Original Article

Assessment of Antibiotics Prescribing Using WHO/ INRUD Indicators and AWaRe Classification in an Indian Regional Hospital

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Abstract

Antimicrobial resistance and irrational antibiotic use are global concerns. Assessing prescribing practices based on drug use indicators and AWaRe classification can help to enhance the healthcare system's standards. A six-month prospective observational study was conducted at a regional tertiary hospital in India, involving patients from various departments who were hospitalized. Data from patient case sheets were analyzed using WHO/International Network of Rational Use of Drugs (INRUD) core prescribing indicators and AWaRe classification, with Microsoft Excel and SPSS 2 for data analysis. In a study of 306 patients, 670 antibiotics were prescribed, revealing significant deviations from World Health Organization (WHO) standards. Access group antibiotics usage was 30% (target: 60%), while the watch group usage was high at 69.25%. Broad-spectrum antibiotics were prescribed in 85.53% of cases, and beta-lactamase inhibitor combinations in 40%, contributing to antimicrobial resistance. Only 49.85% of antibiotics were from the National Essential Drugs List (target 100%). The hospital lacks its own institutional Standard Therapeutic Guidelines (STG), a formulary List (FL), and a diagnostic tool, 'the culture and the sensitivity test', to choose antibiotics for specific infections was poorly performed. As a global community, it is essential now to stop discussing and move beyond the antimicrobial resistance problem by implementing solutions. Establishing antimicrobial stewardship programs (ASP) from the regional healthcare settings in India helps promote prudent antibiotic use. Strengthening the healthcare system could make this achievable.

Keywords: AWaRe, WHO prescribing indicators, Hospital and patient care indicators, Antimicrobial stewardship program

Introduction

In hospitals, drugs are critical to patient care, impacting immediate and long-term health outcomes. They are important in treating acute conditions, managing chronic diseases, supporting surgical procedures, providing specialized treatments such as chemotherapy and immunotherapy, preventing infections, and improving patient ease and quality of life. Antibiotics are among the most commonly prescribed drugs used in health care. They occupy a critical position due to their life-saving role in reducing mortality from infectious diseases. Before antibiotics, many common infections were often fatal. Thus, antibiotics established themselves as powerful medications and greatly aid doctors in their treatment processes in healthcare globally. Their discovery is considered one of the most significant medical advancements of the 20th century, by turning potentially fatal infections into manageable conditions.

Antibiotics are antimicrobial products used to treat bacterial infections by either killing the bacteria or preventing their growth. Although the target of antibiotics is bacteria, some antibiotics also attack fungi, protozoan infections, and some viruses. Doctors prescribing the right drug at the right time to individual patients is a mandate of their profession. However, in cases of antibiotic prescribing, it is important to consider not only cures for infections but also for curbing antibiotic resistance. Antimicrobial resistance (AMR) is defined as inherited or acquired characteristics of microorganisms to survive and multiply in the presence of antimicrobial concentrations that would either kill or inhibit them. In a simplified manner, AMR is the resistance of bacteria, viruses, fungi, and parasites to antimicrobial medicines. AMR is a natural process primarily driven over time through genetic

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changes in microorganisms. Human activities triggered its emergence and spread by the misuse and overuse of antimicrobial drugs in humans and animals. This growing health concern is compromising the ability to treat common infectious diseases, leading to prolonged illness, disability, and increased risk of death.

The increasing antimicrobial resistance in the world is challenging. It is important to consider that implementing strategies only in healthcare facilities is not sufficient to prevent this problem [1]. This is due to the root causes of antimicrobial resistance lie in the usage of antibiotics in agriculture to treat bacterial infections in crops. They are used to treat infections in animals that we consume as food [2]. Thus, antimicrobial resistance is transferred to humans through the food chain. To prevent this, the government should establish stringent restrictions on the use of antibiotics in agriculture. Also, healthcare policies that benefit future generations in the long term should be implemented. In this way, our study focuses on addressing all ongoing problems and attempts to explain the need to strengthen the healthcare system. If irrational prescribing practices by physicians, inadequate surveillance, and monitoring of antimicrobial resistance are one problem, the other is the excess use of over-the-counter drugs, self-medication, and poor infection control and hygiene practices, especially in regional healthcare settings.

