

RESEARCH ARTICLE

Antimicrobial utilization pattern among pediatric inpatients of a tertiary care hospital in Central Gujarat

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ABSTRACT

Background: Drug utilization studies may help to measure various aspects such as disease pattern, medicine use, and prescribing patterns. **Aim and Objective:** The aim of the study was to evaluate the drug utilization pattern of antimicrobials prescribed to the pediatric inpatients at a tertiary care hospital. **Materials and Methods:** The study was prospective and observational based involving 200 pediatric inpatients of Parul Sevashram Hospital, Vadodara, Gujarat. Relevant information was obtained from the interview as well the hospital case record. Structured and pre-tested formats were prepared for compiling the data. **Results:** The majority of the patients (43.5%) were in the age group between 2 and 12 years. The most common indications for antimicrobial use included gastrointestinal diseases (22%), respiratory diseases (17.5%), and genitourinary diseases (13.5%). Cephalosporins (65.5%) were most frequently prescribed antimicrobials followed by aminoglycosides (40%). 73.3% of antimicrobials were prescribed by branded names. The average number of antimicrobials prescribed per patient was 2.21. 93.4% of antimicrobials have been included in the World Health Organization Model List of Essential Medicines. A total of 13 adverse drug reactions were reported from prescribed antimicrobials. **Conclusions:** Medicine utilization assessment can facilitate rational use of medicines in pediatric patients.


KEY WORDS: Pediatric Patients; Antimicrobial Utilization Pattern; Rational

INTRODUCTION

Antimicrobials can be a lifesaving in the management of bacterial infections and are the most commonly used drugs among all medications prescribed to pediatric patients. Their indiscriminate use increases the risk of antimicrobial resistance and thus has prompted their judicious prescribing in pediatrics practice.^[1] Inappropriate use of antimicrobial agent also leads to increased cost of therapy, adverse drug reactions (ADRs), and patient mortality.^[2] Therefore, the medicine

utilization evaluation studies are essential in evaluating drug usage and health-care system. Drug utilization research was defined by the World Health Organization (WHO) in 1977 as “the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social, and economic consequences.”^[3] Drug utilization studies help to understand and improve the prescribing as well as drug usage. This will ensure that medicines are used appropriately, safely, and effectively to improve patient health.^[4]

Prescribers and the consumers are flooded with a vast number of pharmaceutical products with innumerable trade names, available often at an unaffordable price. Drug utilization studies in pediatric population have been limited in India. Looking to paucity of information on this subject in general, and particularly in our region, we planned to undertake this study to gather the relevant data on antimicrobial prescribing

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pattern in patients of pediatric units of Parul Sevashram Hospital – a tertiary care teaching hospital in rural Gujarat.

MATERIALS AND METHODS

The prospective, cross-sectional, observational (non-interventional) study was conducted over a period of 3 months from June 1, 2019, to August 31, 2019, in patients admitted to pediatric wards and neonatal intensive care unit of Parul Sevashram Hospital, a tertiary care teaching hospital, Vadodara, Gujarat. A total of 200 patients receiving one or the other antimicrobial agents were included in the study. The approval for conduction of this study was obtained from Parul University Institutional Ethics Committee for Human Research. Each patient was recruited in the study based on inclusion and exclusion criteria only after obtaining informed consent from a parent/legal guardian and informed assent from the patient where feasible. The prospective participants and their parents/legal guardians were provided all the information about the objective and nature of the study in the language understood by them. Relevant patient demographics and information pertaining to antimicrobials prescribed were collected from the interview from their legal guardians as well the hospital case record and entered in a pre-structured case record form. The data collected included name, age, gender, indications (diagnosis), and details of antimicrobials prescribed including dose, route of administration, frequency, and duration of treatment. Data were analyzed for total number of antimicrobial drug formulations prescribed, average number of antimicrobials per prescription, category wise distribution of drugs, number of antimicrobials prescribed by International Nonproprietary Name (generic name) or branded name, number of antimicrobials prescribed from the WHO Model List of Essential Medicines and adverse drug reactions. Collected data were entered and analyzed using Microsoft Excel and the findings were presented in number and percentages.

