



RESEARCH ARTICLE

Evaluation of Antimicrobial Utilization and Prescribing Practices in an Inpatient Medicine Department: A Prospective Observational Study

Venkatesh M Patil^{1*}, Rajeshwari R Surpur², Sre Harsha H³

ABSTRACT

Inappropriate antimicrobial utilization is an important contributor to the emergence and spread of antimicrobial resistance (AMR). Assessment of prescribing practices at the institutional level can identify inappropriate patterns and provide opportunities for antimicrobial stewardship interventions. Drug utilization studies are therefore useful for evaluating antimicrobial selection, route of administration, spectrum of activity and adherence to rational prescribing principles. Objectives: To assess the pattern of antimicrobial utilization among patients admitted to the Medicine department of a tertiary care hospital; to evaluate prescribing practices using WHO drug-use indicators; to determine the proportion of empirical and culture-guided antimicrobial therapy; and to assess the utilization of broad- and narrow-spectrum antimicrobial agents. Methods: A prospective observational study was conducted in the Department of Medicine of a tertiary care teaching hospital for six months. Adult patients aged 18 years and above who received at least one antimicrobial during hospitalization were included. Prescriptions from intensive care units and other specialty departments were excluded. Data regarding demographic characteristics, diagnosis, antimicrobial class, number of antimicrobials, route of administration, generic or brand prescribing, culture sensitivity-based treatment and inclusion in the Essential Medicines List were collected using a structured proforma. Broad- and narrow-spectrum antimicrobials were classified according to the WHO AWaRe framework. Data were analyzed using descriptive statistics. Results: A total of 400 antimicrobial-containing prescriptions were evaluated. Patients aged 46–60 years constituted the largest age group (31%), and males represented 59% of the study population. Respiratory tract infections were the leading indication for antimicrobial therapy (33%), followed by urinary tract infections (21%). Cephalosporins were the most frequently prescribed antimicrobial class (31%). Intravenous administration was used in 62% of prescriptions. Broad-spectrum antimicrobials accounted for 67% of prescriptions. Culture and sensitivity-guided therapy was documented in 28%, whereas 72% of prescriptions were empirical. Generic prescribing was observed in 42% of prescriptions, while 78% of antimicrobials were from the Essential Medicines List. The mean number of antimicrobials per prescription was 1.46. Conclusion: The study demonstrated substantial use of broad-spectrum and empirical antimicrobial therapy, together with relatively limited culture-guided and generic prescribing. Strengthening antimicrobial stewardship, microbiological support and adherence to standard treatment recommendations may improve the quality and rationality of antimicrobial utilization.

Keywords: Antimicrobial utilization, Medicine, generic prescribing.

Indian J. Pharm. Biol. Res. (2026): <https://doi.org/10.30750/ijpbr.14.4.39>

INTRODUCTION

Antimicrobial resistance (AMR) is a major public health concern because it threatens the effectiveness of antimicrobial therapy and can result in increased morbidity, mortality and healthcare expenditure. The World Health Organization (WHO) has recognized AMR as one of the important challenges to effective management of infectious diseases[1]. The Global Action Plan on Antimicrobial Resistance emphasizes appropriate antimicrobial utilization as an essential component of efforts to control the development and transmission of resistance[2].

The development of antimicrobial resistance is closely associated with inappropriate antimicrobial exposure. Unnecessary prescription, inappropriate antimicrobial selection, incorrect dosage, excessive duration of therapy

and unnecessary use of broad-spectrum agents can all contribute to selection pressure and development of resistant organisms[3]. Hospitalized patients are particularly important in this context because antimicrobial exposure is common and patients may have severe infections, multiple comorbidities and prolonged hospital stays.

The situation is further complicated in resource-constrained settings where microbiological facilities may be limited or culture results may not be available when treatment has to be initiated. Consequently, empirical antimicrobial therapy is frequently used[4,5]. Although empirical treatment can be clinically appropriate when prompt therapy is required, continued treatment without microbiological reassessment may result in unnecessary exposure to broad-spectrum agents.

¹Professor & Head of Department, Department of Pharmacology, Navodaya Medical College, Raichur, Karnataka, India

²Professor and Head of the Department, Department of Microbiology, Navodaya Medical College, Raichur, Karnataka, India

³Associate Professor, Department of Pharmacology, Navodaya Medical College, Raichur, Karnataka, India

Corresponding Author: Venkatesh M Patil, Professor & Head of Department, Dept of Pharmacology, Navodaya Medical College, Raichur, Karnataka, India E-mail: appi1969@yahoo.co.uk

How to cite this article: Patil VM, Surpur RR, Harsha SS. Evaluation of Antimicrobial Utilization and Prescribing Practices in an Inpatient Medicine Department: A Prospective Observational Study. Indian J. Pharm. Biol. Res. 2026;14(4):281-285.