In this study, using a set of indicators developed by the World Health Organization in collaboration with the International Network of Rational Use of Drugs (INRUD) and AWaRe classification, we are measuring the performance of antibiotic drug utilization in a regional healthcare facility [3]. In developing countries such as India, implementing WHO/INRUD indicators in healthcare facilities will help bridge disparities, highlight gaps in antibiotic access, and contribute to enhancing their performance. The current study provides an overview of the healthcare practices currently in India and the actions required to fortify the healthcare system. The study suggests that regional hospitals adopt better protocols, strengthen laboratory diagnostics, and improve infection prevention and control measures. Addressing local antibiotic resistance patterns is essential for creating evidence-based interventions tailored to specific populations. This approach enhances patient care, public health outcomes, and supports national and global efforts to combat antimicrobial resistance (AMR). Rational use of medicines is key for quality health outcomes, particularly for antibiotics, as resistance continues to escalate and the armamentarium of new antibiotics in the market remains limited. Studies identifying how substantially irrational medication use is happening are the first step toward managing it. This study's main emphasis is on raising problems surrounding antibiotic misuse and strategies to tackle those issues.

Materials and Methods

Study Setting, Design, and Period

A hospital-based Prospective Observational study was carried out in a 550-bed tertiary care hospital for Six Months in Warangal, Telangana, India. The study was conducted in the hospital's different departments (General Medicine, Gastroenterology, Neurology, Cardiology, Orthopedics, Nephrology, Urology, Neurosurgery, General Surgery, Gynecology, Burns & Plastic Surgery). Each hospital department is staffed with specialists, general practitioners, nurses, and other healthcare providers. However, there were no clinical pharmacy services in any hospital department.

Source of Study Population

Our study population consisted of all hospitalized patients in various departments who met the inclusion criteria during our study period.

Eligibility Criteria

The study included patients of both sexes, aged 18 years and above, admitted to various hospital wards and receiving antibiotic treatment. Pediatrics, pregnant, and lactating women were excluded due to ethical, safety, and practical concerns. These groups have special prescribing guidelines due to different metabolic rates, hormonal changes, and unpredictable drug responses. Furthermore, certain antibiotics are contraindicated in those populations, which could affect study results.

Study Variables

The study is dependent on antibiotic prescription patterns using WHO/INRUD core drug use indicators (World Health Organization & International Network of Rational Use of Drugs)

Data Collection Tools and Procedure

Patients admitted during the study period were strictly followed during their course of treatment. Data were collected from the case sheets of hospitalized patients, which included demographic details, disease condition, past medical history, social history, and the drugs prescribed for each patient's condition, especially antibiotics.

Statistical Analysis

Microsoft Excel and SPSS 2 are descriptive statistical analytical software used for the collected data due to their convenience and easy accessibility. Results are expressed in percentages and mean-standard deviation.

Results and Discussion

Socio-Demographic Characteristics

From the (n=306) study population, the total number of drugs prescribed was 1581, out of which 670 were antibiotics. Most of the patients were admitted in the age group of 61-80 years, and from gender-wise distribution, 172 males and 134 females were included in the study.

Table 1. Patient demographics details

Age distribution	Total Number (n)	%
1) 18-40	94	30%
2) 41-60	98	32%
3) 61-80	109	35%
4) 80 & above	11	3%
Gender		
1) Male	172	56%
2) Female	134	43%

Table 1 Showing Patient demographic details of study participants.