RESULTS

The study included a total of 200 patients admitted to pediatrics inpatient departments. Out of all the enrolled patients, 114 (57%) were male and 86 (43%) were female. It was observed that by age group, 17 (8.5%), 28 (14%), 87 (43.5%), and 68 (34%) patients were aged 0–30 days, 1 month–2 years, 2–12 years, and 12–18 years of age, respectively. It is indicated in Table 1.

While assessing the disease pattern for antimicrobial prescribing among pediatric inpatients, it was found that majority of the patients 44 (22%) had gastrointestinal diseases followed by 35 (17.5%) had respiratory diseases, whereas 27 (13.5%) had genitourinary diseases, 23 (11.5%) had viral fever, and 17 (8.5%) had neonatal sepsis as presented in Table 2.

Table 1: Age- and gender-wise distribution of inpatients in pediatrics ($n=200$)

Age	Male (%)	Female (%)	Total
Neonate (0–30 days)	9 (52.94)	8 (47.05)	17
Infant (1 month–2 years)	17 (60.71)	11 (39.28)	28
Children (2–12 years)	49 (56.32)	38 (43.67)	87
Adolescent (12–18 years)	39 (57.35)	29 (42.64)	68
Total	114 (57)	86 (43)	200

Table 2: Disease pattern for antimicrobial prescribing in pediatrics

Disease condition	Number of patients (%)
Gastrointestinal disease	44 (22)
Respiratory disease	35 (17.5)
Genitourinary disease	27 (13.5)
Viral fever	23 (11.5)
Neonatal sepsis	17 (8.5)
Dermatological disease	15 (7.5)
Surgical condition	14 (7)
Injuries	7 (3.5)
Malaria	5 (0.25)
Meningitis	5 (0.25)
Other infections	10 (5)

Table 3: Pattern of antimicrobial prescribing in pediatrics

Class of antibiotics	Number of patients (%)
Cephalosporins	131 (65.5)
Penicillins	67 (33.5)
Aminoglycosides	80 (40)
Metronidazole	47 (23.5)
Fluoroquinolones	56 (28)
Macrolides	32 (16)
Vancomycin	13 (6.5)
Linezolid	7 (3.5)
Antimalarials	5 (2.5)
Albendazole	4 (2)

Among gastrointestinal conditions, diarrhea (52.3%) was most frequent among pediatric patients followed by enteric fever (13%), whereas among respiratory conditions, upper respiratory tract infection (67.8%) was found to be the most common indication for antimicrobial prescribing followed by pneumonia (28.6%). Among genitourinary conditions, urinary tract infection (63.6%) was frequent, whereas among dermatological conditions, skin rash (72.7%) was found to be the most common indication.

Most commonly prescribed drug groups included cephalosporins (131 [65.5%]) followed by penicillins (67 [33.5%]), aminoglycosides (80 [40%]), metronidazole

(47 [23.5%]), fluoroquinolones (56 [28%]), macrolides (32 [16%]), vancomycin (13 [6.5%]), linezolid (7 [3.5%]), antimalarials (5 [2.5%]), and albendazole (4 [2%]), as shown in Table 3.

A total of 442 antimicrobials were prescribed for the patients, giving an average of 2.21 antimicrobials per patient. In the present study, 21.2% of patients were prescribed by only one antimicrobial, whereas two antimicrobials were prescribed to 54.5% of the patients, 16.33% of patients had three antimicrobials, and four antimicrobials were prescribed to 7.97% of patients. Out of all antimicrobials prescribed, 26.7% were prescribed by generic name and 73.3% were prescribed by branded name. It was found that 77.2% of the prescribed antimicrobials were administered by intravenous route. In our study, 93.4% of antimicrobials have been included in the WHO Model List of Essential Medicines.

In our study, a total of 13 ADRs were reported which included loose motions (5 cases), skin rashes (3 cases), vomiting (2 cases), nausea (1 case), constipation (1 case), and change in stool color (1 case). Causality assessment of the 13 suspected ADRs using the WHO-Uppsala Monitoring Centre (UMC) criteria indicated that 6 (46.15%) ADRs fell into the “probable” category and 7 (53.84%) into the “possible” category [Figure 1].

