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Original Article

Antibiotic Usage Pattern and Consumption Metrics in Hospitalized Patients with Community-Acquired Pneumonia: An Observational Study from a Tertiary Care Centre in South India.

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ABSTRACT

Introduction: Community-acquired pneumonia (CAP) remains one of the leading causes of hospitalization and mortality globally. Empirical antibiotic use varies regionally, and data from India are limited. Evaluating antibiotic usage and consumption metrics such as Defined Daily Dose (DDD) and Antibiotic Consumption Index (ACI) helps in antibiotic stewardship and optimizing treatment outcomes.

Objectives: To assess the antibiotic usage pattern, microbiological profile, hospital stay characteristics, and consumption indices (DDD and ACI) among hospitalized patients with community-acquired pneumonia in a tertiary care setting.

Methodology: A six-month prospective observational study was conducted at Victoria Hospital, BMCRI, Bengaluru from August 2023 to January 2024. A total of 124 hospitalized CAP patients were included. Data on demographics, antibiotic use, culture results, comorbidities, duration of hospital stay, and outcomes were analyzed. Antibiotic consumption was quantified using WHO ATC/DDD methodology and expressed as DDD/100 bed-days and ACI (DDD/patient).

Results: Among 124 patients, 84 (67.7%) were males, and 40 (32.3%) were females. 104 (83.9%) were direct admissions, and 20 (16.1%) were referred.

Prior antibiotic use (>5 times/year) was noted in 24 (19.4%), and 36 (29%) had over-the-counter (OTC) antibiotic exposure,40(32%) patients had not taken any Antibiotic.

Comorbidities were present in 38 patients (30.6%): diabetes (10), hypertension (12), COPD (16), asthma (2), hypothyroidism (2), cerebrovascular accident (4), and ischemic heart disease (6).

Patients with ≥3 comorbidities (8/124, 6.5%) had significantly higher mortality.

Sputum culture was sent for all 124 patients and positivity was 58.06% (72/124) blood cultures were positive in 18/64 (28.1%)

The most common organism was Streptococcus pneumoniae (44.4%), followed by Staphylococcus aureus (25%), Klebsiella pneumoniae (8.3%), Pseudomonas aeruginosa (6.9%), E. coli (6.9%), Acinetobacter (2.8%), and H. influenzae (2.8%).

Empirical antibiotics: Ceftriaxone was most common (72), followed by Azithromycin (24) and Amoxiclav (18). Single-drug therapy was used in 91 (73.4%), dual in 22 (17.7%), and triple in 11 (8.9%). Antibiotic modification post-culture occurred in 44 (35.5%).

Duration of stay

Hospital stay	Outcomes
3-5 days	40 patients (32.3%

6-8 days	36 patients (29%)
9-11 days	22 patients (17.7%)
>11 days	18 patients (14.5%)

Place of stay:

Ward	96
HDU	18
ICU	10

Mortality: 8 (6.45%) — mainly elderly (>70 years), with multiple comorbidities and prior antibiotic abuse. Culture-negative patients (n=52) had higher rates of prolonged stay (12/52), ICU admission (6/52), and death (5/52).
Antibiotic Consumption: The total antibiotic use was 1204 DDDs over 868 bed-days, giving 139 DDD/100 bed-days and an ACI of 9.7 DDDs/patient.
Ceftriaxone accounted for the highest consumption (58.1 DDD/100 bed-days), followed by Azithromycin (19.4) and Amoxiclav (14.5).
Conclusion: Ceftriaxone-based empirical therapy predominates in CAP management at our centre. High rates of OTC and repeated antibiotic use were observed. S. pneumoniae remains the leading pathogen, but Gram-negative organisms are emerging. Elevated antibiotic consumption indices emphasize the need for stewardship programs. Culture-based modification and regular local antibiogram updates are essential to optimize outcomes and curb resistance.

Keywords*: Community-acquired pneumonia, antibiotic consumption, defined daily dose, antibiotic stewardship, tertiary care hospital.*

INTRODUCTION

Community-acquired pneumonia (CAP) is among the top causes of hospitalization and mortality worldwide. Antibiotic prescription practices vary by region and are influenced by microbial prevalence, resistance patterns, and local guidelines. In India, easy access to antibiotics and frequent over-the-counter (OTC) use contribute to irrational prescribing and resistance.