Table 2. Most common diagnoses in different departments [4, 5]

Departments	Most common diagnosis
1) General medicine	Typhus fever, Dengue & Typhoid fevers, LRTI, UTI, Sepsis, Anaemia, Pneumonia, DSH, AFI, Hepatitis, Liver abscess
2) Gastroenterology	Pancreatitis, Gastroenteritis, Cirrhosis of the liver, DCLD, PAD
3) Neurology	Ischemic & Haemorrhagic CVA, Seizure disorder
4) Cardiology	CAD, ACS, AWMI, PTCA with Stent, Acute LVF, CCF
5) Neurosurgery	Spinal cord injuries, Head injury - Subdural, Intracerebral or other hematomas, PVID, Radiculopathy, Spondylolisthesis
6) Orthopaedics	Fractures of the femur, Knee, Leg, shoulder joints, Wrist, Clavicle, Hip
7) Urology	Hydroureteronephrosis, Renal calculi, Ureteric calculi
8) Nephrology	Nephrectomy, CKD on MHD
9) General Surgery	Amputation for gangrene of Foot, D12 wedge compression, Debridement & fasciotomy for cellulitis, S/P Cholelithiasis, Appendicitis
10) Gynecology	Endometrial hyperplasia, fibro adenomas, Ovarian cystectomy
11) Burns & plastic surgery	Multiple facial abrasions, Abrasions over the body, palms

NOTE: [List of Abbreviations from Table2] 1) General Medicine: LRTI - Lower respiratory tract infections, UTI - Urinary tract infections, DSH - Deliberate self-harm (Cases such as Tablets & Organophosphorus poisonings), AFI- Acute febrile illness; **2) Gastroenterology:** DCLD - Decompensated liver disease, PAD - Peptic ulcer disease; **3) Neurology:** CVA - Cerebrovascular accident; **4) Cardiology:** CAD - Coronary artery disease, ACS indicates Acute coronary syndrome, AWMI - Anterior wall myocardial infarction, PTCA - Percutaneous transluminal coronary angioplasty with stent (a surgical procedure to treat aneurysm), narrowing arteries, LVF - Left Ventricular Failure, CCF - Congestive heart failure; **5) Neurosurgery:** PVID - Prolapsed herniated or extruded intervertebral disc; **8) Nephrology:** CKD - Chronic Kidney disease, MHD - Maintenance Hemodialysis

Table 2 Showing the most standard diagnosis/indication that led to antibiotic prescription.

During our study period, some patients were admitted with two health conditions, such as LRTI with AFI, UTI, typhoid fever, gastroenteritis with dengue and typhoid fever, and CAD with severe metabolic acidosis, respiratory distress, and anemia [4].

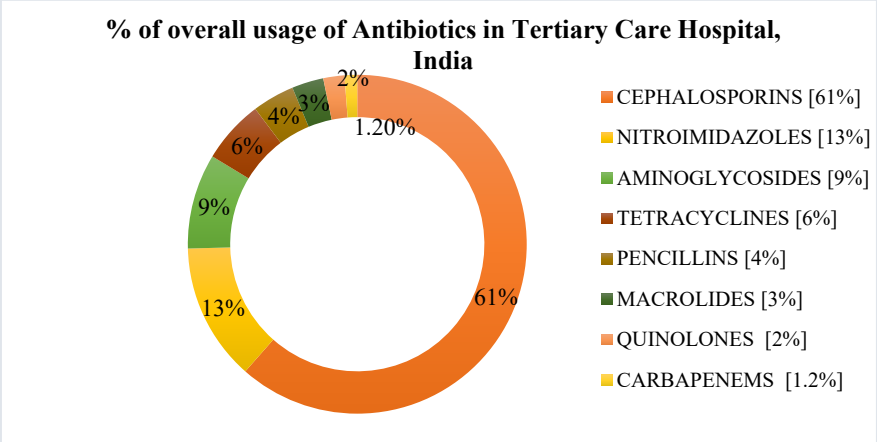

Figure 1. Percentage of overall antibiotic usage among patients in a Tertiary Regional Hospital, India, 2024

Figure 1 illustrates the distribution of antibiotic usage, with Cephalosporins 61%, Nitroimidazoles 13%, Aminoglycosides 9%, Tetracyclines 6%, Pencillins 4%, Macrolides 3%, Quinolones 2%, and Carbapenems 1.2%

