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Original Article

Comparing the Cost-Effectiveness of Antibiotics for LRTI's: A Hospital-Based Study in Pakistan

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ABSTRACT

Introduction: Cost-effectiveness analysis describes measurement of relative costs of drugs with their effectiveness. Antibiotics are one of highly consumed medicine in any hospital especially rural areas have high discrepancy among antibiotic utilization. **Objectives:** To evaluate the cost-effectiveness of commonly used antibiotics for treating Lower Respiratory Tract Infections (LRTIs) at a secondary care hospital in Pakistan. **Materials and Methods:** A prospective observational study was designed to analyze cost-effectiveness among five most commonly consumed antibiotics. Study used percentage healing and symptom free days strategy to measure the effectiveness. It was conducted on 123 LRTI patients. Direct costs and effectiveness data were calculated using Data Collection Form. Five most common antibiotics: ceftriaxone, co-amoxiclav, piperacillin/tazobactam, amikacin, and moxifloxacin were selected as comparators. The comparison criteria were Cost Effectiveness Ratio (CER). **Key Findings:** Co-amoxiclav demonstrated the lowest CER at 13.998, indicating it as the most cost-effective option. Amikacin and Ceftriaxone followed, while Piperacillin/Tazobactam and Moxifloxacin exhibited higher CERs (49.563 and 26.569, respectively), showing less economic viability. Prescribing trends were found to be higher for ceftriaxone (*n*=56), followed by moxifloxacin (*n*=26). ICER Analysis of Piperacillin Tazobactam showed a possible increment of 232.32 PKR per unit of effectiveness. **Conclusion:** The study highlights Co-amoxiclav as the most cost-effective antibiotic for treating LRTIs in the evaluated hospital setting. The findings emphasize the importance of cost-effectiveness analysis in antibiotic selection to optimize healthcare resources and improve patient outcomes.

Keywords: Pharmacoeconomics, Cost-Effectiveness Analysis (CEA), Antibiotics, Pharmacy Practice.

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INTRODUCTION

Lower Respiratory Tract Infection (LRTI) results in significant morbidity and death globally, particularly among vulnerable populations. In 2019, there were 488.9 million recorded cases of Lower Respiratory Tract Infections (LRTI) globally, resulting in over 2.4 million fatalities.[1] Lower Respiratory Tract Infections (LRTIs) are the leading cause of death globally, especially in low- and middle-income countries where child malnutrition, solid fuel pollution, and poor sanitation are common risk factors.[2] Individuals under five and over sixty had an elevated incidence of lower respiratory tract infections. Despite the availability of immunizations, children may get very sick with Hemophilus influenzae and Streptococcus pneumoniae.[3] Respiratory infections also affect the elderly, particularly if they have comorbidities. This may lead to higher hospitalization and death rates from lower respiratory tract infections.[4] According to a study, infections need significant investments in long-term impairment costs as well as health systems and services, particularly in low- and low-middle-income nations.[5] Lower Respiratory Tract Infections (LRTIs) are more prevalent in rural Pakistan due to factors such as inadequate healthcare access and Antimicrobial Resistance (AMR). Pakistan is among the world's leading users of antibiotics, with a 65% increase from 2000 to 2015.[6] The extensive use of antibiotics and the ready accessibility of over-the-counter medications have expedited the propagation of Antimicrobial Resistance (AMR). *Streptococcus pneumoniae* and *Hemophilus influenzae* are responsible for numerous Lower Respiratory Tract Infections (LRTIs).[7] However, antibiotic resistance to ciprofloxacin and co-trimoxazole diminishes treatment efficacy and increases hospitalization and treatment failure rates.[8] Divergences in antibiotic prescription practices across healthcare settings diminish the cost-effectiveness of antibiotic treatment for LRTI patients. The majority of antibiotic misuse arises from clinical non-compliance and the lack of accessible laboratory tests for diagnosing bacterial infections.[9] In Pakistani tertiary care facilities, 31.6% of prescriptions use poly-antibiotics, sometimes without

