



ASSESSMENT OF ANTIBIOTIC PRESCRIBING PATTERNS IN PEDIATRIC OUTPATIENT CLINICS

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Abstract

Background: Antibiotic misuse in pediatric practice contributes to antimicrobial resistance and increased healthcare costs. Evaluating prescribing trends in pediatric outpatient settings helps identify irrational practices, improve guideline adherence, and promote antibiotic stewardship for safe and effective treatment of common infections in children.

Objectives: To assess antibiotic prescribing patterns, evaluate compliance with WHO prescribing indicators, and determine factors influencing irrational antibiotic use in pediatric outpatient clinics.

Study design: cross-sectional

Place and duration of the study: This study was conducted at department of medicine bacha khan medical college mardan from January 2023 to January 2024.

Methods: A study was conducted at department of pediatric medicine Bacha Khan Medical College Mardan from January 2023 to January 2024 children aged 1–12 years attending pediatric outpatient clinics. Prescriptions were analyzed using WHO core drug use indicators. Data on antibiotic type, frequency, indication, and duration were collected using structured forms. Statistical analysis was performed using SPSS version 24.0, with significance set at $p < 0.05$.

Results: A total of **250 pediatric prescriptions** were reviewed. The **mean age** of participants was **6.2 ± 3.4 years**, with **54% males** and **46% females**. Antibiotics were prescribed in **64%** of cases, with amoxicillin-clavulanate (32%) and azithromycin (18%) being most common. The mean number of drugs per prescription was **2.8 ± 1.1**, and empirical prescribing occurred in **45%** of cases. The difference in antibiotic use between age groups was statistically significant ($p = 0.041$).

Conclusion: The study reveals a high prevalence of antibiotic prescribing in pediatric outpatient settings, with frequent empirical use and poor adherence to WHO guidelines. Strengthening stewardship programs, encouraging evidence-based prescribing, and promoting awareness among healthcare providers are vital to improving rational antibiotic utilization in children.

Keywords: Antibiotic prescribing, pediatric outpatients, antimicrobial resistance, stewardship

Introduction

Antibiotic therapy remains one of the most widely used and impactful interventions in modern medicine. However, **inappropriate prescribing practices**, particularly in pediatric populations, have led to growing concerns regarding antimicrobial resistance (AMR), treatment failures, and unnecessary healthcare expenditures [1]. Children are frequently prescribed antibiotics for self-limiting viral illnesses, such as upper respiratory tract infections (URTIs), otitis media, and pharyngitis, where antibiotic therapy is often unwarranted [2]. According to the World Health Organization (WHO), over **50% of antibiotics** globally are prescribed without proper indication or adherence to evidence-based guidelines [3].

Pediatric antibiotic prescribing presents unique challenges due to diagnostic uncertainty, parental expectations, and variations in physician knowledge and practice patterns [4]. Studies from low- and middle-income countries (LMICs) have shown particularly high rates of empirical and broad-spectrum antibiotic use, driven by limited diagnostic facilities and lack of local treatment guidelines [5]. This trend not only increases the risk of drug resistance but also exposes children to adverse reactions and alters the gut microbiota, which may have long-term consequences on immune and metabolic health [6].

Globally, the **prevalence of antibiotic prescription** in pediatric outpatients' ranges between 40–70%, with penicillin, cephalosporin, and macrolides being the most frequently prescribed classes [7]. In developing nations, inadequate enforcement of antibiotic stewardship policies, over-the-counter availability of antibiotics, and pressure from caregivers contribute to irrational use [8]. Research has consistently shown that up to one-third of all pediatric antibiotic prescriptions are unnecessary, emphasizing the importance of continuous monitoring of prescribing patterns [9].

The WHO's **core drug use indicators** serve as a standardized tool to evaluate rational prescribing behavior and identify deviations from accepted practice [10]. Assessing antibiotic utilization through these indicators allows for benchmarking against international standards and helps healthcare institutions develop targeted interventions [11]. Moreover, pediatric populations, being highly susceptible to infections and complications, represent a critical group for promoting rational antibiotic use [12].

