A Study of Prescribing Pattern of Antibiotics in a Tertiary Care Hospital: A Prospective Observational Study

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ABSTRACT
BACKGROUND: Antimicrobial agents are the most significant contribution to the 20th century and are used to treat and prevent infections. The widespread use of antimicrobials has contributed to the emergence of resistance. Antibiotic resistance is not just a problem for the individual patient; it also reduces the effectiveness of established treatments and has become a serious threat to public health, increasing the complexity and cost of treatment and reducing the likelihood of a successful outcome.

OBJECTIVE: The primary objective was to investigate the antibiotic prescribing pattern in a tertiary care hospital to assess antibiotic prescribing practices.

METHOD: A prospective observational study involving the evaluation of antibiotics prescribed in a tertiary care hospital. Information on 150 patients was collected from the ward. Patients aged 18 years and older with or without comorbidities were included in the study, while patients under 18 years, surgical ward, pregnant and lactating women were excluded. The study lasted six months, and the collected data were analyzed using statistical methods.

RESULT: According to the inclusion and exclusion criteria, 150 patients were included in this study, of which 52 (35%) were male and 98 (65%) were female. The maximum number of patients was in the age group 41-60 (36%). The mean age of the study population was found to be 48.6 years. The comment diagnosis leading to the prescription of antibiotics was acute gastroenteritis in 37 (23%), followed by UTI in 29 (18%) and LRTI in 26 (16%). The most commonly prescribed antimicrobial drugs were Cephalosporins 157 (45%). Of 157 Cephalosporins, 87 (53%) patients were prescribed ceftriaxone (3rd generation), which was widely prescribed. In this study, 20 (13.3%) prescriptions were used as monotherapy, followed by 64 (42.6%) as dual therapy, 47 (31.3%) as triple therapy, and 19 (12.6%) as more than 3 antibiotic regimens. Most antimicrobials were given by injection (56%), indicating the severity of infections.

CONCLUSION: In our study, most prescriptions included dual antibiotics. Among the 150 prescriptions, it was found that antibiotics of the cephalosporin class were most often prescribed, and among the majority, ceftriaxone was the most popular drug.

KEYWORDS: Antibiotics, Antibiotic resistance, Antimicrobial resistance, prescribing pattern, irrational use

I. INTRODUCTION

The era of antibiotics started with the discovery of Penicillin by Alexander Fleming in 1928. Interestingly, Alexander Fleming himself also sounded off the concept of antimicrobial resistance during his Nobel lecture in 1945 [1]

In developing countries like India, where infectious disease load is high, antibiotics are among the most commonly used drugs. [2] Antibiotics have effectively prolonged the life expectancy. Antibiotics are currently the most widely prescribed drugs in hospitals worldwide. [3]

The emergence of multidrug resistance has become a life-threatening challenge in medicine. The introduction of antibiotics significantly changed the outlook for patients with bacterial infections. Nonetheless, the excessive and indiscriminate application of these remarkable medications in both human and veterinary settings has given rise to the emergence of antibiotic-resistant "superbugs," posing a threat to their effectiveness. [4]

The Centers for Disease Control and Prevention estimates that more than 100 million antibiotic prescriptions are written annually in the ambulatory care setting. [5]

Antibiotic resistance is not only a problem for the individual patient; it also reduces the effectiveness of established treatment and has become a significant threat to public health by increasing the complexity and cost of treatment and

reducing the probability of a successful outcome. Therefore, efforts are needed to counteract the growing problem of anti-microbial resistance. [6]

The emergence of antimicrobial resistance is a complex problem driven by many interconnected factors, particularly the use and misuse of antimicrobials. The interplay of knowledge, expectations and interactions of prescribers and patients, economic incentives, characteristics of the health system and the regulatory environment influence antimicrobial use. The intensity of the use of restricted antibiotics is higher in hospitals, although most antimicrobial usage occurs within the community. Hence, it is crucial to develop integrated approaches to improve the judicious use of these restricted antibiotics and thereby reduce the incidence of the spread of resistant bugs in the hospital. [7]

Irrational use of medicine results in severe morbidity and mortality and an additional economic burden, reducing the quality of the drug and, thereby, wastage of resources, increased treatment cost, increased risk for adverse drug reaction and the emergence of resistance. [8]

In medical practice, drug prescribing is crucial and directly affects patient belief in the health care system. Prescribing drugs depends on the practitioner's training and attitude toward the cure of a disease. [9] An antimicrobial stewardship program entails organized measures to enhance and assess antimicrobials' responsible utilization. This is achieved by advocating for the optimal selection of antimicrobial drugs, their appropriate dosage, duration of treatment, and administration method. Two central components of antimicrobial stewardship involve preauthorization and controlled utilization of potent antibiotics.

To mitigate antimicrobial resistance in hospitalized patients, it is advisable to implement strategies such as monitoring antimicrobial usage and assessing prescription practices. The prescription patterns mirror the physician's grasp of the disease and consider the patient's medical history. The current study aims to illustrate how antibiotics are prescribed for various clinical conditions within a tertiary care hospital.

II. OBJECTIVES
- To analyze the total number of antibiotics prescribed per prescription.
- To Estimate the percentage of most frequently prescribed antibiotics.
- To determine the route of administration of the antibiotic.

- To determine the pattern of antibiotic use in the hospital.
- To determine the disease pattern of the study population.

III. MATERIALS AND METHODS
3.1 STUDY DESIGN
This was a prospective observational study.

3.2 DURATION OF STUDY
The total duration of the study was six months, of which 3 months were for data collection and 3 months for data analysis and compilation.

3.3 NUMBER OF PATIENTS AND STUDY SITES
A total of 150 patients participated in the study.
This single-site study involved patients from BAPS PRAMUKH Hospital, Surat, Gujarat.

