



Assessment of Antibiotic Utilization Pattern & Antimicrobial Resistance in Hospitalized Patients

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ABSTRACT

Antibiotics play a vital role in the management of bacterial infections in hospitalized patients and are among the most frequently prescribed medications. However, the inappropriate, excessive, and irrational use of antibiotics has contributed significantly to the emergence of antimicrobial resistance (AMR), which is now recognized as a major global public health challenge. The increasing prevalence of resistant microorganisms has made the treatment of infections more difficult, leading to prolonged hospital stays, increased healthcare costs, and higher morbidity and mortality rates. The present study was conducted to assess the antibiotic utilization pattern and antimicrobial resistance among hospitalized patients. A retrospective observational study design was adopted, and data from 800 patients were analyzed. The dataset included patient demographic details such as age and gender, clinical diagnosis, antibiotic prescribed, dosage regimen, route of administration, frequency, duration of therapy, and culture sensitivity patterns. The collected data were systematically analyzed using Microsoft Excel with the help of pivot tables, charts, and graphical representations. The study concludes that irrational and excessive use of antibiotics contributes significantly to the development of antimicrobial resistance. Therefore, rational prescribing practices and implementation of antimicrobial stewardship programs are essential to control the rising trend of resistance.

Keywords: Antibiotic, Antimicrobial Resistance, Hospitalized Patients

1. INTRODUCTION

Antibiotics are among the most widely used therapeutic agents in the treatment of bacterial infections, especially in hospitalized patients. They have significantly reduced morbidity and mortality associated with infectious diseases and have become an essential part of modern healthcare. However, the irrational and excessive use of antibiotics has led to the emergence of antimicrobial resistance (AMR), which poses a serious threat to global health. In hospital settings, antibiotics are often prescribed empirically without adequate microbiological evidence. This practice, along with inappropriate selection of antibiotics, incorrect dosage, prolonged duration of therapy, and lack of adherence to treatment guidelines, contributes to the development of resistant microorganisms. As a result, infections become difficult to treat, leading to increased hospital stay, higher healthcare costs, and greater risk of complications. Antimicrobial resistance results in the inability of antibiotics to effectively treat infections caused by resistant microorganisms. This leads to treatment failure, prolonged illness, increased risk of complications, and higher mortality rates. Additionally, it increases the



economic burden on healthcare systems due to longer hospital stays and the need for more expensive and complex therapies.

The evaluation of antibiotic utilization patterns is an essential component of clinical pharmacy and healthcare management. Rational use of antibiotics is necessary to ensure effective treatment outcomes while minimizing the risk of resistance. Clinical pharmacists play a significant role in monitoring drug therapy, optimizing antibiotic use, and educating healthcare professionals and patients about the appropriate use of medications. In recent years, there has been increasing emphasis on antimicrobial stewardship programs, which aim to promote the judicious use of antibiotics and reduce the emergence of resistance. These programs involve regular monitoring of antibiotic prescribing patterns, evaluation of treatment outcomes, and implementation of guidelines to ensure appropriate use.

2. REVIEW OF LITERATURE

2.1 Overview of Related Work

Antibiotic utilization and antimicrobial resistance have been widely studied across the world due to their significant impact on public health. Numerous research studies have focused on evaluating prescribing patterns, identifying irrational use of antibiotics, and analyzing resistance trends in both hospital and community settings. Previous studies have shown that antibiotics are among the most frequently prescribed drugs in hospitals. However, inappropriate prescribing practices, including overuse of broad-spectrum antibiotics and lack of adherence to clinical guidelines, have been reported in many healthcare settings. These practices contribute significantly to the development of antimicrobial resistance. The growing concern regarding antimicrobial resistance has led researchers to emphasize the importance of monitoring antibiotic utilization patterns. Such studies help in identifying areas of misuse and support the implementation of antimicrobial stewardship programs.

