

Evaluation of Antibiotic Utilization Patterns and Prescribing Practices in a Tertiary Care Hospital

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Abstract:

Background: Antibiotics are essential for the treatment of bacterial infections; however, irrational prescribing contributes to antimicrobial resistance, adverse outcomes, and increased healthcare costs. Evaluating antibiotic utilization patterns is important for promoting rational drug use.

Aim: To evaluate antibiotic utilization patterns and prescribing practices among hospitalized patients in a tertiary care hospital.

Methodology: A prospective observational study was conducted in the Department of Pharmacology, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India, over one year from January 2024 to December 2024. Ninety hospitalized patients receiving at least one antibiotic were enrolled. Data regarding demographics, clinical diagnosis, antibiotic utilization, and prescribing indicators were collected and analyzed using descriptive statistics.

Results: The majority of patients were aged 31–45 years (31.1%) and male (57.8%). Respiratory tract infections (26.7%) were the most common indication for antibiotic therapy. Two-antibiotic combination therapy was prescribed in 42.2% of patients, while injectable antibiotics were used in 58.9% of cases. Cephalosporins were the most frequently prescribed antibiotic class (37.8%). Generic prescribing was observed in 64.4% of prescriptions. Culture sensitivity testing was performed in 37.8% of cases, whereas empirical therapy was used in 62.2%. Appropriate prescribing according to guidelines was observed in 80.0% of prescriptions.

Conclusion: Antibiotic prescribing practices were generally satisfactory; however, greater emphasis on culture-guided therapy, antimicrobial stewardship, and rational prescribing is needed to optimize antibiotic use and reduce antimicrobial resistance.

Keywords: Antibiotic utilization, Prescribing practices, Antimicrobial stewardship, Drug utilization evaluation, Tertiary care hospital, Antimicrobial resistance.

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Introduction

Antibiotics are one of the most important therapeutic agents in modern medicine, and have drastically decreased morbidity and mortality associated with bacterial infections [1]. Antibiotics are now a major impact on healthcare, offering effective treatment to many infectious diseases and enhancing patients' survival rates. Their widespread application to hospital, outpatient department and community health care has made a significant contribution to the control of infectious diseases throughout the world. Antibiotics work by stopping bacteria from growing or killing bacteria cells to assist in fighting the infection. Antibiotics can be divided into different groups based on their antimicrobial spectrum and mechanism of action, including the beta-lactam group, macrolides, tetracyclines, aminoglycosides, fluoroquinolones, and sulfonamides [2]. These agents can be bactericidal or bacteriostatic, and can be broad-

spectrum or narrow-spectrum active against microorganisms. The use of antibiotics has improved patient care as they are becoming more available and used, but their misuse and irrational use has become a tremendous concern worldwide [3]. Antibiotics are often used for non-clinical reasons or without microbiological confirmation or according to non-standard treatment recommendations in many healthcare environments. Factors related to empirical prescribing, polypharmacy, self-medication, and lack of awareness on antimicrobial stewardship, and inadequate diagnostic facilities also influence the inappropriate use of antibiotics [4]. This could result in treatment failure, greater side effects, extended hospital stays and wasted health care costs. Furthermore, irrational use of antibiotics promotes the selection and dissemination of antimicrobial resistance—a global public health

threat. Drug Utilization Evaluation (DUE) has become a valuable tool to evaluate appropriateness, effectiveness and safety of medication utilization in health care institutions [5]. DUE is a process of systematic review of drug prescribing, dispensing and administration by following the criteria for optimal therapeutic outcomes. Continuous monitoring and evaluation can be used to recognize patterns of drug use, detect irrational drug prescribing and encourage evidence-based therapy [6]. DUE offers information that is useful for antibiotic choice, dosing, length of treatment, drug delivery and institutional/national protocols. These assessments can help inform the creation of corrective interventions to improve prescribing behaviour and patient outcomes.

Tertiary care hospitals are complicated healthcare settings where numerous patients with severe, chronic and complicated infections are treated [7]. However, these hospitals are more likely to be using a variety of “broad spectrum” and “reserve” antibiotics because of the complexity of the cases and the presence of MDROs. It is therefore crucial to monitor antibiotic usage in tertiary care settings. Periodic review of antibiotic use trends can assist in establishing trends in the use of antibiotics and check the appropriateness of antibiotic treatment and identify the areas that need improvement [8]. Moreover, knowing how an antibiotic is used can help achieve the aim of antimicrobial stewardship programmes (ASPs), which aim for more effective antibiotic use and minimise the risk of antimicrobial resistance.”