3.4 METHODOLOGY
The study was conducted according to ICH-GCP guidelines. Important documents such as protocol, data collection, and case report forms were submitted to the ethics committee for approval.

The investigation continued after clearance. This study was intended to be prospective and illustrative. This study evaluates antibiotics prescribed in the inpatient ward of BAPS HOSPITAL SURAT over three months, i.e. from November 2022 to February 2023.

The primary objective was to determine the pattern of antibiotic prescriptions in a tertiary care hospital. To assess the frequency of use and prescription of antibiotics.
150 participants took part in the study.
The main criteria for patient selection were patients aged 18 years and older with or without comorbidities in the ward.

3.5 PROCEDURE
The study aimed to observe the antibiotic prescription pattern in tertiary care hospitals. For this, the patient's care sheet was carefully monitored until the patient was discharged.

The necessary information was collected from the patient case form to the case report form in the study. Data collection included patient demographic information, medication chart information, and laboratory reports.

Statistical analysis was performed by finding the mean and determining the percentage. The study revealed the most commonly prescribed

antibiotic in the hospital. Based on statistics, it was concluded that cephalosporins were the most prescribed antibiotics.

3.6 STUDY DURATION
The study duration was 3 months for data collection and 3 months for data analysis and compilation.

3.7 STUDY POPULATION
150 people participated in the study.

3.8 INCLUSION & EXCLUSION CRITERIA
INCLUSIONCRITERIA:
• Age 18 years and above, with or without co-morbidities.

• In-patient department

EXCLUSIONCRITERIA:
• Under 18 years of age
• Surgical department
• Pregnant women
• Lactating women.

IV.   RESULT:
4.1 PATIENT DEMOGRAPHIC:
A) GENDER DISTRIBUTION
According to the inclusion and exclusion criteria, 150 prescribers were included in this study, of which 52 (35%) were male, and 98 (65%) were female.

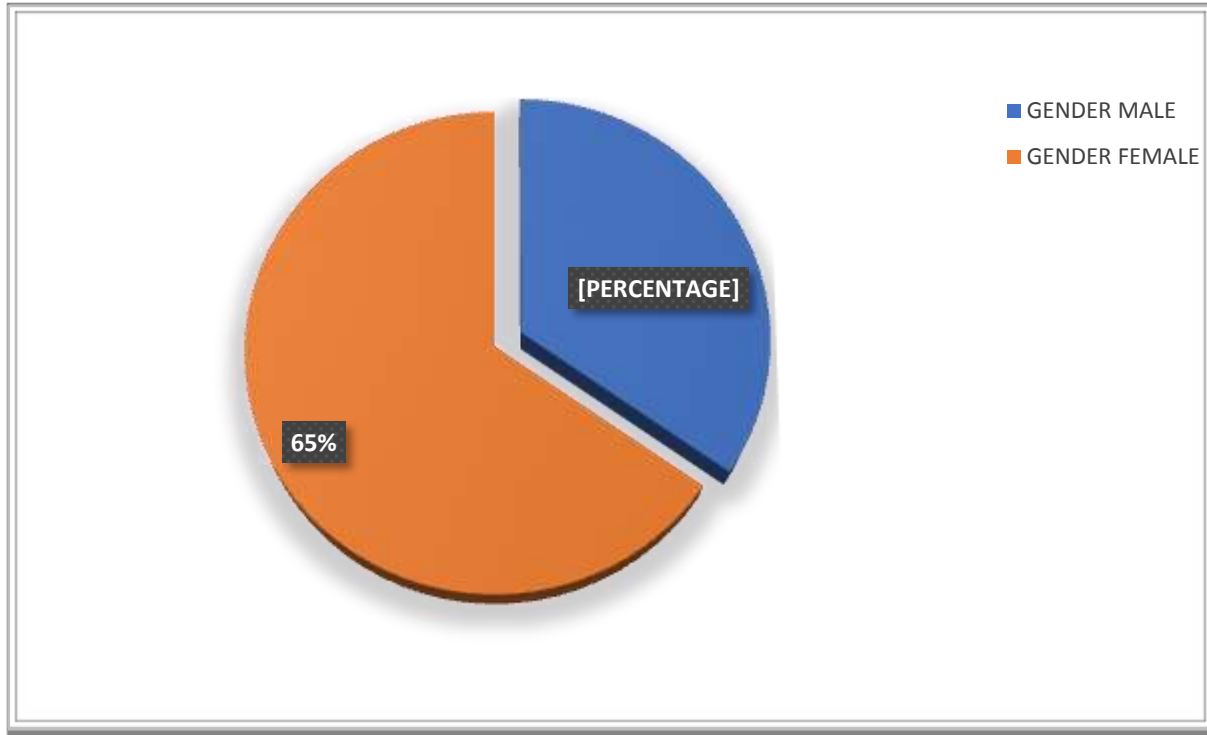| GENDER	NUMBER	PERCENTAGE
MALE	52	35%
FEMALE	98	65%

