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Evaluating Antibiotic Prescribing Appropriateness in a Tertiary Care Hospital in Kerala Using Gyssens' Categorization

Sanjay Sreekumar. K[1], Rakesh Kumar Jat[2]

[1]Research Scholar, Pharmacy department, Shri Jagdish Prasad Jhabarmal Tibrewala University, Vidyanagari, Jhunjhunu, Rajasthan
[2]Department of Pharmacy, Shri Jagdish Prasad Jhabarmal Tibrewala University, Vidyanagari, Jhunjhunu, Rajasthan

Abstract
The irrational use of antibiotics has contributed significantly to the global burden of antimicrobial resistance (AMR). This study evaluates antibiotic prescription patterns and rational drug use in a tertiary care hospital using WHO prescribing indicators. A six-month prospective observational study was conducted, analyzing prescribing trends, adherence to essential drug lists, and prevalence of sensitivity testing. Among 120 inpatients, 65% received antibiotics via the parenteral route, while only 13% were prescribed in generic names. Cephalosporins were the most commonly used antibiotics (30.5%). Sensitivity testing was performed in only 24% of cases, revealing significant resistance to commonly prescribed drugs. The study highlights the urgent need for rational antibiotic prescribing, increased adherence to WHO guidelines, and routine microbiological investigations to curb antibiotic resistance and improve patient outcomes.

Keywords: Antibiotic resistance, Rational drug use, WHO prescribing indicators,

Introduction

Antibiotics have played a pivotal role in revolutionizing medical treatment by effectively combating bacterial infections. However, their irrational and inappropriate use has led to the emergence of antimicrobial resistance (AMR), posing a severe threat to global health. The widespread misuse of antibiotics has resulted in prolonged hospital stays, increased treatment costs, and higher morbidity and mortality rates. It has been observed that over half of all prescribed antibiotics do not comply with standard treatment guidelines, further exacerbating the issue of resistance.

The World Health Organization (WHO) has emphasized the importance of rational antibiotic use, which ensures that patients receive appropriate medications for their clinical conditions at the right dose and duration. Despite the presence of guidelines and essential drug lists, deviations from best prescribing practices remain a major concern in healthcare systems worldwide. The excessive use of broad-spectrum antibiotics, lack of adherence to microbiological testing, and over-reliance on empirical treatment methods are among the leading causes of irrational antibiotic use.

Monitoring antibiotic prescription patterns is crucial in identifying inconsistencies and improving prescribing behaviors. This study aims to evaluate the prescribing trends in a tertiary care hospital,

assess adherence to WHO guidelines, and analyze the prevalence of antibiotic sensitivity testing. Furthermore, the rationality of antibiotic prescriptions will be assessed using the Gyssens category (2001), which categorizes prescriptions based on their appropriateness in terms of timing, dosage, duration, and choice of antibiotics. By integrating this methodology, this study will provide a more comprehensive evaluation of antibiotic prescribing patterns and highlight the need for targeted interventions to promote rational drug use.

By improving antibiotic stewardship programs and emphasizing the importance of microbiological investigations before prescribing antibiotics, healthcare institutions can work toward minimizing the growing threat of AMR. Evaluating prescriptions using the Gyssens category will further enable an evidence-based assessment of prescribing behaviors, leading to more effective and rational use of antibiotics.

Methodology

Study Design and Setting

A prospective observational study was conducted over a period of 12months, at PVS Hospital (P) Ltd, a 350-bedded multispecialty tertiary care hospital in Calicut.

Study Population

The study population consisted of inpatients receiving antibiotic prescriptions. Patients admitted to all hospital wards were included, except for those in casualty or emergency units. The study focused on understanding antibiotic usage, adherence to guidelines, and rationality assessment.

Data Collection

Data were systematically collected using structured forms designed to capture relevant information, including drug names, dosages, routes of administration, and sensitivity tests. Information was extracted from patient case sheets and prescription records. The study also incorporated WHO prescribing indicators and National Formulary of India (NFI) standards for evaluation.

Rationality Assessment

The rationality of antibiotic prescriptions was assessed using the Gyssens category (2001), which classifies prescriptions based on parameters such as appropriateness of drug choice, dose accuracy, duration of treatment, and necessity of antibiotic use. Prescriptions were categorized into rational and irrational based on these criteria.

Study Procedure

The study was conducted in compliance with ethical guidelines and hospital protocols. After obtaining ethical approval, a systematic review of inpatient prescriptions was performed. Data were analyzed to determine the prescribing trends, frequency of generic drug prescriptions, and the extent of adherence to the Essential Drug List (EDL). Sensitivity testing patterns were also examined to assess the prevalence of antimicrobial resistance.