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justification, contributing to increased expenses and antibiotic resistance.[10] This escalates healthcare expenditures and burdens resources. Limited cost-effectiveness studies on pharmacological treatments for lower respiratory tract infections are available in Pakistan. The economic effect of Antibiotic Stewardship (AS) on Antimicrobial Resistance (AMR) remains largely unexplored.[11] Most Cost-Effectiveness Assessments (CEA), particularly those addressing treatment non-compliance, primarily focus on direct treatment costs, neglecting the indirect costs of Antimicrobial Resistance (AMR), especially in countries with limited resources such as Pakistan. Pakistan has a lot of problems, like not being able to get prescriptions easily, a lot of people self-medicating, and people using antibiotics in the wrong way. These all contribute to antibiotic resistance and rising healthcare costs.[12] Various studies are available worldwide on cost-effectiveness analysis, which address one-versus-one analysis in a specific indication, such as the cost-effectiveness analysis of ceftriaxone vs. second-generation cephalosporin in treating pneumonia.[13] We were motivated to work on this topic because there is a lack of a comprehensive study that prospectively addresses the cost-effectiveness of multiple antibiotics in a specific indication, prescription patterns, and methodology in a hospital setting. This study aims to assess and identify the most cost-effective antibiotic for the treatment of lower respiratory tract infections within a continuing antibiotic regimen at a secondary care hospital in Pakistan. We employed a model to evaluate the cost and effectiveness of five principal antibiotics utilized throughout the study period.

MATERIALS AND METHODS

Study Setting

This study was performed at a secondary care facility in southern Punjab, Pakistan, from February 2024 to March 2024, using a time-based sampling approach.

Study Design

We designed an observational cost-effectiveness study according to the Pharmacoeconomics Analysis guidelines established by Rascati KL *et al*., and Jolicoeur *et al*.[14,15] These guidelines are commonly employed by researchers for the economic evaluation of pharmaceutical plans and therapeutic procedures. Numerous researches have utilized this model for cost analysis predictions.[16,17] In his study, Jolicoeur delineates ten fundamental procedures and criteria for evaluating pharmacoeconomic evaluations, which we adhered to in order to ensure the rigor of our method. Although the fundamental concept continued, we assessed the study employing a more accurate method, "Analysis via % healing and Symptom-Free Days (SFDs)." For this study, we examined each patient for data collection. We created a form in accordance with these principles and systematically gathered pertinent data from each patient.

Health Economics Plan

The study uses a Cost-Effectiveness Analysis (CEA) framework to compare the economic efficiency of five commonly prescribed antibiotics for Lower Respiratory Tract Infections (LRTIs) in a secondary care hospital in Pakistan. CEA was chosen because it allows effectiveness comparison with cost. The study was conducted from the patient perspective; it utilized direct costs such as medicine prices and administration costs. Indirect costs were not included due to data limitations. Hospitalization costs were not included because it was a public sector hospital. The study period was February 2024-March 2024. Since all costs and effectiveness outcomes occurred within this short timeframe, discounting was not applied. Costs included drug price (market retail price), administration costs (IV sets, syringes, etc.,) and hospital resource use (where applicable). Effectiveness measures included percentage healing (assessed via prescriber grading, lab results, and patient-reported symptoms) and Symptom-Free Days (SFDs) (number of days without LRTI symptoms post-treatment). The Cost-Effectiveness Ratio (CER) was calculated for each antibiotic by dividing the total treatment cost by effectiveness measures (healing %×SFDs). An Incremental Cost-Effectiveness Ratio (ICER) analysis was conducted to analyze the incremental costs. No predefined Willingness-To-Pay (WTP) threshold was used. ICER was used to evaluate the cost per unit of additional effectiveness. Due to data limitations, Probabilistic Sensitivity Analysis (PSA) was not performed. However, ICER analyses were performed to ensure the rigor (Figure 1).

Data Collection

We gathered case data via both manual and conventional procedures. We conducted separate visits with each subject to gather data. Using a structured data collection form, we gathered demographic information of patients, including name, age, gender, date of admission, primary symptoms at admission, diagnosis, supporting evidence for diagnosis, and planned treatment plan. Subsequently, we gathered patients' medication information about antibiotics, encompassing the drug, dosage, dosing type, frequency, duration, and rationale for selection-if accessible. Our research primarily focused on cost and outcome data. We gathered data on actual expenses, administrative costs, the healing rates of patient laboratory reports, symptom-free days, and the treatment of adverse drug responses. All patients engaged in the data gathering procedures; patient profiles were accessible at the patient bed desk and nursing monitoring room, with the charge pharmacist and charge nurses facilitating data collection.

