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Polypharmacy, Injectable Overuse, And Generic Prescribing In Paediatric Antibiotic Therapy: A Hospital-Based Observational Study

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Abstract

Background: The irrational use of antibiotics is a primary global health concern, contributing to antimicrobial resistance (AMR), increased morbidity, mortality, and rising healthcare costs. In Paediatric populations, inappropriate antibiotic prescribing can lead to adverse drug reactions and treatment failures. This study evaluates antibiotic prescribing patterns in a tertiary care hospital in Pune using WHO core prescribing indicators.

Objectives: To assess antibiotic prescribing patterns in Paediatric patients using WHO core prescribing indicators and evaluate adherence to WHO-recommended standards.

Materials and Methods: A prospective, observational study was conducted over six months in the Department of Paediatrics, Varun Arjun Medical College and Rohilkhand Hospital. Prescription data from 60 Paediatric patients were collected and analyzed using WHO prescribing indicators, including the average number of drugs per encounter, percentage of encounters with antibiotics, percentage of injectables, percentage of generic prescribing, and hospital formulary adherence. Descriptive statistics were used for analysis.

Results: The average number of drugs per prescription was 6.12, exceeding the WHO recommendation of less than 2, indicating polypharmacy. The percentage of encounters with antibiotics (26.30%) was within the WHO standard (20–26.8%). However, 85.71% of antibiotics were administered as injectables, significantly higher than the WHO-recommended 13.4–24.1%. Generic prescribing was low (25.76% vs. WHO target of 100%), while 99.59% of antibiotics were prescribed from the hospital formulary. Cephalosporins (38.77%) and penicillins (24.48%) were the most commonly prescribed antibiotic classes.

Conclusion: The findings indicate significant deviations from WHO prescribing standards, necessitating targeted interventions to promote rational antibiotic use. The study recommends enhancing antibiotic stewardship programs, promoting generic prescribing, and minimizing unnecessary use of injectables to optimize Paediatric antibiotic therapy.

Keywords: Antibiotic prescribing, Paediatric patients, WHO prescribing indicators, antimicrobial stewardship, polypharmacy, rational drug use.

Introduction

The irrational use of antibiotics is a growing public health concern, contributing to antimicrobial resistance (AMR), increased morbidity, mortality, and rising healthcare costs worldwide. The inappropriate use of antibiotics, especially in Paediatric patients, can lead to ineffective treatment, increased adverse drug reactions, and prolonged hospital stays. According to the World Health Organization (WHO), antibiotic resistance is one of the top ten global public health threats, necessitating immediate attention to rational antibiotic prescribing practices [1][2].

In Paediatric populations, antibiotics are among the most commonly prescribed drugs, often used for treating respiratory, gastrointestinal, and urinary tract infections [3][4]. However, studies indicate that a significant proportion of Paediatric antibiotic prescriptions are inappropriate, either due to unnecessary prescriptions, incorrect dosing, or over-reliance on broad-spectrum antibiotics [5][6]. WHO has developed core prescribing indicators to assess and improve rational prescribing practices in healthcare settings [7]. These indicators evaluate parameters such as the number of drugs per prescription, the proportion of encounters with antibiotics, the percentage of antibiotics prescribed in generic form, and the proportion of injectables used. Deviation from WHO standards may indicate overprescription, increased risks of antibiotic resistance, and higher healthcare costs.

In India, several studies have reported high rates of antibiotic prescribing, with an increasing trend in the use of injectable antibiotics in Paediatric care [8][9]. Studies have also shown that only a small proportion of antibiotics are prescribed using generic names, leading to high out-of-pocket expenditures and limited accessibility [10]. The high use of cephalosporins and penicillins in Paediatric prescriptions raises concerns about antimicrobial stewardship and the long-term impact on bacterial resistance patterns [11][12].

The idea for this study originated from the growing concern over irrational antibiotic prescribing in Paediatric healthcare settings. Despite existing guidelines, many hospitals continue to deviate from WHO prescribing standards, warranting a systematic evaluation of antibiotic prescribing trends. By analyzing Paediatric antibiotic prescriptions in a tertiary care hospital in Pune, this study aims to identify gaps in prescribing practices and areas requiring intervention.