Table 4: The WHO indicators for antimicrobial prescribing in pediatrics

WHO prescribing indicators	Percentage
Average number of medicines per prescription	4.73
Average number of antimicrobials per prescription	2.21
Antimicrobials prescribed by generic name	26.7
Antimicrobials prescribed by branded name	73.3
Antimicrobials prescribed from the WHO Model List of Essential Medicines	94.3
Antimicrobials prescribed by intravenous route	77.2

WHO: World Health Organization

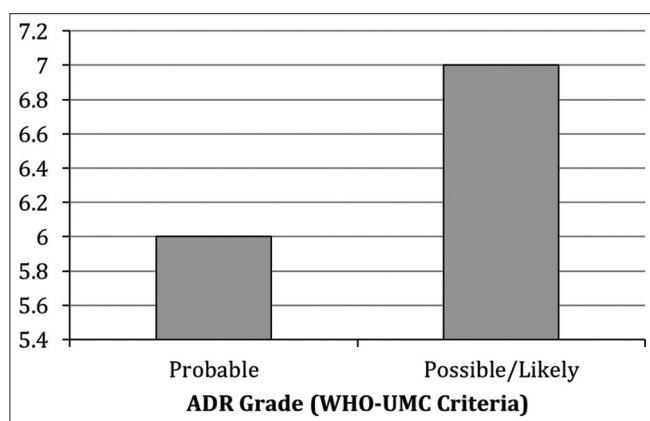


Figure 1: Adverse drug reaction grade (World Health Organization-Uppsala Monitoring Centre criteria)

DISCUSSION

In our study, a total of 200 prescriptions were analyzed prescribed to pediatric inpatients. Cephalosporins were most commonly prescribed drug group (65.5%) in our study followed by aminoglycosides (40%). Average number of medicines prescribed per prescription was 4.73 and average number of antimicrobials prescribed per prescription was 2.21. Around 93% of antimicrobials were prescribed from the WHO Model List of Essential Medicines. Approximately 73% of antimicrobials were prescribed by their branded name. Around 77% of antimicrobials were given through injectable route.

Infants and children constitute a large proportion of the population in developing countries and vulnerable to contract infections and to the adverse effects of medicines due to differences in pharmacodynamic and pharmacokinetic parameters.^[5] Antimicrobials are the mainstay for the treatment of infectious diseases and most commonly prescribed medicines in pediatric patients.^[6] However, the antimicrobial resistance developed due to their rampant and irrational use is a global health problem.^[7] The assessment of medicine utilization is important for clinical, educational, and economic purposes.^[8] In recent years, studies on drug utilization have become a potential tool to be used in the evaluation of health systems. Based on demographic observations from our study, we found more number of male pediatric patients affected with infections as compared to the female patients, thus indicating predominance in male patients. Our findings were consistent with other studies done in India.^[9] Considering the age factor, in our study, it was observed that more number of patients belonged to the age group between 2 and 12 years, comparable to the findings of the study done by Chavda and Rusva, suggesting that children of these age group are more vulnerable to contract infections.^[10] In the present study, similar morbidity pattern was found that is commonly observed in India. We have found that gastrointestinal system was the most commonly affected among pediatric patients. In the study done by Narayan and Mangesh,^[9] they found similar results. In our study, the second most commonly affected systems were respiratory system and genitourinary system. However, from other studies^[11,12] in India, respiratory system was the most commonly affected followed by gastrointestinal system. Further, it was found that cephalosporins were prescribed most frequently. We found similar findings in the study done by Pradeepkumar *et al.*^[13] It was observed that in the present study, average number of medicines prescribed per prescription was 4.73 as compared to 3.53 medicines per prescription reported by Pradeepkumar *et al.*^[13] Further, in our study, it was found that the average number of antimicrobials per prescription was 2.21 as compared to 2.16 per prescription reported by Narayan and Mangesh.^[9] To avoid polypharmacy, the study center being a teaching institute, in which the clinicians are exposed to educational training programs which may

contribute to reduce the number of average drugs prescribed per prescription.^[14] In our study, 73.3% of drug formulations were prescribed by their brand names. In a similar study done by Pradeepkumar *et al.*,^[13] 76.57% of drug formulations were prescribed by branded names.^[11] However, in the study done by Narayan and Mangesh,^[9] 48.92% of prescribing was done by generic name, which has been found higher than our setup. This suggests that there is a need to improve the practice of generic prescribing of the medicines, particularly in a hospital attached to a medical college where medical students are taught in depth about generic drug prescribing.^[14] In the present study, 77.2% of antimicrobials were administered by parenteral route. This result is consistent with the study done by Narayan and Mangesh.^[9] who reported that 90% of antimicrobials were given by parenteral route. In the present study, according to the WHO-UMC grading, 46.15% ADRs fell into the probable category and 53.84% into the possible category. We found similar results from the study done by Murthy and Praveen.^[15] In our study, 93.4% of antimicrobials were prescribed from the WHO Model List of Essential Medicines. However, there were 64.44% of antimicrobials prescribed from the WHO Model List of Essential Medicines in the study done by Chavda and Rusva.^[10] Prescribing from essential medicine drug list would help in rationalizing drug use and improving the patient care.

