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Original Research Article

Assessment of Drug Utilization Pattern in Pediatric Patients: A Retrospective Study

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Abstract:

Background: Drug utilization studies are essential to evaluate prescribing practices and ensure rational, safe, and cost-effective medication use, particularly in pediatric populations where pharmacotherapy differs significantly from adults.

Aim: To assess the drug utilization pattern and prescribing practices in pediatric patients using WHO prescribing indicators.

Methodology: A retrospective, observational study was conducted over six months in a teaching hospital, analyzing 97 pediatric patient records (0–18 years). Data on demographics, prescribed drugs, dosage, route, and adherence to the National List of Essential Medicines (NLEM) were collected and evaluated using descriptive statistics and WHO indicators.

Results: A total of 118 drugs were prescribed, with an average of 1.22 drugs per encounter, indicating low polypharmacy. Branded drugs predominated (72.88%), while only 27.12% were prescribed generically. Essential medicines constituted 30.51% of prescriptions. Antibiotics were used in 24.74% of encounters, and injections in 35.05%. Pantoprazole was the most commonly prescribed drug. Oral (40.67%) and intravenous (28.81%) routes were most frequent.

Conclusion: Prescribing practices showed low polypharmacy but suboptimal adherence to generic prescribing and essential medicine use. Improvement in rational prescribing, particularly increasing generic use and optimizing antibiotic and injection practices, is recommended.

Keywords: Drug Utilization, Pediatrics, WHO Prescribing Indicators, Rational Drug Use, Antibiotics, Essential Medicines.

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Introduction

Drug utilization studies are critical in investigating the prescribing, dispensing and use of medications within the health care system. According to the World Health Organization (WHO), drug utilization studies are "drug marketing, distribution, prescription, and use in society with special emphasis on the resulting medical, social, and economic consequences" [1]. These studies are vital in assessing whether drugs are used safely, effectively, economically and conveniently [2]. Improper drug use - misuse, overuse or underuse - may lead to serious health hazards and waste of scarce healthcare resources [3].

Drug utilization studies address various aspects of drug use, such as prescribing, dispensing, and adherence. They are especially critical in the field of pediatrics, which is a branch of medicine that deals with the health of neonates, infants, children, and adolescents. Children respond differently to the drugs used in adults, as their physiology, pharmacokinetics and pharmacodynamics are different from adults. Thus, it is necessary to provide a systematic review of drug use in children to ensure appropriate prescribing, prevent adverse drug reactions, and enhance therapy [4].

Drug Utilization Evaluation (DUE), according to JCAHO (1994) is an ongoing, systematic process aimed at providing rational prescribing of drugs. DUE studies are conducted to evaluate prescribing practices and rational drug use through the identification, interpretation and optimization of drug use

Such studies are used to achieve a balance between the cost-effectiveness and quality of health care by improving prescribing practices and ensuring safe and appropriate drug use [5].

DUE studies can be classified into qualitative or quantitative studies. Qualitative studies aim to evaluate the appropriateness of drug use according to various criteria, including dose, duration, frequency and indication. These may include therapeutic audits, and their goal is to enhance quality of care. In contrast, quantitative studies measure and examine drug consumption trends, usually using defined daily doses or other statistical measures. Although quantitative studies yield useful information about drug consumption patterns, they are often combined with qualitative studies to assess the appropriateness of drug therapy.

DUE studies can be prospective, concurrent or retrospective. Prospective studies assess prescriptions prior to drug dispensing, enabling health-care professionals to avoid drug-related issues. Concurrent studies monitor treatment while ongoing, allowing for interventions. Retrospective studies, like the current study, involve reviewing historical data on prescribing and drug use to identify patterns, trends and potential problems in drug use [6]. Retrospective studies are helpful in assessing prescribing trends and in devising programs to ensure rational drug use [7].

Drug utilization evaluation involves a series of steps such as planning, data collection, implementation of corrective measures and evaluation of the program. This ensures ongoing monitoring and improvement of drug use. Also, the WHO-recommended Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) system provides a systematic approach to measure drug use. The Defined Daily Dose (DDD) is the assumed average maintenance dose per day for a drug used for its main indication in adults. This allows comparisons of drug consumption between different populations and settings and helps to promote rational drug use.

