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Cost Minimization Analysis for Treatment of the Community Acquired Pneumonia

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ABSTRACT

Objective: Community-acquired pneumonia (CAP) is a major health concern, ranking high as a cause of morbidity and mortality in many parts of the world. This study aims to estimate the direct as well as associated costs of antimicrobials commonly prescribed in CAP, along with economically viable options, including monitoring and follow-up charges. **Materials and Methods:** Information on drug cost data was extracted from the Current Index of Medical Specialties (CIMS) on drug formulations, available brands, price ranges, treatment duration, required monitoring, and follow-up costs. The analysis included fluoroquinolones, macrolides, and beta-lactam antibiotics. Direct medication costs were adjusted for each treatment regimen. Additional considerations included monitoring for blood glucose, liver and renal function tests, complete blood count, ECG, and other relevant tests, along with associated follow-up expenses. Sensitivity analyses were performed to evaluate best-case, worst-case, and intermediate scenarios. **Results**: Amoxicillin-clavulanic acid (average cost INR 20.8 per unit) and cefuroxime axetil (average INR 50.4 per unit) emerged as the most economical first-line treatment options, with overall treatment expenses falling between INR 4,189 and INR 15,381. Azithromycin prices varied widely, ranging from INR 5.4 to INR 475 per unit, whereas clarithromycin was consistently the most expensive, costing between INR 15.7 and INR 1,149 per unit. Fluoroquinolones like levofloxacin (INR 4–98 per unit) and moxifloxacin (INR 24–80 per unit) showed relatively stable pricing but entail added monitoring requirements. Sensitivity analysis revealed that beta-lactam antibiotics remained the most cost-effective across all tested conditions, while macrolides and fluoroquinolones proved particularly vulnerable to price fluctuations driven by brand differences. **Conclusion:** Beta-lactams reflects as the most cost-effective choice for managing community-acquired pneumonia in India. While macrolides and fluoroquinolones are included in treatment guidelines, their costs vary significantly due to brand differences. A pharmacoeconomic assessment highlights the need for streamlined drug formularies and effective price controls to promote fair and consistent access to treatment.

Keywords: Cost-Minimization Analysis; Community-Acquired Pneumonia; Azithromycin; Pharmacoeconomics

INTRODUCTION

Community-acquired pneumonia (CAP) remains a major public health concern worldwide, causing considerable illness and death across diverse populations[1,2]. In India, the disease places a substantial burden on the healthcare system, leading to high rates of hospitalization and significant medical costs[3-5]. The impact is especially pronounced in areas with limited resources, where treatment expenses can overwhelm both individuals and health services. Although antimicrobial therapy is the primary treatment for CAP, the wide variety of available formulations and brands often leads to large differences in price even when patient outcomes are similar[6-8].

While the safety and effectiveness of these antibiotics are well documented, their cost implications are commonly ignored in routine prescribing. Marked price variations between brands can make treatment financially out of reach, particularly for extended courses. This affects patients' ability to follow prescribed regimens and raises issues around fair access to care. In such settings, pharmacoeconomic assessments play a critical role[8,9]. Cost-minimization analysis (CMA) is especially useful when treatments have comparable clinical results, enabling healthcare providers and decision-makers to select the most cost-effective option without sacrificing therapeutic benefit[9-13].

This study uses CMA to evaluate frequently prescribed antimicrobial regimens for CAP in India. By combining drug acquisition costs with expenses related to monitoring and follow-up, and aligning with national and international treatment guidelines, the analysis offers a detailed assessment of treatment affordability. The results aim to promote evidence-based prescribing, support decisions on medication formularies, and guide policy efforts to reduce disparities in access[13-17]. Overall, the study highlights the need to align clinical effectiveness with financial feasibility in managing CAP.

Materials and Methods

The present study has been carried out using the method of Cost Minimization Analysis (CMA) under the assumption of therapeutic equivalence of all the systemic agents commonly employed for treating community acquired pneumonia[13-15].

The drugs Included were Amoxicillin-clavulanic acid, cefuroxime axetil, cefpodoxime proxetil, ceftriaxone, azithromycin, clarithromycin, levofloxacin, and moxifloxacin.

Exclusion criteria for the study is the formulations that are not administered systemically were excluded[14-16].

Cost Elements: Direct medication acquisition costs which is reported as minimum, maximum, and average unit prices, Monitoring expenses covering liver function tests, renal function tests, complete blood count, ECG, and blood glucose checks and follow-up visit costs.

Guideline Comparison: Findings were assessed against the Indian National Treatment Guidelines (NCDC 2025) and the ATS/IDSA CAP Guidelines (2019)[14-17].

Sensitivity Scenarios: Analysis included lowest drug cost with minimal monitoring, worst-case highest drug cost with intensive monitoring, and intermediate-case average drug cost with standard monitoring assumptions.