Source of support: Nil

Conflict of interest: None.

Received: 27/08/2026 **Revised:** 30/09/2026 **Accepted:** 06/10/2026

Drug utilization studies provide an important mechanism for assessing medication use in clinical practice. Such studies can identify commonly prescribed antimicrobial classes, indications for treatment, route of administration, extent of polypharmacy and the degree to which prescribing conforms to accepted standards[6]. The WHO prescribing indicators provide standardized parameters for evaluating selected aspects of rational prescribing, including generic prescribing and use of medicines included in essential medicines lists[7].

Antimicrobial consumption has increased considerably worldwide, with substantial utilization of broad-spectrum agents including third-generation cephalosporins and other higher-spectrum antibiotics[8]. The global burden of bacterial antimicrobial resistance further emphasizes the need for appropriate antimicrobial use and effective stewardship interventions[9].

Antimicrobial stewardship programs are designed to optimize antimicrobial therapy by ensuring appropriate drug selection, dose, route and duration while minimizing unnecessary antimicrobial exposure. Such programs also encourage microbiological investigation, de-escalation when appropriate and adherence to institutional or standard treatment guidelines[10].

Assessment of prescribing practices at the hospital level is therefore important for identifying specific areas that may benefit from stewardship interventions. The present study was undertaken in the Medicine department of a tertiary care hospital to evaluate antimicrobial prescribing practices, assess selected WHO prescribing indicators, determine the extent of culture-guided therapy and examine

Table 1: Demographic and Clinical Profile of the Study Population (n = 400)

Variable	Category	Frequency	Percentage (%)
Age group (years)	18–30	72	18
	31–45	108	27
	46–60	124	31
	>60	96	24
Gender	Male	236	59
	Female	164	41
Indication for antimicrobial therapy	Respiratory tract infections	132	33
	Urinary tract infections	84	21
	Gastrointestinal infections	56	14
	Skin & soft tissue infections	48	12
	Sepsis	36	9
	Others	44	11

the utilization of broad- and narrow-spectrum antimicrobial agents.

MATERIALS AND METHODS

A prospective observational study was conducted in the Department of Medicine of a tertiary care teaching hospital over a period of six months to evaluate antimicrobial prescribing practices under routine clinical conditions. Adult patients aged ≥ 18 years who received at least one antimicrobial agent during their hospital stay were eligible for inclusion. Prescriptions originating from intensive care units and other specialty departments were excluded to maintain uniformity of the study population. Prescriptions with incomplete essential information were also excluded. The required sample size was calculated using the formula $n = Z^2pq/d^2$, assuming a 50% expected proportion, 95% confidence level and 5% allowable error. The calculated sample size was 384, and 400 prescriptions were ultimately included.

Table 2: Pattern of Antimicrobial Prescribing According to Number, Class and Route of Administration

Parameter	Category	Frequency / Percentage
Number of antimicrobials per prescription	1	252 (63%)
	2	112 (28%)
	≥3	36 (9%)
Mean number of antimicrobials/prescription	—	1.46
Antimicrobial class	Cephalosporins	31%
	Penicillins	24%
	Fluoroquinolones	16%
	Macrolides	12%
	Carbapenems	8%
	Others	9%
Route of administration	Intravenous	248 (62%)
	Oral	140 (35%)
	Other routes	12 (3%)

Data were collected prospectively using a structured, predesigned proforma. Information regarding age, sex, clinical diagnosis, number and class of antimicrobials, route of administration, dosage form, duration of therapy, generic or brand prescribing, and culture and sensitivity-guided therapy was recorded. Antimicrobials were categorized as broad- or narrow-spectrum according to the WHO AWaRe classification. Selected WHO prescribing indicators, including average number of drugs per prescription, average number of antimicrobials, generic prescribing and use of medicines from the Essential Medicines List, were assessed. Data were entered into Microsoft Excel and analyzed using descriptive statistics, with categorical variables expressed as frequencies and percentages and continuous variables as means. Institutional Ethics Committee approval was obtained, and patient confidentiality was maintained throughout the study.

RESULTS

A total of 400 antimicrobial-containing prescriptions were evaluated. Patients aged 46–60 years constituted the largest age group (31%), followed by those aged 31–45 years (27%) and those aged >60 years (24%). Males accounted for 59% of the study population, indicating a male predominance.

