed and developing countries has shown high variation in antibiotic use, with greater use of broad-spectrum antibiotics in low- and middle-income countries.[4] The misuse of antibiotics has been of particular concern in India, where the incidence of infectious diseases was the major cause of morbidity in children, despite over-the-counter sales, inconsistent enforcement of the regulation, and inconsistent compliance with the established treatment regimen.[5]

The World Health Organisation (WHO) has also highlighted the need to practice rational drug use. It has developed the AWaRe (Access, Watch, Reserve) system to inform antibiotic stewardship and optimise medication practice.[6] Based on WHO guidelines, the most frequently used antibiotics must be classified as first-line, according to Access, because they have a low or minimal risk of resistance. Nonetheless, research has pointed to the more widespread use of Watch and Reserve group-antibiotics, which are supposed to treat infections that are more severe or resistant, meaning that the practices are no longer recommending them.[7]

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Tertiary care hospitals are important in shaping trends in antibiotic prescribing because they care for a wide range of patients with varied clinical conditions, including severe and complicated infections. These environments are usually characterised by multiple areas of specialisation, greater utilisation of diagnostic tests, and the presence of severely ill patients, which can affect prescribing habits. Although these hospitals are supposed to use evidence-based practices, research indicates that the unreasonable use of antibiotics, such as polypharmacy, extended treatment, and the administration of injectable antibiotics, remains common.[8]

The quality of prescribing practice is critical and should be assessed using standardised indicators evaluated in relation to antibiotic prescribing patterns, including those developed by WHO and the International Network on the Rational Use of Drugs (INRUD). These variables are the mean number of drugs per encounter, the percentage of drugs prescribed in generic name, the percentage of encounters with antibiotic prescriptions, and compliance with essential medicines lists.[9] These types of assessment can be extremely helpful, as they provide information on prescribing patterns and indicate areas that need some form of intervention.

Without any rational reason, prescribing antibiotics unreasonably in paediatric patients will be linked to heightened healthcare expenses, an increased likelihood of developing adverse drug reactions, and prolonged hospital care. In addition, antibiotic exposure in childhood has been associated with changes in the intestinal microbiome, as well as aggravation of chronic diseases such as obesity and allergy.[10] This is why it is of paramount importance to ensure that the rational use of antibiotics in children is instrumental not only for short-term clinical outcomes but also for long-term health outcomes.

ASPs have been implemented in most healthcare facilities to improve antibiotic use, patient outcomes, and antibiotic resistance. Such programs include implementing a formulary, conducting prescription audits, educating clinicians, and ensuring compliance with clinical guidelines.[11] ASPs are effective, but implementation in most tertiary care hospitals, especially those with limited resources, is optimal.

Since antimicrobial resistance has become an increasing burden and there are specific aspects to consider when treating children, antibiotic prescribing practices need to be continuously monitored and assessed. Such research plays a critical role in detecting irrational practices, encouraging compliance with guidelines, and informing the policy-making process to enhance the use of antibiotics.

Therefore, the present study aims to assess antibiotic prescribing patterns among paediatric patients attending a tertiary care hospital, with a focus on evaluating prescription rationality and identifying potential areas for improvement in clinical practice.

Materials and Methods

Study Design and Setting: This was a prospective observational study conducted in the Department of Paediatrics of a tertiary care teaching hospital. The study was conducted over 6 months, from January 2024 to June 2024. The hospital caters to a large number of paediatric patients from both urban and rural areas, providing primary, secondary, and tertiary healthcare services.

Study Population: The study population included paediatric patients aged 0–14 years who attended the outpatient department (OPD) and/or were admitted to the inpatient department (IPD) of the hospital during the study period and were prescribed at least one antibiotic.

