Original Article

Assessment of Irrational Use of Antibiotics at a Tertiary Care Hospital in Kharian, Pakistan

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ABSTRACT

Background: Inappropriate antibiotic prescribing contributes substantially to antimicrobial resistance, prolonged hospitalization, and increased healthcare costs. Evidence regarding the magnitude of irrational antibiotic use in tertiary care hospitals in Pakistan remains limited. This study aimed to assess the pattern of antibiotic prescribing and determine the frequency of irrational antibiotic use among hospitalized patients at a tertiary care hospital in Kharian, Pakistan.

Methodology: A cross-sectional descriptive study was conducted among 385 hospitalized patients aged ≥18 years who had been admitted for more than 24 hours and were receiving at least one antibiotic. Data regarding demographic characteristics, temperature, indication for antibiotic therapy, antibiotic class, and laboratory investigations (complete blood count, urine routine examination, and culture and sensitivity reports where available) were collected using a structured data collection form. Descriptive statistics were performed using SPSS version 20. Irrational antibiotic use was assessed based on the absence of clinical or laboratory evidence of bacterial infection and the lack of culture-guided therapy.

Results: A total of 385 patients (mean age: 42.5 ± 18.1 years) were included, with a mean hospital stay of 4.2 ± 4.3 days. Overall, 555 antibiotics were prescribed; 224 (58.2%) patients received one antibiotic, 152 (39.5%) received two antibiotics, and 9 (2.3%) received more than two antibiotics. Empirical antibiotic therapy without prior culture and sensitivity testing was observed in 333 (86.5%) patients. Penicillins were the most frequently prescribed antibiotics (14.5%), followed by the combination of cephalosporins and metronidazole (13.8%). Genitourinary infections were the most common documented indication (17.9%). However, 202 (52.4%) patients received antibiotics despite the absence of laboratory evidence suggestive of bacterial infection.

Conclusion: A high proportion of hospitalized patients received empirical antibiotics, and more than half were prescribed antibiotics without objective laboratory evidence of bacterial infection. These findings highlight the need to strengthen antimicrobial stewardship strategies and promote evidence-based antibiotic prescribing practices in tertiary care hospitals.

Keywords: Antimicrobial stewardship; Antibacterial agents; Antimicrobial resistance; Drug Utilization; Prescription patterns.

INTRODUCTION

Antibiotics have revolutionized the management of bacterial infections by substantially reducing morbidity and mortality.[1] However, their inappropriate and excessive use has become one of the leading contributors to antimicrobial resistance (AMR), which is recognized by the World Health Organization (WHO) as a major global public health threat.[2] Irrational antibiotic use[3] includes prescribing antibiotics without an appropriate clinical indication, using broad-spectrum agents unnecessarily, inappropriate selection[4], dose, duration, or route of administration, and failure to use microbiological evidence to guide therapy.[5] Such practices increase the risk of antimicrobial resistance, prolong hospital stay, increase healthcare costs, and adversely affect patient outcomes.[6]

In low- and middle-income countries, irrational antibiotic use remains particularly challenging because of limited diagnostic facilities, empirical prescribing practices, inadequate implementation of antimicrobial stewardship programmes, and poor adherence to institutional treatment guidelines.[7] In Pakistan, inappropriate antibiotic prescribing has been reported in both primary and tertiary healthcare settings despite increasing awareness of antimicrobial resistance.[8] Continued empirical prescribing without adequate laboratory confirmation contributes to the emergence and spread of resistant organisms[9], i.e., carbapenems[10], colistin[11], placing an additional burden on healthcare systems.[12]

Hospitals play a critical role in promoting rational antibiotic use through evidence-based prescribing

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practices and effective antimicrobial stewardship programmes.[13] Regular audits of antibiotic prescribing patterns can identify inappropriate practices, facilitate adherence to clinical guidelines, and support targeted interventions to improve prescribing behavior.[14-16] However, data describing antibiotic utilization and the extent of irrational prescribing in tertiary care hospitals of Pakistan remain limited, particularly in smaller healthcare institutions. While updated institutional antibiograms are universally accessible across the studied departments, variations exist regarding the systemic implementation of standardized antibiotic indication guidelines, which are currently more localized within high nursing care units.

The objective of the study was to assess the pattern of antibiotic prescribing and determine the frequency of irrational antibiotic use among adult in-patients admitted to the Medicine, Surgery, and Gynaecology wards of a tertiary care hospital in Kharian, Pakistan, and to highlight any trends or areas of concern that might inform future guidelines on antibiotic stewardship within the hospital settings.

