

Cost Analysis of Antibiotics Utilization in Emergency Department and Other Wards: A Comparative Study

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ABSTRACT

Background: An excessive amount of antibiotics is prescribed, which not only adds to the problem of antibiotic resistance but also exposes patients to their negative effects and raises the expense of medical care. Healthcare professionals are considering more complete models for making medical decisions because of medical, ethical, and societal concerns regarding the costs and quality of care associated with antibiotics. This study aims to estimate and compare the cost of antibiotics drugs in the emergency departments and wards of a private tertiary care hospital. **Materials and Methods:** A comparative prospective observational study was conducted for six months in Navodaya Medical College, Hospital, and Research Center with a sample size of 180. Data were collected from all hospitalized patients who are admitted to the emergency department and another ward with chronic diseases in the hospital during the study period. **Results:** In the emergency department, Penicillin was the most expensive class of antibiotics 30% (9165rs) and in other words, carbapenem was the most expensive class of antibiotics 40% (16448rs). Of 90 patients, In the emergency department, piperacillin/tazobactam was the most expensive antibiotic which was 29.94% (9075rs), and of 90 patients in other ward meropenem was the most expensive antibiotic with 40% (16448rs). **Conclusion:** A high cost of treatment was noticed, comparable to other published data. Regular prescription audits and modifications of antibiotics policy are required to curtail the inapt use of antibiotics and the economic burden of hospitals.

Keywords: Cost analysis, Antibiotic, Emergency department, Other Wards.

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INTRODUCTION

Antibiotics play a crucial role in the management of various bacterial infections in the healthcare setting. The cost of antibiotics significantly affects healthcare budgets and drug utilization. Patients must receive medications that are appropriate for their clinical needs in doses that meet their needs for an adequate amount of time and at the least expensive cost to them and their community for the medication to be used rationally.¹ The high utilization of antibiotics results in a significant portion of the total healthcare cost. Irrational drug use causes unpleasant medication reactions, worsening or prolonging of sickness, and inadequate and risky pharmacological treatment.²

The financial effects of high drug costs are felt by patients, and the cost of prescription drugs has a big impact on patient compliance. Several studies have found that medicine prices have an impact on therapeutic compliance.³ Users, suppliers, and most importantly

payers in healthcare systems can be impacted by prescription drug prices. In the pharmaceutical sector, price discrimination exists in India and other nations.

Industry reports that although India has the lowest prescription prices worldwide, access to these medications is becoming increasingly limited to those who can afford them. The costs of pharmaceuticals made by various companies range greatly from one another. Very few patients in India have access to health insurance, thus they must pay out of cash.⁴ Antibiotic resistance, a growing problem in many parts of the world, is another factor contributing to antibiotic therapy's cost. The cost of antibiotics varies based on the type of antibiotic, the hospital setting, and the patient's underlying health conditions.

This comparative study aims to analyze the cost of antibiotics used in the Emergency Department (ED) and other wards of tertiary care teaching hospitals. The objective of this study is to estimate the cost of antibiotics in these settings and to make recommendations for reducing the cost of antibiotic therapy in healthcare facilities. The study will focus on two main objectives: first, to compare the cost of antibiotics in the ED and other wards, and second, to identify the factors that contribute to the cost of



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antibiotics in each set. The results of this study will be useful for healthcare providers, policymakers, and administrators.

In conclusion, this comparative study on the cost of antibiotics in the ED and other wards of tertiary care teaching hospitals will provide important information on the factors that contribute to the cost of antibiotics in healthcare facilities. The results of this study will inform decision-making and provide.

MATERIALS AND METHODS

Study site

The study was conducted in Navodaya Medical College Hospital and Research Center, Raichur Karnataka.

Study duration

The study duration was 6 months after getting consent from the ethics committee.

Study method and size

A prospective observational study was conducted with consecutive sampling, and 180 patients were included in the study.

Inclusion Criteria

- Patients who are prescribed antibiotics and admitted to the Emergency Department (ED) and other wards.
- **Age:** All age groups.
- **Gender:** Male and Female.

Exclusion Criteria

- Patients who are not willing to participate.
- Patients who were not prescribed antibiotics.
- Incomplete data entry case records.

Study Design

Prospective observational research was conducted for six months. 180 pieces of data altogether were gathered. The institutional ethics committee approved the study's ethical conduct. A data collection form was designed to collect patient information. The information based on the patient's demography, complaints

on admission, diagnosis, past medical, medication, and family history, and treatment chart were collected and documented from all hospitalized patients who are prescribed at least one antibiotic in the hospital during the study.