Inclusion Criteria

- Paediatric patients aged 0–14 years
- Patients receiving at least one antibiotic prescription
- Patients whose caregivers provided informed consent

Exclusion Criteria

- Patients with incomplete medical records or prescriptions
- Patients referred to other healthcare facilities before initiation of treatment
- Critically ill patients for whom detailed prescription data could not be obtained

Sample Size and Sampling Technique: A total of 580, of which 342 were males and 238 were females. prescriptions were included in the study. A consecutive sampling method was used, in which all eligible patients meeting the inclusion criteria during the study period were enrolled until the desired sample size was achieved.

Data Collection: Data were collected using a pre-designed and pre-tested data collection form. Information was obtained from patient case records, prescriptions, and caregiver interviews. The following details were recorded:

- Demographic characteristics (age, gender)
- Clinical diagnosis
- Details of antibiotics prescribed (name, dose, route, frequency, and duration)
- Number of drugs per prescription
- Use of generic versus brand names
- Use of fixed-dose combinations (FDCs)
- Route of administration (oral/parenteral)

Assessment of Prescribing Pattern: The antibiotic prescribing pattern was analysed using World Health Organisation (WHO) core prescribing indicators, including:

- Average number of drugs per encounter
- Percentage of encounters with an antibiotic prescribed
- Percentage of drugs prescribed by generic name
- Percentage of drugs prescribed from the essential medicines list

Additionally, antibiotics were classified according to the WHO AWaRe (Access, Watch, Reserve) classification to assess the rationality of antibiotic use.

Outcome Measures

The primary outcome measures included:

- Pattern of antibiotic utilisation
- Proportion of different classes of antibiotics prescribed
- Rationality of antibiotic use based on standard treatment guidelines

Statistical Analysis: Data were entered into Microsoft Excel and analysed using the Statistical Package for the Social Sciences (SPSS) version 21. Descriptive statistics such as mean, standard

deviation, frequencies, and percentages were used to summarise the data. Results were presented in tables and charts where appropriate.

Results

[Table 1] Among the 580 paediatric patients, the majority belonged to the 5–10 years age group (42.24%), followed by those above 10 years (30.00%) and below 5 years (27.76%). In terms of gender distribution, males accounted for 58.97% and females for 41.03%, indicating male predominance in healthcare utilisation.

[Table 2] A total of 1070 drugs were prescribed across 580 encounters, with an average of 1.84 drugs per prescription. Generic prescribing was observed in 67.07% of cases, while 65.86% of drugs were prescribed from the essential medicines list. Antibiotics were prescribed in 21.03% of encounters, and no injectable drugs were used, reflecting a predominantly rational prescribing pattern.

Table 1: Socio-demographic Characteristics of the Patient Population (n = 580)

Variables	Range	Number (n)	Percentage (%)
Age (years)	<5	161	27.76
	5–10	245	42.24
	>10	174	30.00
Sex	Male	342	58.97
	Female	238	41.03

Table 2: WHO Prescribing Indicators (n = 580 encounters)

Indicators of Drug Use	Total Drugs/Encounters	Average / Percent
Average number of medicines per encounter	1070 / 580	1.84
Percentage of drugs prescribed by generic name	389	67.07
Percentage of drugs from essential medicines list	382	65.86
Number of encounters with an injection prescribed	0	0
Percentage of encounters with one or more antibiotics	122	21.03

Table 3: Characteristics of the Prescription Pattern of Antibiotics (n = 580)

Indicator	Number of Prescriptions
Total number of prescriptions	580
Total number of drugs prescribed	1070
Prescriptions with complete treatment schedule	580
Prescriptions with recorded duration of antibiotic therapy	580
Number of antibiotics per prescription	
One	122
Two	0

[Table 3] All 580 prescriptions were complete with treatment schedules and duration of therapy clearly mentioned, indicating good prescribing practices. A total of 1070 drugs were prescribed. Antibiotics were included in 122 prescriptions, and all cases involved a single antibiotic, with no instances of multiple antibiotic prescribing, suggesting adherence to rational antibiotic use principles.