Among all groups of antibiotics, cephalosporins were found to be prescribed in large numbers with 61%, Nitroimidazoles with 13%, Aminoglycosides 9%, Tetracyclines 6%, Pencillins 4%, Macrolides 3%, Quinolones 2%, Carbapenems 1.2% other minor groups are Anti-viral drugs 0.4%, Anti T.B drugs 0.1%, Anti-fungal drugs 0.1% and other antibiotics occupy 0.2% respectively. This classification helps to understand the prescribing pattern from various antibiotic categories [6, 7].

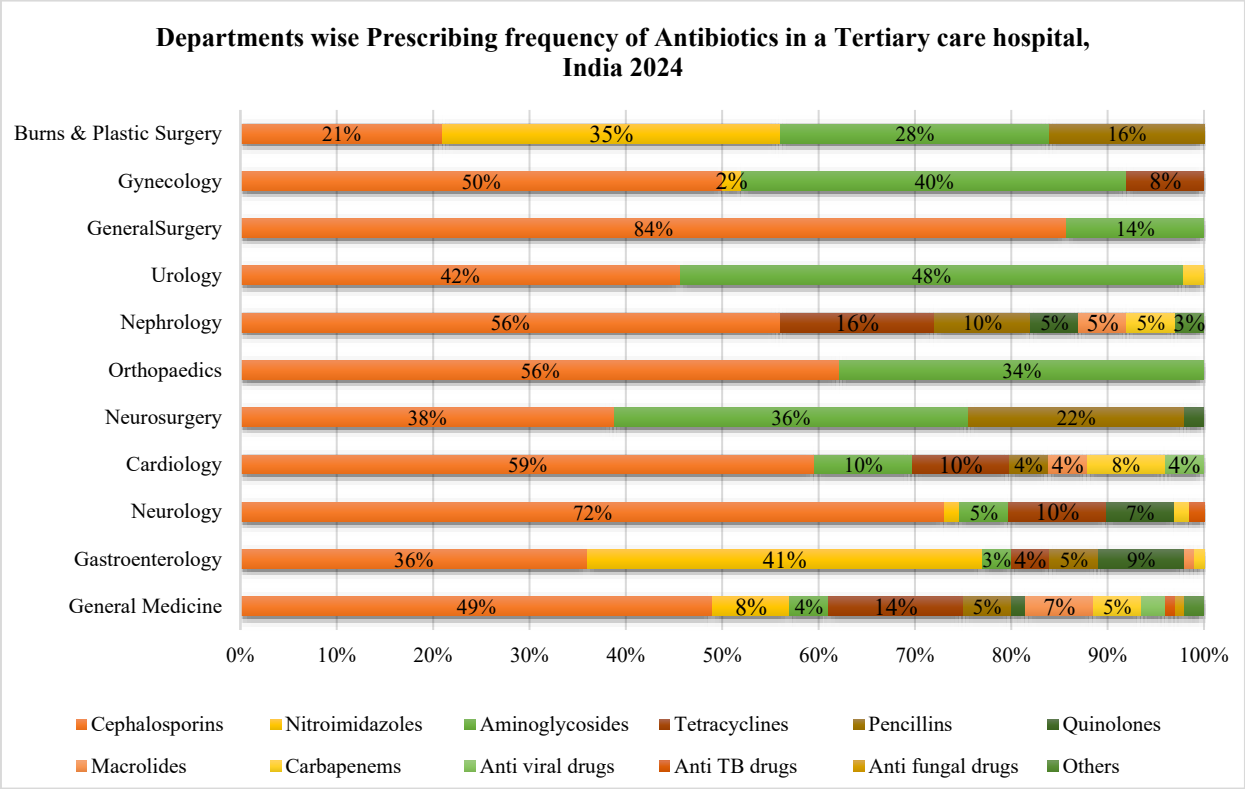

Figure 2. Bar Graph representing department-wise antibiotics prescribing frequency in tertiary regional hospitals, India [5].