“Assessment of antibiotic usage also gives guidance on the outcomes of antibiotic use, prescribing practices and resource usage in health care facilities. Prescription analysis allows healthcare professionals to evaluate if antibiotics are being prescribed for appropriate clinical indications, microbiological results and treatment guidelines. This data is crucial for developing antibiotic strategies in hospitals, for assessing quality of care, to reduce adverse drug events and to reduce health care expenditure. Hence, it is of paramount importance that antibiotic utilization and antibiotic prescribing patterns are studied in a tertiary care hospital for rational use of antibiotic, management of infections and to help overcome the increasing problem of antimicrobial resistance. Results of such studies can provide a platform for the implementation of evidence-based practices to improve patient safety and optimize antibiotic treatment in practice.

Methodology

Study Design: The study was conducted as a prospective observational study to evaluate antibiotic utilization patterns and prescribing practices among patients receiving antibiotic therapy in a tertiary care hospital. The study aimed to assess the appro-

priateness of antibiotic prescriptions, identify commonly prescribed antibiotics, and analyze prescribing trends among healthcare professionals.

Study Area: The study was conducted in the Department of Pharmacology, ESIC Medical College and Hospital, Bihta, Patna, Bihar, India.

Study Population: The study population consisted of hospitalized patients who received one or more antibiotics during their treatment period in the selected departments of the hospital.”

Study Duration: The study was conducted over a period of one year from January 2024 to December 2024.

Study Participants

Inclusion Criteria

- Patients aged 18 years and above.
- Patients of either gender.
- Patients admitted to various inpatient departments during the study period.
- Patients who received at least one antibiotic during hospitalization.
- Patients whose medical records contained complete prescription and treatment details.
- Patients who provided informed consent to participate in the study.

Exclusion Criteria

- Patients who did not receive any antibiotic therapy during hospitalization.
- Outpatients and emergency cases not admitted to the hospital.
- Patients with incomplete or missing medical records.
- Patients who were discharged against medical advice before completion of treatment.
- Patients who refused to participate in the study.
- Pregnant women and critically ill patients whose records were inaccessible for complete data collection.

Sample Size: A total of 90 patients who fulfilled the inclusion criteria were enrolled in the study.

Procedure: Eligible patients receiving antibiotic therapy were identified from various inpatient departments of the hospital. Patients who satisfied the inclusion criteria were enrolled consecutively until the desired sample size of 90 was achieved. Data were collected prospectively from patient case records, prescription charts, laboratory reports, and treatment sheets. Information regarding demographic characteristics, diagnosis, duration of hospital stay, type of infection, antibiotics prescribed, dosage regimen, route of administration, frequency of administration, duration of therapy, and concomitant medications was recorded in a structured data collection form. Antibiotic utilization patterns were evaluated by assessing the classes of antibiotics prescribed,

frequency of use, monotherapy and combination therapy practices, and adherence to standard prescribing guidelines wherever applicable. Prescribing indicators such as the average number of antibiotics per prescription, generic prescribing, and the use of broad-spectrum antibiotics were also analyzed. Continuous monitoring and verification of collected data were performed to ensure accuracy and completeness throughout the study period.

Statistical Analysis: The collected data were entered into Microsoft Excel and subsequently analyzed using Statistical Package for Social Sciences (SPSS) version 27.0. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize demographic characteristics and prescribing patterns. Categorical variables were expressed as numbers and percentages, while continuous variables were presented as mean \pm standard deviation. Appropriate inferential

statistical tests, including the Chi-square test, were applied to determine associations between relevant variables. A p-value of less than 0.05 was considered statistically significant.”

Result

Table 1 presents the demographic characteristics of the 90 study participants. The majority of patients belonged to the 31–45 years age group, accounting for 28 (31.1%) participants, followed by the 46–60 years age group with 24 (26.7%) patients. Participants aged 18–30 years constituted 22 (24.4%) of the study population, while those above 60 years represented the smallest group with 16 (17.8%) patients. Regarding gender distribution, males comprised 52 (57.8%) participants, whereas females accounted for 38 (42.2%). Overall, the study population was predominantly middle-aged, with a higher proportion of male participants compared to females.