2.2 Existing Research Studies

Several studies have been conducted to evaluate antibiotic usage patterns in hospitalized patients. A study conducted in a tertiary care hospital reported that broad-spectrum antibiotics such as ceftriaxone and amoxicillin-clavulanic acid were among the most commonly prescribed drugs. The study also highlighted that empirical therapy was frequently used without microbiological confirmation. Another study focusing on antimicrobial resistance patterns found that commonly used antibiotics such as ciprofloxacin and amoxicillin showed increased resistance rates. The study emphasized that frequent and inappropriate use of these antibiotics contributed to the emergence of resistant strains. . In addition, research studies have demonstrated that intravenous administration of antibiotics is more prevalent in hospitalized patients due to the severity of infections. However, prolonged use of intravenous antibiotics without timely switching to oral therapy has been identified as a concern. Overall, these studies can indicate that irrational antibiotic prescribing and lack of proper monitoring are major contributors to antimicrobial resistance (AMR).

2.3 Technologies and Solutions in Use

In recent years, various tools and technologies have been used to analyze antibiotic utilization patterns and resistance trends. Data analysis software such as Microsoft Excel, SPSS, and other



statistical tools are commonly used to organize, analyze, and interpret healthcare data. Microsoft Excel is widely used due to its simplicity and ability to handle large datasets. Features such as pivot tables, charts, and data filtering allow researchers to analyze patterns in antibiotic usage and resistance efficiently. These tools help in identifying trends such as frequently prescribed drugs, duration of therapy, and resistance rates. In addition to data analysis tools, hospital information systems and electronic health records (EHRs) have also been used to collect and manage patient data. These technologies improve the accuracy and accessibility of data, enabling better analysis and decision-making.

2.4 Gaps and Limitations in Current Solutions

Despite the availability of numerous studies on antibiotic utilization and antimicrobial resistance, several gaps and limitations still exist. Many studies are limited by small sample sizes, short study durations, and lack of comprehensive data. In some cases, studies do not include detailed information on dosage, duration, and frequency of antibiotic therapy. Another major limitation is the lack of correlation between antibiotic usage and resistance patterns. While some studies focus on prescribing patterns, others focus on resistance trends, but very few studies integrate both aspects effectively. Additionally, the absence of real-time microbiological data and culture sensitivity reports in many studies limits the accuracy of resistance analysis. This highlights the need for more comprehensive and integrated studies that combine antibiotic utilization. There is also a need for more standardized methodologies in antibiotic utilization studies. Variations in study design, data collection methods, and analysis techniques make it difficult to compare results across different studies.

3. MATERIALS AND METHODS

3.1 Study Design and Population

The present study was designed as a retrospective observational study to assess the antibiotic utilization pattern and antimicrobial resistance among hospitalized patients. A retrospective study involves the analysis of previously recorded data without direct involvement or intervention in patient treatment. This type of study is widely used in clinical and pharmaceutical research to evaluate real-world prescribing practices and identify trends in drug utilization. The observational nature of the study ensures that the data reflects actual clinical practices without any modifications. The study focuses on analyzing antibiotic prescribing behavior, utilization patterns, and resistance trends in a hospital setting. This approach helps in identifying irrational drug use and supports the development of strategies to improve patient care. The study population consisted of 800 hospitalized patients who were prescribed antibiotics during their course of treatment. In addition to the basic study framework, the retrospective observational design of the present study allowed for the evaluation of real-world antibiotic prescribing practices without influencing clinical decision-making. This approach is particularly useful in identifying patterns of drug utilization and understanding the practical challenges faced in hospital settings. The selection of hospitalized patients provided a comprehensive understanding of antibiotic usage in moderate to severe infections, where antibiotic therapy is more frequently required. Hospitalized patients often receive multiple drugs, including combination antibiotic therapy, which makes this population highly relevant



for studying drug utilization patterns and resistance development. Hospitalized patients were selected as the study population because they are more likely to receive antibiotic therapy due to the severity of infections. The hospital setting provides a suitable environment for evaluating antibiotic utilization, as it includes a wide range of clinical conditions and treatment practice. The inclusion of a diverse population enhances the reliability and generalizability of the study findings. Overall, the study design and population selection were appropriate for achieving the objectives of the study, as they provided a realistic and comprehensive overview of antibiotic prescribing practices and antimicrobial resistance patterns in hospitalized patients.