TABLE 5- GENDER DISTRIBUTION
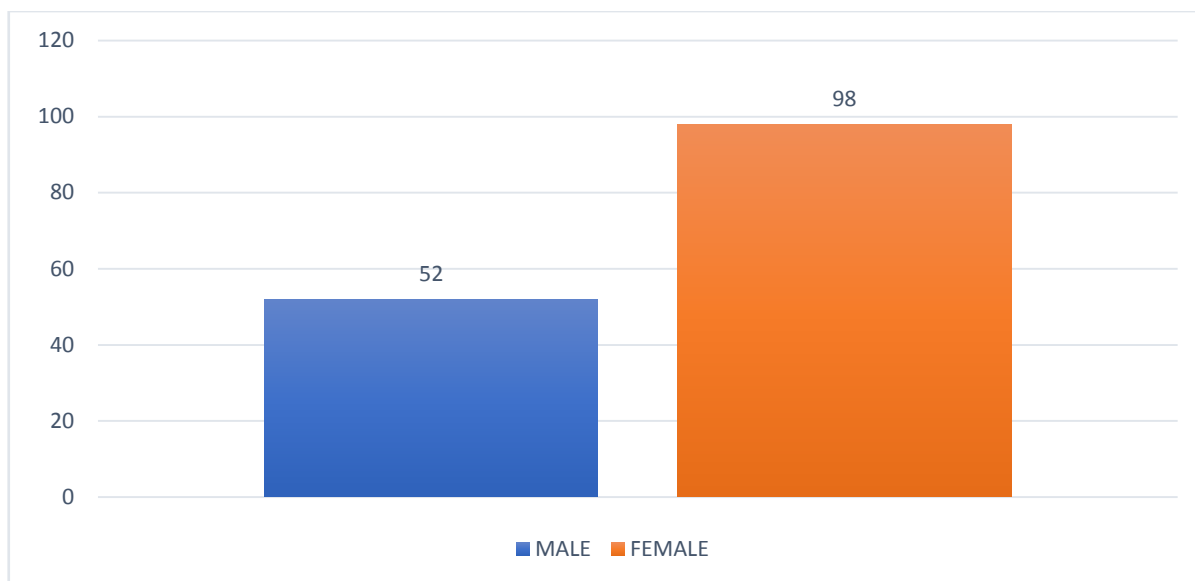
FIGURE 6 - GENDER DISTRIBUTION

FIGURE 7 – GENDER IN PERCENTAGE

B) AGE CATEGORIZATION

The study group was divided by age. There were 51 (34%) patients in the age group 18–40, 54 (36%) in the age group 41–60, and 45 (30%) in the age group >60. The maximum number of patients was 41-60 years old (36%). The mean age of the study population was found to be 48.6 years.

TABLE 6- AGE CATEGORIZATION

AGE-GROUP	NUMBER OF PATIENTS	PERCENTAGE
18-40	51	34%s
41-60	54	36%
>60	45	30%
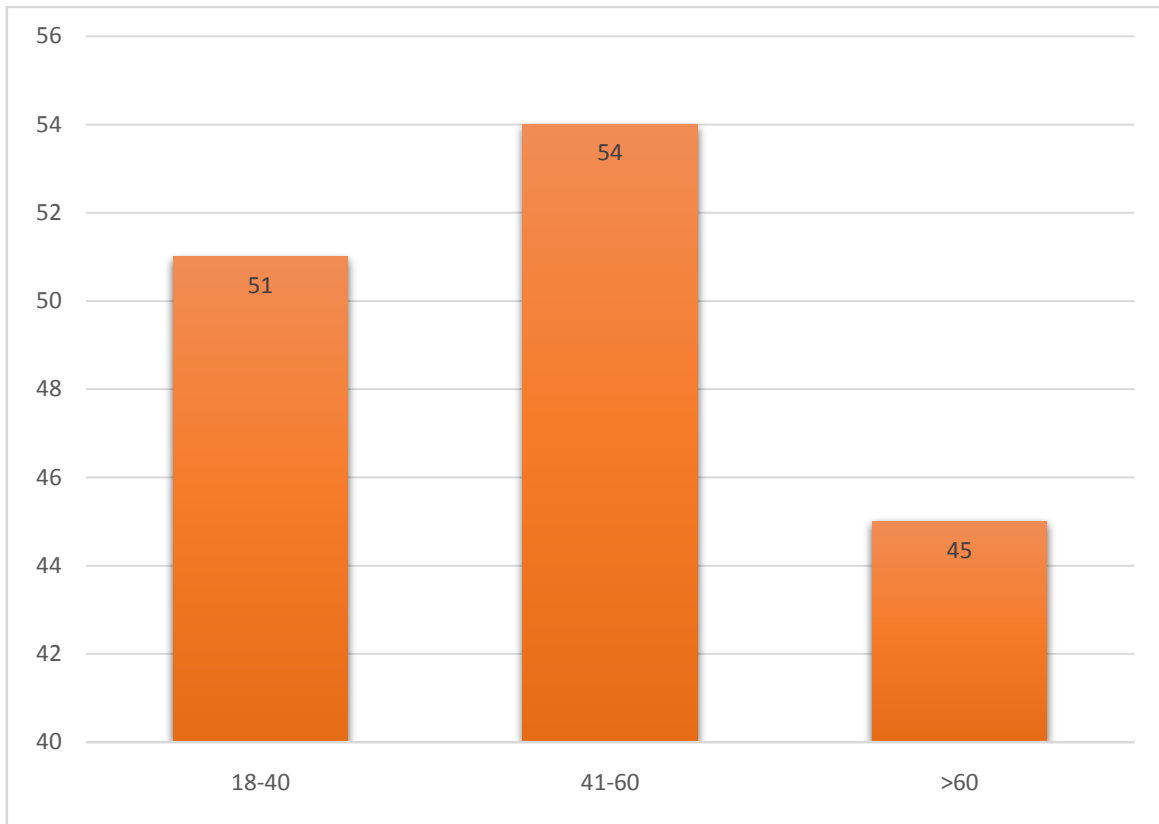
FIGURE 8 – AGE CATEGORIZATION
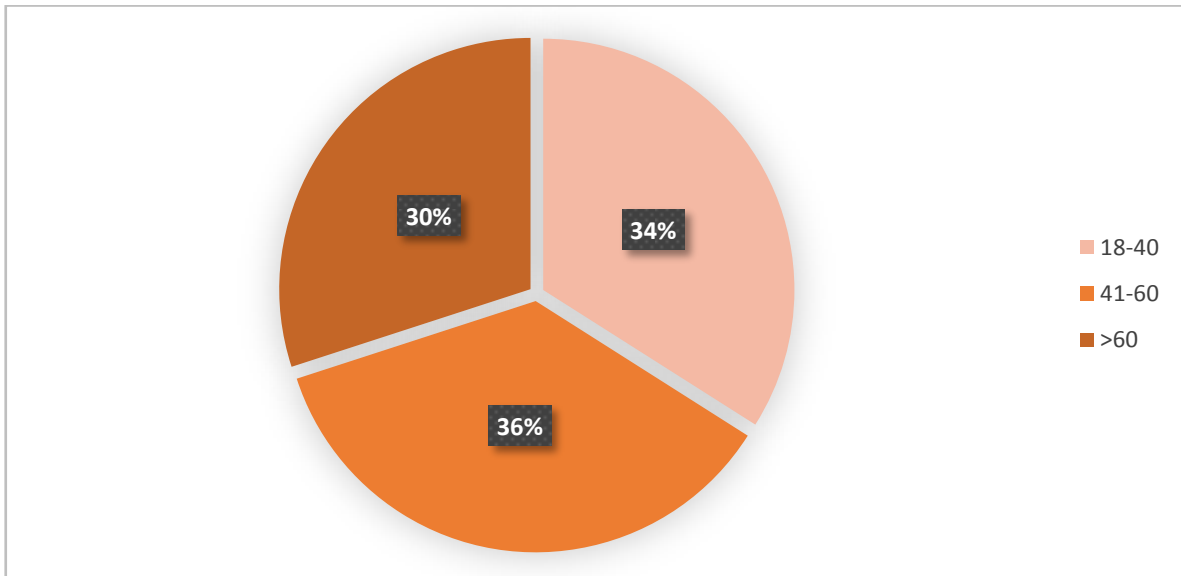
FIGURE 9 – PATIENT'S AGE IN PERCENTAGE