Patient Selection Criteria

This study included hospitalized patients receiving multiple antibiotics for LRTIs. We excluded patients without any possible infection and those without a diagnosis of Lower Respiratory Tract Infections (LRTIs). We also excluded patients with multiple comorbidities and LRTIs in order to ensure the proper effectiveness of our findings. Our targeted population was patients with lower respiratory tract infections, including pneumonia, general chest infections, COPD, eCOPD, asthma-induced infections, pulmonary infections, tuberculosis, and others. The study included both adult and pediatric patients to ensure broader validity. We used a time-based sampling approach to testify our hypothesis, which was further verified by a Rao soft sample size calculator with a 5% margin and 95% confidence.

Study Approval

The study was approved Hospital's administration. Due to its nature as an observational study, we obtained a waiver for ethical approval. However, all procedures were followed in accordance with the ethical standards of the responsible committee on human experimentation and the Helsinki Declaration. We obtained verbal consent from each patient during the history-taking and data collection.

Data Analysis

After completing all data collection procedures, we conducted data analysis to determine the cost and effectiveness of patient care. We divided our data into two subsets: cost data and effectiveness data, as discussed in the plan of work section. Here is the detailed explanation of our data analysis procedures. We adopted the cost-effectiveness formula and incremental cost-effectiveness ratio as defined by Rascati *et al.*, for the bivariate analysis of costs and outcomes. The Cost-Effectiveness Ratio (CER) is determined by dividing the total treatment cost by the recovery rate and the number of Symptom-Free Days (SFDs). It can be expressed numerically as follows:

$$\text{CER}=\frac{Total\ Cost}{\%\ Healing * SFDs}$$

Where Total cost is defined as the amount spent on antibiotic treatment, Percentage healing refers to the proportion of patients who successfully recover from their infections and SFDs refer to the number of symptom-free days experienced by patients after treatment. This formula is a quantitative measure of antibiotic treatments' cost-effectiveness that considers both economic and clinical outcomes.

To determine the cost of each antibiotic, we used the market price value. We also added the drug's administration cost to the total cost. For example, the total cost of ceftriaxone was 427 rupees (1.54 $) plus 50 rupees (0.18 $) in administration costs. We calculated Average Percentage Healing by applying the mean to all patients who received that particular drug. For example, in 100 patients, ceftriaxone has a healing percentage of 78%. Symptom-Free Days