Children are a high-risk population because of their developing immune systems, variable growth and greater risk of infectious diseases. In settings like Bihar, India, where access to health care and resources may be scarce and infectious diseases are prevalent, rational drug use is critical. Medicines use studies in these regions can identify the irrational prescribing of drugs such as polypharmacy, excessive use of antibiotics and incorrect dosages. Not only can these practices affect patient safety but also increase the risk of antibiotic resistance and the cost of health care.

Irrational prescribing is a global issue, especially in the developing world. Regular monitoring of prescription data can improve therapeutic outcomes, minimise side effects, and give feedback to prescribers, thereby improving patient outcomes [7,8]. Drug utilisation studies also play a vital role in the development of healthcare policy by providing information on current prescribing trends and areas that need improvement. They aid clinical, educational and economic improvements in health care [9].

Further, the evolution of health information technology and the existence of electronic databases improve the quality and scope of drug utilization studies. Information from hospital databases, pharmacy claims and health insurance claims can be used to study prescribing patterns and assess interventions [10]. These evidence-based strategies are crucial in improving drug therapy and achieving rational drug use in children.

Recognising the need for rational drug use in children, this retrospective analysis will evaluate the pattern of drug use in children in Bihar, India. The study will examine the prescribing pattern and highlight the potential sources of irrational drug use, offering insights into the pharmacotherapy of children. This study's results will help inform healthcare practitioners and policymakers in their efforts to improve prescribing, ensuring patient safety and rational drug use in children.

Methodology

Study Design: The present study was conducted as a retrospective, observational, record-based study to assess the drug utilization pattern in pediatric patients. It involved systematic evaluation of previously recorded prescriptions and medical records to analyze prescribing trends, rational drug use, and adherence to standard treatment guidelines such as WHO prescribing indicators and essential medicine lists.

Study Area: The study was carried out in the Department of Pharmacology at Bhagwan Mahavir Institute of Medical Sciences. Data were obtained from the associated teaching hospital, including both inpatient and outpatient departments, where pediatric patients receive medical care.

Study Duration: The duration of the study was six months from July 2025 to December 2025.

Sample Size: A total of 97 pediatric patient records were included in the study. These records were selected based on predefined inclusion and exclusion criteria to ensure reliability and completeness of data.

Study Population: The study population comprised pediatric patients aged between 0 and 18 years who attended the inpatient and outpatient departments of the hospital during the study period. Both male and female patients were included, and their prescriptions and treatment details were analyzed.

Data Collection: Data were collected retrospectively from medical records and electronic health records maintained by the hospital. Information regarding patient demographics such as age and gender, along with clinical diagnosis, was recorded. Details of prescribed drugs, including drug name (both generic and brand), drug class, dosage form, route of administration, and number of drugs per prescription, were documented. The prescribed medications were compared with the National List of Essential Medicines (NLEM) India 2022 to assess essential drug usage. Additionally, the use of fixed dose combinations (FDCs) was evaluated based on approved lists issued by the Drug Controller General of India. A random sampling technique was applied to select prescriptions for analysis using WHO prescribing indicators.

Inclusion Criteria

- Pediatric patients aged 0–18 years
- Complete and legible medical records
- Patients receiving at least one prescribed medication
- Records from both inpatient and outpatient departments

Exclusion Criteria

- Incomplete or illegible medical records
- Patients above 18 years of age
- Records without drug prescription details
- Patients discharged against medical advice or referred elsewhere before treatment completion

Ethical Considerations: Prior approval for the study was obtained from the Institutional Ethics Committee. Patient confidentiality and privacy were strictly maintained throughout the study, and no personal identifiers such as names or contact details were recorded. As the study was retrospective in nature and based on record review, informed consent from patients was waived.