Sampling and Selection Techniques

The sample size was calculated by the biostatistician according to Confidence Interval 1.96 standard normal variate at 95%, the required sample size for the study was a minimum of 180 participants. Hence, 90 samples were allotted to the emergency department and 90 samples were allotted to other wards. This is depicted in Figure 1.

Analysis of data

Prospective data was gathered from all the study participants during the study period. The data were analyzed and monitored for the following variables:

- Patient demographic
- Past medical and medication history of the patient
- Medication chart of the patients
- Cost per unit of antibiotics

RESULTS

Distribution of participants according to age group (N=180)

A total of 180 patients who met the inclusion criteria were recruited into the study. Among cases recorded in the emergency department, the majority of patients fall into the age group 19 to 44 years i.e., 44% While in the other wards, the majority of patients are between 45 to 64 years old i.e., 46%. This is depicted in Table 1.

Distribution Cost According to Class of Antibiotics (N=180)

In this study Penicillin was the most expensive antibiotic class in the emergency department at 30% (9165rs), followed by cephalosporin at 22% (6925rs), quinolones at 21% (6354rs), carbapenem at 14.80% (4400rs) and nitroimidazole 6% (1682rs) and in other wards carbapenem was the most expensive antibiotic class 40% (16448rs) followed by cephalosporin 24% (10042rs),

Table 1: Distribution of participants according to age group (N=180).

Sl. No.	Age	No of patients in Emergency Department (n=90)	Percentage (ED)	No of patients in OW (n=90)	Percentage (OW)
1	0-18 years	21	23.30%	3	3.30%
2	19-44 years	40	44%	34	37%
3	45-64 years	23	25.50%	42	46.66%
4	>65 years	6	6.60%	11	12.22%

Table 2: Distribution Cost According to Class of Antibiotics (N=180).

Class Of Antibiotics	Emergency Department		Other Wards	
	Total Cost/Day(n=90) (INR)	Percentage	Total Cost/Day(n=90) (INR)	Percentage
Cephalosporins	6925	22%	10042	24%
Penicillin's	9165	30%	6365	16%
Nitroimidazole	1682	6.0%	2563	7%
Fluoroquinolones	6354	21.00%	2246	5%
Macrolide	451	1.40%	26.5	0.07%
Lincosamide	0	0%	396	1%
Carbapenems	4400	14.80%	16448	40%
Aminoglycoside	218	0.80%	2855	7%
Tetracyclines	148	0.50%	21	0.05%
Glycopeptide	843	2.70%	0	0%
Anti-TB	112	0.30%	22.15	0.06%
Nitrofurantoin derivatives	117.6	0.38%	88.2	0.24%
Total	30415	100%	41073	100%

penicillin 16% (6365rs), nitroimidazole 7% (2563rs), quinolones 5% (2246rs). This is depicted in Table 2.

Distribution of Cost According to Antibiotics Prescribed (N=180)

The study shows that in the total cost of antibiotics prescribed for 90 patients per day in the emergency department, piperacillin/tazobactam was the most expensive antibiotic which was 29.94% (9075rs), followed by ceftriaxone 22% (6840rs), ofloxacin 19.24% (5832rs), meropenem 14.80% (4400rs), Metronidazole 6% (1682rs) and in other wards Meropenem was the most expensive antibiotic with 40% (16448rs) followed by Piperacillin/Tazobactam 13% (5420rs), Ceftriaxone 11% (4926rs), Cefoperazone/Sulbactam 8.47% (3480rs), Metronidazole 7.00% (2563rs), Amikacin 6.91% (2427rs). This is depicted in Table 3.

Distribution of Cost According to the Route of Administration (N=180)

According to this study, the cost of parenteral antibiotics in the emergency department was approximately 24216 (79%) and the cost of oral antibiotics was approximately 6195 (21%). In other words, the cost of parenteral antibiotics was approximately Rs. 37039 (90.18%) and the cost of oral antibiotics was approximately Rs. 4029. (9.81%). This is depicted in Table 4.