Figure 2 illustrates a representation of the different types of antibiotic prescribing frequency from each department in a Tertiary Regional hospital, India

As this study was examined department-wise, a bar graph showing different categories of antibiotics that were prescribed during our study period is shown in **Figure 2**. In the 306-study population, in almost all departments, cephalosporins were prescribed in high quantities. But in gastroenterology, burn and plastic surgery departments, nitroimidazoles were prescribed in high quantities, whereas in the urology department, aminoglycosides were given in high amounts. In neurosurgery, orthopedics, gynecology, burn, and plastic surgery departments also aminoglycosides were also given in good amounts. In the neurosurgery department, penicillins were given in good amounts after cephalosporins and aminoglycosides. All other category drugs were given in smaller quantities to the patients in various departments during our study period. To know in detail about what antibiotics were prescribed during our study period, refer to **Table 4**, which mentions a list of drugs prescribed from all classes of antibiotics. Adherence to antibiotic guidelines varies among different departments, and factors such as patient population, clinical urgency, and complexity of cases contribute to it. We observed that each department is failing to adjust therapy based on culture results due to limited access to this diagnostic tool in the hospital. Time-sensitive decision-making is seen in emergency and critically ill patients, leading to empirical antibiotic prescribing. Department-specific interventions should be established in each hospital to combat AMR.

WHO Indicators

Prescribing Indicators

A comprehensive assessment using WHO prescribing Indicators is given in **Table 3**, which might help health institutions measure the performance of healthcare providers in fostering responsible utilization of medications. The

average (mean) number of drugs prescribed per encounter is **7.5,** which not only exceeds WHO's optimal value of **≤ 3,** and reports from similar studies. The percentage of the overall antibiotics prescribing rate per encounter is **42.3%.** This also exceeds the standard endorsed by the WHO of **≤ 30%,** which indicates that our hospital prescribes antibiotics at a high rate. The percentage of antibiotics prescribed from the National Essential Drugs List (EDL) is **49.85%,** which deviates from meeting the target endorsed by their national EML of **100%.** This suggests that hospitals at the regional level in India do not function as per the national standard therapeutic guidelines. The percentage of antibiotic prescriptions with the parenteral route via injections is **66%.** This value is much higher than the optimal value of **13.4%-24.1%,** which could be explained by the fact that our study mostly focused on hospitalized patients who are typically prescribed a high number of injections. The percentage of antibiotic prescriptions through the oral route is **34%.** The percentage of antibiotics prescribed by generic name is **83.1%,** which couldn't reach the WHO's optimal target of **100%.**

Some other prescribing indicators not from the WHO list are also used to assess and learn more about antibiotic usage in the hospital. Some of them include the percentage of patients who received antibiotic prescriptions as monotherapy was **50%**, dual therapy at **35.3%,** and triple therapy at **14.7%,** i.e., patients who received three or more antibiotic prescriptions while in the hospital. The purpose of this evaluation was to find out whether antibiotics were overly prescribed. Another finding is that the % of antibiotics with Beta-lactamase inhibitors combination was 40%. This combination approach is particularly for treating infections caused by resistant bacterial strains. Antibiotics are co-administered with beta-lactam inhibitors to prevent bacteria from disabling these antibiotics using their enzymes. To prevent resistance and for effective clinical outcomes in patients' beta-lactam antibiotics such as penicillins and cephalosporins are combined with β-lactamase inhibitors like clavulanic acid, sulbactam, and tazobactam. The increasing use of beta-lactamase combination antibiotics is an indication of escalating antimicrobial resistance [1].