The justification for this study lies in its potential to inform antibiotic stewardship programs, optimize prescribing patterns, and contribute to national efforts in combating antimicrobial resistance. Unlike previous studies, which have primarily focused on adult populations or multi-center data, this study provides a focused analysis of Paediatric antibiotic prescribing patterns using WHO indicators in a single tertiary care hospital.

The purpose of this study is to evaluate the prescribing pattern of antibiotics in Paediatric patients using WHO core prescribing indicators and to assess adherence to WHO-recommended standards. The findings will help identify prescribing trends, highlight areas of improvement, and support the development of strategies to promote rational antibiotic use in Paediatric healthcare settings.

Materials and Methods

Study Design and Setting

This prospective, observational study was conducted over a period of six months from August 2023 to January 2024 in the Paediatric department Varun Arjun Medical College and Rohilkhand Hospital, India. The study aimed to assess the prescribing patterns of antibiotics in Paediatric patients using WHO core prescribing indicators to evaluate rational drug use.

Study Population and Selection Criteria

A total of 60 Paediatric patients who received antibiotic prescriptions during their hospital stay were included in the study. Patients were selected randomly, ensuring that only those with complete prescription records were considered for analysis. The study included Paediatric patients aged 0–12 years who were prescribed at least one antibiotic during their hospital stay or outpatient visit. Patients with incomplete prescription data, those receiving antibiotics for surgical prophylaxis, or those discharged against medical advice were excluded from the study.

Data Collection and Study Variables

Prescription data were collected from hospital medical records and analyzed based on WHO core prescribing indicators. The recorded variables included demographic details such as age and gender, the average number of drugs per prescription, the percentage of encounters in which an antibiotic was prescribed, the number and class of antibiotics per prescription, the route of administration, the

percentage of antibiotics prescribed using generic names, and the percentage of antibiotics prescribed from the hospital formulary.

Study Outcomes and Statistical Analysis

The primary outcome of the study was to assess the rationality of antibiotic prescriptions based on WHO indicators. The collected data were analyzed using descriptive statistics, and results were expressed as percentages, means, and standard deviations. The observed values were compared with WHO-recommended standards to evaluate deviations and assess areas requiring improvement in prescribing practices.

Ethical Considerations

The study received ethical approval from the Institutional Ethics Committee before initiation. Patient confidentiality was strictly maintained by anonymizing all personal identifiers in compliance with ethical guidelines. The study adhered to the principles outlined in the Declaration of Helsinki, ensuring that no harm was caused to participants.

Results

The study population consisted of the youngest Paediatric patients, with a highest proportion of males compared to females (Table 1).

Table 1: Demographic Characteristics of Study Population

Characteristic	Value (n=60)
Mean Age (years)	4.92 ± 4
Male (%)	35 (58.33%)
Female (%)	25 (41.66%)

The number of drugs per encounter was greatest, far exceeding the WHO-recommended threshold, indicating (Table 2). The antibiotic prescribing rate was closest to the WHO standard, but the use of injectables was highest, surpassing the upper limit of recommended values (Table 2).

Table 2: WHO Core Prescribing Indicators

Indicator	Observed Value (n=60)	WHO Standard
Average number of drugs per encounter	3.12	<2
Percentage of encounters with an antibiotic prescribed	26.30%	20-26.8%
Average number of antibiotics per prescription	1.63	1.6-1.8
Percentage of antibiotics prescribed as injectables	85.71%	13.4-24.1%
Percentage of antibiotics prescribed by generic name	25.76%	100%
Percentage of antibiotics prescribed from the hospital formulary	99.59%	100%

Cephalosporins were the most frequently prescribed antibiotic class, followed by penicillins, with other classes being least commonly used (Table 3).

Table 3: Most Commonly Prescribed Antibiotic Classes

Antibiotic Class	Frequency (%) (n=98)
Cephalosporins	38 (38.77%)
Penicillins	24 (24.48%)
Macrolides	16 (16.32%)

Aminoglycosides	10 (10.20%)
Others	10 (10.20%)

Among routes of administration, injectables were predominantly used, with oral and topical routes being least preferred (Table 4).

