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PATTERNS AND PREDICTORS OF ANTIBIOTIC PRESCRIBING IN OUTPATIENT CARE: A CROSS-SECTIONAL STUDY FROM A TERTIARY HOSPITAL IN INDIA

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Abstract

BACKGROUND: Rising antimicrobial resistance, compounded by a substantial increase in outpatient antibiotic use, particularly of broad-spectrum drugs like cephalosporins and fluoroquinolones, poses a serious public health and economic threat in India, where community consumption accounts for approximately 80% of antibiotic use and up to half of it is potentially inappropriate

OBJECTIVES: To assess the frequency and pattern of antibiotic prescriptions in the General Medicine outpatient department and evaluate demographic factors influencing prescription trends.

METHODS: A retrospective cross-sectional study was conducted over three months at a tertiary care teaching hospital, analysing 300 patient records aged 18–70 years who received at least one antibiotic. Data on demographics, prescribed antibiotic classes, number of prescriptions per patient, and associated diagnoses were extracted from pharmacy records. Descriptive statistics were applied using Microsoft Excel.

RESULTS: The mean number of antibiotics prescribed per patient was 1.61 ± 0.72. The most represented age group was 31–45 years (n = 96; 32.00%), and males comprised 174 (58.00%) of the sample. One antibiotic was prescribed to 132 (44.00%) patients, two to 105 (35.00%), three to 45 (15.00%), and four or more to 18 (6.00%). Cephalosporins were the most frequently prescribed class (n = 114; 38.00%), followed by fluoroquinolones (n = 63; 21.00%) and macrolides (n = 48; 16.00%). The primary indications included respiratory tract infections (n = 111; 37.00%), urinary tract infections (n = 69; 23.00%), and gastrointestinal infections (n = 48; 16.00%). Cephalosporins drove antibiotic spending, representing 38.20% of OPD antibiotic costs and 16.80% of total pharmaceutical

expenditure. Cephalosporin use (OR = 4.26, r = 0.71) and polypharmacy (OR = 3.35, r = 0.62) were the strongest predictors of high-cost antibiotic prescriptions, whereas nitroimidazole use (r = −0.65) was associated with the lowest cost, highlighting significant variations in prescribing patterns and economic impact.

CONCLUSIONS: Broad-spectrum antibiotics were frequently prescribed in the outpatient setting, often empirically. These findings underscore the urgent need for localized antibiotic stewardship to optimize prescribing behaviors.

Key Words: Antibiotic stewardship; Cephalosporins; Outpatient department; Prescription audit; Rational drug use

Introduction

Antibiotic resistance is a pressing public health challenge worldwide, driven largely by the overuse and misuse of antibiotics in both hospital and outpatient settings. The World Health Organization has emphasized that antimicrobial resistance threatens the effective prevention and treatment of an increasing range of infections caused by bacteria, parasites, viruses, and fungi [1]. A significant contributor to this crisis is the inappropriate prescription of antibiotics, particularly in outpatient departments (OPDs), where the majority of antibiotics are dispensed without adequate microbiological guidance [2–4].

In India, the ease of over-the-counter access, patient pressure, lack of diagnostic facilities, and absence of antibiotic stewardship programs often result in irrational antibiotic use in OPDs [5,6]. Studies across the country have shown a high prevalence of broad-spectrum antibiotic prescriptions, sometimes for self-limiting or viral infections such as upper respiratory tract infections, where they are not warranted [7,8]. The Indian Council of Medical Research and WHO's GLASS initiative have attempted to address these issues by promoting surveillance systems and treatment guidelines [9,10], yet prescribing behaviors vary greatly among clinicians, institutions, and regions.

A growing body of literature has documented patterns in inpatient antibiotic use [11–13], but far fewer studies have focused on OPDs, particularly in tertiary care teaching hospitals. The unique dynamics of OPDs—such as high patient volume, limited consultation time, and absence of microbiological testing—demand targeted studies that capture the prescribing trends in these real-world scenarios [14,15].