3.2 Data Collection and Variables

The data used in the present study was collected from hospital records and compiled into a structured dataset using Microsoft Excel. The dataset was organized in a tabular format, making it easier to analyze and interpret. The collected data included both demographic and clinical variables, which are essential for evaluating antibiotic utilization and antimicrobial resistance patterns. The parameters included in the dataset are as follows:

- **Age:** Represents the age group of the patient and helps in demographic analysis
- **Gender:** Used to analyze differences in antibiotic usage between male and female patients
- **Diagnosis:** Indicates the clinical condition or infection for which antibiotics were prescribed
- **Name of Antibiotic:** Identifies the drug used for treatment
- **Route of Administration:** Includes oral and intravenous (IV) routes.
- **Frequency of Dosage:** Includes OD (once daily), BD (twice daily), TDS (three times daily), etc.
- **Culture Sensitivity Pattern:** Categorized as Sensitive, Intermediate, or Resistant.
- **Date of Data Entry:** Helps in analyzing trends over time.
- **Duration of Therapy:** Indicates the number of days the antibiotic was administered.

The demographic variables, such as age and gender, played an important role in understanding variations in antibiotic prescribing patterns. Age-wise analysis helped in identifying whether certain age groups were more prone to receiving antibiotics, while gender-based analysis provided insights into differences in resistance patterns. The structured nature of the dataset enabled efficient data handling and analysis. By organizing the data into clearly defined variables, the study ensured that meaningful conclusions could be drawn from the analysis.

3.4 Data Processing, Analysis and Ethical Considerations

Before performing the analysis, the dataset was carefully processed and cleaned to ensure accuracy and consistency. Data cleaning is an essential step in research to eliminate errors and improve data quality.

Data Processing

The following steps were carried out:

- Removal of duplicate entries to avoid repetition
- Correction of spelling errors in drug names and diagnosis
- Standardization of data format for consistency



- Handling of missing or incomplete values by excluding unreliable records
- Verification of numerical values such as duration and frequency.

Data Analysis

The cleaned dataset was analyzed using Microsoft Excel, which provides efficient tools for organizing and interpreting data.

The following methods were used:

- **Descriptive Analysis:** Calculation of counts, percentages, and averages to summarize the data
- **Pivot Tables:** Used to analyze frequency of antibiotic usage, resistance patterns, and demographic distribution
- **Graphical Representation:** Bar charts, pie charts, and column charts were used to present data visually

Comparative Analysis: Comparison between variables such as:

- Drug vs resistance pattern
- Diagnosis vs antibiotic usage
- Gender vs resistance

Ethical Considerations: The study was conducted using secondary data obtained from hospital records without direct involvement of patients. Ethical standards were maintained throughout the study.

- Patient confidentiality was strictly preserved
- No personal identifiers such as names or contact details were included.
- Data was used only for academic and research purposes.

4. RESULTS

4.1 Overview Results

The present study analyzed data from 800 hospitalized patients to assess antibiotic utilization patterns and antimicrobial resistance. The dataset included demographic details, clinical diagnosis, antibiotic therapy, and culture sensitivity patterns. The analysis was performed using Microsoft Excel with the help of pivot tables and graphical representations. The results are presented in the form of tables and charts, followed by their interpretation to provide a clear understanding of antibiotic usage trends and resistance patterns. The use of Microsoft Excel for data analysis enabled systematic organization and interpretation of large volumes of data. Tools such as pivot tables and graphical representations helped in identifying patterns and trends in antibiotic usage. The results were categorized into different sections to provide a clear and structured understanding of the findings. Overall, the results provide a comprehensive overview of antibiotic utilization and resistance patterns, highlighting key areas where improvements in prescribing practices are required.

4.2 Antibiotic Utilization Pattern

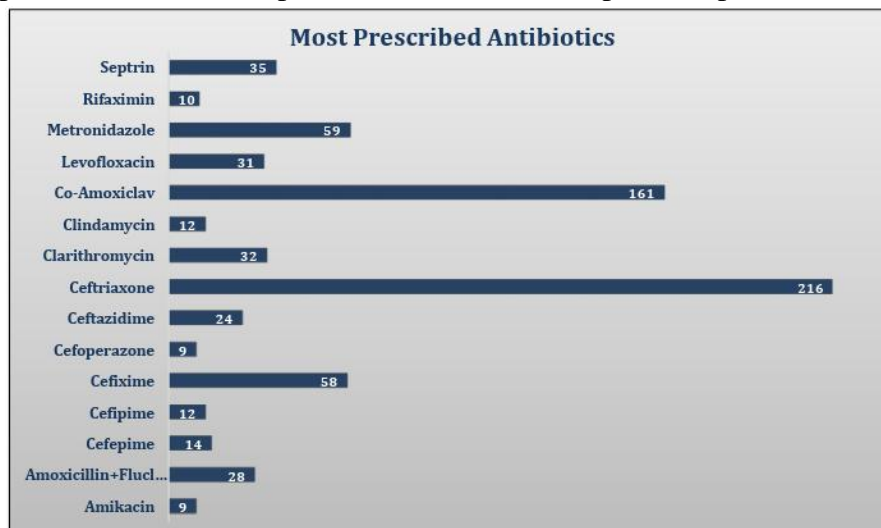
The analysis of antibiotic utilization patterns revealed that certain antibiotics were prescribed more frequently than others. Among the top prescribed antibiotics, Ceftriaxone was found to be the most commonly used drug, followed by CoAmoxiclav, Metronidazole, and Cefixime.