METHODOLOGY

A cross-sectional observational study was conducted in the Departments of Medicine, Surgery, and Gynaecology at a tertiary care hospital in Kharian, Pakistan, from January to June 2025. The study was conducted to evaluate antibiotic prescribing patterns and determine the frequency of irrational antibiotic use among hospitalized adult patients. Ethical approval was obtained from the Institutional Ethical Review Board of CMH Kharian Medical College (Ref. No. CKMC/IERB/AC-0245). Written informed consent was obtained from all participants before data collection. Patient confidentiality was maintained by assigning unique identification numbers to each participant, and all collected information was kept confidential and used exclusively for research purposes.

A sample size of 385 patients was calculated using Cochran formula. Patients aged 18 years or older admitted to the Departments of Medicine, Surgery, or Gynaecology wards for more than 24 hours and receiving at least one antibiotic during hospitalization were included in the study. Patients who were not prescribed any antibiotic during admission and those who declined to participate were not enrolled.

For the purpose of this study, antibiotic use was operationally defined as “unnecessary or irrational if a patient was prescribed an antimicrobial course despite having a normal total leukocyte count (TLC 4,000-11,000 cells/microliter), or fewer than 4–5 pus cells per high-power field on urine routine examination”. Laboratory findings, including total leukocyte count (TLC) and urine routine examination, were reviewed to assess the presence of objective evidence of bacterial infection. Culture and sensitivity reports, where available, were reviewed to determine whether antibiotic therapy was empirical or culture-guided.

Data were entered and analysed using Statistical Package for the Social Sciences (SPSS) version 20. Continuous variables were summarized as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. The primary outcome was the frequency of irrational antibiotic prescribing among hospitalized patients. Secondary outcomes included antibiotic prescribing patterns, frequency of empirical antibiotic therapy, and type of infection prevalent across different hospital wards, and class of antibiotic being prescribed for that infection.

RESULTS

A total of 385 patients were included in the study. Of these, 77 (20%) patients were admitted to the Gynaecology ward, 191 (49.6%) to the Surgery ward, and 117 (30.4%) to the Medicine ward. The Surgery ward included 167 (87.4%) males and 24 (12.6%) females, whereas the Medicine ward included 107 (91.5%) males and 10 (8.5%) females. The mean age of the study participants was 42.5 ± 18.1 years, while the mean duration of hospital stay was 4.2 ± 4.3 days.

A total of 555 antibiotics were prescribed to 385 patients. Single antibiotic therapy was prescribed to 224 (58.2%) patients, dual antibiotic therapy to 152 (39.5%), and more than two antibiotics to 9 (2.3%) patients. Overall, 333 (86.5%) patients received empirical antibiotic therapy without prior culture and sensitivity testing, whereas only 52 (13.5%) patients received antibiotics based on culture and sensitivity reports. Abnormal body temperature was observed in 23 (12.0%) post-operative patients admitted to the Surgery ward and in 84 (71.8%) patients admitted to the Medicine ward. None of the patients admitted to the Gynaecology ward had documented fever during hospitalization. The distribution of laboratory findings based on complete blood count and urine routine examination is presented in Figures 1 and 2, respectively. The most frequently documented infection was genitourinary (69, 17.9%), followed by respiratory tract infection (34, 8.8%) and gastrointestinal infection (29, 7.5%). Soft tissue infections, musculoskeletal infections, central nervous system infections, and other infections were less frequently observed. Notably, 202 (52.4%) patients had no confirmed clinical or laboratory evidence of bacterial infection but nevertheless received antibiotic therapy.

Among the individual wards, genitourinary infections were the most common indication in the Gynaecology ward (46/77, 59.7%), respiratory tract infections predomi-

nated in the Medicine ward (26/117, 22.2%), whereas gastrointestinal infections were the most frequent documented infections in the Surgery ward (20/191, 10.5%) (Table 1).

Penicillins were the most frequently prescribed antibiotics (56 prescriptions, 14.5%), followed by the combination of cephalosporins and metronidazole (53 prescriptions, 13.8%), cephalosporins (43 prescriptions, 11.2%), and fluoroquinolones (38 prescriptions, 9.9%). Further stratification by sub-classification or route of administration was outside the parameters of the current data collection.

Based on the predefined operational criteria, 202 (52.4%) patients received antibiotics despite the absence of objective laboratory evidence suggestive of bacterial infection. Most of these patients had a normal total leukocyte count (4,000-11,000 cells/µL) and no significant pyuria on urine routine examination. In addition, most antibiotic prescriptions (86.5%) were empirical because culture and sensitivity testing had not been performed before initiating therapy.

Table 2 shows the most frequent antibiotic class being used in different types of infections. The classes of antibiotics least frequently used or rarely used are omitted from the table for the sake of simplification.