Table 1: Demographic Characteristics of Study Participants (n = 90)

Variable	Number of Patients (n)	Percentage (%)
Age Group (Years)		
18–30	22	24.4
31–45	28	31.1
46–60	24	26.7
>60	16	17.8
Gender		
Male	52	57.8
Female	38	42.2
Total	90	100

Table 2 shows the distribution of patients according to the clinical diagnosis requiring antibiotic therapy among the 90 study participants. Respiratory tract infections were the most common indication for antibiotic use, accounting for 24 patients (26.7%). This was followed by urinary tract infections in 18 patients (20.0%) and gastrointestinal infections in 14 patients (15.6%). Skin and soft tissue infections

contributed to 12 cases (13.3%), while post-operative infections were observed in 10 patients (11.1%). Septicemia accounted for 7 cases (7.8%), and other infections represented the smallest group with 5 patients (5.5%). The findings indicate that respiratory and urinary tract infections were the leading causes necessitating antibiotic therapy in the study population.”

Table 2: Distribution of Patients According to Clinical Diagnosis Requiring Antibiotic Therapy (n = 90)

Clinical Diagnosis	Number of Patients (n)	Percentage (%)
Respiratory Tract Infections	24	26.7
Urinary Tract Infections	18	20
Gastrointestinal Infections	14	15.6
Skin and Soft Tissue Infections	12	13.3
Post-operative Infections	10	11.1
Septicemia	7	7.8
Other Infections	5	5.5
Total	90	100

“Table 3 depicts the pattern of antibiotic utilization among the 90 study participants. Regarding the number of antibiotics prescribed, the majority of patients received two antibiotics (42.2%, n=38), followed by monotherapy with one antibiotic (40.0%, n=36), while 17.8% (n=16) were

prescribed three or more antibiotics. This finding indicates a predominance of combination antibiotic therapy in the study population. With respect to the route of administration, injectable antibiotics were the most commonly used, accounting for 58.9%

(n=53) of prescriptions, followed by oral antibiotics in 27.8% (n=25) of patients.

A smaller proportion of participants (13.3%, n=12) received both oral and injectable formulations, reflecting varied treatment approaches based on clinical requirements.

Table 3: Pattern of Antibiotic Utilization among Study Participants (n = 90)

Variable	Number of Patients (n)	Percentage (%)
Number of Antibiotics Prescribed		
One Antibiotic (Monotherapy)	36	40
Two Antibiotics	38	42.2
Three or More Antibiotics	16	17.8
Route of Administration		
Oral	25	27.8
Injectable	53	58.9
Oral + Injectable	12	13.3
Total	90	100

Table 4 presents the distribution of commonly prescribed classes of antibiotics among the 90 prescriptions evaluated in the study.

Cephalosporins were the most frequently prescribed antibiotic class, accounting for 34 prescriptions (37.8%), indicating their predominant use in the management of infections in the hospital setting. Penicillins were the second most commonly prescribed class with 18 prescriptions (20.0%), followed by fluoroquinolones with 14

prescriptions (15.6%). Aminoglycosides and macrolides contributed 11.1% and 8.9% of prescriptions, respectively. Carbapenems were prescribed in only 4 cases (4.4%), while other antibiotic classes accounted for 2 prescriptions (2.2%).

Overall, cephalosporins and penicillins constituted the majority of antibiotic utilization in the study population.”

Table 4: Commonly Prescribed Classes of Antibiotics (n = 90)

Antibiotic Class	Number of Prescriptions (n)	Percentage (%)
Cephalosporins	34	37.8
Penicillins	18	20
Fluoroquinolones	14	15.6
Aminoglycosides	10	11.1
Macrolides	8	8.9
Carbapenems	4	4.4
Others	2	2.2
Total	90	100

“Table 5 depicts the prescribing practices and indicators of antibiotic use among 90 prescriptions evaluated in the study. The majority of prescriptions were written using generic names, accounting for 58 cases (64.4%), while 32 prescriptions (35.6%) were prescribed by brand names. Culture sensitivity testing before initiation of antibiotic therapy was performed in only 34 cases (37.8%), whereas empirical antibiotic therapy was adminis-

tered in 56 cases (62.2%), indicating a greater reliance on empirical treatment. Regarding adherence to standard treatment guidelines, 72 prescriptions (80%) were found to be appropriate, while 18 prescriptions (20%) were categorized as inappropriate. These findings suggest generally satisfactory prescribing practices, although improvements are needed in microbiological testing and rational antibiotic utilization.