The high usage of Ceftriaxone indicates a strong reliance on broad-spectrum antibiotics in hospital settings. This may be due to its effectiveness against a wide range of bacterial infections and its frequent use in empirical therapy, especially in cases where immediate treatment is required. Co-Amoxiclav was also widely prescribed, reflecting its role in treating infections caused by both gram-positive and gram-negative bacteria. The use of combination antibiotics suggests an attempt to enhance therapeutic effectiveness and overcome resistance. The preference for broad-spectrum antibiotics, while beneficial in managing severe infections, may also contribute to the development of antimicrobial resistance if not used appropriately. Therefore, careful selection of antibiotics based on clinical guidelines and microbiological evidence is essential.

Table 1: Most Prescribed Antibiotics

Antibiotic (Top 15)	Total Use
Amikacin	9
Amoxicillin+Flucloxacillin	28
Cefepime	14
Maxipime	12
Cefixime	58
Cefoperazone	9
Ceftazidime	24
Ceftriaxone	216
Clarithromycin	32
Clindamycin	12
Co-Amoxiclav	161
Levofloxacin	31
Metronidazole	59
Rifaximin	10
Septtrin	35

Interpretation: The analysis of antibiotic utilization shows that Ceftriaxone (216 cases) was the most frequently prescribed antibiotic, followed by Co-Amoxiclav (161 cases). Other commonly used antibiotics included Metronidazole and Cefixime. The high use of these drugs indicates a preference for broad-spectrum antibiotics in hospitalized patients.



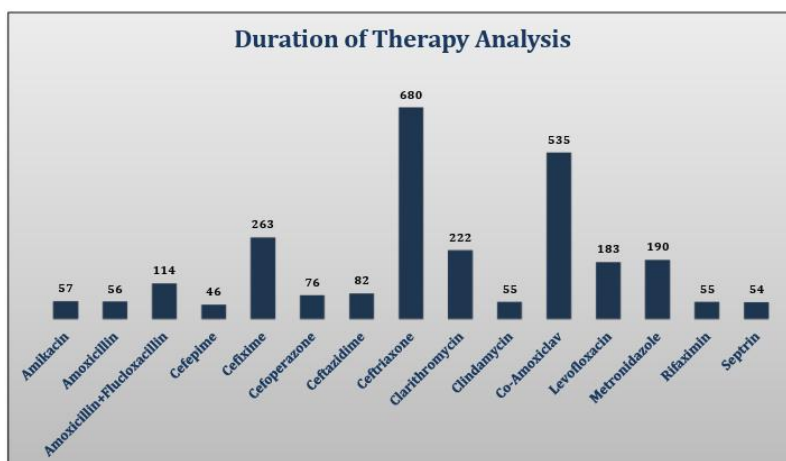
4.3 Duration of Therapy Analysis

The duration of antibiotic therapy varied significantly among different drugs. Ceftriaxone and Co-Amoxiclav were associated with the highest total duration of use, indicating prolonged treatment in many cases. Prolonged duration of antibiotic therapy is often necessary in severe or complicated infections; however, excessive use beyond recommended guidelines can lead to several issues, including increased risk of antimicrobial resistance, higher treatment costs, and potential adverse drug reactions. It is important to optimize the duration of therapy by following evidence-based guidelines and regularly reviewing patient response. Shortening the duration of therapy where appropriate can help in reducing the risk of resistance and improving overall treatment outcomes.