Measuring antibiotic use quantitatively via Defined Daily Dose (DDD) and Antibiotic Consumption Index (ACI) allows objective assessment of usage intensity, benchmarking, and stewardship evaluation. This study evaluates both antibiotic prescribing patterns and consumption indices in CAP patients hospitalized in a tertiary care setting.

MATERIALS AND METHODS

Study Design:
Prospective observational study

Setting:
Department of General Medicine, Victoria Hospital, BMCRI, Bengaluru

Study Period:
1st August 2023 to 31st January 2024

Participants:
124 adult patients with clinical and radiographic evidence of community-acquired pneumonia.

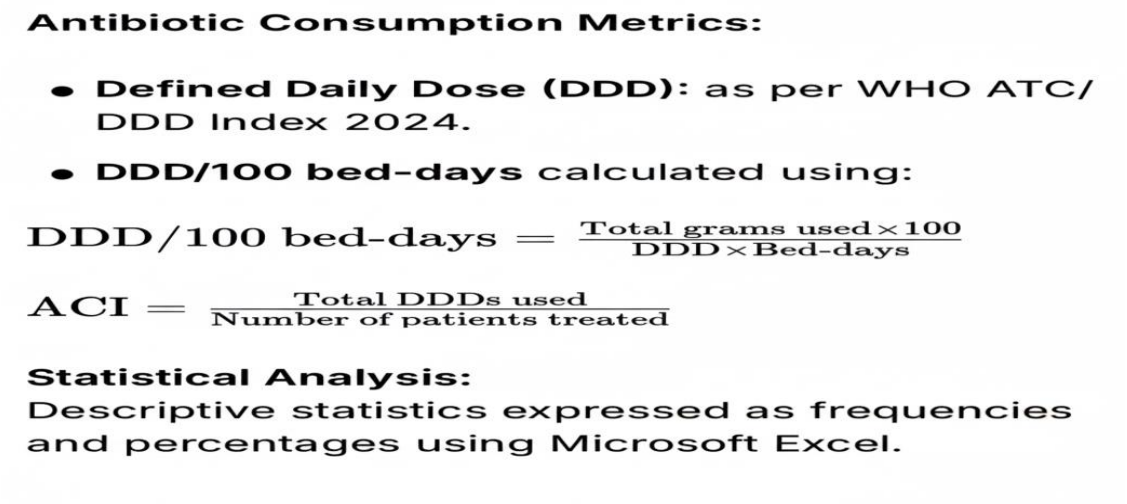
Exclusion:
Hospital-acquired or ventilator-associated pneumonia, immunocompromised states.

Data Collection:

Demographics, comorbidities, prior antibiotic exposure, empirical and modified antibiotic regimens, culture reports, hospital stay, and clinical outcomes.

Antibiotic Consumption Metrics:
Defined Daily Dose (DDD): as per WHO ATC/DDD Index 2024.

DDD/100 bed-days calculated using:



Statistical Analysis:
Descriptive statistics expressed as frequencies and percentages using Microsoft Excel.

RESULTS
Demographics and Clinical Profile

Total patients	124
Male 84 (67.7%)	Female 40 (32.3%)
Direct admissions 104 (83.9%)	Referred 20 (16.1%)
Prior antibiotic exposure>5 times/year	24 (19.3%)
OTC antibiotic use	36 (29%)

Comorbidities

Diabetes mellitus	10 (8.1%)
Hypertension	12 (9.7%)
COPD	16 (12.9%)
Asthma	2 (1.6%)
Hypothyroidism	2 (1.6%)
Cerebrovascular accident	4 (3.2%)
Ischemic heart disease	6 (4.8%)
More than or equal to 3 co morbidities	8 (6.5%)