Our study also found that **85.53%** of antibiotics used were broad-spectrum, while narrow-spectrum usage was **14.45%.** Broad-spectrum antibiotics target a wide range of organisms, killing harmful and beneficial bacteria, disrupting normal bacterial flora, and promoting resistant bacteria or opportunistic pathogens that grow unchecked in the human body. The empirical misuse of these broad-spectrum antibiotics facilitates the development of AMR. Because patients are becoming more resistant to antibiotics, physicians can cure only if broad-spectrum antibiotics are prescribed. Assessing antibiotics based on their spectrum of activity is an attempt to request physicians to limit the prescribing of broad-spectrum antibiotics. Their use can be reduced by performing culture and sensitivity tests in hospitals, which involve identifying the specific pathogen responsible for an infection, thereby helping in prescribing targeted antibiotics to the patients. Through this study, as mentioned in the list of hospital care indicators **(Table 4)**, no such tests are being conducted. Therefore, we suggest that hospital upgrade their functioning capability by conducting culture and sensitivity tests. This diagnostic tool helps physicians to reduce irrational prescribing of antibiotics and combat globally threatening AMR.

Table 3. WHO Prescribing Indicators of Antibiotics in a Tertiary Regional Hospital, India 2024 [3, 6, 8]

Prescribing Indicators	Total medicines or encounters	Average or Percentage	WHO Optimal Value
1) The average number of drugs prescribed per encounter	1581	7.5	≤ 3
2) Percentage of antibiotics prescribed per encounter	670	42.3%	≤ 30%
3) Percentage of antibiotics prescribed from the National Essential Drugs List (EDL) or the facility's formulary	670	49.85%	100%
4) Percentage of antibiotic prescriptions with the parenteral route via injections	442	66%	13.4%-24.1%
5) Percentage of antibiotics prescriptions through the oral route	228	34%	-
6) Percentage of drugs prescribed by generic name	1314	83.1%	100%
7) Percentage of antibiotics as monotherapy	335	50%	-
8) Percentage of antibiotics as dual therapy	236	35.3%	-
9) Percentage of antibiotics as triple therapy or more	99	14.7%	-
10) Percentage of antibiotics with Beta-lactamase inhibitors combination	268	40%	-
11) Percentage of antibiotics without any combinations	402	60%	-
12) Percentage of broad-spectrum antibiotic usage	573	85.53%	-

13)	Percentage of narrow-spectrum antibiotic usage	97	14.47%	-

Hospital and Patient Care Indicators

Assessing hospital performance was done using hospital and patient care indicators. This revealed that the hospital does not have a fully functional Drug and Therapeutic Committee (DTC) to evaluate, manage, and develop proper policies for drugs being used in the hospital. So, through our study, we recommend actively functional DTC in hospitals. There is a copy of the National Standard Therapeutic Guidelines (STG) and National Essential Medicine List (EML), but the hospital does not follow them. So, we recommend that hospitals function in compliance with national standards. We also recommend institutional EML or a list of hospital Formulary medicines, especially for infectious diseases, to avoid antimicrobial resistance. During our study period, the availability of essential antibiotics in the hospital was **65.2%,** which proves that some key antibiotics were not readily available. Not performing culture and sensitivity tests proves that all antibiotics were prescribed empirically.

Table 4. Hospital and Patient Care Indicators for Antibiotics in a Tertiary Regional Hospital, India 2024, Hospital [3]

Hospital Indicators	Results	Recommended
1) Presence of Drug Therapeutic Committee (DTC) in the hospital	Yes	Yes
2) The presence of a copy of the National Standard Therapeutic Guidelines (STG) in the hospital	Yes	Yes
3) Presence of Institutional STGs for infectious diseases	No	Yes
4) Presence of a copy of the National Essential Medicine List (EML)	Yes	Yes
5) Presence of institutional EML / Formulary List	No	Yes
6) Availability of essential antibiotics in the hospital during the study period	65.2%	100%
7) Culture sensitivity tests were performed for the prescribed antibiotics	No	Yes