Expenditure on Antibiotics and Non-Antibiotics Medicines in ED and OW (N=180)

The study shows that the total cost of all drugs prescribed to 90 patients for a day in the emergency department was Rs. 59,556, with antibiotics costing Rs. 30,415 (51%) and other non-antibiotic drugs costing Rs. 29,141 Rs (49%), while the total cost of all drugs

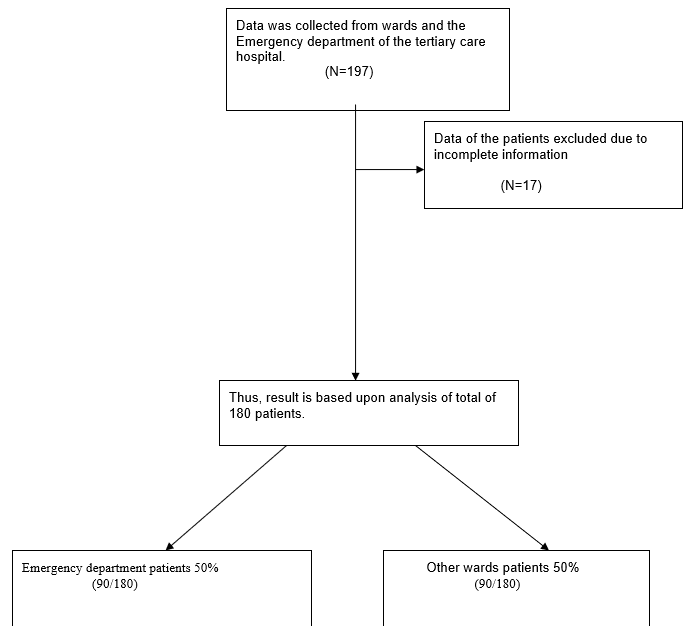


Figure 1: CONSORT Diagram showing enrollment of patients in the study.

prescribed to 90 patients in a day was Rs. 66,775 in other words, with the cost of antibiotics being Rs. 41,073 (61.49%) and the cost of other non-antibiotic drugs being Rs. 25,702 (38.50%). This is depicted in Table 5.

DISCUSSION

The result of the present study is based on the data from 180 patients. The participant's ages are a crucial consideration because different antibiotics are administered for different age groups, and the price varies according to the antibiotic. The ages are divided into 4 categories, and it has been discovered that in

Table 3: Distribution Cost According to Antibiotics Prescribed (N=180).

Antibiotics	Emergency Department		Other Wards	
	Total Cost/Day(n=90) (INR)	Percentage	Total Cost/Day(n=90) (INR)	Percentage
Ceftriaxone	6840	22.00%	4926	11.00%
Metronidazole	1682	6%	2563	7.00%
Ofloxacin	5832	19.24%	1031	2.51%
Doxycycline	148.7	0.49%	21	0.05%
Piperacillin/tazobactam	9075	29.94%	5420	13.00%
Azithromycin	312.8	1.40%	26	0.07%
Cefoperazone/Sulbactam	0	0%	3480	8.47%
Nitrofurantoin	117.6	0.38%	88	0.24%
Ciprofloxacin	378	1.24%	768	1.87%
Clarithromycin	138.8	0.45%	0	0%
Amikacin	218	0.80%	2427	6.91%
Cefotaxime	85.26	0.28%	803	1.95%
Amoxicillin/Clavulanic acid	22.3	0.07%	945	2.30%
Meropenem	4400	14.80%	16448	40.00%
Levofloxacin	144	0.47%	447	1.08%
Vancomycin	843	2.78%	0	0%
Amoxicillin	68	0.22%	0	0%
Anti-TB	113	0.30%	22	0.06%
Cefoperazone	0	0%	729	1.77%
Clindamycin	0	0%	375	1.00%
Cefuroxime	0	0%	380	0.92%
Cefixime	0	0%	150	0.36%
Gentamicin	0	0%	24	0.05%
Total	30415	100%	41073	100%

Table 4: Distribution Cost According to The Route of Administration (N=180).

Route Of Administration	Emergency Department Cost (INR)	Percentage (ED)	Other Wards Cost (INR)	Percentage (OW)
Parenteral	24216	79%	37039	90.18%
Oral	6195	21%	4029	9.81%

the emergency department, most patients between the ages of 19 and 64 receive antibiotic prescriptions, while in other wards, most patients are between the ages of 19 and 64. This study can be contrasted with one done by Prity Rani *et al.*⁵ According to our analysis, patients under the age of 64 accounts for most of the expenditure associated with antibiotics in the emergency department and other wards at tertiary care teaching hospitals.