Study Procedure: The study procedure involved identification and retrieval of relevant patient records from hospital databases. Data were extracted using a structured data collection form. Each prescription was analyzed to determine the number of drugs per encounter, use of generic versus brand names, prescription of antibiotics and injections, and the use of fixed dose combinations. The prescribed drugs were also evaluated for their inclusion in the essential medicines list, and WHO prescribing indicators were calculated to assess rational drug use.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using appropriate statistical methods. Descriptive statistics such as mean, frequency, and percentage were used to summarize the data. WHO prescribing indicators were calculated, including the average number of drugs per prescription, percentage of drugs prescribed by generic name, percentage of encounters with antibiotics and injections, and percentage of drugs prescribed from the essential medicines list. The results were presented in the form of tables, charts, and graphs for better interpretation".

Result

Table 1 presents the demographic and clinical characteristics of patients (N=97). The majority of patients were in the 1–3 years age group (22, 22.68%), followed by 6–12 years (20, 20.61%) and 1 month–1 year (18, 18.56%). Infants aged 0–1 month accounted for 12 (12.37%), children aged 3–6 years for 17 (17.53%), and adolescents 12–18 years formed the smallest group (8, 8.25%). There was a clear male predominance with 61 patients (62.89%) compared to 36 females (37.11%). Overall, the study population mainly consisted of younger children with a higher proportion of males.

Table 1: Demographic and Clinical Characteristics of Patients (N = 97)

Characteristics	Number (n)	Percentage (%)
Total patients	97	100
Age Group		
0 days – 1 month	12	12.37
1 month – 1 year	18	18.56
1 year – 3 years	22	22.68
3 years – 6 years	17	17.53
6 years – 12 years	20	20.61
12 years – 18 years	8	8.25
Sex		
Male	61	62.89
Female	36	37.11

Table 2 presents the drug utilization pattern based on total drugs prescribed (n=118). A majority of the drugs were prescribed as branded medications, accounting for 86 (72.88%), while only 32 (27.12%) were prescribed by generic name. Most prescriptions consisted of single drugs (111, 94.07%), with a small proportion of fixed-dose combinations (7, 5.93%). Regarding essential drug use, only 36 drugs

(30.51%) were from the National List of Essential Medicines (NLEM), whereas a larger share, 82 (69.49%), were not. Overall, the findings indicate predominant use of branded, single-drug prescriptions with relatively low utilization of essential medicines.

Table 2: Drug Utilization Pattern (Based on Total Drugs, n = 118)		
Parameter	**Number (n)**	**Percentage (%)**
Total drugs prescribed	118	100
Type of Drugs		
Generic drugs	32	27.12
Branded drugs	86	72.88
Formulation Type		
Fixed Dose Combinations (FDC)	7	5.93
Single drugs	111	94.07
Essential Drug Use		
Drugs from NLEM	36	30.51
Drugs not from NLEM	82	69.49

Table 3 shows the commonly prescribed drugs among the study population (n=118). Pantoprazole was the most frequently prescribed drug with 25 prescriptions (21.18%), followed by Ondansetron in 17 cases (14.4%) and Paracetamol in 12 cases (10.16%). Among antibiotics, Ceftriaxone (8, 6.77%), Metronidazole (7, 5.93%), Azithromycin (6, 5.08%), and Amoxicillin + Clavulanate (6, 5.08%) were commonly used. Supportive therapies such as zinc preparations and multivitamins were prescribed in 5 cases each (4.23%), while other drugs together accounted for 27 prescriptions (22.87%). Overall, proton pump inhibitors, antiemetics, analgesics, and antibiotics constituted the major share of prescriptions.

Table 3: Commonly Prescribed Drugs (n = 118)		
Drug	**Number (n)**	**Percentage (%)**
Pantoprazole	25	21.18
Ondansetron	17	14.4
Paracetamol	12	10.16
Ceftriaxone	8	6.77
Metronidazole	7	5.93
Azithromycin	6	5.08
Amoxicillin + Clavulanate	6	5.08
Zinc preparations	5	4.23
Multivitamins	5	4.23
Others	27	22.87
Total	118	100

Table 4 shows the distribution of drug classes prescribed among the study population (n=118). Antibiotics were the most commonly prescribed class, accounting for 22 drugs (18.64%), followed by multivitamins and supplements (9, 7.63%), NSAIDs (7, 5.93%), and antipyretics/analgesics (6, 5.08%). Antihistamines (5, 4.23%), proton pump inhibitors (4, 3.38%), corticosteroids (4, 3.38%), and bronchodilators (3, 2.54%) were less frequently used. A large proportion of drugs fell under other categories, comprising 58 prescriptions (49.15%). Overall, antibiotics formed the major specific class, while a diverse range of other drugs contributed to nearly half of the prescriptions.