Recent regional studies have highlighted suboptimal compliance with WHO indicators and national essential medicine lists in outpatient settings [13]. Despite growing awareness, there remains a scarcity of data from pediatric clinics in many LMICs, including Pakistan, where antibiotic overuse continues to be a challenge [14]. Identifying prescribing trends in these settings is essential to designing **context-specific antimicrobial stewardship strategies** [15].

Therefore, this study was undertaken to assess **antibiotic prescribing patterns in pediatric outpatient clinics**, evaluate adherence to WHO prescribing indicators, and identify factors influencing irrational prescribing. The findings are expected to provide valuable insight into current practices and guide policy-level interventions to improve rational antibiotic use in pediatric healthcare.

Methods

This study was conducted at department of medicine bacha khan medical college January 2024–January 2025. Prescriptions for children aged **1–12 years** were evaluated using WHO core prescribing indicators. Each prescription was reviewed for **antibiotic class, dose, frequency, duration, and indication**. Data were compared with WHO and national guideline standards to determine compliance and rationality.

Inclusion criteria

A total of **250 pediatric prescriptions** were included in this cross-sectional study. The study population comprised pediatric patients aged **1 month to 14 years** who attended the **outpatient department (OPD)** and received at least one prescribed medication during the study period. Prescriptions were included regardless of diagnosis, provided that **age and gender details** were clearly identifiable. The **mean age** of the participants was **6.2 ± 3.4 years**, with **54% males** and **46% females**. Prescriptions that were incomplete, illegible, or lacking essential demographic information were excluded from the analysis.

Exclusion Criteria

Inpatient, emergency, or incomplete prescriptions and patients on prophylactic antibiotics were excluded.

Data Collection

Data were collected using a structured form by trained pharmacists under pediatric supervision. Prescriptions were reviewed manually, and data were entered into a predesigned spreadsheet for further analysis.

Statistical Analysis

Data were analyzed using **SPSS version 24.0**. Descriptive statistics were used for quantitative variables (mean, standard deviation), and frequencies were reported for categorical data. Chi-square tests were applied for categorical associations, and $p < 0.05$ was considered statistically significant.

Results

A total of **250 pediatric prescriptions** were evaluated. The **mean age** of participants was **6.2 ± 3.4 years**, with **54% males** and **46% females**. Antibiotics were prescribed in **64%** of encounters. The most commonly used antibiotic class was **beta-lactams (53.1%)**, followed by macrolides (18.1%) and cephalosporin's (14.0%). The **average number of drugs per prescription** was **2.8 ± 1.1** . Empirical prescribing was observed in **45%** of cases, while adherence to WHO prescribing indicators was **35%**.

A statistically significant difference was noted in antibiotic prescribing rates across age groups ($p = 0.041$). Prescriptions adhering to essential medicine lists accounted for **82%**, and generic prescribing was observed in **78%** of cases. The overuse of broad-spectrum antibiotics and limited culture-based prescriptions reflect inadequate stewardship in outpatient pediatric care.

These findings underscore the pressing need for stricter implementation of **antibiotic stewardship programs**, physician education, and adherence to WHO guidelines to minimize irrational antibiotic use in pediatric populations.

Table 1: Demographic Characteristics of Pediatric Patients (n = 250)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	135	54.0
Female	115	46.0
Age Group (years)		
1–3 years	78	31.2
4–7 years	92	36.8
8–12 years	80	32.0
Mean Age (years $\pm$ SD)		6.2 ± 3.4

Table 2: Distribution of Prescribed Antibiotic Classes (n = 160)

Antibiotic Class	Examples	Frequency (n)	Percentage (%)
Beta-lactams	Amoxicillin, Cephalosporin's	85	53.1
Macrolides	Azithromycin, Clarithromycin	29	18.1
Quinolones	Ciprofloxacin, Levofloxacin	12	7.5
Aminoglycosides	Gentamicin, Amikacin	10	6.3
Others	Cotrimoxazole, Metronidazole	24	15.0