In the hospital, we observe certain barriers adhering to hospital and patient care indicators. Through government support, training healthcare professionals, and including clinical pharmacists in ASPs, we can overcome these challenges. We propose some feasible steps the hospital can take to create Standard Therapeutic Guidelines. Firstly, form a multidisciplinary DTC, conduct baseline assessment studies, and then, through group discussions and survey results, establish evidence-based practices by using global and national standards as reference. Focus on tailoring the guidelines to local epidemiology, patient population, and resource availability. Ensure clear, concise, accessible guidelines and include diagnostic tools as a mandate to the patients while prescribing antibiotics. Hospitals should regularly be up-to-date with new evidence, shifts in resistance patterns, and feedback from clinical practice. Conduct pilot studies in selected departments and implement guidelines. Establishing monitoring and feedback mechanisms, such as an audit system to track adherence to STGs and patient outcomes [9]. With advancements in healthcare globally, countries such as India should begin integrating STGs into Electronic Medical Records, which facilitate the efficiency of healthcare services [3].

In India, the problem is that cultural and systemic factors significantly influence antibiotic prescribing practices. High patient expectations for prompt symptom relief often pressure healthcare providers to prescribe antibiotics, even for viral infections. Additionally, the easy availability of antibiotics without prescriptions in some settings contributes to misuse. Systemic challenges such as limited access to diagnostic facilities, time constraints in busy clinical practices, and inconsistent regulatory enforcement exacerbate inappropriate prescribing [10]. Cultural beliefs about medicine's potency and reliance on informal healthcare providers further complicate the issue, contributing to widespread AMR [11].

AWaRe Classification

In 2017 WHO Expert Committee developed the AWaRe classification for the Selection and Use of Essential Medicines. In this classification, antibiotics are classified into access, watch, and reserve groups. This categorization is updated every 2 years and serves as a tool for monitoring antibiotic consumption, establishing targets, and assessing the effects of antimicrobial stewardship initiatives globally [12]. In this study, 30% of antibiotics used were from the access group, 69.25% from the watch group, and 0.05% from the reserve group, as shown in **Table 5**.

Table 5. AWaRe Classification and percentage of Antibiotics prescribed in each group [12, 13]

Class of Antibiotic drugs and percentage	Drugs	(%) of Prescription	AWaRe group	Included in EML	Spectrum of antibiotics used
1) Penicillins (4%)	Piperacillin +Tazobactam	2%	Watch	Yes	Broad
	Amoxycillin + clavulanate	2%	Access	Yes	Narrow

2) Cephalosporins (61%)	Cefaperazone + Sulbactam	49%	Watch	No	Broad
	Ceftriaxone	8%	Watch	Yes	Broad
	Cefotaxime	3%	Watch	Yes	Broad
	Cefuroxime	0.05%	Watch	Yes	Broad
	Cefixime	0.6%	Watch	Yes	Broad
	Ceftazidime + Tazobactam	0.2%	Watch	Yes	Broad
	Cefixime + Clavulanic acid	0.05%	Watch	Yes	Broad
	Cefepime + Sulbactam	0.05%	Watch	No	Broad
	Cefpodoxime proxetil & K+ Clavulanate	0.05%	Watch	No	Broad
3) Nitroimidazoles (13%)	Metronidazole	12%	Access	Yes	Narrow
	Ornidazole	1%	Access	No	Broad
4) Aminoglycosides (9%)	Amikacin	8%	Access	Yes	Broad
	Gentamycin	1%	Access	Yes	Broad
5) Tetracyclines (6%)	Doxycycline	6%	Access	Yes	Broad
6) Macrolides (3%)	Clarithromycin	2.5%	Watch	Yes	Broad
	Azithromycin	0.5%	Watch	Yes	Broad
7) Quinolones (2%)	Ofloxacin	1%	Watch	Yes	Broad
	Ciprofloxacin	1%	Watch	Yes	Broad
8) Carbapenems (1.2%)	Meropenem	1.2%	Watch	Yes	Broad
9) Anti-viral drugs (0.4%)	Acyclovir Oseltamivir	0.3% 0.1%	- -	- -	Narrow Narrow
10) Anti-T.B. drugs (0.1%)	Forecox (Rifampicin + Isoniazid + Pyrazinamide 5+ Ethambutol)	0.2%	-	-	
11) Antifungal drugs (0.1%)	Fluconazole	0.1%	-	-	Broad
12) Others (0.1%)	Faropenem	0.05%	Reserve	No	Broad
	Vancomycin	0.05%	Watch	Yes	Narrow

Table 5 summarizes the Antibiotics based on AWaRe Classification, WHO Model List of Essential Medicines (EML), and the Spectrum of antibiotics [12, 14].