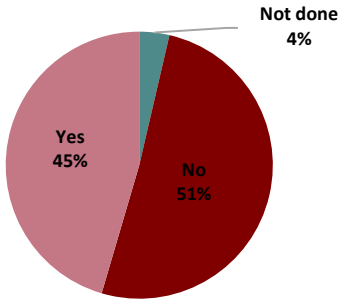


Figure 1: Leukocytosis observed on complete blood count (CBC).

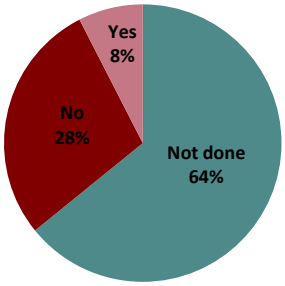


Figure 2: Frequency of patients reported with pyuria.

Table 1: Distribution of documented infections and patients receiving empirical antibiotics across hospital wards.

Types of infection	Gynae Ward	Surgery Ward	Medicine Ward	Total
Respiratory tract infection	0	8	26	34
Gastroenterology infection	0	20	9	29
Central nervous system infection	0	4	1	5
Genitourinary infection	46	18	5	69
Soft tissue infection	0	7	0	7
Musculoskeletal infection	0	11	2	13
Other infections	0	10	16	26
Diagnosis not confirmed (Empirical)	31	113	58	202
Total	77	191	117	385

Table 2: Distribution of antibiotic classes according to the documented clinical indications

Class of antibiotics	Respiratory tract infection	Gastroenterology infection	Central nervous system infection	Genitourinary infection	Soft tissue infection	Musculoskeletal infection	Other infections	Diagnosis not confirmed (empirical)	Total
Metronidazole	0	2	0	4	0	0	0	13	19
Penicillin	3	1	0	3	2	3	3	41	56
Penicillin + aminoglycoside	1	0	1	0	0	4	1	11	18
Carbapenem + tetracycline	0	1	0	1	0	0	2	4	8
Metronidazole + cephalosporin	0	1	0	25	0	0	0	27	53
Cephalosporin	2	8	0	8	2	0	3	20	43
Glycopeptide	1	1	2	0	0	0	0	3	7
Tetracycline	0	0	0	3	0	1	8	19	31
Fluoroquinolone	11	1	0	2	0	1	1	22	38
Carbapenem	0	5	1	9	0	0	2	7	24
Aminoglycoside	0	0	0	0	0	0	0	7	7
All	18	20	4	55	4	9	20	174	304

DISCUSSION

The present study assessed antibiotic prescribing practices among hospitalized patients admitted to the Medicine, Surgery, and Gynaecology wards of a tertiary care hospital in Kharian, Pakistan. A high frequency of empirical antibiotic prescribing was observed, with 86.5% of patients receiving antibiotics without prior culture and sensitivity testing. Furthermore, more than half of the patients (52.4%) received antibiotics despite the absence of objective laboratory evidence suggestive of bacterial infection. These findings indicate considerable irrational antibiotic use and highlight important gaps in antimicrobial stewardship.

Our findings suggest that 86.5% of antibiotic prescriptions were empirical, which is consistent with recent evidence from Pakistan. A WHO point prevalence survey conducted in 14 tertiary care hospitals reported that nearly three-quarters of hospitalized patients received antibiotics, with empirical therapy accounting for the majority of prescriptions.[17,18] Similarly, a recent antimicrobial stewardship benchmarking study from a tertiary care hospital in Karachi reported that 99.2% of antibiotic prescriptions were empirical, emphasizing the continued dependence on empirical therapy in Pakistani hospitals.[19] The slightly lower proportion observed in the present study may reflect differences in hospital size, patient population, and prescribing practices; however, both studies demonstrate inadequate utilization of microbiological investigations before initiating antibiotic therapy.

More than half of the patients in the present study received antibiotics despite lacking laboratory evidence of bacterial infection. This observation agrees with the findings of Kitano et al., who demonstrated that higher prescribing rates were strongly associated with unnecessary antibiotic use[2], and with the systematic review by Mortazhejri et al., which reported widespread unnecessary antibiotic prescribing, particularly for infections in which bacterial involvement was unlikely.[4] In two of Ghanaian hospitals, nearly all antibiotics (92.9%) were prescribed without mentioning the reason for their prescription in the medical records.[20] These findings collectively suggest that clinical judgment alone frequently results in unnecessary antibiotic exposure, increasing the risk of antimicrobial resistance and avoidable adverse drug reactions.