Table 4: Classes of Drugs Prescribed (n = 118)		
Drug Class	**Number (n)**	**Percentage (%)**
Antibiotics	22	18.64
Multivitamins & Supplements	9	7.63
NSAIDs	7	5.93
Antipyretics & Analgesics	6	5.08
Antihistamines	5	4.23
Proton Pump Inhibitors	4	3.38
Corticosteroids	4	3.38
Bronchodilators	3	2.54

Others	58	49.15
Total	118	100

Table 5 shows the distribution of routes of drug administration among the study population (n=118). The oral route was the most commonly used, accounting for 48 prescriptions (40.67%), followed by the intravenous (IV) route in 34 cases (28.81%). Intramuscular (IM) administration was used in 6 cases (5.08%). Less commonly used routes included rectal and nasal routes with 3 cases each (2.54%), and topical and other routes with 2 cases each (1.69%). Overall, oral and intravenous routes were the predominant modes of drug administration.

Table 5: Route of Administration (n = 118)		
Route	**Number (n)**	**Percentage (%)**
Oral	48	40.67
Intravenous (IV)	34	28.81
Intramuscular (IM)	6	5.08
Rectal	3	2.54
Nasal	3	2.54
Topical	2	1.69
Others	2	1.69
Total	118	100

Table 6 presents the WHO prescribing indicators based on patient encounters (N=97). The average number of drugs per encounter was 1.22, indicating low polypharmacy. However, only 27.12% of drugs were prescribed by generic name, reflecting limited adherence to generic prescribing practices. Antibiotics were prescribed in 24.74% of encounters, while injections were used in 35.05%, suggesting a moderate reliance on injectable therapy. Additionally, only 30.51% of drugs were from the essential drug list, indicating suboptimal utilization of essential medicines. Overall, while the number of drugs per prescription was low, there is considerable scope for improving rational prescribing practices, particularly in increasing generic prescribing and the use of essential drugs.

Table 6: WHO Prescribing Indicators (Based on Patient Encounters, N = 97)	
Indicator	**Value**
Average number of drugs per encounter	1.22
Percentage of drugs prescribed by generic name	27.12%
Percentage of encounters with an antibiotic (n = 24)	24.74%
Percentage of encounters with an injection (n = 34)	35.05%
Percentage of drugs from essential drug list	30.51%

Discussion

Our study on drug use patterns in children reveals a number of significant features compared to previous studies in comparable health care settings. In terms of age and sex distribution, we found that the highest number of patients were toddlers (1-3 years) (22.68%) followed by school children (6-12 years) (20.61%) as observed by Kopparthy et al. (2019) [1] and Senthilselvi et al. (2019) [2], where the majority of the patients were toddlers and school children. This may be due to higher incidence of infectious diseases and developmental immaturity in these age groups. Further, our study also showed a male bias (62.89%), similar to the Parekar et al. (2020) [3] study, which also found a higher number of male patients, likely due to sociocultural influences on health-seeking behaviours of male children."

In terms of prescribing, the average number of drugs prescribed per encounter in our study (1.22) is much lower than the comparative discussion data (12.93). This indicates lower levels of polypharmacy and rational prescribing practices in our study. This lower average number of drugs has been reported by Biradar et al. (2018) [11] as well and reflects the World Health Organisation (WHO) guidelines that discourage excessive polypharmacy. Alternatively, higher numbers of drugs per encounter in other studies may reflect a greater burden of complex disease or irrational prescribing.