Justification for the Research Aims and Objectives

Despite ongoing efforts to monitor antibiotic consumption, there remains a lack of granular data on OPD prescription practices within tertiary care institutions in northern India. This study was conceptualized to bridge this gap, focusing on quantifying the average number of antibiotics prescribed per patient, economic burden and evaluating the types and frequencies of antibiotics used in the General Medicine OPD. It also aims to identify demographic and clinical variables influencing the selection of specific antibiotic classes. Understanding these factors is essential to inform local antimicrobial stewardship initiatives and reduce inappropriate antibiotic use.

Purpose of the Study

The purpose of this study is to assess the antibiotic prescription trends in the General Medicine outpatient department of a tertiary care hospital. By analyzing data from 300 patients, the study seeks to generate evidence-based insights that can help develop guidelines for rational antibiotic use, ultimately contributing to improved patient outcomes, reducing economic burden and containment of antimicrobial resistance.

Material and Methods

Study Design and Setting

This was a retrospective cross-sectional study conducted from March 2025 to June 2025 over a period of three months in the Outpatient Department (OPD) of General Medicine at Varun Arjun Medical College & Rohilkhand Hospital, Shahjahanpur, Uttar Pradesh.

Study Population

A total of 300 patient records were reviewed. The study included adult patients aged between 18 and 70 years who received at least one antibiotic prescription during the study period. Patients with incomplete medical records and those outside the specified age range were excluded from the analysis.

Data Collection Procedure

Data were collected retrospectively from the hospital's pharmacy dispensing database. The following variables were extracted:

- Patient demographics: age, sex, medical history
- Antibiotic-related data: generic name, class, dosage (mg/kg), route of administration, and duration of therapy
- Clinical diagnoses associated with antibiotic prescriptions
- Cost per prescription was calculated by multiplying the WHO-defined DDD by the institutional unit cost, aggregating class-level totals in Excel 2021, and expressing each as a percentage of overall OPD antibiotic expenditure after data integrity checks

All drug names were recorded using their non-proprietary (generic) names. For new or uncommon antibiotics, the chemical name was documented.

Ethical Considerations

Prior approval for the study was obtained from the Institutional Ethics Committee (IEC) of Varun Arjun Medical College & Rohilkhand Hospital (ICE/VAMC/Pharmac/001/Mar2025). Patient confidentiality was maintained throughout the study. Identifiable information was removed prior to analysis to ensure anonymity and data privacy in accordance with ethical guidelines.

Statistical Analysis

Descriptive statistics were used to calculate the mean and standard deviation (SD) of antibiotic prescriptions per patient. Frequency and percentage distributions were computed for antibiotic classes and patient demographic characteristics. Logistic regression and Pearson's correlation were used to identify key predictors of high-cost antibiotic prescriptions (≥ ₹60), with cephalosporins, polypharmacy, and treatment duration as primary variables.

Materials and Resources

- Software: Microsoft Excel for data entry and statistical analysis.
- Personnel: Data analysts and administrative staff.
- Resources: Hospital pharmacy database for data extraction.
- Funding: Self-funded; no external or institutional financial support was involved.

Results

A total of 300 patient records from the General Medicine Outpatient Department were analyzed. The average number of antibiotics prescribed per patient was 1.61 ± 0.72, indicating a moderately high antibiotic usage rate in this population.

The age distribution showed that the 31–45 years age group constituted the largest proportion of patients (32.00%), followed by those aged 18–30 years (26.00%) and 46–60 years (25.00%). Patients

above 60 years comprised 17.00% of the total sample. Males formed the majority (58.00%) of the study population, as shown in Table 1.

Table 1: Demographic Profile of Study Participants

Demographic Variable	Category	Frequency (%)
Age Group (years)	18–30	78 (26.00%)
	31–45	96 (32.00%)
	46–60	75 (25.00%)
	61–70	51 (17.00%)
Sex	Male	174 (58.00%)
	Female	126 (42.00%)

The study results showed single-antibiotic prescriptions were most common (44.00%), while more than two antibiotics were prescribed in 21.00% of patients, suggesting the presence of complex or multi-infection cases (Table 2).