Each prescription was evaluated based on:

- Compliance with WHO prescribing indicators.
- Adherence to essential medicine guidelines.
- Appropriateness of antibiotic choice according to infection type.
- Sensitivity test results to determine antimicrobial resistance.

The collected data were analyzed using statistical methods to identify significant trends and areas requiring improvement in antibiotic prescribing practices.

RESULTS AND DISCUSSION

The study was conducted in the inpatient unit of PVS Hospital (P) LTD, a 350-bedded tertiary care hospital. It was designed as a prospective observational study spanning 12 months, with a total of 120 cases included to assess prescription patterns, rationality, and sensitivity of antibiotics.

Demographic Characteristics

The demographic characteristics of the study population were analyzed, and it was found that out of 120 patients, 68 (56.6%) were male, while 52 (43.3%) were female. The distribution of patients by age showed that 30 individuals (25%) were within the 0–10 age group, 13 (10.8%) were between 11–30 years, 18 (15%) were in the 31–50 age group, and 59 (49.1%) were above 51 years. A higher number of male patients were admitted during the study period. The largest proportion of antibiotic users was observed among patients above 51 years (49.2%), while the smallest proportion (10.8%) was noted in the 11–30 age group.

Patterns of Antibiotic Usage

A total of 12 different classes of antibiotics were identified in the prescriptions. It was observed that 213 antibiotics were prescribed, with cephalosporins being the most frequently used (30.5%), followed by penicillins (28%) and macrolides (13%). Among the fixed-dose combinations, amoxicillin + clavulanic acid was prescribed most frequently, followed by piperacillin + tazobactam. The most commonly administered parenteral antibiotic was amoxicillin + clavulanic acid.

Indications for Antibiotic Use

Antibiotics were prescribed for a variety of infections, with respiratory tract infections being the most commonly treated condition (37.2%). Other frequently observed indications included urinary tract infections (14%), acute gastroenteritis (10%), and diabetic complications (10%).

Prescribing Indicators

In the 120 cases analyzed, a total of 213 antibiotics were prescribed. Among these, only 28 (13%) were prescribed by their generic names, while 92 (43%) were selected from the essential drug list. It was noted that 134 antibiotics (62%) were administered as monotherapy, and 139 (65%) were given parenterally. Oral administration was observed in 74 (34%) of the cases. Azithromycin was identified as the most commonly used oral antibiotic.

Sensitivity Analysis

Sensitivity testing was conducted for 29 patients out of the 120 included in the study. The most commonly identified organisms included *Streptococcus* species, *E. coli*, *Klebsiella pneumoniae*, *Staphylococcus* species, *Candida* species, and *Enterococcus* species. It was found that penicillin and levofloxacin exhibited high resistance to these organisms.

Rationality Assessment

The rationality of antibiotic use was evaluated, revealing that 170 (79.8%) of the prescribed antibiotics were deemed rational, whereas 43 (20.18%) were categorized as irrational. According to the Gyssens classification, irrational prescriptions were attributed to factors such as incorrect dosage, inappropriate administration, excessive or insufficient treatment duration, and the selection of less effective or more toxic drugs.

Relationship Between Disease Type and Rationality

A chi-square test was conducted to determine whether a significant relationship existed between different disease types and the rationality of antibiotic use. The test produced a p-value of 0.876, which was greater than 0.05, leading to the acceptance of the null hypothesis. This indicated that no statistically

significant association was found between disease type and the rationality of antibiotic prescriptions

Table 1: Distribution of patients as per demographic Characteristics

Sl. No	Variables	Category	Frequency	Percentage
1.	Gender	Male	68	56.6%
		Female	52	43.3%
2.	Age	0-10 years	30	25 %
		11-30 years	13	10.8 %
		31-50 years	18	15 %
		>51 years	59	49.2 %

Table 2: Patterns of use of various class of antibiotics

Sl no	Category	Usage (Percentage)
1	Penicillin	60 (28%)
2	Cephalosporin	65 (30.5%)
3	Macrolide	28 (13%)
4	Fluroquinolones	14 (6.5%)
5	Nitrofurantoin	4 (1.8%)
6	Nitroimidazole	10 (4.6%)
7	Tetracyclines	5 (2.3%)
8	Aminoglycoside	18 (8.4%)
9	Linezolid	4 (1.8%)
10	Mupirocin	1 (0.4%)
11	Carbapenams	2 (0.9%)
12	Polypeptide antibiotics	2 (0.9%)