Possible limitations of the present study include the small sample size (albeit adequate) (more studies involving large population are required) and the lack of inclusion of patients from outpatient department as well as pediatric intensive care unit. Despite the limitations in our study, strength of the study is that it has generated baseline data for comparison with similar studies at state, national, and international level and similar type of studies in the future at this institution. It is evident that this study will help to establish antimicrobial prescribing guidelines in a tertiary care set up and will boost rational prescribing.

CONCLUSIONS

Antimicrobials are frequently prescribed in pediatric population. Hence, their judicious use in clinical practice is urgent need to reduce antimicrobial resistance; cost of therapy and ADRs. Drug utilization studies may help to provide information on prescribing patterns to all health care professionals and that will prompt judicious use of antibiotics. Hospital committee for prescription audit and establishment of guidelines for antibiotic usage can be useful to encourage the rational and appropriate use of antimicrobials.

REFERENCES

1. Nicolini G, Sperotto F, Esposito S. Combating the rise of antibiotic resistance in children. *Minerva Pediatr* 2014;66:31-9.
2. Sachdeva PD. Drug utilization studies-scope and future perspectives. *Int J Pharm Biol Res* 2010;1:11-7.
3. World Health Organisation. Introduction to Drug Utilization Research. Geneva: World Health Organisation; 2003.
4. Robert N. Managed Care Pharmacy Practice. 2nd ed. USA: Jones and Bartlett Learning; 2008.
5. Shankar PR, Upadhyay DK, Subish P, Dubey AK, Mishra P. Prescribing patterns among paediatric inpatients in a teaching hospital in Western Nepal. *Singapore Med J* 2006;47:261-5.
6. Choudhury DK, Bezbaruah BK. Antibiotic prescriptions pattern in paediatric in-patient department Gauhati medical college and hospital, Guwahati. *J Appl Pharm Sci* 2013;3:144.
7. Togoobaatar G, Ikeda N, Ali M, Sonomjams M, Dashdemberel S, Mori R, *et al.* Survey of non-prescribed use of antibiotics for children in an urban community in Mongolia. *Bull World Health Organ* 2010;88:930-6.
8. Uppal R, Chhabra A, Narang A. Pattern of drug use in neonatal intensive care unit. *Indian Pediatr* 1998;35:647-9.
9. Narayan DS, Mangesh MM. A study of prescription pattern of antibiotics in paediatric in-patients at a tertiary care hospital in central India. *Int J Pharmacol Res* 2016;6:286-90.
10. Chavda DA, Rusva MA Drug utilization study in the inpatients of pediatric department of a tertiary care hospital. *Int J Basic Clin Pharmacol* 2015;4:729-33.
11. Thapaliya K, Shrestha S, Sheela B, Damodar B, Chaudhary RK. Prescribing pattern of antibiotics in pediatric hospital in Chitwan district in Nepal. *World J Pharm Pharm Sci* 2015;4:163-141.
12. Patra S, Singh V, Pemde HK, Chandra J. Antibiotic prescribing pattern in paediatric in patients with first time wheezing. *Ital J Pediatr* 2011;37:40.
13. Pradeepkumar B, Alameri T, Narayana G, Reddy YP, Ramaiah JD. Assessment of antibiotic prescribing pattern in pediatric patients: A cross-sectional hospital-based survey. *CHRISMED J Health Res* 2017;4:235-7.
14. Desai MH, Sattigeri BM. Drug utilization study in geriatric patients visiting the outpatient department in tertiary care rural hospital. *Int J Sci Res* 2019;8:90-2.
15. Murthy SN, Praveen VJ. Adverse drug reactions in hospitalized paediatric patients in a tertiary care center in Kerala, India. *Int J Basic Clin Pharmacol* 2018;7:1998-2004.

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