Table 2: Number of Antibiotic Prescriptions per Patient

Number of Antibiotics Prescribed	Patients (n)	Percentage (%)
1	132	44.00%
2	105	35.00%
3	45	15.00%
≥4	18	6.00%

Cephalosporins were the most frequently prescribed antibiotic class (38.00%), followed by fluoroquinolones (21.00%) and macrolides (16.00%) (Figure 1). The least prescribed categories were nitroimidazoles and other agents.

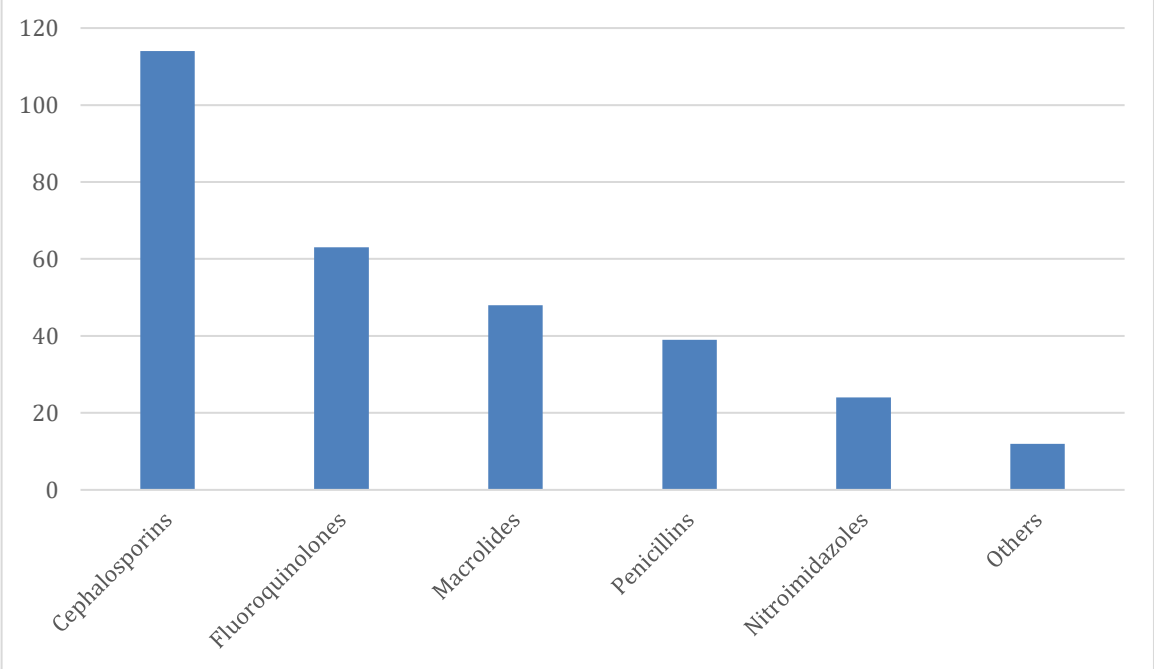

Figure 1: Distribution of Antibiotic Classes Prescribed

Among the diagnostic indications, respiratory tract infections (RTIs) accounted for the highest share of prescriptions (37.00%), followed by urinary tract infections (23.00%) and gastrointestinal

infections (16.00%). The remaining cases were associated with skin/soft tissue infections and undifferentiated fevers (Figure 2).

