Antibiotic Prescribing Pattern Among Patients Admitted in a Secondary Care Hospital in South India

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Abstract

Background: Antibiotics are pivotal in managing infectious diseases, yet their overuse contributes to rising Antimicrobial Resistance (AMR). Monitoring prescribing patterns is essential to promote rational antibiotic use, minimize polypharmacy, and reduce healthcare costs. **Objective:** To analyze inpatient antibiotic prescribing patterns with respect to adherence to guidelines, demographic trends, types of infections treated, antibiotic classes used, and duration of therapy. **Methods:** A retrospective observational study was conducted to assess the prevalence and characteristics of antibiotic prescriptions among hospitalized patients. Data on patient demographics, diagnosis, antibiotic class, duration, and route of administration were collected and compared against national and WHO benchmarks. **Results:** Antibiotics were prescribed in 45.8% of total prescriptions, with intravenous administration being the most common route (66%). About 99% of antibiotics prescribed were from National List of Essential Medicine,2022 (NLEM). The average number of antibiotics per patient was 1.6, aligning with WHO recommendations. Male patients (60%) and the 41–60 years age group (33%) were the most frequent recipients. Respiratory tract infections (19%) were the leading indication for antibiotic use. Cephalosporins (31%) and penicillins (23%) were the most commonly prescribed classes. The average duration of therapy was 6.3 ± 3.2 days. Based on the WHO AWaRe classification, the most frequently used antibiotics were from the Watch group (51%), followed by Access (48%) and least by Reserve (1%). **Conclusion:** The study demonstrates encouraging trends toward rational antibiotic use, with high adherence to NLEM and appropriate prescribing practices. However, the predominant use of watch group antibiotics and cephalosporins highlights the need for ongoing antimicrobial stewardship to curb AMR. Targeted interventions, particularly among high-risk groups, are essential for optimizing antibiotic therapy and ensuring sustainable healthcare practices.

1. Introduction

Antibiotics play a critical and central role in modern clinical medicine[1]. In underdeveloped nations, infections remain a major cause of mortality. Antibiotic resistance is commonly acquired in developing countries, leading to ineffective treatment outcomes and greater use of healthcare resources. Antibiotic resistance may develop due to various causes such as medication non-adherence, multiple prescribers and dispensers, inappropriate medication use, incorrect dosage, use of counterfeit medicines, and both overuse and underuse of antibiotics.

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Antibiotic resistance can be avoided by monitoring patient doses and formulations, following standard treatment guidelines, reviewing patients' pharmacokinetic profiles regularly, and monitoring and treating patients for ADRs[1].

With the number of infections rising, antibiotics are used more often for prophylaxis and treatment of disease. Irrational prescribing of antibiotics leads to antibiotic resistance, ineffective treatment and an increase in treatment cost[2].

Antimicrobial Resistance (AMR) is a growing public health challenge worldwide that has been identified as one of the top ten threats to global health by the World Health Organization (WHO)[3]. WHO emphasises the need for countries to monitor antibiotic consumption to combat AMR[4]. The major consumers of antibiotics are low- and middle-income countries, including India[5]. The knowledge about rational antibiotic utilization patterns is necessary for a constructive approach to problems that arise from multiple antibiotic usages and prevention of AMR[6].

2. Aim and Objectives

To evaluate the antibiotic prescribing pattern among inpatients in a secondary care hospital in South India.

3. Review of Literature

Antibiotics are the most frequently prescribed drugs for hospitalized patients; for instance, Williams et al reported that in a tertiary hospital ICU, Northern India approximately 95% of patients received antibiotics upon admission, with third-generation cephalosporins being the most commonly used, followed by metronidazole[7].

Habib Hasan Farooqui et al reported that the highest antibiotic prescription rates were in children between the ages were 0-4 and treatment offered was mainly for respiratory related infections[8].

In Delhi, India, Anita Kotwani and team found that the most common class of drug administered for acute diarrhoea was fluroquinolones. Their survey had provided evidence of the irrational use of antibiotics for acute diarrhoea in primary care settings for ambulatory patients in both the public (43%) and private sectors (69%). A lower percentage of children with acute diarrhoea received antibiotics at public healthcare facilities (23%) compared to those treated at private clinics, where the rate was notably higher at 51%[9].