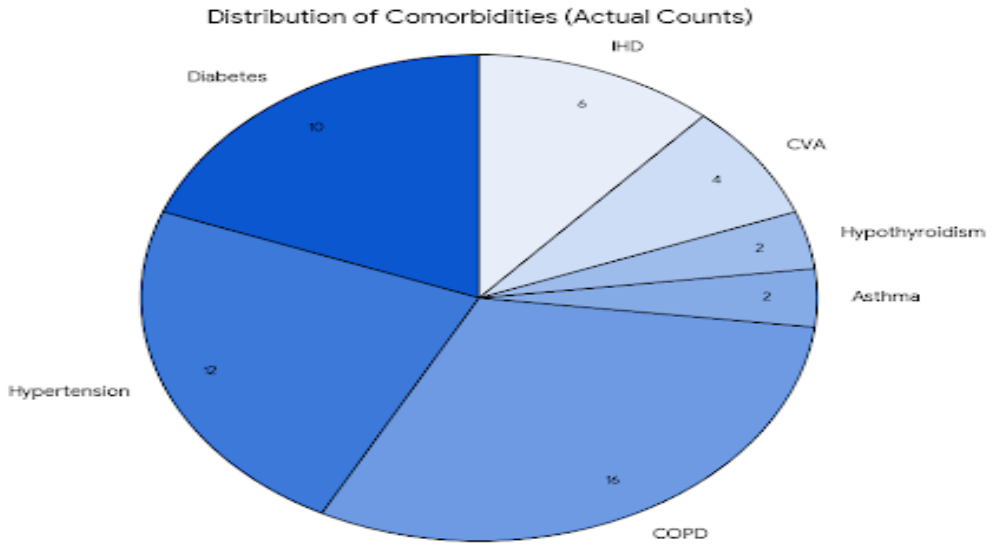


Figure showing comorbidities distribution

Microbiological Profile

Organism	Number	Percentage
Streptococcus pneumoniae	32	44.4%
Staphylococcus aureus	18	25%
Klebsiella pneumoniae	6	8.3%
Pseudomonas aeruginosa	5	6.9%
E.coli	5	6.9%
Acinetobacter	2	2.8%
H.influenza	2	2.8%
Mixed growth	2	2.8%

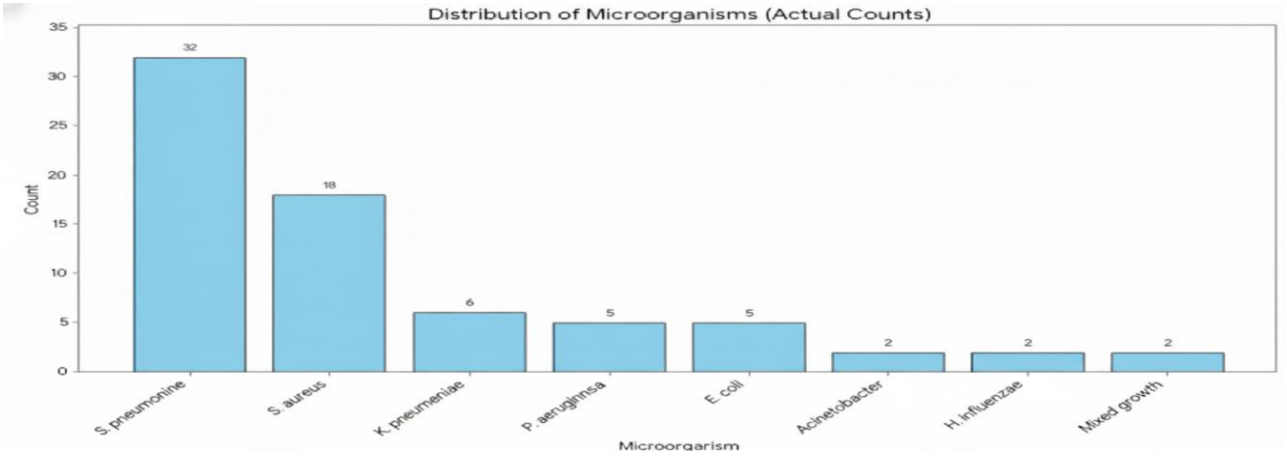


Figure showing distribution of microorganisms

Hospital Stay and Outcomes

Duration of stay	Patients	Percentage
3-5 days	40	32.3%
6-8 days	36	29%
9-11 days	22	17.7%
>11 days (prolonged)	18	14.5%

Place of stay	Patients	Percentage
Ward	96	77.4%
HDU	18	14.5%
ICU	10	8.1%

Mortality: 8 (6.45%)

Sepsis with mods	4
ARDS	2
renal failure	1
DKA	1

Antibiotic Consumption Metrics
Total antibiotic use: 1204 DDDs
Overall ACI: 9.7 DDDs/patient
Overall DDD/100 bed-days: 139

Antibiotic	Patients	Total DDDs	DDD/100 bed days	ACI (DDD/PATIENT)
ceftriaxone	72	504	58.1	7.00
Ceftriaxone + sulbactum	10	70	8.1	7.00
Amoxiclav	18	126	14.5	7.00
Cefuroxime	6	42	4.8	7.00
Ciprofloxacin	6	42	4.8	7.00
Clarithromycin	18	126	14.5	7.00
Azithromycin	24	168	19.4	7.00
Meropenem	10	70	8.1	7.00
Piperacillin-tazobactam	8	56	6.5	7.00