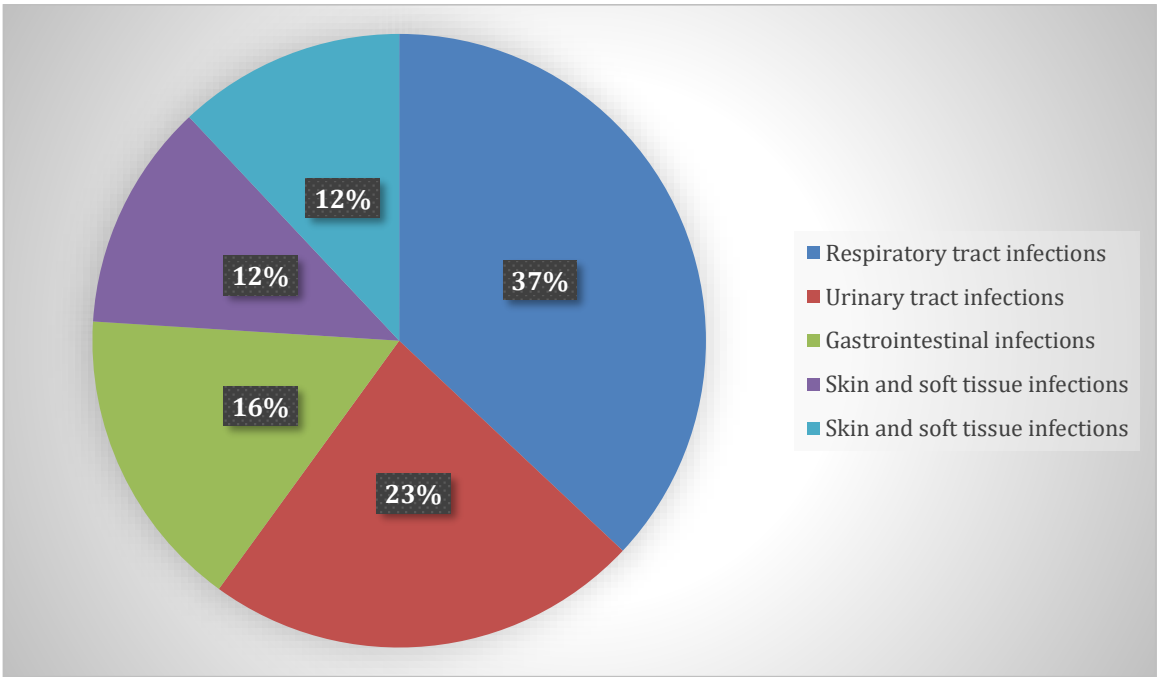

Figure 2: Clinical Indications for Antibiotic Use

In the outpatient cost analysis (Table 3), cephalosporins incurred the highest total expenditure (₹7,695), while nitroimidazoles had the lowest (₹1,920). Cephalosporins also carried the highest average cost per prescription (₹67.50), compared with nitroimidazoles at the low end (₹40.00). The Defined Daily Dose peaked with nitroimidazoles (1,600 mg) and was smallest for fluoroquinolones (500 mg), whereas unit costs were highest for cephalosporins (₹45 per DDD) and lowest for nitroimidazoles (₹25 per DDD).

Table 3: Cost Metrics of Antibiotic Prescriptions

Antibiotic Class	DDD (mg)	Avg. Unit Cost (INR)	Avg. Cost per Prescription (INR)	Total Expenditure (INR)	% of Total Expenditure
Cephalosporins	1,500	45	67.50	7,695	38.20
Fluoroquinolones	500	30	60.00	3,780	18.80
Macrolides	1,000	35	56.00	2,688	13.40
Nitroimidazoles	1,600	25	40.00	1,920	9.50
Total				**20,000**	**100**

The correlation results (Table 4) revealed that cephalosporin use had the strongest positive correlation with prescription cost (r = 0.71), indicating it as the most significant cost driver among all antibiotic classes. This was followed by polypharmacy (r = 0.62) and fluoroquinolone use (r = 0.58), both showing substantial positive associations with increased expenditure. In contrast, nitroimidazole use demonstrated the strongest negative correlation with cost (r = −0.65), identifying it as the most cost-effective option. Among the treatment characteristics, longer duration (≥ 5 days) also showed a notable positive correlation with cost (r = 0.53), suggesting extended therapy contributes to higher financial burden.