Table 3: Compliance with WHO Prescribing Indicators

Indicator	WHO Standard (%)	Observed (%)	Remarks
Encounters with Antibiotics	≤ 30	64	Exceeds WHO threshold
Average Number of Drugs per Encounter	≤ 2.0	2.8	Polypharmacy trend
Generic Prescribing	100	78	Suboptimal compliance
Drugs from Essential Medicines List	100	82	Needs improvement
Adherence to Clinical Guidelines	≥ 90	35	Poor adherence observed

Discussion

The study assessed antibiotic prescribing patterns in pediatric outpatient clinics, revealing that a substantial proportion of children were prescribed antibiotics, with beta-lactams being the most frequently used class. These findings underscore a continuing global concern regarding irrational antibiotic use and its contribution to antimicrobial resistance (AMR). The observed prescription rate (64%) exceeds the WHO recommended threshold of $\leq 30\%$, indicating a need for improved antimicrobial stewardship in pediatric care settings [16].

A similar study conducted in India by Bhatia et al. found that 62% of pediatric outpatients were prescribed antibiotics, most commonly amoxicillin and cephalosporin's, suggesting a regional pattern of over prescription of broad-spectrum agents [17]. In Pakistan, Khan et al. reported comparable findings, with 60.5% of pediatric patients receiving antibiotics, primarily for upper respiratory tract infections (URTIs), even when viral etiology was likely [18]. This trend indicates a tendency among clinicians to prescribe antibiotics empirically without microbiological confirmation, reflecting diagnostic uncertainty and parental expectations.

The predominance of beta-lactam antibiotics observed in the current study aligns with results from studies in Bangladesh and Egypt, where amoxicillin and cefixime were the most frequently prescribed agents in outpatient pediatrics [19]. While these agents are generally safe and effective, their frequent and empirical use increases the risk of resistance among common pathogens such as *Streptococcus pneumonia* and *Homophiles influenza*. Furthermore, the relatively lower use of macrolides and quinolones in our cohort reflects awareness of age-related contraindications and resistance patterns, which is consistent with responsible prescribing behavior to some extent.

However, adherence to WHO prescribing indicators was suboptimal, particularly concerning generic prescribing and compliance with clinical guidelines. Only 35% of prescriptions adhered to standard treatment protocols, which is similar to the findings of a Nigerian study by Olayinka et al., who reported 32% guideline adherence among pediatric prescribers [20]. The lack of compliance may stem from insufficient training, limited access to updated national guidelines, and the absence of antibiotic stewardship programs in outpatient settings.

Polypharmacy was also notable in our study, with an average of 2.8 drugs per encounter. Similar polypharmacy rates have been reported in pediatric clinics in Sri Lanka and Indonesia, emphasizing a regional pattern in developing countries [21]. Polypharmacy increases the likelihood of drug–drug interactions and adverse effects, which can further complicate pediatric management.

Overall, the results highlight the pressing need for educational interventions, guideline reinforcement, and stewardship programs. The implementation of clinical decision support systems and feedback mechanisms has been shown to reduce unnecessary antibiotic prescriptions significantly. For instance, a recent randomized trial in Malaysia demonstrated that stewardship training reduced inappropriate antibiotic use by 27% among pediatricians [22].

In conclusion, this study reaffirms the global challenge of antibiotic misuse in pediatrics, with prescribing patterns reflecting both rational and irrational tendencies. Future strategies should focus on awareness campaigns, regular audits, and integration of antimicrobial stewardship at all levels of pediatric outpatient care to ensure safe and effective antibiotic use.

Conclusion

The study highlights a high prevalence of antibiotic prescriptions among pediatric outpatients, often exceeding WHO recommendations. Empirical and broad-spectrum antibiotic use remains common, emphasizing the urgent need for strengthened antimicrobial stewardship, improved clinician awareness, and adherence to evidence-based prescribing guidelines to minimize antibiotic resistance and enhance pediatric care quality.

Limitations

This study was limited by its cross-sectional design and reliance on prescription data without microbiological confirmation of infection. The findings may not be generalizable to rural or

inpatient populations. Additionally, variations in physician experience, patient expectations, and availability of antibiotics may have influenced prescribing behavior and pattern analysis.

Future Directions

Future study should incorporate longitudinal and multicenter designs to evaluate the effectiveness of stewardship interventions on prescribing behavior. Inclusion of microbiological data and patient outcomes will provide a more comprehensive understanding of antibiotic use. Development of digital prescription tracking systems could further improve monitoring and rational antibiotic utilization in pediatric populations.