Table 3: Indicators of Antimicrobial Stewardship and Rational Prescribing (n = 400)

Indicator	Category	Frequency	Percentage (%)
Basis of antimicrobial therapy	Culture & sensitivity-guided	112	28
	Empirical	288	72
Spectrum of antimicrobial	Broad-spectrum	—	67
	Narrow-spectrum	—	33
Prescribing by name	Generic	168	42
	Brand	232	58
Essential Medicines List	Included in EML	—	78
	Not included in EML	—	22

Respiratory tract infections were the most frequent indication for antimicrobial therapy (33%), followed by urinary tract infections (21%) and gastrointestinal infections (14%). Skin and soft tissue infections accounted for 12%, while sepsis represented 9% of the indications.

Most prescriptions contained a single antimicrobial agent, accounting for 63% of prescriptions, while 28% contained two antimicrobials and 9% contained three or more. The mean number of antimicrobials per prescription was 1.46. Cephalosporins were the most frequently prescribed antimicrobial class (31%), followed by penicillins (24%) and fluoroquinolones (16%). Macrolides, carbapenems and other antimicrobial classes accounted for 12%, 8% and 9%, respectively. Intravenous administration was the predominant route (62%), whereas 35% of prescriptions involved oral administration and 3% used other routes.

The pattern of antimicrobial use demonstrated a predominance of empirical and broad-spectrum therapy. Culture and sensitivity reports guided treatment in 28% of prescriptions, whereas 72% were empirical. Broad-spectrum antimicrobials constituted 67% of prescriptions compared with 33% for narrow-spectrum agents. Generic prescribing was observed in 42% of prescriptions, while 58% were prescribed by brand name. Overall, 78% of antimicrobial agents were reported to be from the Essential Medicines List.

The WHO prescribing indicators showed an average of

Table 4: WHO Prescribing Indicators and Summary of Antimicrobial Utilization

WHO / Study Indicator	Value
Average number of drugs per prescription	3.8
Average number of antimicrobials per prescription	1.46
Prescriptions containing ≥ 1 antimicrobial	100%*
Antimicrobials prescribed by generic name	42%
Antimicrobials from Essential Medicines List	78%
Culture & sensitivity-guided therapy	28%
Empirical therapy	72%
Broad-spectrum antimicrobial use	67%
Narrow-spectrum antimicrobial use	33%

3.8 drugs per prescription and 1.46 antimicrobials per prescription. All prescriptions contained at least one antimicrobial because this was an inclusion criterion. Generic prescribing accounted for 42%, while 78% of antimicrobials were from the Essential Medicines List. The combination of a high proportion of empirical therapy and broad-spectrum antimicrobial use with relatively limited culture-guided and generic prescribing identifies important areas for antimicrobial stewardship and prescription-review interventions.

DISCUSSION

The present prospective observational study evaluated antimicrobial prescribing practices in an inpatient Medicine department of a tertiary care hospital. The findings provide information regarding the clinical indications, antimicrobial classes, routes of administration, spectrum of therapy and selected prescribing indicators.

Respiratory tract infections were the leading indication for antimicrobial therapy in the present study, accounting for one-third of prescriptions. This observation is consistent with the substantial contribution of respiratory infections to antimicrobial utilization in hospitalized patients. File and Marrie have described the considerable clinical burden associated with community-acquired pneumonia and respiratory infections, which frequently require antimicrobial treatment.¹² Similar patterns have also been described in drug-utilization literature, where respiratory infections constitute an important indication for antimicrobial use^[13].

Cephalosporins were the most frequently prescribed antimicrobial class in the present study, accounting for 31% of prescriptions. Penicillins and fluoroquinolones followed in frequency. The high utilization of β -lactam agents is

consistent with their broad clinical application in hospital practice. Global antibiotic consumption studies have also documented substantial use of β -lactam and related antimicrobial classes^[8].

The relatively high utilization of broad-spectrum antimicrobials is an important finding. In the present study, broad-spectrum agents constituted 67% of antimicrobial prescriptions, while narrow-spectrum agents accounted for 33%. Broad-spectrum therapy may be clinically appropriate in selected patients, particularly when serious infection is suspected and immediate treatment is required. However, prolonged or unnecessary exposure can increase antimicrobial selection pressure. The WHO AWaRe framework emphasizes careful stewardship of antibiotics, particularly agents belonging to groups associated with greater resistance-selection concerns^[11].

Empirical treatment constituted 72% of prescriptions in the present study, whereas only 28% were guided by culture and sensitivity reports. Empirical treatment is often necessary in hospitalized patients because antimicrobial therapy may need to be initiated before microbiological results are available. Nevertheless, microbiological testing can facilitate subsequent optimization of therapy. In settings where diagnostic support is limited, empirical treatment may remain predominant, highlighting the importance of strengthening microbiological services and developing mechanisms for review and de-escalation of antimicrobial therapy^[4,5].