4.2 DIAGNOSIS CATEGORIZATION:

All study populations were classified according to their diagnosis, for example acute gastroenteritis 37 (23%), UTI 29 (18%), LRTI 26 (16%), gastritis 21 (13%), bronchitis 9 (6%), pyelonephritis 8 (5%), urosepsis 4 (3%), pancreatitis 4 (3%), cellulitis 4 (3%), PTB 3 (2%), enterocolitis 3 (2%), acute infectious colitis 3 (2%) and others listed. The diagnosis of the comment

that led to the prescription of antibiotics was acute   gastroenteritis.

TABLE 7- DIAGNOSIS CATEGORIZATION

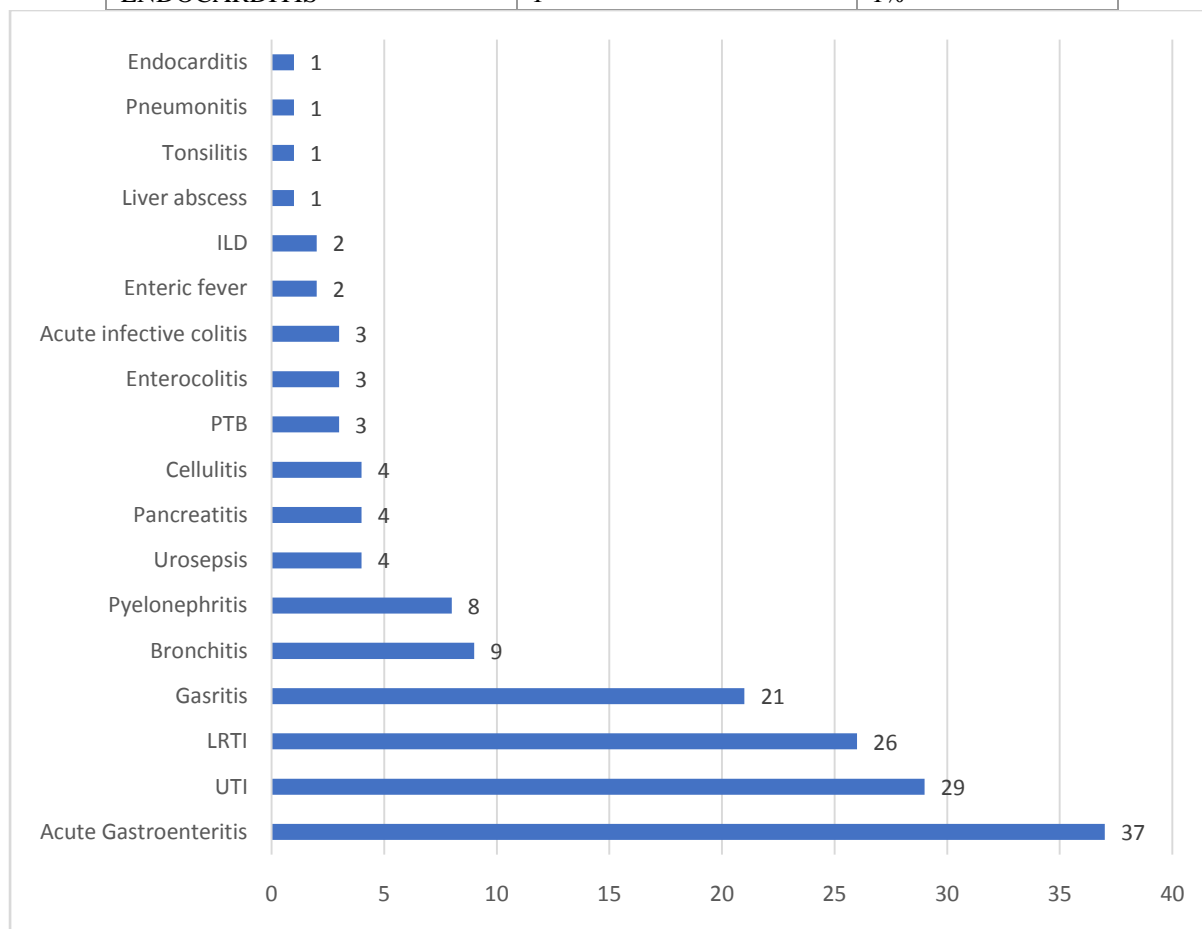| DIAGNOSIS	NUMBER OF CASES	PERCENTAGE
ACUTE GASTROENTERITIS	37	23%
UTI	29	18%
LRTI	26	16%
GASTRITIS	21	13%
BRONCHITIS	9	6%
PYELONEPHRITIS	8	5%
UROSEPSIS	4	3%
PANCREATITIS	4	3%
CELLULITIS	4	3%
PTB	3	2%
ENTEROCOLITIS	3	2%
ACUTE INFECTIVE COLITIS	3	2%
ENTERIC FEVER	2	1%
ILD	2	1%
LIVER ABSCESS	1	1%
TONSILITIS	1	1%
PNEUMONITIS	1	1%
ENDOCARDITIS	1	1%