Results

Amoxicillin-clavulanic acid, averaging INR 20.8 per unit, and cefuroxime axetil, at INR 50.4 per unit, proved to be the most cost-effective first-line treatment choices, with total treatment costs ranging from INR 4,189 to INR 15,381. Azithromycin prices showed significant variation, from INR 5.4 to INR 475 per unit, while clarithromycin remained consistently the priciest option, with prices between INR 15.7 and INR 1,149 per unit. Fluoroquinolones such as levofloxacin (INR 4–98 per unit) and moxifloxacin (INR 24–80 per unit) displayed more stable pricing but require additional monitoring during use. In comparison, macrolides showed considerable price differences across brands azithromycin prices varied widely, from very low to extremely high, while clarithromycin was uniformly the most costly option. Fluoroquinolones like levofloxacin and moxifloxacin had relatively stable pricing but led to higher overall expenditures due to added monitoring requirements. The sensitivity analysis showed that beta-lactams remained the least expensive option under all conditions, whereas macrolides and fluoroquinolones were more sensitive to price changes. Table 1 represents mean, minimum, and maximum unit costs of antimicrobial therapies, table 2 represents annual total costs for commonly used antimicrobials and table 3 gives comparative affordability of first-line vs. second-line therapies.

Table 1. Mean, Minimum, and Maximum Unit Costs of Antimicrobial Therapies (₹ per tablet/capsule/injection)

DRUGS	MINIMUM COST	MAXIMUM COST	MEAN COST
Amoxicillin+ Clavulanic Acid	5.83	92.5	20.8
Cefuroxime Axetil	7.4	107.75	50.4
Cefpodoxime Proxetil	2.5	25.9	18.9
Ceftriaxone	13.5	143.1	48.4
Azithromycin	4.5	475.3	29.9
Clarithromycin	13.3	1149	127.2
Levofloxacin	4.0	98.1	11.4
Moxifloxacin	24.0	80.0	43.1

Table 2. Annual Total Costs for Commonly Used Antimicrobials in CA

DRUGS	DURATION OF REGIMEN	DRUG COST	MONITORING COST	TOTAL COST
Amoxicillin+ Clavulanic Acid	5-7 days	324-744	2000-2500	4189–4605
Cefuroxime Axetil	5-7 days	3725-8921	1300-1500	10,185–15,381
Ceftriaxone	5-7 days	20,629-81,264	1050-1500	34,079-48,692
Azithromycin	3-5 days	29,679-44,292	1050-1500	34,079-48,692
Clarithromycin	5-7 days	39,783	1050-1500	44,183
Levofloxacin	5 days	20,629-39,190	1300-1500	31,209-49,770
Moxifloxacin	5-7 days	29,679-44,292	1050-1500	34,079-48,692

Table 3. Comparative Affordability of First-Line vs. Second-Line Therapies vs

CATEGORY	DRUGS	AFFORDABLE DRUGS	RESULTS
First-line	Amoxicillin+ Clavulonic acid, Cefuroxime axetil	Highly affordable	Most cost-minimizing options
Second Line	Azithromycin, Clarithromycin, Levofloxacin, Moxifloxacin	Moderate to low affordability	Clarithromycin consistently costliest

Discussion

This study reveals significant variation in the costs of antimicrobial treatments for community-acquired pneumonia (CAP) in India. Beta-lactam antibiotics, especially amoxicillin-clavulanic acid, proved to be the most cost-effective choice, aligning with both national and international treatment guidelines[15,16]. Their low cost and minimal need for monitoring make them particularly well-suited as first-line therapy in settings with limited resources. In contrast, macrolides despite their clinical efficacy it shows substantial price differences across brands, with clarithromycin consistently being the most expensive option. Fluoroquinolones displayed moderate price stability but incurred higher overall costs due to additional monitoring needs, reducing their economic advantage[19-21].

Sensitivity analyses showed that first-line treatments remained the most cost efficient across all scenarios, whereas second-line options were affected by brand related price increases and monitoring demands[20-22]. These results describes the need for rationalizing drug formularies, regulating prices, and promoting prescribing practices based on solid evidence to improve access and equity. While the study did not account for indirect costs such as hospitalization or lost productivity, it offers a practical framework for healthcare providers[23-25]. Further research should incorporate these indirect factors along with emerging resistance patterns to enable a more complete assessment of treatment economics[26-31].

Conclusion

In India, the cost-minimizing approaches for CAP management are represented by the class of beta-lactams. Although the use of macrolides and fluoroquinolones is of clinical importance, it is associated with a high economic cost. The pharmacoeconomic study of CAP reiterates the importance of rational use of antimicrobials.

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