International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Prospective Study on the Practice of Antibiotic Escalation and De-Escalation in A Tertiary Care Hospital

Dr. S. Sriram[1], M. Srinath[2]

[1]Principal and Head of the Department, Department of Pharmacy Practice, College of Pharmacy, Sri Ramakrishna Institute of Paramedical Science, Coimbatore – 641044.
[2]Post Graduate Scholar, Department of Pharmacy practice, College of Pharmacy, Sri Ramakrishna Institute of Paramedical Sciences, Coimbatore – 641 044.

ABSTRACT

Antibiotics have revolutionized the management of bacterial infections; however, their inappropriate and excessive use has accelerated the emergence of antimicrobial resistance, posing a major challenge to modern healthcare. In this context, the abstract describes a prospective observational study conducted in a tertiary care hospital to evaluate patterns of antibiotic escalation and de-escalation and their associated clinical outcomes. The study design, setting, duration, and patient population are clearly defined, providing a strong methodological foundation. Data collection encompassed demographic details, clinical characteristics, microbiological findings, antibiotic prescribing patterns, and treatment modifications, allowing a comprehensive assessment of antibiotic use. The results indicate that both escalation and de-escalation strategies were actively practiced, with escalation occurring slightly more frequently. The predominance of elderly patients and the high burden of comorbidities reflect real-world inpatient scenarios. Broad-spectrum antibiotics were commonly used as empirical therapy, particularly piperacillin–tazobactam and meropenem, highlighting the need for prompt treatment in critically ill patients. Subsequent modification of therapy based on culture and sensitivity results demonstrates adherence to antimicrobial stewardship principles. The predominance of Gram-negative organisms, especially *Escherichia coli* and *Klebsiella pneumoniae*, underscores the importance of continuous surveillance of local resistance patterns. Hospital stay duration and the frequent use of concomitant medications further contextualize clinical decision-making. Overall, the abstract effectively integrates background, methodology, results, and conclusions, emphasizing the role of culture-guided therapy, rational antibiotic use, and stewardship interventions in optimizing patient outcomes and limiting the progression of antimicrobial resistance in tertiary care hospital settings.

Keywords: Antibiotic escalation; Antibiotic de-escalation; Antimicrobial stewardship; Antimicrobial resistance; Tertiary care hospital; Empirical therapy; Culture and sensitivity; Gram-negative bacteria; Rational antibiotic use.

INTRODUCTION

The discovery of antibiotics represents one of the most transformative achievements in modern medicine, leading to a dramatic reduction in morbidity and mortality associated with bacterial infections. The

availability of effective antimicrobial agents has enabled the successful treatment of previously fatal conditions such as sepsis, pneumonia, meningitis, and postoperative infections. Despite these advances, the benefits of antibiotics are increasingly threatened by the rapid emergence and spread of antimicrobial resistance (AMR), a phenomenon largely driven by inappropriate, excessive, and irrational antibiotic use. AMR has become a major global public health concern, compromising treatment efficacy, prolonging hospital stays, increasing healthcare costs, and elevating mortality rates.

Hospitals are critical environments in which antibiotic use is both essential and highly prevalent. In acute care settings, particularly among critically ill patients, clinicians often initiate empirical broad-spectrum antibiotic therapy to ensure prompt coverage of potential pathogens. While this approach can be life-saving, continued use without timely reassessment contributes significantly to resistance development. Therefore, rational antibiotic use—guided by clinical judgment, microbiological evidence, and stewardship principles—is essential to balance effective infection management with resistance containment. Within this framework, antibiotic escalation and de-escalation strategies play a central role. Evaluating these practices provides insight into prescribing behavior and highlights opportunities for improving antimicrobial stewardship in tertiary care hospitals.

Classification of Antibiotics

Antibiotics may be classified using several criteria, each of which aids clinicians in selecting appropriate therapy and optimizing patient outcomes.