Table 5: Prescribing Practices and Indicators of Antibiotic Use (n = 90)

Prescribing Indicator	Number (n)	Percentage (%)
Prescriptions Written by Generic Name	58	64.4
Prescriptions Written by Brand Name	32	35.6
Culture Sensitivity Test Performed Before Antibiotic Therapy	34	37.8
Empirical Antibiotic Therapy	56	62.2
Appropriate Antibiotic Prescription as per Guidelines	72	80
Inappropriate Antibiotic Prescription	18	20
Total	90	100

Discussion

The current study aimed to assess antibiotic utilization and prescription patterns of in-patients in tertiary care hospital. The demographic profile of the patients showed that the age group which had the highest percentage of patients was 31-45 years (31.1%) followed by 46-60 years (26.7%). The results are similar to the findings of Kaur, et al. (2014) [9] in a tertiary health care facility where they noted that the highest proportion of patients taking antibiotics were middle aged adults. Kala et al (2018) [10] found that antibiotic usage was higher in the age group 30-60 years. The male children were 57.8% and the female children were 42.2% in the present study. The male dominance was also observed by Govind Naik et al. (2013) [11] who reported that almost 60% of the people who used antibiotics were males. The increased occupational exposure and increased healthcare utilization are likely to be responsible for this trend observed in males.”

“The most frequent indications for antibiotic use in the current study were respiratory tract infections (26.7%), urinary tract infections (20.0%) and gastrointestinal infections (15.6%). Govind Naik et al. (2013) also noted that around 30% of the patients who were prescribed antibiotics had respiratory tract infections. Respiratory infections were also found to be among the most common indications for antibiotic use in hospitalized patients [12]. But there are some reports that urinary tract infections were the top reason for taking antibiotics, which suggests that local and institutional variations may exist in disease patterns.

In terms of antibiotic use, two antibiotics were prescribed in 42.2% of patients, one antibiotic in 40.0% and \geq three antibiotics in 17.8% were prescribed. The results are comparable to those of Thomas et al. (2022) [13] which found combination antibiotic treatment was used in almost 45% of hospitalized patients. For severe and/or suspected polymicrobial infections, combination therapy is generally used, due to the wider antimicrobial coverage. However, Kaur et al. (2014) reported higher rate of prescribing of monotherapy, indicating differences in the prescription patterns in different healthcare institutions. As for the route of administration, injectable antibiotics were given in 58.9% of cases, oral antibiotics in 27.8% and both routes in 13.3%. The same has been reported by Soltani et al. (2021) where over half of antibiotic prescriptions were administered parenterally. Choices of injectable antibiotics in the current study are probably due to the severity of infections seen in hospitalised patients and the need for quick intervention. However, a heavy use of injectable formulations can lead to higher treatment expenses and utilization of hospital resources.

The most commonly prescribed antibiotic class was cephalosporins, with 37.8% of the prescriptions, followed by penicillins (20.0%) and fluoroquinolones (15.6%). Similar findings were observed by Rajini 2019 [14] who reported that about 35-40% of all antibiotic prescriptions were cephalosporins in a tertiary care hospital. Ceftriaxone was also identified as the most commonly prescribed antibiotic by Saleem et al. 2019 [15] who reported that almost 1/4 of prescriptions contained this antibiotic. The broad-spectrum activity, clinical efficacy and good safety profile of cephalosporins could be responsible for their widespread use. In the present study, carbapenems accounted for only 4.4% of the prescription, suggesting that the use of these reserve antibiotics was relatively judicious, and that antimicrobial stewardship principles were followed.

Prescribing practices were assessed and it was found that 64.4% of prescriptions were numbered with the generic name and 35.6% were numbered with the brand name. This is higher than the generic prescribing rate of Kaur et al. (2014) who reported it as almost half of all prescriptions. The "generic prescribing" measure is regarded as one of the main indicators of rational drug use, as it promotes the affordability and accessibility of treatment. However, the fact that over a third of prescriptions were given a brand name implies that there are still opportunities for further promotion of generic prescribing. Only 37.8% were tested for culture sensitivity prior to starting antibiotic therapy, while 62.2% received empirical therapy. Soltani et al. (2021) also found similar results, with about 1/3 receiving culture-guided therapy and the other 2/3 receiving empirical therapy. Empiric therapy may be needed in an acute clinical setting, but overreliance on empirical therapy can lead to inappropriate antibiotic choice and development of antimicrobial resistance. Thus, there is a need to strengthen microbiological investigations to improve antibiotic use.”

“A positive aspect of the present study was that the majority of medications (80.0%) were deemed appropriate by treatment guidelines and 20.0% were inappropriate. Similar levels of adherence have been reported by Kala et al. (2018) whose findings showed that guideline compliant prescribing was only 75-82% of cases. Prescribing practices were satisfactory overall, however there was a large amount of inappropriate prescribing, further signifying the need for ongoing prescription monitoring, antimicrobial stewardship programmes and clinician education. In general, the prescriptions of the antibiotics in the present tertiary care hospital were found to be rational and similar to the previous studies. But rational use of antibiotics and fighting against antimicrobial

resistance through strengthening culture-based therapy, increasing generic prescribing and reduction of unnecessary empirical and combined antibiotic use are still important aspects of antimicrobial use.