FIGURE 10 - DIAGNOSIS CATEGORIZATION

4.3 ANTIBIOTIC PRESCRIPTION:

In this study, 157 (45%) patients were prescribed cephalosporins, then 65 (19%) beta-lactam-beta-lactamase inhibitors, 37 (11%) macrolides, 28 (9%) Nitroimidazole, 14 (4%) fluoroquinolones, 11 (3.1%) aminoglycosides, 10 (2.8%) Cefixime-ornidazole, 8 (2.2%) Carbapenems, 7 (2%) Rifaximin, 4 (1.1%) Oxazolidinones, 3 (1%) urinary antibiotics and other antibiotics.

TABLE 8- ANTIBIOTICS PRESCRIBED

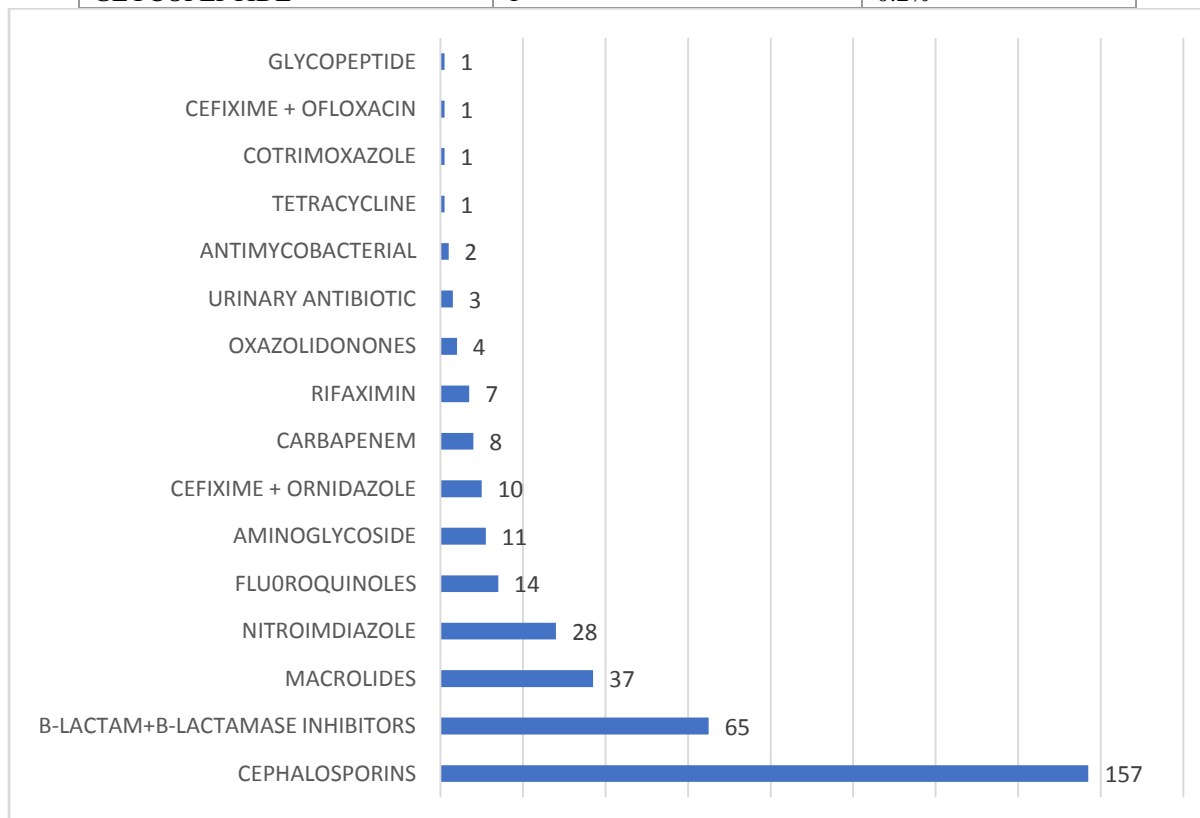| ANTIBIOTIC	NUMBER OF ANTIBIOTICS	PERCENTAGE
CEPHALOSPORINS	157	45%
B-LACTAM + B-LACTAMASE INHIBITORS	65	19%
MACROLIDES	37	11%
NITROIMIDAZOLE	28	8%
FLUOROQUINOLONES	14	4%
AMINOGLYCOSIDES	11	3%
CEFIXIME + ORNIDAZOLE	10	3%
CARBAPENEM	8	2%
RIFAXIMIN	7	2%
OXAZOLIDONONES	4	1%
URINARY ANTIBIOTIC	3	1%
ANTI-MYCOBACTERIAL	2	1%
TETRACYCLIN	1	0.2%
CO-TRIMOXAZOLE	1	0.2%
CEFIXIME + OFLOXACIN	1	0.2%
GLYCOPEPTIDE	1	0.2%

FIGURE 11 – NUMBER OF ANTIBIOTICS PRESCRIBED

The Most commonlyprescribed antimicrobials were Cephalosporins, followed by beta-lactam+ Beta-lactamaseinhibitors, macrolide, and Nitroimidazole. Of 157 Cephalosporins, 87 (53%) patients were prescribed Ceftriaxone (3rd generation), which was widely prescribed.