The cost of antibiotics for patients in the emergency department and other wards is shown in the result. In the emergency department Penicillin, cephalosporin, and quinolones were

the most expensive class of antibiotics, whereas carbapenems, cephalosporin, and penicillin were the most expensive antibiotics in other wards. The overall cost of antibiotics class in other wards was higher than in emergency departments, according to trends we've seen in the price of antibiotics in both those settings. Moses Kayode *et al.* works can be compared. Our research revealed that the emergency department costs associated with the prescription of penicillin-type antibiotics (Piperacillin and tazobactam) are greater than those associated with other classes of antibiotics. By administering other antibiotics with the same efficacy, which

Table 5: Expenditure on Antibiotics and Non- Antibiotics Medicines in ED and OW (N=180).

	Emergency Department (INR)	Other Wards (INR)
Cost Of All Medicines	59556	66775
Cost Of Antibiotics (%)	30415(51%)	41073(61.49%)
Cost Of Non-Antibiotic Medicines (%)	29141(49%)	25702(38.50%)

were previously the most expensive class of antibiotics in other words, the cost can be decreased. This suggested that the top three most expensive classes of antibiotics in OW and ED were carbapenem, cephalosporin, and penicillin.

Meropenem was the most expensive antibiotic used in other words, followed by piperacillin/tazobactam and ceftriaxone, whereas, in the emergency room, piperacillin/tazobactam was the most expensive antibiotic, followed by ceftriaxone and ofloxacin. The results were similar to those of the Nikhilesh Anand *et al.*⁶ investigations. When analyzing the number of antibiotics prescribed in emergency rooms and other wards, we discovered that ceftriaxone was most frequently prescribed, although its price is less expensive than that of meropenem and the piperacillin/tazobactam combination. Even when some antibiotics were purchased in greater quantities, the price did not remain the same. Antibiotics are sometimes used inappropriately, adding to the patient's financial burden.

Most antibiotics recommended in the emergency room were administered by the parenteral route, and similar trends were seen in other wards as well. The parenteral route of antibiotic delivery cost the most money. In contrast to other wards, the emergency department prefers the parenteral route due to the evolving situation. However, to our surprise, antibiotics were prescribed more frequently via the parenteral route than through the oral route in other wards; approximately 90% of antibiotics are administered via the parenteral route in other words, at a cost of more than 90% of all antibiotics; this is an unacceptable high. The parenteral form of delivery is driving up the price of antibiotics. This needs to be considered and improved upon to cut costs.

The cost of every drug prescribed to our sample population was computed as part of our study, and as a result, we were able to determine that the overall cost of antibiotics is higher than the cost of non-antibiotic treatments. The results of our comparison of the costs of antibiotics and non-antibiotics in emergency departments and other wards revealed that the cost of antibiotics was higher in other wards than in emergency departments. It was demonstrated in both the emergency room and other wards that purchasing antibiotics is more expensive for patients than purchasing non-antibiotic medication.

CONCLUSION

In this study, we assessed how much it cost patients who were hospitalized to buy antibiotics from the emergency department and other wards. The findings reveal that there are significant differences in antibiotic usage patterns and costs between these two settings, with other wards using antibiotics more frequently and at higher costs than the emergency room. Meropenem was found to be responsible for a larger portion of the total cost of antibiotics, highlighting the need for cost-effective antibiotic prescribing practices. The high cost of treatment underscores the need for regular prescription audits and changes to the antibiotic policy to reduce the inappropriate use of antibiotics and the financial burden on hospitals.

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CONFLICT OF INTEREST

The authors declare that no conflict of interest exists.

ABBREVIATIONS

ED: Emergency Department; OW: Other Wards.

SUMMARY

The present study analyzed data from 180 patients to examine the cost of antibiotics in emergency departments and other wards, with a focus on the age of the patients and the type of antibiotics prescribed. The study found that most patients between the ages of 19 and 64 receive antibiotic prescriptions in both the emergency department and other wards. The cost of antibiotics was higher in other wards than in emergency departments, with carbapenems, cephalosporin, and penicillin being the most expensive classes of antibiotics. Meropenem was the most expensive antibiotic used in other words, while piperacillin/tazobactam was the most expensive in the emergency room. The parenteral route of antibiotic delivery was found to be driving up the cost of antibiotics, particularly in other words, where approximately 90% of antibiotics were administered via this route. The study suggests that using alternative antibiotics with the same efficacy and switching to the oral route of delivery may help reduce the cost of antibiotics for patients.

Overall, the study demonstrated that the cost of antibiotics is higher than the cost of non-antibiotic treatments, and purchasing antibiotics is more expensive for patients than purchasing non-antibiotic medication. The study suggests that administering other antibiotics with the same efficacy could help reduce costs in both settings.

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