Table 4: Predictors of Antibiotic Prescribing in Outpatient Care

Predictor Variable	Odds Ratio (OR)	95% Confidence Interval	p-Value	Correlation Coeffficient
Cephalosporin Use	4.26	2.31 – 7.85	<0.001	**0.71**
Fluoroquinolone Use	2.41	1.32 – 4.42	0.004	0.58
Macrolide Use	1.73	0.89 – 3.34	0.101	0.46
Nitroimidazole Use	1.00	–	–	**–0.65**
Polypharmacy (>1 antibiotic)	3.35	1.77 – 6.32	<0.001	0.62
Duration ≥ 5 Days	1.95	1.02 – 3.71	0.043	0.53

Discussion

This study analyzed the patterns of antibiotic prescriptions in a tertiary care outpatient department, revealing a mean of 1.61 antibiotics per patient and identifying cephalosporins as the most frequently prescribed class. The findings underscore the ongoing concerns about the high frequency of broad-spectrum antibiotic use in outpatient settings, particularly in developing countries where antimicrobial stewardship is still evolving.

The predominance of cephalosporin prescriptions (38.0%) in the present study is consistent with the findings of Kaur et al., who reported that third-generation cephalosporins were the most commonly prescribed antibiotics in urban outpatient settings in northern India [16]. Similarly, Bansal et al. documented a 40–45% prevalence of cephalosporin use in their outpatient audit in a tertiary care hospital, attributing this trend to perceived efficacy and broad coverage, despite limited microbiological confirmation [17]. This suggests a possible empirical approach in outpatient prescribing that may contribute to rising antimicrobial resistance.

The frequent prescription of fluoroquinolones (21.0%) and macrolides (16.0%) also aligns with observations by Dey et al. and Nagpal et al., who noted an increase in fluoroquinolone use for urinary and gastrointestinal infections without routine culture support [18,19]. These classes are widely available and relatively inexpensive, making them a common empirical choice. However, their irrational use has been strongly associated with increasing resistance patterns, particularly in *Escherichia coli* and *Klebsiella pneumoniae* strains [20].

The highest proportion of antibiotics was prescribed for respiratory tract infections (37.00%), followed by urinary tract infections (23.00%). Similar findings were reported by Singh et al., who highlighted a tendency among general practitioners to prescribe antibiotics for upper respiratory infections despite clear guidelines recommending otherwise [21]. This behavior may stem from patient expectations, lack of rapid diagnostic tools, and clinician time constraints in high-volume OPD settings. Consistent with study results Kotwani et al. (2018), who identified third-generation cephalosporins as the most frequently dispensed antibiotics in India's private sector, the study results similarly found cephalosporins to drive 38.20% of OPD antibiotic expenditure [22]. Cephalosporin use and polypharmacy were significant predictors of high-cost prescriptions, consistent with findings by Sharma et al., who reported similar cost drivers in outpatient antibiotic use patterns [23].

Study Strengths and Limitations

A key strength of this study lies in its focused evaluation of real-world prescribing practices in a tertiary care OPD using robust pharmacy records. The sample size of 300 patients provides a reasonable snapshot of local antibiotic trends. However, several limitations must be acknowledged. First, the study's retrospective nature limited access to microbiological confirmation of diagnoses, preventing assessment of prescription appropriateness. Second, the findings are limited to a single center and may not be generalizable to rural or primary care settings. Additionally, the study did not assess prescriber-level factors such as years of experience or adherence to treatment guidelines, which could have influenced prescription behavior.

Conclusions

In conclusion, this study identified a high frequency of antibiotic prescriptions, especially broad-spectrum agents like cephalosporins and fluoroquinolones, in an outpatient setting. These findings reflect a prescribing pattern driven by empirical treatment rather than culture-based diagnosis. The association between polypharmacy and older age groups highlights the need for age-sensitive antibiotic stewardship. These insights justify the implementation of localized prescribing guidelines, regular audits, and educational interventions for clinicians to ensure rational antibiotic use. The study underscores that cephalosporin use and polypharmacy are the primary predictors of high-cost antibiotic prescriptions, emphasizing the need for targeted stewardship interventions. Future research should incorporate microbiological data and expand to multiple centers to build a comprehensive antibiotic usage surveillance framework.

Abbreviations Used

- **OPD** – Outpatient Department
- **RTI** – Respiratory Tract Infection
- **UTI** – Urinary Tract Infection
- **GI** – Gastrointestinal
- **n** – Number of Patients
- **p-value** – Probability Value (used in statistical significance testing)

Conflicts of Interest: None declared.

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