TABLE 9- CEPHALOSPORINS CLASS

CEPHALOSPORIN DRUG	NUMBER OF DRUGS	PERCENTAGE
CEFTRIAXONE	84	53%
CEFIXIME	55	35%
CEFUROXIME	7	4%
CEFOPERAZONE	4	3%
CEFDITOREN	3	2%
CEFOTAXIME	3	2%
CEFPODOXIME	1	1%
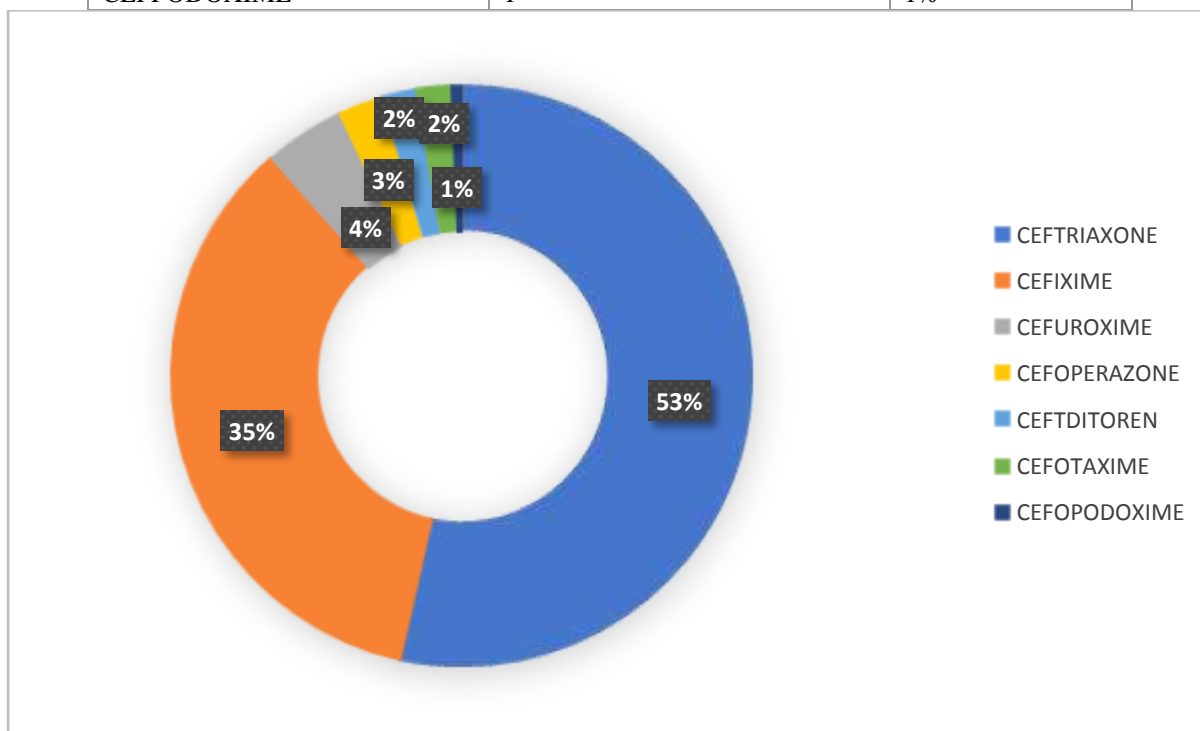
FIGURE 12 - CEPHALOSPORINS CLASS

4.4 PATTERN OF ANTIBIOTIC USE IN THE STUDY POPULATION:

Of the 150 prescriptions included in the study, 20 (13.3%) were used as monotherapy, 64 (42.6%) as dual therapy, 47 (31.3%) as triple therapy, and 19 (12.6%) as more than 3 antibiotic prescriptions. therapy