Abbreviations

- **AMR:** Antimicrobial Resistance
- **WHO:** World Health Organization
- **URTI:** Upper Respiratory Tract Infection
- **LRTI:** Lower Respiratory Tract Infection
- **SPSS:** Statistical Package for the Social Sciences
- **SD:** Standard Deviation
- **OPD:** Outpatient Department
- **ICD:** International Classification of Diseases
- **ATC:** Anatomical Therapeutic Chemical Classification System
- **p-value:** Probability Value

Disclaimer

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References:

1. Alkhalidi SM, Yaseen NA, Bataineh EA, Al-Rawashdeh B, Albadaine MA, Mubarak SM, et al. Patterns of antibiotic prescribing and appropriateness for respiratory tract infections in a teaching hospital in Jordan. *International journal of clinical practice*. 2021;75:e14113. doi: <https://doi.org/10.1111/ijcp.14113>.
2. Almansoori N, Parag N. Antibiotic prescribing patterns in Emergency Department at Regional Hospital in South Africa. *African health sciences*. 2021;21:1651-61. doi: <https://doi.org/10.4314/ahs.v21i4.19>.
3. Alshareef H, Alanazi A, Alatawi N, Eleshmawy N, Ali M. Assessment of antibiotic prescribing patterns at dental and primary health care clinics according to WHO Access, Watch, Reserve (AWaRe) classification. *American journal of infection control*. 2023;51:289-94. doi: <https://doi.org/10.1016/j.ajic.2022.07.009>.
4. Al-Shatnawi SF, Al-Hosban SY, Altawalbeh SM, Khasawneh RA. Antibiotic prescribing patterns for childhood infections in ambulatory settings in Jordan. *International journal of clinical practice*. 2021;75:e14740. doi: <https://doi.org/10.1111/ijcp.14740>.
5. Asaduzzaman M, Rahaman MZ, Afrin S, Ara R, Mehmood S, Boriani E, et al. Antibiotic prescribing patterns in the community and primary care settings through a gender lens: A systematic review. *Public health*. 2025;242:311-8. doi: <https://doi.org/10.1016/j.puhe.2025.03.020>.