Table 3: Clinical Conditions for Which Antibiotics Were Prescribed

Sl no	Condition	Number of patients (Percentage)
1	Respiratory tract infection	48 (37.2%)
2	Viral infection	4 (3%)
3	Urinary tract infection	19 (14%)
4	Acute gastroenteritis	13 (10%)
5	Diabetic complication	13 (10%)
6	Skin infection	5 (3.8%)
7	Acute febrile illness	2 (1.5%)
8	Meningitis	2 (1.5%)
9	Typhoid	2 (1.5%)
10	Others	21 (16.27%)
Total		129

Table 4: WHO Core Indicators for Rational Antibiotic Prescription

Prescribing indicators	Number of drugs(percentage)
Total number of prescription analysed	120 cases
Total number of antibiotics prescribed	213 drugs
Number of antibiotics prescribed by generic name	28 (13%)
Number of antibiotics prescribed from essential drug list	92 (43%)
Number of antibiotics prescribed in parentral form	139 (65%)
Number of antibiotics prescribed in oral form	74 (34%)
Number of antibiotics given as monotherapy	134 (62%)

Table 5: Pattern of sensitivity test

Total number of cases	Total number of organism identified	Sensitivity done	Percentage
120	9	29	24%

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Table 6: Classification of Prescriptions as Rational and Irrational

Rational	Irrational
170(79.8%)	43(20.18%)

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Table 7: Evaluation of Antibiotic Rationality Using Gyssens Criteria (2001)"

The category of therapy Rationality	Total N (%)
0=Rational	43(20.18%)
1=Not on time	2(0.93%)
IA=Not exactly dose	6(2.81%)
II B=Not exactly interval	2(0.93%)
II C=Not exactly administration	2(0.93%)
III A=Giving too long	3(1.4%)
III B=Giving too short	-
IV A=More effective antibiotics	10(4.69%)
IV B=More toxic antibiotic	12(5.63%)
IV C=Cheaper antibiotics	10(4.69%)

IV D=More specific antibiotics	14(6.57%)
V=Antibiotics without indication	17(7.98%)
Total	213(100)

Table 8 :Chi-Square Tests for independence of attributes of different types of Diseases and Rationality

Test	Value	Df	p-value
Pearson Chi-Square	4.490	9	.876
Likelihood Ratio	5.478	9	.791
Linear-by-Linear Association	.011	1	.918
N of Valid Cases	213		

Figure No 1: Evaluation of Antibiotic Rationality Using Gyssens Criteria (2001)

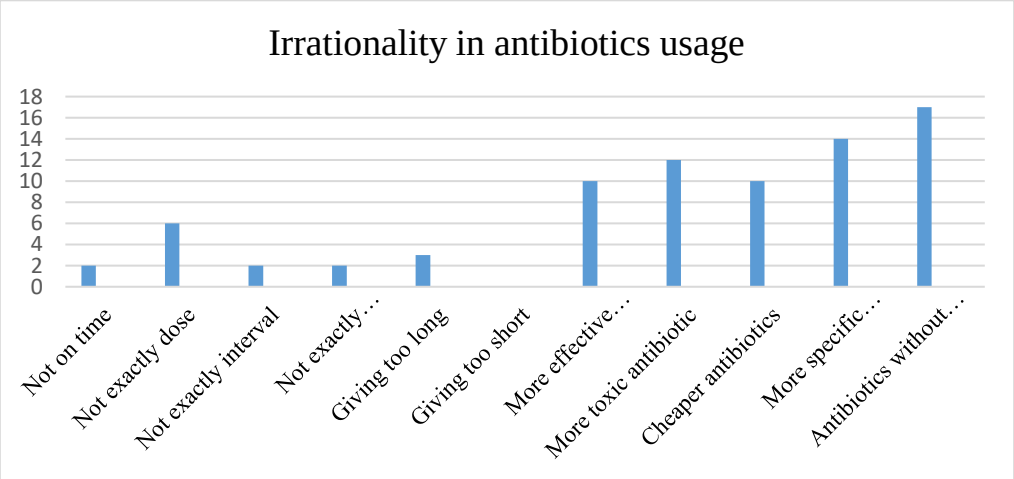
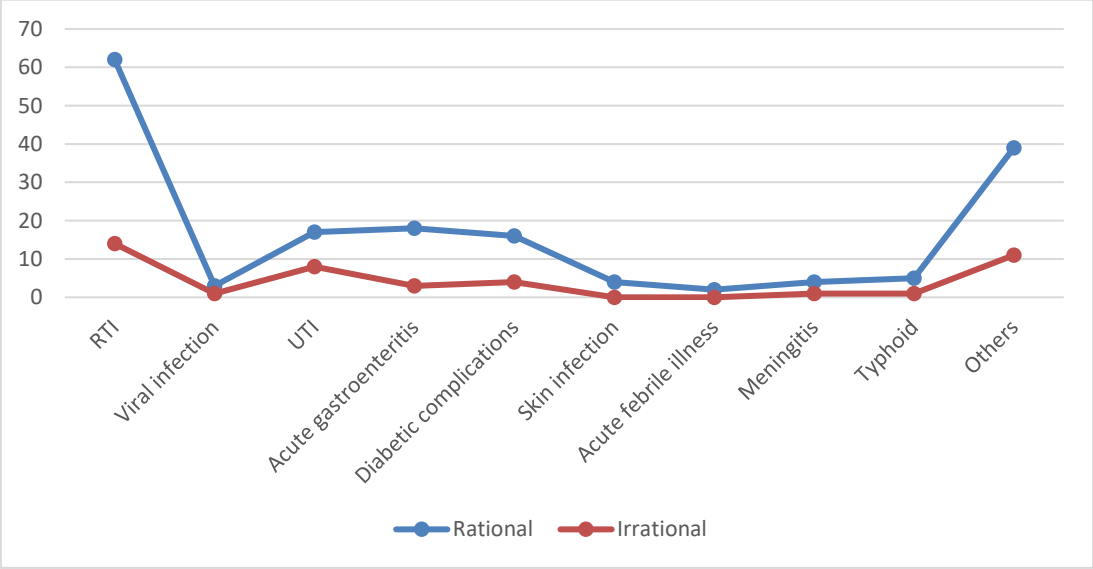