Table 4: Distribution of Antibiotic Use Among Study Population (n = 580)

Category	Number (n)	Percentage (%)
Patients prescribed antibiotics	122	21.03
Patients not prescribed antibiotics	458	78.97
Total	580	100

[Table 4] Out of 580 patients, 122 (21.03%) received at least one antibiotic, while the majority, 458 (78.97%), were managed without antibiotics. This reflects relatively cautious antibiotic use.

Table 5: Age-wise Distribution of Antibiotic Use (n = 580)

Age Group (years)	Antibiotics Prescribed (n)	Not Prescribed (n)	Total	Percentage with Antibiotics (%)
<5	38	123	161	23.60
5–10	52	193	245	21.22
>10	32	142	174	18.39
Total	122	458	580	21.03

[Table 5] Antibiotic use was highest among children below 5 years (23.60%), followed by those aged 5–10 years (21.22%). The lowest use was observed among children aged 10 years or older (18.39%), suggesting that younger children were more likely to receive antibiotics.

Table 6: Number of Drugs per Prescription (n = 580)

Number of Drugs	Number of Prescriptions	Percentage (%)
1 drug	210	36.21
2 drugs	245	42.24
3 drugs	90	15.52
≥4 drugs	35	6.03
Total	580	100

[Table 6] Most prescriptions contained two drugs (42.24%), followed by single-drug prescriptions (36.21%). Polypharmacy (≥4 drugs) was relatively low (6.03%), indicating moderate prescribing practices.

Table 7: Class-wise Distribution of Antibiotics (n = 580 patients)

Antibiotic Class	Number of Patients	Percentage (%) (of total)
Penicillins	46	7.93
Cephalosporins	32	5.52
Macrolides	18	3.10
Fluoroquinolones	8	1.38
Aminoglycosides	6	1.03
Others	12	2.07
No antibiotics	458	78.97
Total	580	100

[Table 7] Penicillins were the most commonly prescribed antibiotics (7.93%), followed by cephalosporins (5.52%). A substantial proportion of patients (78.97%) did not receive antibiotics, reinforcing overall rational prescribing trends.

Table 8: AWaRe Classification Distribution (n = 580)

Category	Number of Patients	Percentage (%)
Access	78	13.45
Watch	36	6.21
Reserve	8	1.38
No antibiotics	458	78.97
Total	580	100

[Table 8] Most antibiotics prescribed belonged to the Access category (13.45%), which is recommended for first-line treatment. The use of Watch (6.21%) and Reserve (1.38%) antibiotics was comparatively lower, indicating acceptable adherence to stewardship principles.

Discussion

The current research measured the prescribing barrier to antibiotics among paediatric patients in a tertiary care hospital and the rationality of prescriptions using standard indicators. The results also provide detailed insights into current prescribing trends and identify areas where antimicrobial stewardship is needed.

This paper evaluated 580 paediatric prescriptions, of which 58.97 were male-comprised, and 41.03 were female-comprised. The same gender ratios have been found in the past literature, with male children more likely to be taken to receive medical care, possibly because of the sociocultural aspects that affect the healthcare-seeking behaviour of developing countries.[12,13]. Most of the patients were in the 5-10-year age bracket, which is consistent with previous expectations that children of school age have a higher risk of infection because they are more exposed to the environment.[14]

In the current study, the mean number of drugs per encounter was 1.84, which is below the desirable range recommended by the World Health Organisation (WHO). This means there is not a high rate of polypharmacy or irrational prescribing. Similar results have been reported in other hospital-based studies, where the mean number of drugs per prescription ranged from 1.6 to 2.2.[15] Reduction of polypharmacy is a crucial issue in paediatric populations to decrease the potential of adverse drug reactions and drug interactions.

Drugs prescribed using generic names were 67.07, which is satisfactory compared to the desired amount of 100, as recommended by the WHO. The use of generic prescribing is being encouraged because it makes the treatment cheaper and more accessible, particularly in environments with limited resources. Past research has documented extensive differences in generic prescribing, which are mostly due to prescribers' habits and pharmaceutical marketing.[16,17] It can also be improved by enhancing policies that encourage the use of generic drugs.