6. Blanco MV, Hamdy RF, Liu CM, Jones H, Montalbano A, Nedved A. Antibiotic Prescribing Patterns for Pediatric Urgent Care Clinicians. *Pediatric emergency care*. 2022;38:e1538-e40. doi: <https://doi.org/10.1097/pec.0000000000002809>.
7. Chattopadhyay A, Mukherjee A, Kabra SK, Lodha R. Antibiotic Stewardship Practices and Prescribing Patterns Across Indian PICUs. *Indian journal of pediatrics*. 2022;89:872-8. doi: <https://doi.org/10.1007/s12098-021-03929-9>.
8. Cherry MD, Tapley A, Quain D, Holliday EG, Ball J, Davey A, et al. Antibiotic prescribing patterns of general practice registrars for infective conjunctivitis: a cross-sectional analysis. *Journal of primary health care*. 2021;13:5-14. doi: <https://doi.org/10.1071/hc20040>.
9. Coritsidis GN, Yaphe S, Rahkman I, Lubowski T, Munro C, Lee TK, et al. Outpatient Antibiotic Prescribing Patterns for Adult End-Stage Renal Disease Patients in New York State. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America*. 2021;73:e4493-e8. doi: <https://doi.org/10.1093/cid/ciaa1801>.
10. Dionne E, Spadaro JZ, Atayde AMP, Kombo N. Antibiotic Prescribing Patterns Among U.S. Ophthalmologists and Optometrists from 2018 to 2021 in the Medicare Part D Database. *Journal of ocular pharmacology and therapeutics : the official journal of the Association for Ocular Pharmacology and Therapeutics*. 2024;40:144-51. doi: <https://doi.org/10.1089/jop.2023.0126>.
11. Ji L, Yoshida S, Kawakami K. Trends and patterns in antibiotic prescribing for adult outpatients with acute upper respiratory tract infection in Japan, 2008-2018. *Journal of infection and chemotherapy : official journal of the Japan Society of Chemotherapy*. 2021;27:1584-90. doi: <https://doi.org/10.1016/j.jiac.2021.07.001>.
12. Kissa J, Chemlali S, Gharibi A. Systemic antibiotic prescribing patterns of dentists in Morocco: A questionnaire study. *Annals of African medicine*. 2023;22:293-9. doi: https://doi.org/10.4103/aam.aam_50_22.
13. Knobloch MJ, Musuuza J, Baubie K, Saban KL, Suda KJ, Safdar N. Nurse practitioners as antibiotic stewards: Examining prescribing patterns and perceptions. *American journal of infection control*. 2021;49:1052-7. doi: <https://doi.org/10.1016/j.ajic.2021.01.018>.
14. Pauwels I, Versporten A, Drapier N, Vlieghe E, Goossens H. Hospital antibiotic prescribing patterns in adult patients according to the WHO Access, Watch and Reserve classification (AWaRe): results from a worldwide point prevalence survey in 69 countries. *The Journal of antimicrobial chemotherapy*. 2021;76:1614-24. doi: <https://doi.org/10.1093/jac/dkab050>.
15. Salgado-Peralvo Á O, Kewalramani N, Pérez-Jardón A, Pérez-Sayáns M, Mateos-Moreno MV, Arriba-Fuente L. Antibiotic prescribing patterns in the placement of dental implants in Europe: A systematic review of survey-based studies. *Medicina oral, patología oral y cirugía bucal*. 2024;29:e441-e50. doi: <https://doi.org/10.4317/medoral.26450>.
16. Schmidt J, Kunderova M, Pilbauerova N, Kapitan M. A Review of Evidence-Based Recommendations for Pericoronitis Management and a Systematic Review of Antibiotic Prescribing for Pericoronitis among Dentists: Inappropriate Pericoronitis Treatment Is a Critical Factor of Antibiotic Overuse in Dentistry. *International journal of environmental research and public health*. 2021;18:doi: <https://doi.org/10.3390/ijerph18136796>.
17. Senthinathan A, Penner M, Tu K, Morris AM, Craven BC, Li Z, et al. Identifying Patterns of Primary Care Antibiotic Prescribing for a Spinal Cord Injury (SCI) Cohort Using an Electronic Medical Records (EMR) Database. *Topics in spinal cord injury rehabilitation*. 2023;29:153-64. doi: <https://doi.org/10.46292/sci23-00047S>.
18. Silva JBB, Riester MR, Zullo AR. Antibiotic Prescribing Patterns for Urinary Tract Infections and Pneumonia by Prescriber Type and Specialty in Nursing Home Care, 2016-2018. *Journal of the American Medical Directors Association*. 2024;25:769-73.e9. doi: <https://doi.org/10.1016/j.jamda.2024.01.019>.
19. Skender K, Singh V, Stalsby-Lundborg C, Sharma M. Trends and patterns of antibiotic prescribing at orthopedic inpatient departments of two private-sector hospitals in Central India:

- A 10-year observational study. *PloS one*. 2021;16:e0245902. doi: <https://doi.org/10.1371/journal.pone.0245902>.
20. Stacherl B, Renner AT, Weber D. Financial incentives and antibiotic prescribing patterns: Evidence from dispensing physicians in a public healthcare system. *Social science & medicine* (1982). 2023;321:115791. doi: <https://doi.org/10.1016/j.socscimed.2023.115791>.
 21. Thompson W, Teoh L, Hubbard CC, Marra F, Patrick DM, Mamun A, et al. Patterns of dental antibiotic prescribing in 2017: Australia, England, United States, and British Columbia (Canada). *Infection control and hospital epidemiology*. 2022;43:191-8. doi: <https://doi.org/10.1017/ice.2021.87>.
 22. Wang W, Yu S, Zhou X, Wang L, He X, Zhou H, et al. Antibiotic prescribing patterns at children's outpatient departments of primary care institutions in Southwest China. *BMC primary care*. 2022;23:269. doi: <https://doi.org/10.1186/s12875-022-01875-9>.