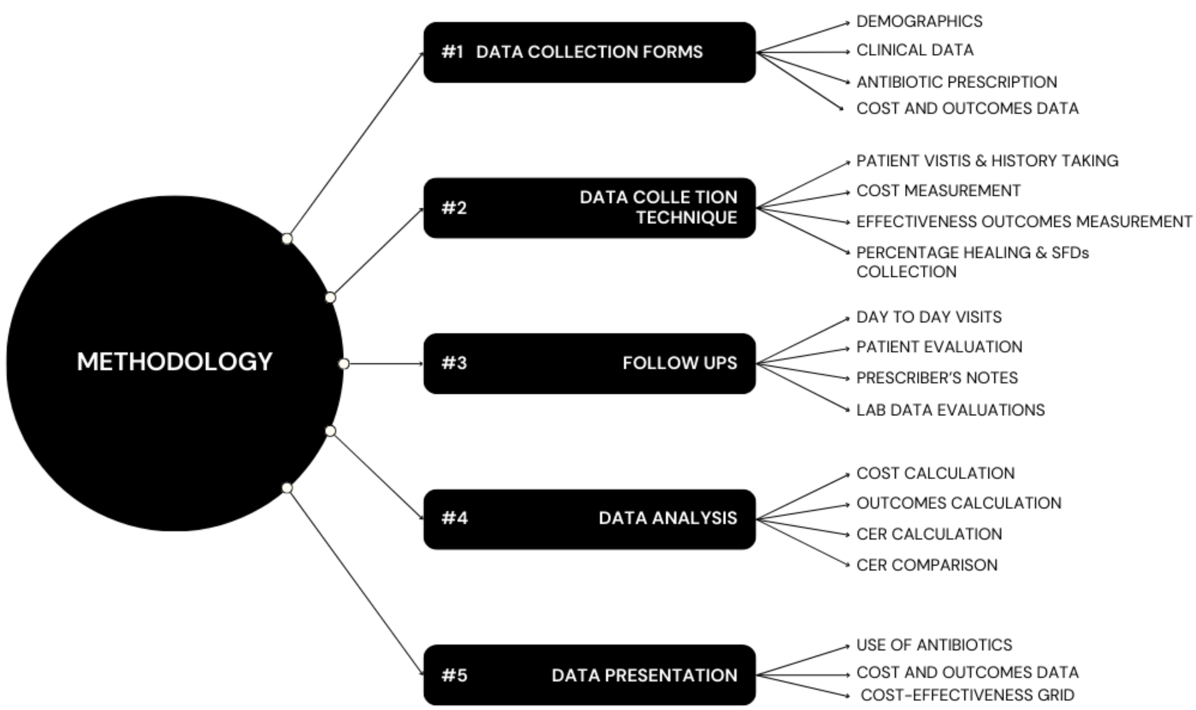

Figure 1: Methodology of study.

were counted after the average patient's recovery. After gathering the data, we calculated the CER. We compared the CER and selected the most cost-effective drug with the least CER.

To measure healing percentage, it was included in standard cost-effectiveness protocol by Rascati *et al*. It was calculated by Patient Recovery Response (Verbal Note: Grading 1-10), Prescriber Point of View (Grading 1-10), Lab Data Evaluations (X-rays, Sputum Results, CBC, and others) and Daily Follow-ups. Symptom-free days are days counted after the approximate removal of symptoms of the patient. It was calculated by estimating approximate Removal of Symptoms, Patients Recovery (Verbal Grading), Prescriber Point of View (Verbal Grading), Percentage Healing and Lab Data Evaluations.

Software used in the analysis

We collected and analyzed the data using Microsoft Excel 2021, We used Microsoft PowerPoint 2021 and Canva Pro for the data illustration.

RESULTS

Demographics

A total of 123 patients who had Lower Respiratory Tract Infections (LRTIs) were analyzed in this research with the utilization of a time-based sampling framework. There were 86 adult patients and 37 pediatrics patients from the study group to have an effective cost-evaluation sample pool. The average age of the male and female adult patients was 49.75 years and 45.75 years, respectively (Table 1). The pediatric patients included a range of ages with an average of 9.2 months, which points towards an emphasis on infants and young children. Distribution of Population shows positive prevalence of LRTI's among Pediatrics and Young Adults which is a predisposing factor of high antibiotic consumption. All patients included were diagnosed with LRTI's with different severities and clinical presentations. The most frequent infections diagnosed were pneumonia, bronchitis, chest infections, pleural edema, COPD-induced infections, and asthma-induced infections. Certain patients had severe complications and comorbidities, such as status asthmaticus, cardiovascular complications, and paralysis due to pneumonia.

Prescribing Pattern

Antibiotic prescribing patterns for LRTIs had two main trends, Prophylactic therapy and empiric therapy. Lack of an antimicrobial stewardship program and microbiological testing led to the non-use of targeted therapy. Antibiotics were given according to empiric therapy guidelines, not culture sensitivity reports. The five most commonly prescribed antibiotics for LRTIs were analyzed in this study, Ceftriaxone, Co-amoxiclav, Piperacillin/Tazobactam, Amikacin, Moxifloxacin (Table 2). Two different prescribing patterns were observed, Monotherapy-Certain

Table 1: General demographics.

General Characteristics of Patients	
Patients with LRTI	123
Male Adult age	49.75
Female Adult age	45.75
Male Patients	46
Female Patients	40
Pediatrics Patients	37
Pediatrics Age	9.2 months
Infection Details	
Pneumonia	43 patients
Bronchitis	37 Patients
Chest Infection	18 Patients
Plural Edema	12 Patients
Asthma/COPD-Induced Infection	13 Patients
Classification of Antibiotics	
Access	Co-amoxiclav
Watch	Ceftriaxone, Piperacillin-Tazobactam, Amikacin, Moxifloxacin
Reserve	-

Table 2: Cost Utilization of Antibiotics.