The observed high rate of branded drug prescriptions (72.88%) in our study is in line with the findings of Thiruthopu et al. (2014) [4], who also found a higher rate of prescribing branded drugs over generics. But this is in contrast to the WHO recommendation to prescribe generics to enhance affordability and availability. Our generic prescribing rate of 27.12% is comparable to the 25.49% rate reported in the discussion data but still not ideal. This indicates a gap between guidelines and prescribing practices, possibly due to marketing, prescriber preferences, or perceived differences in drug efficacy.

In terms of drug classes, the most commonly prescribed class in our study was antibiotics (18.64%) which is lower than the 22.22% antibiotic encounter rate reported in the discussion dataset but still high. Similar research conducted by Thomas et al. (2020) [12] also reported high antibiotic prescribing in children, suggesting a risk for antibiotic resistance. The high use of commonly prescribed antibiotics like ceftriaxone and amoxicillin-clavulanate in our study is consistent with observations made by Ali et al (2018) [8], where broad-spectrum antibiotics were commonly used in tertiary care facilities. This again highlights the need for more robust antibiotic stewardship.

Pantoprazole (21.18%) and ondansetron (14.4%) were the most commonly prescribed medications in our study, with proportions similar to those in the discussion dataset (20.89% and 13.82%, respectively). This could reflect a general pattern in managing gastrointesinal symptoms and preventing nausea and vomiting in children. These results were also reported by Senthilselvi et al. (2019) [2], suggesting that these drugs are commonly used in pediatric practice. However, the common use of drugs such as proton pump inhibitors (PPIs) such as pantoprazole needs to be assessed for suitability, given the overuse documented in many studies.

We also observed that single drugs (94.07%) were preferred over fixed-dose combinations (FDCs) (5.93%) in our study, consistent with previous studies where FDCs were used with caution because of safety and efficacy issues. This is similar to the discussion dataset where single drugs were also more common. This can be explained by rational drug use and following the guidelines.

The mode of administration in our study was most commonly oral (40.67%) followed by intravenous (28.81%) whereas the discussion dataset had most common mode of administration as intravenous. This could be due to differences in severity of disease or patient profiles at admission. Other studies such as Kopparthy et al. (2019) [1] have also found oral administration to be the most common, consistent with our study. But a relatively high proportion of injections (35.05% encounters) in our study still exceeds the World Health Organisation (WHO) recommendations and suggests moderate to high dependence on injection therapy.

The compliance of our study with the National List of Essential Medicines (NLEM) was 30.51%, similar to the 28.76% seen in the discussion data but still low. These findings are also consistent with those of Parekar et al. (2020) [3], which indicate poor adherence to NLEM guidelines for prescribing medicines in children. This can be attributed to the presence of new drugs, physician preference, or lack of awareness of NLEM guidelines.

In summary, the comparison indicates that while our study exhibits relatively rational prescribing patterns as reflected by minimal polypharmacy and a preference for single drug therapy, there are still areas to improve generic prescribing, inappropriate use of antibiotics, and compliance with essential medicine guidelines. This reflects the World Health Organization's concerns about rational drug use globally. Further effort is needed in education of prescribers, implementation of policies and monitoring of drug usage to improve pharmacotherapy for children and provide safe, effective and cost-effective therapy.

Conclusion

The current study reveals significant patterns of drug use in the pediatric population, revealing that prescribing patterns are shaped by age-related medical conditions, with greater representation of children under 10 years of age and a significant majority of males. The study shows a strong preference for branded rather than generic drugs and a lack of use of essential medicines, suggesting opportunities to enhance cost-effective and rational prescribing. The majority of prescriptions were for single drugs, reflecting care being taken to avoid polypharmacy. The most frequently prescribed drugs were mainly supportive and symptomatic, with a significant proportion of antibiotics, which are commonly prescribed for children. Prescribing patterns of drug classes and routes of administration suggest the use of oral and parenteral medicines for more severe disease. In conclusion, the prescribing indicators reflect moderate follow up of the rational drug use principles but also reveal the need for a greater focus on generic prescribing, use of essential medicines and prudent use of antibiotics and injections to ensure safer and cost-effective pediatric practice.

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