Penicillins were the most frequently prescribed antibiotics in the present study, followed by cephalosporins combined with metronidazole. In contrast, the multicenter Pakistani WHO survey and retrospective study at Karachi hospital identified third-generation cephalosporins as the most commonly prescribed antibiotic class[21], while a point prevalence survey from The Indus Hospital, Karachi, reported amoxicillin-clavulanate and ceftriaxone as the predominant agents. These differences are likely attributable to variations in local antimicrobial resistance patterns, institutional prescribing policies, patient case-mix, and specialty-specific clinical practice.[13,17]

Genitourinary infections constituted the most common indication for antibiotic therapy in the present study, particularly among patients admitted to the Gynaecology ward. This differs from previous Pakistani and international studies, where surgical prophylaxis and respiratory tract infections are the dominant forms of infection, affecting up to 24–50% of patients and hence becoming the leading indications for antimicrobial use.[22] The discrepancy is likely explained by differences in study populations, as the inclusion of a dedicated Gynaecology ward in the present study increased the proportion of patients requiring treatment for genitourinary conditions.

Only 13.5% of patients in the present study underwent culture and sensitivity testing before antibiotic initiation. Similar observations have been reported from Sudan, where irrational antibiotic use in hospitalized patients was associated with poorer clinical outcomes and inadequate microbiological confirmation before treatment.[23] Likewise, studies from Bangladesh have identified limited diagnostic support and excessive empirical prescribing as important contributors to inappropriate antibiotic use.[24] These findings indicate that inadequate diagnostic stewardship remains a common challenge across many low- and middle-income countries.[25]

The findings are also comparable with those reported by Al-Jumaili et al. from Iraq, who documented widespread irrational antibiotic use in public hospitals despite the availability of treatment guidelines.[1] Their study identified excessive empirical prescribing, poor adherence to antimicrobial policies, and limited stewardship implementation as major contributors to inappropriate antibiotic use.[26] The similarity between their findings and those of the present study suggests that irrational antibiotic prescribing remains a regional challenge requiring coordinated institutional interventions. The findings of this study are consistent with those of Afzal et al., who reported that empirical prescribing without susceptibility testing and the lack of standardized antibiotic policies promote irrational antibiotic use in Pakistani hospitals[27], emphasizing the urgent need to strengthen antimicrobial stewardship programs.

The findings of the present study have important clinical implications. Irrational antibiotic prescribing contributes to antimicrobial resistance, adverse drug reactions, prolonged hospitalization[28], and increased healthcare expenditure.[29] Recent antimicrobial stewardship studies from Pakistan have shown that implementation of institutional prescribing guidelines, regular prescription audits, prospective feedback to clinicians, and improved diagnostic stewardship can substantially reduce inappropriate antibiotic use and improve the quality of patient care.[30]

The present study has several strengths. It evaluated antibiotic prescribing practices across three major clinical departments and incorporated laboratory parameters, including complete blood count, urine routine examination, and culture and sensitivity reports, when assessing the appropriateness of antibiotic use. The findings provide useful baseline data for planning antimicrobial stewardship interventions in similar tertiary care hospitals.

However, certain limitations should be acknowledged. This was a single-centre study; therefore, the findings may not be generalizable to other healthcare settings. Only hospitalized adult patients from three departments were included, and prescribing practices in outpatient clinics and other specialties were not evaluated. In addition, the cross-sectional design precluded assessment of temporal trends and patient outcomes following antibiotic therapy.

Overall, the findings demonstrate a high prevalence of empirical and potentially irrational antibiotic prescribing among hospitalized patients. Strengthening antimicrobial stewardship programmes, improving adherence to institutional antibiotic guidelines, encouraging culture-guided therapy whenever clinically appropriate, and conducting regular prescription audits are likely to improve antibiotic prescribing practices and help mitigate the growing threat of antimicrobial resistance.

CONCLUSION

This study demonstrates a high prevalence of non-evidence-based antimicrobial prescribing across major inpatient departments, driven largely by empirical treatment decisions without prior diagnostic testing. Addressing prescribing habits requires the introduction of standardized clinical protocols and institutional guidelines tailored to local hospital wards to optimize patient care and enforce rational drug use. There is an urgent need to implement antimicrobial stewardship programs to promote rational antibiotic use and improve public health outcomes.

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Author Contributions

RK: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, and Visualization (references and results compilation). NS: Writing – Review & Editing, Formal Analysis, and Supervision. KR: Investigation, Writing – Original Draft, and Resources (literature review and references). IN: Investigation, Data Curation, and Writing – Original Draft. HTI: Investigation, Writing – Original Draft, and Writing – Review & Editing. KS: Investigation and Writing – Original Draft. MM: Investigation and Writing – Original Draft. RM, MB, EM, and SK: Investigation and Methodology.

AI Disclosure

The authors used ChatGPT (OpenAI) solely for language editing, including grammar, spelling, readability, and clarity. All scientific content, data analysis and interpretation, and conclusions were developed and verified by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the manuscript.

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