Cost Utilization of Antibiotics								
Name of Drug	**Strength**	**Total Quantity**	**Price (PKR)**	**Product**	**Manufacturer**	**(Freq)**	**Duration of Therapy**	**Adm-Cost**
Ceftriaxone	1g	56	427	Cefxone	Bosh Pharma	BD	7 Days	30
Co-amoxiclav	1.2g	12	275	Calamox	Bosh Pharma	BD	7 Days	30
Piperacillin Tazobactam	4.5g	13	1134	Tanzo	Bosh Pharma	BD	7 Days	156
Amikacin	250mg/ 2MI	9	250	Amkay	Bosh Pharma	BD	7 Days	156
Moxifloxacin	400mg/ 250mL	26	542	Moxiget	Getz Pharma	BD	7 Days	96

patients were given a single antibiotic and Combination therapy-Other patients were given more than one antibiotic for the same or different reasons. For example, a patient was administered Piperacillin/Tazobactam for pneumonia and another with a combination of Moxifloxacin and Co-amoxiclav.

Cost Data

To approximate costs, all prices were quoted in Pakistani Rupees (PKR) using an exchange rate of 279.2 PKR/USD as of February 2024. As hospital stays differed among patients, a mean hospitalization stay of 7 days was used. Drug prices were sourced from Pakistani pharmaceutical markets and online drug databases. All antibiotics were administered twice a day to patients, as they were given empirically and prophylactically. Administration costs involved items like syringes, IV cannulas, drip sets, and alcohol swabs, with estimates derived from observational data of hospital practice.

Effectiveness Data

To assess the cost-effectiveness of antibiotics, we computed Total drug costs (inclusive of administration costs), Frequency and duration of treatment and Effectiveness measures (Percentage healing×Symptom-Free Days (SFDs)). As evident from Table 3, Co-amoxiclav was the most cost-effective antibiotic with the lowest Cost-Effectiveness Ratio (CER) (13.998). Amikacin (CER=17.543) and Ceftriaxone (CER=20.065) also showed comparatively low CER values, while Moxifloxacin (CER=26.569) and Piperacillin/Tazobactam (CER=49.563) were the least cost-effective in this context. These findings indicate that Co-amoxiclav is the most appropriate choice of antibiotic for LRTI treatment in this secondary care setting, providing the greatest clinical benefit at the lowest price. The results are useful for prescribers and healthcare decision-makers to optimize choice of antibiotic and the use of resources (Figure 2).

ICER Analysis

To further verify cost-effectiveness, we performed an Incremental Cost-Effectiveness Ratio (ICER) analysis, comparing the most and least cost-effective antibiotics (Figure 3). Important comparisons were Piperacillin/Tazobactam (highest CER) and Co-amoxiclav (lowest CER), Amikacin and Ceftriaxone (almost identical CER values), Moxifloxacin and Ceftriaxone and Co-amoxiclav and Ceftriaxone. Results showed that while Piperacillin/Tazobactam was more effective, it also had a much higher cost, with an ICER of 232.32 PKR per unit of effectiveness. Amikacin was both more cost-effective and clinically advantageous compared to Ceftriaxone in pediatrics population mostly. Moxifloxacin was less costly per unit effectiveness (146.21 PKR), implying clinical benefit in certain instances. Switching from Ceftriaxone to Co-amoxiclav is a cost-effective strategy, with an ICER of 154.00 PKR, implying no major difference in effect but a considerable decrease in price. These results underscore cost-clinical benefit trade-offs, enabling more rational antibiotic choice where resources are limited just like the study center. The evidence indicates that emphasizing cost-effective prescribing can maximize healthcare outcomes without jeopardizing patient outcomes.