According to the WHO AWaRe classification, access group antibiotics should be the first choice for common infections due to their lower resistance potential and constant availability. The WHO's 13th General Programme of Work (2019-2023) recommends that at least **60%** of a nation's antibiotic use should be from the access group. However, the study shows only **30%** usage from this group, highlighting the need for increased usage. The high usage **(69.25%)** of watch group antibiotics should be used judiciously due to the higher resistance potential. This is a questionable scenario and raises concerns in the Indian healthcare system. This indicates that current prescribing practices may contribute to antimicrobial resistance. The reserve group of antibiotics, constituting only **0.05%** of use, are last-resort drugs and meant for limited, critical use against multidrug-resistant organisms to maintain their effectiveness. High cost is one of the reasons for the limited availability of these drugs in healthcare settings. Their minimal use is deliberate and guided by public health priorities. Hospitals must prioritize increasing access to group usage and judiciously manage watch and reserve group antibiotics to align with WHO recommendations and combat resistance.

Based on these study findings, deviations from the WHO guidelines are observed in the regional hospital, which is why implementing appropriate antimicrobial stewardship (ASP) policies is necessary. The ASP policy development is a strategic approach to optimizing the use of antibiotics and other antimicrobial medications. It involves establishing definite protocols such as hospital guidelines for empiric and targeted antimicrobial prescribing, tailoring therapy based on culture results or patient-specific factors, reviewing the appropriateness of therapy, educating and training healthcare providers about AMR, and working with infection control

teams are some such policies. Hospitals at the regional level in India should follow a set norm of normative practices to ensure optimal medication use. Only a few studies are available to assess antibiotic prescribing practices at the regional level in India. We hope that this study might serve as a better exemplification of the need for continuous drug therapy monitoring in hospitals and serve as a source for other researchers who are interested in performing such studies. Researchers in hospitals, medical professionals, or hospital administrators in every nation should begin to assess the status of their hospital prescribing practices to determine whether they are currently adherent to standard therapeutic guidelines, especially concerning antibiotics [13, 15].

Conclusion

This study concludes that hospitals in India are struggling with diagnostic challenges, limited use of narrow-spectrum agents, and poor regulation, especially at the regional level. The problem is that changing each hospital administration is exceedingly difficult due to a lack of incentives in India's healthcare system. This challenge can be solved through coordination, collaboration, communication, and teamwork among healthcare professionals, doctors, nurses, and pharmacists within the hospital. Also, emphasizing the creation of institutional drug policies and enhancing healthcare staff training contribute to solving the problem. Involving clinical pharmacists in reviewing prescriptions and monitoring the emergence of antibiotic resistance among patients might also help to overcome this problem. Encouraging and guiding students in medical fields to perform studies in each regional healthcare setting will be cost-effective and help to evaluate antimicrobial drug usage. Such studies help healthcare facilities to implement needful antimicrobial stewardship programs. The volume and appropriateness of antibiotic use in hospitals vary between countries, hospitals, and physicians. As a global community, it is essential that we now stop discussing and move beyond the antimicrobial resistance problem by implementing solutions. These problems can be reduced by intensifying national and international cooperation concerning antibiotic use and antimicrobial resistance, as well as by focusing on strengthening the healthcare system.

Limitations of the Study

Our study has certain limitations. Firstly, excluding pediatrics and pregnant populations from research studies leads to gaps in knowledge and suboptimal healthcare outcomes for these populations. This study examined the antibiotic prescribing practices in a single hospital. Thus, the study's results cannot be generalized to all hospitals in India. Also, the conclusions of our research do not cover the entire healthcare system practices in India.

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