Figure No 2: Distribution of Rational and Irrational Antibiotic Prescriptions by Disease Type



DISCUSSION

The findings of this study indicate that a significant proportion of antibiotic prescriptions were administered inappropriately, leading to concerns about antimicrobial resistance. It was observed that cephalosporins were the most frequently prescribed antibiotics, followed by penicillins and macrolides. A preference for parenteral administration was noted, with 65% of antibiotics being given via injection rather than orally. This reliance on injectable formulations suggests a deviation from the preference for oral administration, which is recommended whenever feasible to minimize hospital-related complications and costs.

A low level of adherence to the WHO prescribing indicators was detected. Generic prescribing was found to be limited, with only 13% of antibiotics being prescribed by their generic names. Additionally, prescriptions from the essential drug list accounted for just 43% of the total, reflecting a considerable deviation from standard guidelines. These results suggest that improvements in antibiotic selection are necessary to align with WHO recommendations and national prescribing protocols.

Sensitivity testing was carried out in only 24% of cases before prescribing antibiotics. This finding reveals a gap in microbiological confirmation prior to antibiotic initiation, which is crucial in reducing the inappropriate use of broad-spectrum antibiotics. The presence of resistant strains such as *E. coli*, *Klebsiella pneumoniae*, and *Streptococcus* species was detected, with high resistance observed against penicillins and fluoroquinolones. These resistance patterns highlight the need for stricter antibiotic stewardship and routine culture sensitivity testing before initiating treatment.

When the rationality of antibiotic use was assessed using the Gyssens category, 79.8% of prescriptions were deemed rational, whereas 20.2% were classified as irrational. The major reasons for irrational prescribing included inappropriate drug selection, incorrect dosages, and unnecessarily prolonged treatment durations. These factors indicate that inappropriate antibiotic use remains prevalent and must be addressed through systematic interventions such as prescriber training and protocol reinforcement.

The WHO prescribing indicators revealed additional areas of concern. A high percentage of prescriptions contained an antibiotic, suggesting possible overprescription. The frequent use of non-essential drugs and a lack of adherence to evidence-based guidelines were also noted. The necessity of prescriber education, along with regular audits, was emphasized in order to improve rational prescribing practices.

SUMMARY AND CONCLUSION

The findings of this study indicate that irrational antibiotic prescribing remains a significant concern, contributing to antimicrobial resistance and increased healthcare costs. A substantial proportion of prescriptions deviated from WHO prescribing indicators, with low adherence to generic prescribing and essential drug list recommendations. Sensitivity testing was underutilized, leading to the frequent empirical use of broad-spectrum antibiotics. Resistance patterns were observed in key bacterial strains, highlighting the urgent need for enhanced microbiological testing. Rationality assessment using the Gyssens category revealed that 20.2% of prescriptions were irrational due to inappropriate drug selection, incorrect dosages, and extended treatment durations. To address these issues, greater adherence to WHO prescribing indicators, increased use of essential medicines, and routine microbiological testing must be prioritized. Healthcare institutions should implement training programs and policy interventions to improve prescribing practices, minimize antibiotic resistance, and promote rational drug use.

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