Generic prescribing was documented in 42% of prescriptions. Generic prescribing is an important component of rational medicine use because it can promote standardization and may reduce medicine costs. WHO prescribing indicators include prescribing by generic name as an important measure of prescribing practice^[7]. The relatively limited proportion of generic prescribing observed in this study suggests an area where institutional prescribing policies could potentially be strengthened.

The study also found that 78% of antimicrobial agents were reported to be included in the Essential Medicines List. Essential medicines lists are intended to support access to medicines that meet priority healthcare needs and promote rational selection and utilization^[6-7]. Continued monitoring of adherence to institutional and national essential medicines policies can contribute to improved prescribing practices.

Intravenous administration was used in 62% of prescriptions, while oral therapy accounted for 35%. The high proportion of intravenous antimicrobial use may partly reflect the inpatient nature of the study population and

the clinical severity of patients requiring hospitalization. However, where clinically appropriate, conversion from intravenous to oral therapy can be considered as part of antimicrobial stewardship and appropriate inpatient medication management.

The average number of antimicrobials per prescription was 1.46, with 63% of prescriptions containing a single antimicrobial. Although combination therapy can be clinically justified for selected infections, continued monitoring of antimicrobial combinations is useful to ensure that additional agents have an appropriate indication.

Overall, the findings demonstrate several areas relevant to antimicrobial stewardship, particularly the predominance of empirical therapy, substantial use of broad-spectrum antimicrobials and relatively limited generic prescribing. WHO and other public health agencies have emphasized antimicrobial stewardship, surveillance and rational prescribing as important strategies for addressing AMR[2,10].

CONCLUSION

The present study demonstrated a substantial reliance on empirical antimicrobial therapy and broad-spectrum agents in the Medicine department of a tertiary care hospital. Respiratory tract infections were the most common indication, and cephalosporins were the most frequently prescribed antimicrobial class. Intravenous administration was common, while culture-guided prescribing was documented in less than one-third of prescriptions.

Generic prescribing was observed in 42% of prescriptions, whereas 78% of antimicrobial agents were reported to be from the Essential Medicines List. These findings indicate opportunities to strengthen antimicrobial prescribing practices through improved microbiological support, regular prescription review, promotion of appropriate generic prescribing, rational selection of antimicrobial spectrum and adherence to standard treatment guidelines.

Institution-specific antimicrobial stewardship interventions, supported by regular prescription audits and feedback to prescribers, may help optimize antimicrobial

utilization and contribute to efforts aimed at limiting antimicrobial resistance.

REFERENCES

1. World Health Organization. Antimicrobial resistance. Geneva: World Health Organization; 2023.
2. World Health Organization. Global action plan on antimicrobial resistance. Geneva: World Health Organization; 2015.
3. Ventola CL. The antibiotic resistance crisis. *P T*. 2015;40(4):277-283.
4. Centers for Disease Control and Prevention. Antibiotic use in the United States, 2022 update. Atlanta: CDC; 2022.
5. Laxminarayan R, Duse A, Wattal C, Zaidi AKM, Wertheim HFL, Sumpradit N, et al. Antibiotic resistance—the need for global solutions. *Lancet Infect Dis*. 2013;13(12):1057-1098.
6. Wettermark B, Elseviers M, Almarsdóttir AB, Andersen M, Benko R, Bennie M, et al. Introduction to drug utilization research. In: *Drug Utilization Research: Methods and Applications*. *Br J Clin Pharmacol*. 2016;81(2):347-351.
7. World Health Organization. How to investigate drug use in health facilities: selected drug use indicators. Geneva: World Health Organization; 1993.
8. Klein EY, Van Boeckel TP, Martinez EM, Pant S, Gandra S, Levin SA, et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proc Natl Acad Sci USA*. 2018;115(15):E3463-E3470.
9. Antimicrobial Resistance Collaborators. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet*. 2022;399:629-655.
10. Centers for Disease Control and Prevention. Core elements of hospital antibiotic stewardship programs. Atlanta: CDC; 2019.
11. World Health Organization. AWaRe classification of antibiotics for evaluation and monitoring of use, 2019. Geneva: World Health Organization; 2019.
12. File TM Jr, Marrie TJ. Burden of community-acquired pneumonia in North American adults. *Postgrad Med*. 2010;122(2):130-141.
13. Holloway KA, van Dijk L. The World Medicines Situation 2011: Rational Use of Medicines. Geneva: World Health Organization; 2011.