Table 2: Duration of Therapy by Antibiotics:

Antibiotics (Top 15)	Total Duration (days)
Amikacin	57
Amoxicillin	56
Amoxicillin+Flucloxacillin	114
Cefepime	46
Cefixime	263
Cefoperazone	76
Ceftazidime	82
Ceftriaxone	680
Clarithromycin	222
Clindamycin	55
Co-Amoxiclav	535
Levofloxacin	183
Metronidazole	190
Rifaximin	55
Seprin	54

Interpretation: The duration of therapy varied among different antibiotics. Ceftriaxone (680 days) and Co-Amoxiclav (535 days) showed the highest total duration of use. This indicates prolonged use of these antibiotics in hospitalized patients, which may increase the risk of antimicrobial resistance.





5. DISCUSSION

The present study was conducted to evaluate the antibiotic utilization pattern and antimicrobial resistance among hospitalized patients. The findings revealed that antibiotics are extensively used in hospital settings, particularly broad-spectrum antibiotics. Among the drugs analyzed, Ceftriaxone and Co-Amoxiclav were found to be the most frequently prescribed antibiotics. The high utilization of these antibiotics indicates a preference for empirical therapy, which is commonly practiced in hospital settings where immediate treatment is required, especially in severe infections. Broad-spectrum antibiotics are often chosen because they act against a wide range of microorganisms and provide quick therapeutic coverage. However, such practices, when not supported by culture sensitivity testing, may lead to inappropriate use. The findings of the present study are consistent with previous research, which has reported extensive use of cephalosporins and beta-lactam antibiotics in hospitalized patients. While these drugs are effective, their frequent and sometimes unnecessary use may contribute significantly to the development of antimicrobial resistance.

Therefore, it is important to ensure that antibiotic selection is based on clinical guidelines and microbiological evidence whenever possible. The high utilization of broad-spectrum antibiotics can be attributed to their ability to act against a wide range of microorganisms, making them suitable for initial therapy when the causative organism is unknown. However, this approach, if not supported by culture sensitivity testing, may lead to inappropriate use and contribute to the development of antimicrobial resistance. The over-reliance on empirical therapy highlights the need for improved diagnostic support and increased use of microbiological investigations. Rational selection of antibiotics based on clinical guidelines and laboratory evidence is essential to ensure effective treatment and minimize the risk of resistance. Similar findings have been reported in previous studies, where cephalosporins and beta-lactam antibiotics were among the most frequently prescribed drugs in hospital settings.

6. CONCLUSION

The present study was undertaken to evaluate the antibiotic utilization pattern and antimicrobial resistance among hospitalized patients using a retrospective dataset. The study included analysis of various parameters such as demographic characteristics, antibiotic prescribing patterns, route of administration, frequency and duration of therapy, and culture sensitivity patterns. These antibiotics were found to be the most frequently prescribed drugs, indicating a strong reliance on empirical therapy. This may be due to the urgent need for immediate treatment in hospitalized patients, especially in severe infections where waiting for culture reports may not be feasible. The analysis of route of administration showed that the intravenous (IV) route was more commonly used compared to the oral route. This reflects the severity of infections in hospitalized patients and the need for rapid onset of action. However, prolonged use of intravenous antibiotics without timely conversion to oral therapy may increase treatment cost and risk of complications.



6.1 Interpretation of Findings

The findings of the study suggest that antibiotic prescribing practices in hospital settings are largely influenced by the need for immediate and effective treatment. The preference for broad-spectrum antibiotics indicates that empirical therapy is commonly practiced. While this approach is beneficial in managing severe infections, it may also lead to overuse and misuse of antibiotics. The higher use of intravenous antibiotics reflects the clinical condition of hospitalized patients; however, it also emphasizes the need for timely de-escalation and switching to oral therapy when appropriate. The observed frequency and duration patterns suggest that antibiotics are often used aggressively, which may contribute to resistance if not properly monitored. The presence of antimicrobial resistance, particularly in commonly used antibiotics, highlights the consequences of irrational prescribing practices. These findings are consistent with previous studies, which have reported increasing resistance due to overuse of antibiotics. The antimicrobial resistance analysis indicated that commonly used antibiotics exhibited higher resistance rates, suggesting a direct relationship between frequent antibiotic use and the development of resistance. Although a considerable proportion of cases remained sensitive, the presence of resistance highlights a growing concern in clinical practice.

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