The Centers for Disease Control and Prevention (CDC) currently advise healthcare professionals to enhance the appropriate prescribing and usage of antibiotics in clinical practice. It also advocates for the implementation of Antibiotic Stewardship Programs (ASPs) to support this effort[10].

In 2017, the World Health Organization (WHO) Expert Committee on the Selection and Use of Essential Medicines introduced the AWaRe classification system to aid antibiotic stewardship efforts at local, national, and global scales. This system groups antibiotics into three categories—Access, Watch, and Reserve—based on factors such as their therapeutic role, potential to cause resistance, and drug class, to promote their appropriate usage. As part of the WHO's 13th General Programme of Work (2019–2023), a target was set for countries to ensure that at least 60% of their total antibiotic use falls within the Access category[11].

Establishing an antibiotic policy within institutions and hospitals is crucial to guide prescribers in making the most appropriate treatment decisions. Highly representative data aids the prescribers in rational antibiotic use and can improve the quality of patient care. This further envisages the need for the current study[6].

Therefore, understanding the prescribing pattern of antibiotics is a key first step for the establishment of Antibiotic stewardship program and this study was aimed to investigate prescribing patterns of antibiotics and identify the most frequently prescribed antibiotics for hospitalized patients[12].

Antibiotic utilization at healthcare institutions in India has been assessed through various studies, including those with cross-sectional and longitudinal methodologies analyzing prescribing trends[13].

Our study was conceptualized to assess and evaluate the prescribing pattern of antibiotics among patients admitted in a secondary care centre in south India and also classified usage of antibiotics according to the WHO AWaRe classification.

4. Material and Methods

4.1 Methodology

Study protocol was approved by the Institutional Review Board and Ethics committee, CMC Vellore (IRB Min. No: 0624020 dated 05.06.2024).

4.1.1 Study Design

This was a retrospective cross-sectional study done on the inpatients of medical ward of a Secondary care hospital in South India.

4.1.2 Study Duration

The study was carried out for a period of one year

4.1.3 Study Centre

Community Health and Development (CHAD) Hospital, Christian Medical College, Vellore.

4.2 Methods

Inclusion criteria – All the in-patients who were prescribed at least one antibiotic in medical wards. Exclusion criteria – All Outpatients and in-patients admitted in wards other than Medicine such as ICU and HDU patients.

4.2.1 Data Sources

Prescription charts of inpatients of medical wards in CHAD hospital from period of Jan to Jun 2024.

The data collected from inpatients' charts of medicine ward included: Age, gender, co-morbidities, provisional diagnosis, antibiotic prescribed to them – class, dosage form, route of administration; frequency, change of antibiotics, duration, culture report, final diagnosis, duration of hospital stay, and outcome of the patient.

4.3 Statistical Analysis

Sample size: Based on the previous study[13], sample size obtained was 171 with a 30% relative precision and 95% confidence interval.

Data was collected and entered into Microsoft Excel. The analysis was done using STATA version 16.0. All the continuous variables were reported using mean (SD) or median (IQR) and the categorical variables like Antibiotics prescribed route, indications were reported using frequency and percentages.

5. Results (Including Observations)

A total of 203 inpatient medical records were analyzed from period of Jan to Jun 2024. Out of which, 93 (45.8%) were prescribed at least one antibiotic. 99% of antibiotics prescribed were from National List of

Essential Medicine, 2022 (NLEM). The average number of antibiotics per patient was 1.6. Among the total inpatients, male patients comprised 60% while females comprised 40%. Analysis of age showed that 7% of patients were in the age group 17-20 years, 30% of the patients in the age group 20-40 years, 33% in the age group 41-60 years and 30% were in the age group above 60 years of age. Age distribution is shown in Figure 1. Their comorbid disease conditions are listed in Table 1.

Figure 2 describes the indications for which antibiotics were prescribed. Respiratory tract infections were the most common clinical condition in patients for which antibiotics were prescribed in high percentage (19%), followed by urinary tract infections (13%), acute febrile illness (12%), blood stream infections (12%) and skin and soft tissue infections (11%).