DISCUSSION

Cost effectiveness is an essential tool to address the appropriate use of medicine, especially antibiotics. Our study also explores the cost-effectiveness analysis of antibiotic therapy for treating LRTIs at a secondary care facility in Pakistan. The study's aim was the assessment of cost-effective antibiotics among the most commonly used five major antibiotics. We evaluated the study using a model of percentage healing and symptom-free days. Findings reveal that co-amoxiclav is cost-effective among the other five antibiotics. The study explored 123 patients, including 86 adults and 37 children with various lower respiratory tract diseases. In terms of cost-effectiveness, Co-amoxiclav had the lowest score (13.998), followed by Amikacin (17.543), Ceftriaxone (20.065), Moxifloxacin (26.569), and Piperacillin/Tazobactam (49.563). It shows that co-amoxiclav is cost-effective among all antibiotics, making it a good choice for LRTI.

Our findings are consistent with a study which confirms the cost-effectiveness of co-amoxiclav in LRTI treatment.[18] In low- and middle-income countries, co-amoxiclav is a better option for LRTI due to its lowest cost per unit of effectiveness.[11] Additionally, it is a broad-spectrum antibiotic that excels in treating respiratory pathogens. Furthermore, it belongs to the Access class in the AWaRe Classification of Antibiotics, allowing for easy access without the need for antimicrobial stewardship protocols.[19] According to this study's data, co-amoxiclav has

Table 3: Cost Effectiveness Data.

Cost-Effectiveness of Antibiotics Therapy							
Antibiotic	**Cost**	**Administration Cost**	**Total Cost**	**SFD**	**Healing (%)**	**Effectiveness**	**CER**
Ceftriaxone	427	30	6398	5.3	60.16	318.85	20.065
Co-amoxiclav	275	30	4270	5.15	59.23	305.03	13.998
Piperacillin Tazobactam	1134	156	18060	5.83	62.5	364.38	49.563
Amikacin	250	156	5684	5.4	60	324.00	17.543
Moxifloxacin	542	96	8932	5.36	62.72	336.18	26.569

the lowest CER due to its incredible low drug cost, reasonable administration cost, and high efficacy. The remaining antibiotics, such as amikacin and ceftriaxone, also demonstrate a relatively low CER of 17.543 and 20.065, respectively. Ceftriaxone is widely used to treat infections caused by respiratory pathogens and other common infections.[20] Although ceftriaxone is more expensive than co-amoxiclav, its prescribing tendency is high due to several factors: its availability in every hospital formulary, its effectiveness, marketing trends, and the trust of prescribers. Although amikacin was more utilized in pediatric patients as it exhibits better results due to penicillin's hypersensitivity.

On the other hand, piperacillin tazobactam is the drug of choice for aspiration pneumonia,[21] but it comes with considerably higher costs. It is true that piperacillin tazobactam exhibited high effectiveness in the study results, but in low- and middle-income countries, due to financial issues, it is not preferred. Private hospitals commonly use such medicines to provide optimal treatments at a higher cost; this is a trend in the market.

Frequent ceftriaxone prescriptions highlight the reliance on third-generation cephalosporins, which may contribute to antibiotic resistance in the absence of antimicrobial stewardship programs. However, they also highlight the inappropriate prescribing trends, indicating a lack of antibiotic stewardship practices. The hospital lacked proper guidelines for prescribing antibiotics to treat LRTI patients, and the absence of an antimicrobial stewardship program further contributed to inappropriate prescribing practices in these patients. This clearly demonstrates the importance of an Antimicrobial Stewardship (AMS) program.[22] During the hospital stay of patients, prescribers randomly selected different antibiotics. These included Ceftriaxone, Ceftazidime, Fluroquinolones, Vancomycin, Meropenem, Amikacin and other macrolides, co-amoxiclav, piperacillin, tazobactam, and others. Such circumstances made empirical therapy and prophylactic use of antibiotics significant, as these shed light on the inappropriate use of these drugs. The absence of microbiology and culture sensitivity analysis resulted in the lack of available microbial resistance data, a crucial factor in determining the cost-effectiveness of antibiotics, which directly potentiates the circumstances of AMR.[23]