Table 4: Route of Administration of Antibiotics

Route of Administration	Frequency (n=98)	Percentage (%)
Injectable	84	85.71%
Oral	12	12.24%
Topical	2	2.04%

Ceftriaxone was the most commonly prescribed antibiotic, whereas metronidazole had the lowest prescription frequency (Table 5).

Table 5: Most Frequently Prescribed Individual Antibiotics

Antibiotic Name	Frequency (n=98)	Percentage (%)
Ceftriaxone	30	30.61%
Amoxicillin-Clavulanate	20	20.40%
Azithromycin	15	15.30%
Gentamicin	10	10.20%
Metronidazole	8	8.16%

Discussion

The findings of this study highlight significant deviations from WHO prescribing indicators, particularly in polypharmacy, excessive use of injectable antibiotics, and low generic prescribing rates. The average number of drugs per prescription was 3.12, exceeding the WHO-recommended limit of less than 2, indicating a tendency toward overprescription and polypharmacy. Such trends have been reported in previous studies conducted in similar settings, where excessive prescribing was associated with increased risk of drug interactions and adverse drug reactions in Paediatric patients [13][14].

The percentage of encounters with an antibiotic prescribed (26.30%) in this study aligns with the WHO-recommended range (20–26.8%), suggesting a relatively appropriate antibiotic prescribing rate. However, the high proportion of injectables (85.71%) is a major concern, as WHO standards recommend a range between 13.4–24.1% [15]. The overuse of injectables has been linked to increased healthcare costs, higher risks of complications such as injection-site infections, and poor patient compliance [16][17]. Studies in developing countries have shown that physicians often prefer injectable antibiotics due to perceived efficacy, patient demand, and inadequate regulation of prescribing practices [18][19]. Addressing this issue requires improved physician training, implementation of hospital antibiotic stewardship programs, and stricter adherence to WHO guidelines.

A key finding of this study is the low percentage of antibiotics prescribed using generic names (25.76%), which falls significantly short of the WHO-recommended 100%. Similar findings have been reported in studies conducted in India, Pakistan, and Bangladesh, where brand-name prescribing was linked to pharmaceutical marketing influences and limited awareness among prescribers [20][21]. Generic prescribing is crucial for reducing healthcare costs, improving accessibility, and ensuring rational drug use. The high compliance with hospital formulary prescribing (99.59%) is encouraging, indicating prescribers' adherence to institutional policies, which could be leveraged to promote rational prescribing [22][23].

Regarding antibiotic classes, cephalosporins (38.77%) and penicillins (24.48%) were the most frequently prescribed, which aligns with previous studies reporting an increasing preference for cephalosporins due to their broad-spectrum activity [24]. However, overuse of broad-spectrum antibiotics has been associated with the emergence of resistant bacterial strains, particularly in Paediatric populations [25][26]. The results suggest a need for stricter antibiotic stewardship programs to regulate the selection of antibiotics based on microbiological evidence rather than empirical use.
Despite the strengths of this study, several limitations must be acknowledged. First, the study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings to other healthcare settings, especially rural hospitals and primary care facilities. Second, the study did not evaluate the appropriateness of antibiotic prescriptions based on microbiological culture and sensitivity tests, which is crucial for assessing rational antibiotic use. Third, the study period was limited to six months, and seasonal variations in antibiotic prescribing patterns were not considered. Future studies should incorporate multi-center data, evaluate antibiotic appropriateness using microbiological data, and assess seasonal influences on prescribing patterns.

Conclusion

This study underscores significant concerns in Paediatric antibiotic prescribing, particularly high polypharmacy, excessive injectable antibiotic use, and low rates of generic prescribing. While the overall antibiotic prescribing rate aligns with WHO recommendations, the findings highlight an urgent need for targeted interventions to promote rational prescribing. Strategies such as regular audits of antibiotic use, prescriber education programs, and strengthening hospital antibiotic stewardship initiatives are recommended. Future research should focus on evaluating prescribing appropriateness using microbiological data and expanding the study to multiple healthcare settings to better understand national prescribing trends.

Conflicts of Interest

The authors declare no conflicts of interest in relation to this study.

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