Among 93 patients, 50% (47) of the patients were on therapy with a single antibiotic, 39% (36) of patients were on therapy with two antibiotics while 11% (10) of patients were on therapy with three antibiotics (Figure 3). And 34% were on oral antibiotics, 27% were on parenteral antibiotics and 39% were on both oral and parenteral antibiotics.
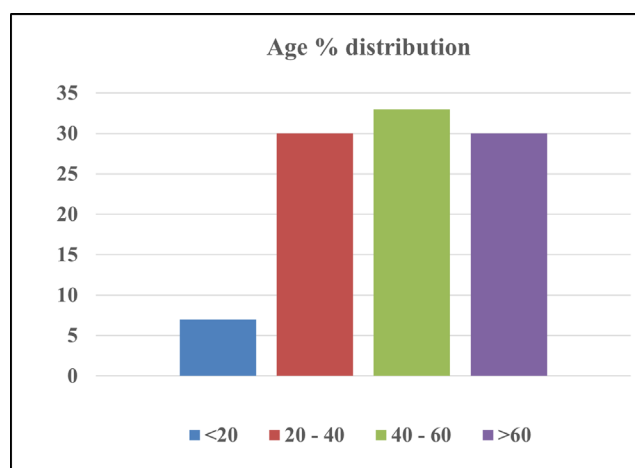

Figure 1. Age distribution of patients.

Table 1. Co morbidities associated with patients

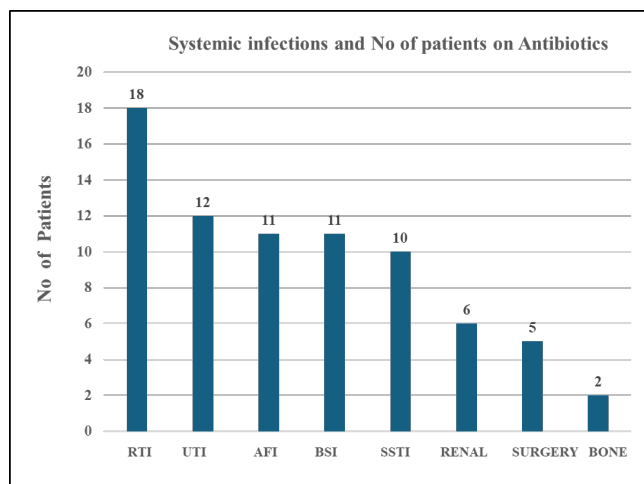| Co-morbidities	Patients, n (%)
Diabetes mellitus	27 (29)
Hypertension	22 (24)
Bronchial asthma	8 (9)
Ischemic heart disease	3 (3)

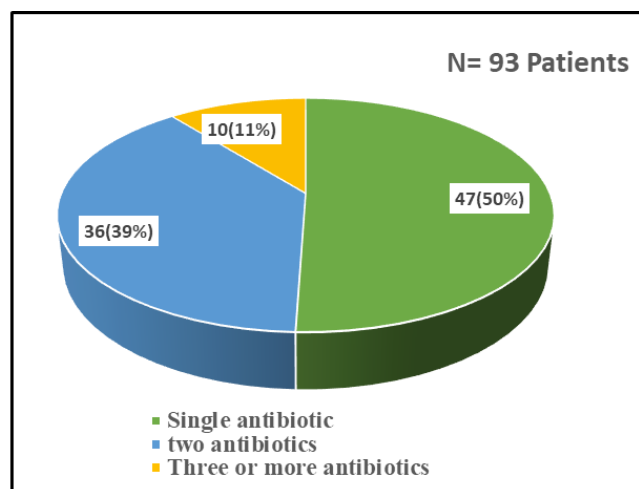**Figure 2.** Systemic infections and number of patients prescribed antibiotics.

Figure 3. Number of Antibiotics per patient.

Total number of antibiotics prescribed was 143. From them, 44 (31%) were cephalosporins, 33 (23%) were penicillin, 25 (17.5%) were tetracyclines, 21 (15%) were macrolides, 7 (5%) were fluoroquinolones while the remaining 13(8.5%) were other antibiotics like aminoglycosides, sulfonamides and nitrofurantoin (Figure 4).

Additionally, the distribution of antibiotic therapy according to WHO AWaRe classification was analysed (Figure 5), where the Watch group antibiotics constituted the majority of prescriptions (51%) followed by Access group antibiotics (48%) and Reserve group (1%).