Multiple studies have evaluated the cost-effectiveness of antibiotics separately in treating LRTIs. Joseph *et al.*, previously identified moxifloxacin as cost-effective in a regional Indian study, whereas our findings suggest co-amoxiclav is preferable in a Pakistani hospital setting.[17] File TM, in his famous study on the cost-effectiveness of LRTIs' antibiotics, explored multiple antibiotics, suggesting co-amoxiclav and moxifloxacin as cost-effective antibiotics. Our findings are also consistent with File's study.[24]

Antimicrobial resistance is another big factor that is being affected by inappropriate antibiotic practices and cost-effective trends. A study by Raymond Oppong explored the use of amoxicillin to treat LRTIs as a cost-effective way to reduce antimicrobial resistance.[11] We also found that co-amoxiclav is a cost-effective drug in this situation. Quenzer conducted a trial-based pharmacoeconomic analysis of selected antibiotics in treating LRTIs, providing support for this methodology. However, our study was observational in nature and did not include any clinical trials.[25]

Our study promotes the cost-effective use of antibiotics in LRTI patients. It provides extensive methodology and framework work to conduct a cost-effectiveness analysis at the hospital level. The study underscores the potential harm to antimicrobial resistance and the public health threat posed by the inappropriate use of

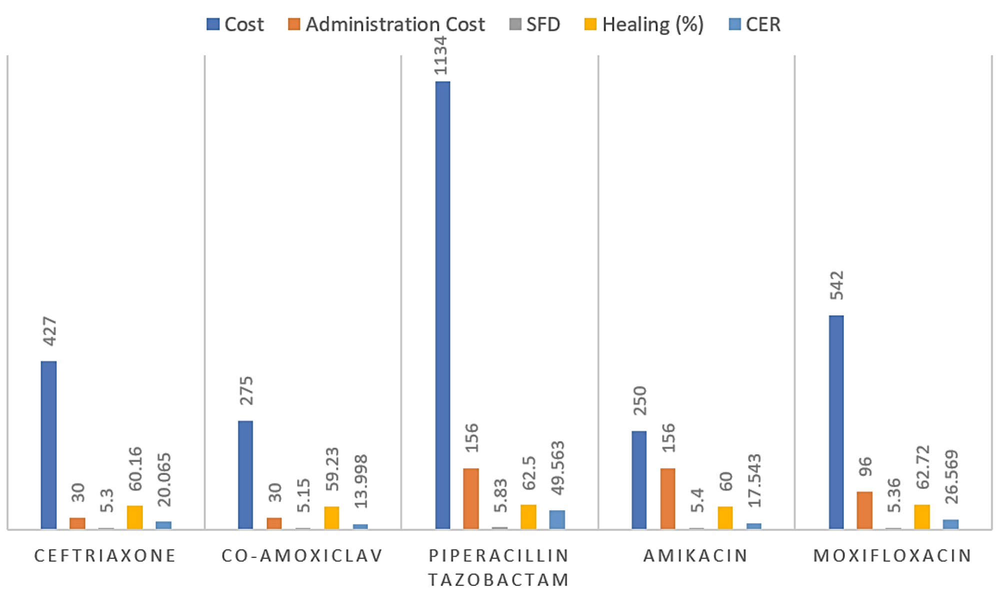

Figure 2: Bar Graph Analysis.