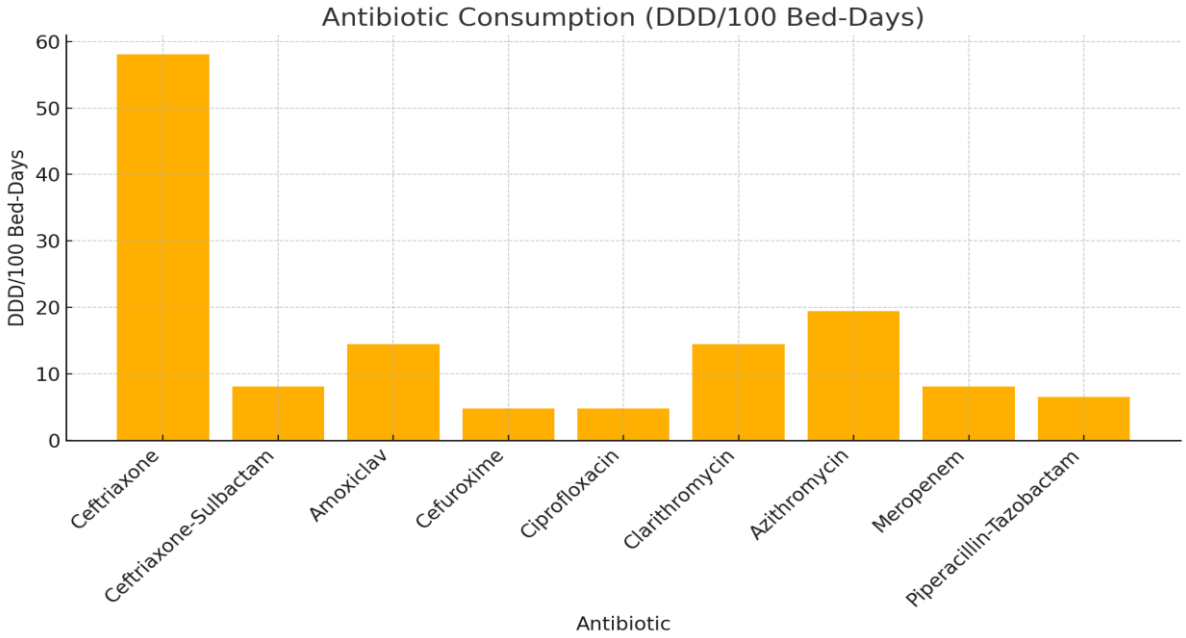


Figure: Antibiotic consumption (DDD/100 bed-days) shows ceftriaxone as the predominant agent, followed by azithromycin and amoxiclav.

DISCUSSION

- This study reveals key insights into CAP management and antibiotic use patterns in an Indian tertiary-care context:
- Ceftriaxone-based regimens remain the mainstay of empirical therapy, consistent with national recommendations.
- High empirical and OTC antibiotic exposure was noted, predisposing to resistance and masking culture results.
- Culture-negative CAP (42%) correlated with prolonged stay, ICU admission, and mortality, highlighting prior antibiotic impact.
- Antibiotic consumption indices (DDD = 139/100 bed-days) were moderately elevated, compared to global average suggesting a need for optimization through stewardship programs.
- Mortality (6.45%) was primarily among elderly, comorbid, and culture-negative patients.
- The inclusion of ACI and DDD quantification standardizes antibiotic usage assessment and aligns this study with global benchmarks.

CONCLUSION

- Ceftriaxone is the most used empirical antibiotic for CAP in this cohort.
- OTC antibiotic use and prior exposure are widespread.
- S. pneumoniae remains predominant; emerging Gram-negative pathogens indicate changing patterns.
- Culture-negative CAP and multimorbidity predict prolonged stay and mortality.
- Regular antibiogram monitoring and DDD/ACI-based audits are vital for stewardship.

Recommendations

- Implement routine antibiotic consumption audits using DDD/ACI.
- Strengthen hospital antibiotic stewardship programs.
- Encourage microbiological confirmation before initiating therapy.
- Public and clinician education against OTC antibiotic use.

Limitations

- Single-centre study with limited sample size
- No severity score correlation (CURB-65/PSI)
- No Antibiotic pattern correlation for severity of disease, place of stay.

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