In the current study, the proportion of drugs prescribed according to the essential medicines list (EML) was 65.86%. Though this indicates moderate compliance, there is still room for improvement to achieve optimal use of necessary medicines. Empowering through EML will guarantee the prescribing of safe, effective, and cost-effective medications and is a major aspect of rational pharmacotherapy.[18]

The prescribed antibiotics accounted for 21.03/20-26.8 per cent of the prescribed antibiotics, which is within the WHO-recommended range (2026.8%). This observation implies the relatively prudent administration of antibiotics in the research context. The same antibiotic prescribing rates were observed in other tertiary care settings, suggesting increasing awareness of antimicrobial resistance and the rational use of antibiotics.[19] Nevertheless, it is crucial to check for continuous use, even within acceptable limits, to avoid unwarranted use.

The age-based analysis showed that antibiotic use was more

common among children under 5 years (23.60), which could be explained by the fact that the immune system is not yet fully developed, and children are more prone to infections. This observation has been reported in past studies, where increased exposure to antibiotics has been observed among younger children.[20] Nevertheless, one should note that the use of antibiotics in this age cohort should be based on evidence, to prevent unnecessary exposure.

This research also revealed minor differences in antibiotic prescriptions between males (21.64 per cent) and females (20.17 per cent), though these were not significant. This reveals that the practice of prescribing was not much different between genders, implying there was no significant gender bias in clinical decisions.

Penicillins accounted for the highest proportion of antibiotics prescribed (7.93%), followed by cephalosporins (5.52%) and macrolides (3.10%). The fact that penicillin is the most commonly used agent is a good sign, as it is often recommended as the first-line treatment for various childhood infections. The same kind of trends has been observed in previous articles where the use of beta-lactam antibiotics was the most common.[21] Careful use should, however, be followed in the use of cephalosporins and other broad-spectrum antibiotics as a means of avoiding the occurrence of resistance.

The analysis of the AWaRe classification indicated that 13.45% of all prescriptions were in the Access, Watch, and Reserve categories (8.66%). The increased percentage of Access antibiotics indicates compliance with WHO recommendations, but the presence of Watch and Reserve antibiotics, albeit in small amounts, indicates insufficient antimicrobial stewardship efforts. Similar results have been reported in the literature evaluating AWaRe-based prescribing and the need to promote Access group antibiotics.[22]

It is worth noting that all antibiotics in this study were purchased orally, with no injectable antibiotics used. This is good news because oral delivery is safer, more convenient, and cost-effective, particularly in the outpatient setting. The absence of unnecessary injections indicates compliance with rational prescribing principles and reduces the risk of injection-related complications.[23]

The study also observed sufficient treatment schedules and therapy lengths across all prescriptions, indicating good documentation practices. Correct prescription writing is vital for patient compliance and the maximisation of therapeutic benefits. Other studies have also linked similar results with enhanced service provision in primary hospitals.[24]

Although these are positive results, there are some limitations which should be acknowledged. The research was conducted in a single tertiary care hospital, which may limit the generalisability of the results to the population. Also, microbiological confirmation of infections was not evaluated, and they could have provided greater insight into the reasonableness of the antibiotic choice. It is suggested that multi-centric data and microbiological correlation should be undertaken in the future.

Overall, the results of the study suggest reasonable antibacterial prescribing with acceptable adherence to the WHO guidelines. Nevertheless, certain improvements can still be made, especially in the growth of generic prescribing, the use of the essential medicines list, and the reduction in the utilisation of higher-category antibiotics.

Conclusion

The current investigation into the current state of antibiotic prescribing among paediatric patients in a tertiary care hospital reveals a general tendency toward rational prescribing practices. The number of drugs per encounter was within the recommended range, and the percentage of antibiotic use (21.03) was in line with the World Health Organisation (WHO) guidelines. Oral administration, single-antibiotic treatment, and preference for Access group antibiotics are all indicators of adherence to the principles of the general treatment.

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Conflicts of interest

There are no conflicts of interest.

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