The Mean ±SD duration of prescribed antibiotics was calculated to be 6.3±3.2 days during their inpatient

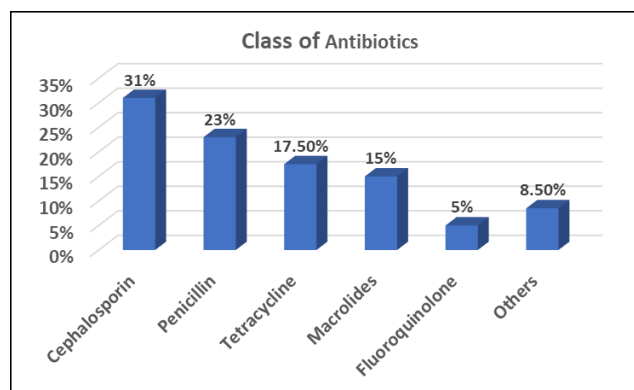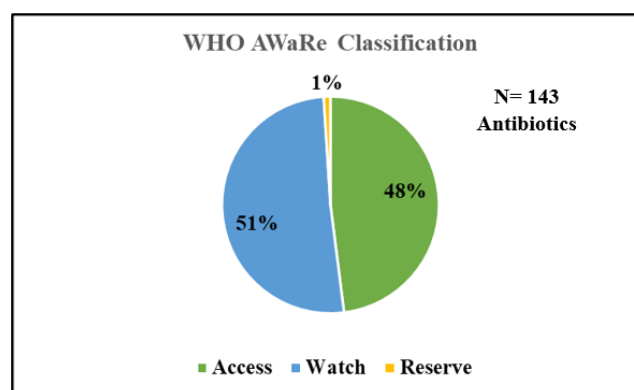**Figure 4.** Distribution of Antibiotic classes according to frequency.
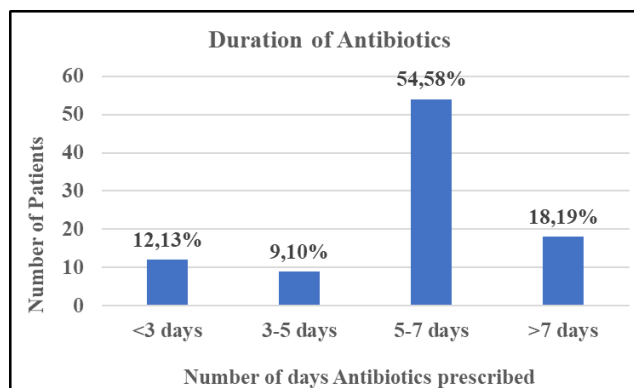

Figure 5. WHO AWaRe classification.

Figure 6. Duration of antibiotics.

care. About 58% of patients were on antibiotics for a duration of 5 to 7 days while 19% of patients were taking longer than 7 days and 13% for less than 3 days (Figure 6).

(RTI- Respiratory tract infection, UTI- Urinary tract infection, AFI- Acute febrile illness, BSI- Blood stream infection, SSTI-Skin and soft tissue infection).

6. Discussion

Antibiotics represent one of the most pivotal discoveries in clinical medicine and are widely utilized to treat infectious diseases. Analyzing antibiotic prescribing patterns is a valuable tool for assessing the appropriateness of antibiotic use. Such evaluations aid in reducing healthcare costs, minimizing polypharmacy, and promoting rational antibiotic use.

In this study, a high prevalence of antibiotic use was observed among inpatients, with 45.8% of prescriptions involving antibiotics. This finding is consistent with global trends, reflecting the substantial dependence on antibiotics in healthcare settings[14]. Intravenous administration was the predominant route (66%), suggesting the severity of patient conditions or the preference for rapid therapeutic effects in conditions that are severe and can lead to complications. This rate exceeds that reported by Vineel B J *et al.*, (50.9%)[2].