TABLE 10- PATTERN OF ANTIBIOTICS USE

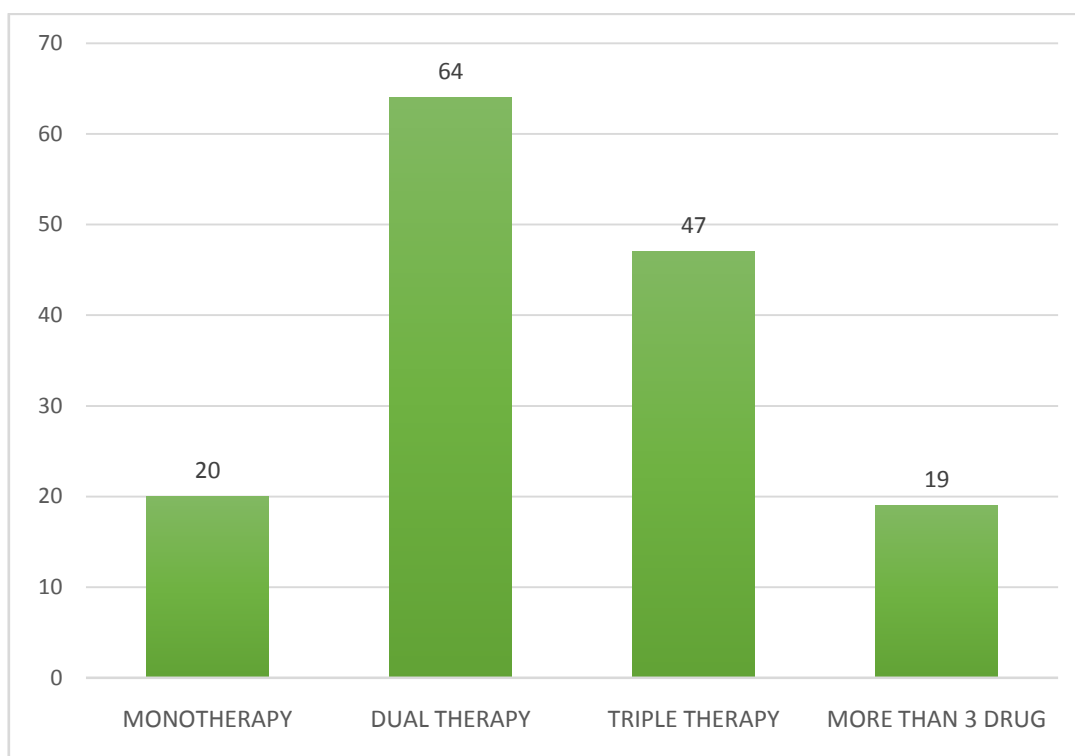| DRUG PATTERN	NUMBER
MONO THERAPY	20
DUAL THERAPY	64
TRIPLE THERAPY	47
MORE THAN 3 DRUG	19

FIGURE 13 – PATTERN OF ANTIBIOTICS USE

4.5 ROUTES OF ADMINISTRATION OF ANTIBIOTICS

The most commonly used form of antibiotic was injection (56%), followed by oral (43%).

TABLE 11-ROUTES OF ADMINISTRATION

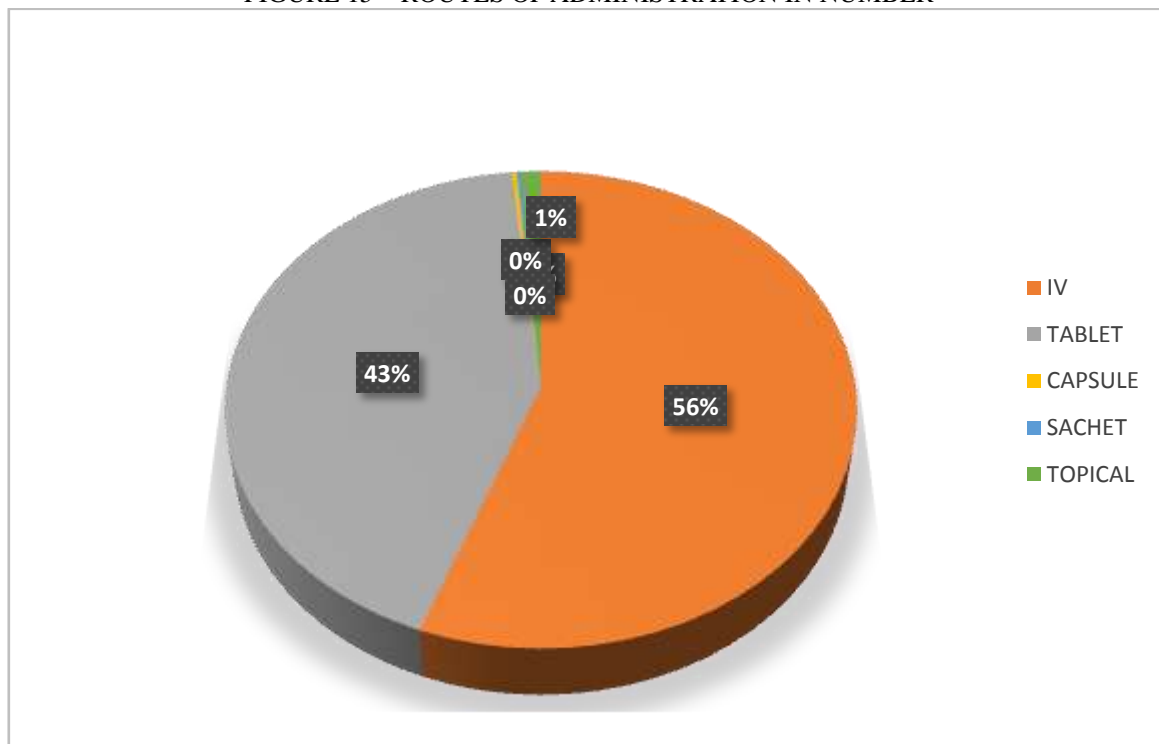| DOSAGE FORM	NUMBER OF DRUGS	PERCENTAGE
IV	205	56%
TABLET	157	43%
CAPSULE	1	0.0
SACHET	1	0.0
TOPICAL (CREAM)	4	1%
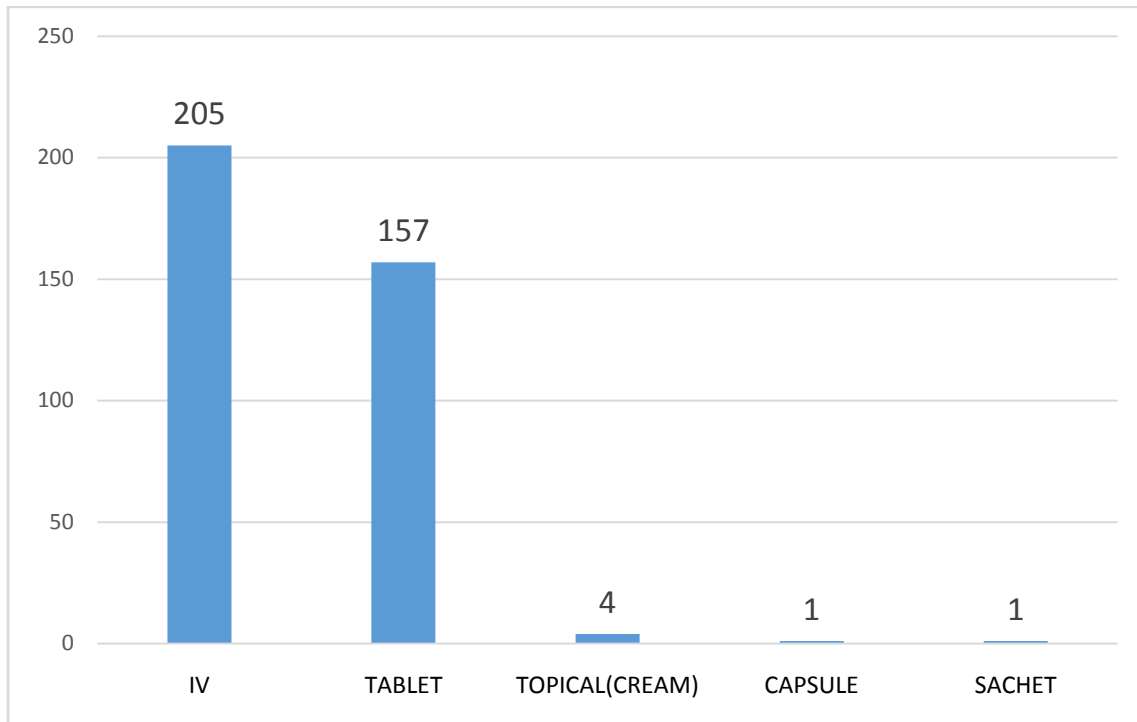
FIGURE 15 – ROUTES OF ADMINISTRATION IN NUMBER