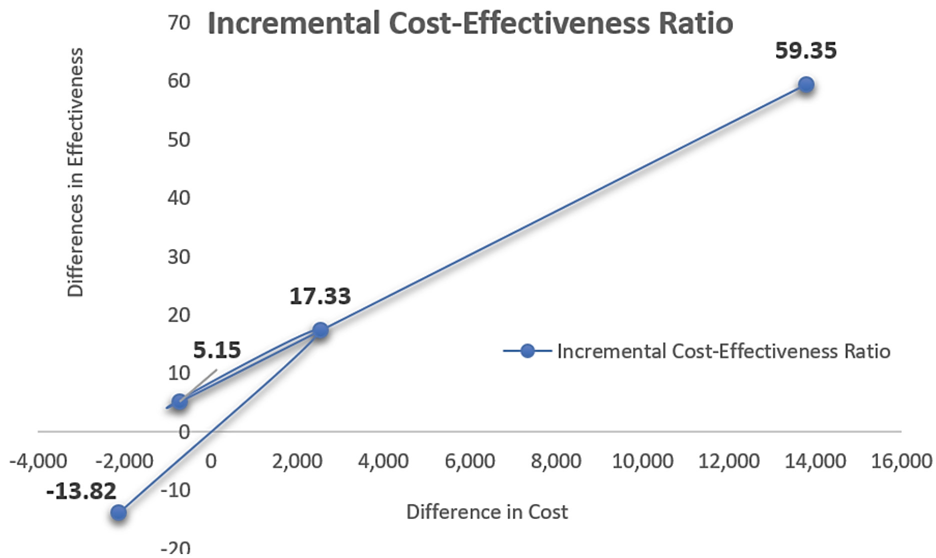

Figure 3: ICER analysis.

antibiotics. It provides the foundation for a proper antimicrobial stewardship program to compensate for the overuse of antibiotics.

The study outlines the rationale and guided use of restricted antimicrobials with the support of prescribers or consultants. It strengthens the role of the clinical pharmacist in providing direct patient care and collaborating with medical staff.[26] The significance of this study lies in its unique pattern and methodology, setting it apart from others in the field. This study elucidates the percentage-healing and symptom-free days methodology for cost-effectiveness, while other established methodologies for CE analysis, such as QALY modeling, exist. We chose this method due to its prospective nature, robustness, and ease of simulating cost and healing data.

Future studies need to look at Trial-based cost-effectiveness analyses to validate findings in terms of real-world clinical results. ICER grid modeling to allow more granular cost comparison. Subgroup analyses by patient demographics, comorbidities, and disease severity. Longitudinal studies to determine the effect of cost-saving prescribing on AMR trends in the long run.

LIMITATIONS

The study presents a useful model for the execution of cost-effectiveness analyses within hospitals. It applies a well-tested percentage-healing and symptom-free days model, which enables thorough evaluation of economic and clinical outcomes. The study also highlights the clinical pharmacist's intervention in maximizing the selection of antibiotics towards improved healthcare resource utilization and patient outcomes. Some limitations exist, though: Absence of an Incremental Cost-Effectiveness Ratio (ICER) grid model, which might have created a more nuanced cost-effectiveness comparison. Lack of subgroup analyses according to disease severity, comorbidities, or hospital stay length, which might have given more insight into antibiotic cost-effectiveness in various patient profiles. Lack of long-term follow-up data, so that probable relapse rates and AMR development could not be examined. In spite of such limitations, the research provides robust evidence to inform cost-effective prescribing of antibiotics and recommends the launch of AMS programs to improve antibiotic stewardship.

CONCLUSION

Our study discusses the cost-effectiveness analysis of antibiotics in treating lower respiratory tract infections with respect to the patient perspective. We used a model of percentage healing and SFDs to evaluate cost effectiveness among five major antibiotics. Co-amoxiclav showed significant cost-effectiveness, making it an appropriate choice for LRTI in low- and middle-income countries. We also measured the inappropriate prescribing trends of ceftriaxone. Our study contributes to the growing field of Pharmacoeconomics and highlights the importance of clinical pharmacists in hospital settings. It provides substantial recommendations for policymaking and medical decision-taking in improving patient care, optimizing finance allocation, and maintaining the sustainability of the healthcare system.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

LRTI: Lower Respiratory Tract Infection; **CER:** Cost-Effectiveness Ratio; **ICER:** Incremental Cost-Effectiveness Ratio.

SUMMARY

This study provides a hospital-based cost-effectiveness analysis of commonly prescribed antibiotics for the treatment of lower respiratory tract infections (LRTIs) in Pakistan. Using a prospective observational design and measuring both clinical outcomes and direct treatment costs, the analysis identified co-amoxiclav as the most cost-effective antibiotic among the five evaluated options. The findings reveal significant variations in economic efficiency among the antibiotics, with co-amoxiclav offering the greatest value in terms of cost per unit of effectiveness, followed by amikacin and ceftriaxone. In contrast, piperacillin/tazobactam and moxifloxacin presented higher cost-effectiveness ratios, indicating lower economic viability. These results underscore the utility of integrating pharmacoeconomic evaluations in clinical decision-making to promote rational antibiotic use, optimize resource allocation, and support antimicrobial stewardship efforts in similar healthcare settings.

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