The analysis of antibiotic prescribing patterns demonstrates a highly encouraging trend toward rational antibiotic use, particularly in terms of adherence to national guidelines and World Health Organization (WHO) recommendations. Notably, 99% of antibiotics prescribed were from the National List of Essential Medicines (NLEM), 2022, underscoring a commendable alignment with national policy aimed at promoting safe, effective, and affordable medications[15]. The NLEM serves as a standard reference for prescribing in both public and private healthcare sectors, and high adherence reflects both awareness and implementation of evidence-based prescribing practices[16]. The average number of antibiotics prescribed per patient was 1.6, which is within the WHO- recommended limit of 1.6 to 1.8[17]. This value was similar to the results obtained from Sharma *et al.,* study[18]. This suggests judicious use of antibiotics, minimizing the risk of polypharmacy and its associated complications, such as increased side effects, drug interactions, and the development of Antimicrobial Resistance (AMR). Maintaining this average number indicates that prescribers generally avoid unnecessary antibiotic combinations and are likely to tailor therapy based on clinical judgment or empirical evidence.

Demographic data shows a male predominance (60%) among inpatients receiving antibiotics, compared to 40% females. This was similar to a study conducted by Vineel *et al.*, out of 300 patients, 53% were male

patients and 47% were female patients[2]. Future studies may consider exploring gender-related differences in antibiotic use to understand whether this distribution correlates with disease burden or other demographic factors.

Age-wise distribution reveals that the highest proportion of patients (33%) were in the 41–60 years age group, followed closely by 30% each in the 20–40 and >60 years age groups, and a smaller proportion (7%) in the 17–20 years group which was similar to Akram et al study, 48% belonged to 41 to 60 yrs age group[1]. This pattern is consistent with the epidemiology of infectious diseases and comorbidities that tend to increase with age. Older adults are often more susceptible to infections due to underlying chronic conditions such as diabetes, hypertension, or compromised immunity. The significant percentage of patients above 60 years of age further emphasizes the need for careful antibiotic stewardship in elderly populations, who are more vulnerable to adverse drug reactions and are often on multiple medications.

Antibiotic therapy distribution varied by diagnosis, with respiratory tract infections accounting for the highest proportion of prescriptions (19%), followed by urinary tract infections (13%), acute febrile illnesses (12%), bloodstream infections (12%), and skin and soft tissue infections (11%). These results align with those of Butt *et al.*, who also reported a high prevalence of antibiotic use in respiratory tract infections[19].

In this study, Cephalosporins were the most commonly prescribed antibiotic class (31%), followed by Penicillins (23%). This aligns with findings by Patel *et al.,* who reported that cephalosporins (54.87%) were the most frequently prescribed class of antibiotics, followed by Penicillin (10.97%)[20]. A similar study was conducted by Vineel *et al.,* in which cephalosporins (44.51%) followed by tetracyclines (14.19%) were the most frequently prescribed class of antibiotics[2]. Cephalosporins' widespread use can be probably attributed to its broad-spectrum activity, favorable safety profile, and availability in multiple formulations. However, the extensive use of higher- generation cephalosporins—raises concerns about emergence of antimicrobial resistance and the need for antimicrobial stewardship interventions.

Another finding in our study was that patients took antibiotics for an average duration (mean±SD) of

6.3±3.2 days during their hospital stay. Majority (58%) of patients were on antibiotics for a duration of 5 to 7 days while 19% of patients were taking them for longer than 7 days and 13% for less than 3 days. This figure 6 was similar to Amaha *et al.*, study which reported that antibiotics were prescribed for a duration of 6.36 days reflecting typical prescribing practices that favor short-course therapy when suitable and about 23% of patients were taking antibiotics for longer than 10 days[21].

According to the WHO AWaRe classification, watch group antibiotics were most frequently prescribed (51%), followed by Access group (48%) and Reserve group (1%). Similar trends were reported by Butt *et al.,* with Access group antibiotic usage falling short of the country-level target of at least 60%[19].

7. Summary and Conclusion

The analysis of antibiotic prescribing patterns among inpatients reveals an appropriate and rational use of antibiotics. Prescribing practices largely adhered to national and WHO guidelines, as evidenced by the high utilization of NLEM-listed antibiotics and an average number of antibiotics per patient within WHO-recommended limits. The predominant prescription of Watch group antibiotics, with suboptimal use of Access group agents, highlights the ongoing need to strengthen antimicrobial stewardship programs. Demographic and diagnostic trends reaffirm the importance of targeted interventions, particularly among middle-aged and elderly populations who are more susceptible to infections and at risk of polypharmacy. The findings of our study reveal a well- established rational antibiotic prescribing system that works under the guidance of a well-trained team of antibiotic stewardship personnel.

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