Conclusion

The present study concluded that antibiotic utilization and prescribing practices in the tertiary care hospital were generally satisfactory, with most prescriptions adhering to standard treatment guidelines. Middle-aged males constituted the majority of patients receiving antibiotic therapy, and respiratory tract infections were the leading indication for antibiotic use. Combination therapy, particularly the use of two antibiotics, was more common than monotherapy, while injectable antibiotics were the preferred route of administration. Cephalosporins emerged as the most frequently prescribed antibiotic class, reflecting their important role in infection management. Although generic prescribing was observed in a majority of cases, a considerable proportion of prescriptions were still written by brand name. The low rate of culture sensitivity testing and the high reliance on empirical therapy highlight areas requiring improvement. Strengthening antimicrobial stewardship programs, promoting culture-guided therapy, and encouraging rational prescribing practices are essential to optimize antibiotic use and minimize antimicrobial resistance.

References

1. Banin E, Hughes D, Kuipers OP. Bacterial pathogens, antibiotics and antibiotic resistance. *FEMS microbiology reviews*. 2017 May 1;41(3):450-2.
2. Etebu E, Arikekpar I. Antibiotics: Classification and mechanisms of action with emphasis on molecular perspectives. *International journal of applied microbiology and biotechnology research*. 2016 Oct;4(2016):90-101.
3. Sweileh WM. Global research publications on irrational use of antimicrobials: call for more research to contain antimicrobial resistance. *Globalization and Health*. 2021 Aug 24;17(1):94.
4. Torres NF, Chibi B, Middleton LE, Solomon VP, Mashamba-Thompson TP. Evidence of factors influencing self-medication with antibiotics in low and middle-income countries: a systematic scoping review. *Public health*. 2019 Mar 1;168:92-101.
5. Subramanian PA. Importance of drug utilization evaluation studies in patient health care. *Indian Journal of Pharmacy Practice*. 2017 Jul;10(3):157.
6. Jain S, Upadhyaya P, Goyal J, Kumar A, Jain P, Seth V, Moghe VV. A systematic review of prescription pattern monitoring studies and their effectiveness in promoting rational use of medicines. *Perspectives in clinical research*. 2015 Apr 1;6(2):86-90.
7. Celebi FO, Senel SA. Patients with chronic conditions and their complex care needs in a tertiary care hospital. *Archives De Pédiatrie*. 2021 Aug 1;28(6):470-4.
8. Olesen SW, Barnett ML, MacFadden DR, Lipsitch M, Grad YH. Trends in outpatient antibiotic use and prescribing practice among US older adults, 2011-15: observational study. *Bmj*. 2018 Jul 27;362.
9. Kaur S, Rajagopalan S, Kaur N, Shafiq N, Bhalla A, Pandhi P, Malhotra S. Drug utilization study in medical emergency unit of a tertiary care hospital in North India. *Emergency medicine international*. 2014;2014(1):973578.
10. Kala K, Sodhi RK, Jain UK. Drug utilization evaluation of antibiotics in district hospital Rudraprayag. *J Drug Deliv Ther*. 2018 Nov 15;8:87-90.
11. Naik HG, Khanwelkar CC, Kolur A, Desai R, Gidamudi S. Drug utilization study on antibiotics use in lower respiratory tract infection. *Natl J Med Res*. 2013 Oct;3(4):324-27.
12. Soltani R, Hakamifard A, Mousavi S, Amani Z. Drug Utilization Evaluation of Antibiotics in Intensive Care Units of a Referral Teaching Hospital. *Journal of Pharmaceutical Care*. 2021 Apr 4:31-8.
13. Thomas AP, Kumar M, Johnson R, More SP, Panda BK. Evaluation of antibiotic consumption and compliance to hospital antibiotic policy in the surgery, orthopedics and gynecology wards of a tertiary care hospital. *Clinical Epidemiology and Global Health*. 2022 Jan 1;13:100944.
14. Rajini S. Drug Use Evaluation Of Antibiotics In Non-Teaching Tertiary Care Hospital. *World Journal of Current Medical and Pharmaceutical Research*. 2019 Apr 30:55-8.
15. Saleem Z, Saeed H, Hassali MA, Godman B, Asif U, Yousaf M, Ahmed Z, Riaz H, Raza SA. Pattern of inappropriate antibiotic use among hospitalized patients in Pakistan: a longitudinal surveillance and implications. *Antimicrobial Resistance & Infection Control*. 2019 Nov 21;8(1):188.