FIGURE 16: ROUTES OF ADMINISTRATION IN PERCENTAGE

V. DISCUSSION

Prescribing surveillance studies are essential to obtain information about consumption patterns and quality, determinants of drug use and outcomes of use. Antibiotics are considered to be the most commonly prescribed drugs in the world. Most infectious diseases can be treated with antibiotic therapy [10]

Examining antibiotic prescribing patterns is an effective way to consider the appropriateness of antibiotic use. In addition, it can help reduce treatment costs, minimize polypharmacy, and improve the rational use of antibiotics [11].

This study investigated the antibiotic prescriptions of patients in tertiary care hospitals. This study analyzed the pattern of antimicrobial prescriptions based on 150 prescriptions. There were more female patients than male patients. Most of the patients belonged to the age group of 41-60 years. The mean age of the study population was 48.6 ± 17.84 years.

In our study, the average length of hospital stay was 3.98 ± 1.48 days, shorter than the previous study, where the average length of hospital stay was 5.48 ± 4.28 days.[13]

In our study, cephalosporin was the most frequently prescribed antimicrobial, followed by beta-lactam-beta-lactamase inhibitors. This may be because cephalosporin is a broad-spectrum antimicrobial agent that is effective against most organisms with a convenient dosing schedule and fewer side effects; therefore, they are prescribed more often. This may be one reason for the increase in cephalosporin resistance. Beta-lactam Beta-lactamase inhibitors were the most common antibiotic in our study. The most common antimicrobial in our study was ceftriaxone (53%), a third-generation injectable cephalosporin susceptible to a wide range of organisms, with Cefixime (35%) being the most common cephalosporin.

The average number of drugs per person is an essential index of prescription control. The average number of drugs per prescription should be kept as low as possible. Higher numbers always increase the risk of bacterial resistance and hospital costs. In our study, the average number of drugs per prescription was 2.41, less than the previous study, where the number of antimicrobials per prescription was 5.1. The number of antimicrobial prescriptions should be low to avoid the development of antimicrobial resistance.

Most antimicrobials were given by injection (56%), indicating the severity of infections. This was similar to previous studies where most antimicrobial agentswere administered via the IV route. Most prescriptions were collected from hospital wards, which may be why more injectable drugs were prescribed.

In this study, the majority of the study population, i.e., 23% (37) of patients, were diagnosed with acute gastroenteritis, followed by 18% (29) of patients diagnosed with urinary tract infection and 16% (26) of patients diagnosed with LRTI.

VI. CONCLUSION

Prescribing model studies have become a potential tool for health system evaluation. The spread of antimicrobial-resistant bacteria worldwide is a significant problem, and it is the responsibility of physicians to develop good prescribing practices that help reduce the severity of the problem. Antibiotic resistance is increasing alarmingly, increasing morbidity, mortality and medical costs. A critical factor in antibiotic resistance development is inappropriate antibiotic use. In our study, most prescriptions contain dual antibiotics.

Among the 150 prescriptions, it was found that antibiotics of the cephalosporin class were most often prescribed, and among the majority, ceftriaxone was the most popular drug.

The Areas that need further research and improvement include:

1. Making recommendations for choosing an empiric antibiotic for critically ill patients and those infected with MDR organisms.
2. Failure to follow/follow the recommendations of the microbiology group.
3. Perform additional checks on disposing of prescribed antibiotics according to microbiological reports and filling prescriptions based on antibiotic resistance.

VII. LIMITATIONS:

Our study has certain limitations. As the prescribing antibiotics patterns were investigated in a single hospital, the study's results cannot be generalized to all hospitals. As this study was conducted among inpatients, it may not represent outpatients.

ABBREVIATION
URTI – Upper respiratory tract infection
ICH-GCP- International Council for Harmonisation – Good Clinical Practice
UTI- Urinary tract infection

PTB- Pulmonary Tuberculosis
ILD- Intestinal Lung Disease
IV- Intravenous
MDR- Multi-Drug Resistance

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