Based on Spectrum of Activity

Broad-spectrum antibiotics are active against a wide range of Gram-positive and Gram-negative organisms and are commonly used in empirical therapy when the causative pathogen is unknown. Examples include Tetracyclines, Carbapenems, and fluoroquinolones. In contrast, narrow-spectrum antibiotics target specific bacteria or bacterial groups and are preferred once the pathogen has been identified, as they reduce collateral damage to normal flora and limit resistance selection.

Based on Mechanism of Action

Antibiotics exert their effects through distinct mechanisms. Cell wall synthesis inhibitors, such as penicillins, cephalosporins, and Carbapenems, cause bacterial lysis. Protein synthesis inhibitors—including Aminoglycosides, Macrolides, Tetracyclines, and clindamycin—interfere with ribosomal function. Agents like fluoroquinolones and Rifampicin inhibit nucleic acid synthesis, while Polymyxins disrupt cell membrane integrity. Sulfonamides and trimethoprim inhibit essential metabolic pathways required for bacterial growth.

Based on Chemical Structure and Source

Classification by chemical structure includes beta-lactam, Aminoglycosides, Macrolides, Tetracyclines, fluoroquinolones, glycopeptides, and Oxazolidinones. Antibiotics may also be categorized by origin as natural, semi-synthetic, or synthetic agents. These classifications are fundamental to rational prescribing and stewardship implementation.

Antibiotic Escalation Therapy

Antibiotic escalation therapy refers to the practice of intensifying antimicrobial treatment by switching from a narrow-spectrum agent to a broader-spectrum antibiotic or by adding additional agents. This strategy is typically employed in response to clinical deterioration, treatment failure, or suspicion of resistant pathogens. Escalation is particularly important in severe infections such as sepsis, septic shock, and infections in critically ill or Immunocompromised patients, where delayed or inadequate therapy can be fatal.

Despite its clinical importance, escalation therapy presents several challenges. Excessive reliance on broad-spectrum antibiotics increases selective pressure for multidrug-resistant organisms, disrupts normal microbiota, and raises the risk of adverse drug reactions and secondary infections. Additionally, escalation is associated with higher healthcare costs and prolonged hospital stays. Diagnostic uncertainty during early infection stages often leads to unnecessary escalation, underscoring the need for rapid diagnostics and regular reassessment of therapy.

Antibiotic De-escalation Therapy

Antibiotic de-escalation involves narrowing the antimicrobial spectrum, reducing the number of antibiotics, or discontinuing therapy based on clinical improvement and microbiological evidence. This approach is a cornerstone of antimicrobial stewardship, aiming to minimize unnecessary antibiotic exposure while maintaining clinical efficacy. De-escalation has been shown to reduce toxicity, limit resistance development, and optimize resource utilization without compromising patient outcomes.

Effective de-escalation relies on timely culture and sensitivity results, daily clinical evaluation, and, in some cases, the use of biomarkers to guide treatment duration. However, several barriers hinder its implementation, including culture-negative infections, delayed laboratory turnaround times, fear of clinical deterioration, and lack of standardized stewardship protocols. Limited institutional support and variability in clinician perceptions further contribute to inconsistent application.

In summary, antibiotic escalation and de-escalation therapies are complementary strategies essential for effective infection management. Escalation ensures early control of severe infections, while de-escalation preserves antibiotic efficacy and reduces resistance. Strengthening stewardship programs, improving diagnostic support, and promoting evidence-based decision-making are crucial for optimizing antibiotic use in tertiary care settings.

OBJECTIVES:

Primary objective:

- To assess the pattern and frequency of antibiotic escalation and de-escalation in patients admitted to a tertiary care hospital.
- To evaluate the clinical outcomes associated with antibiotic escalation and de-escalation practices.

Secondary objective:

- To identify the factors influencing decisions related to antibiotic escalation and de-escalation in the hospital setting.

MATERIALS AND METHODS

The study was conducted in the General medicine and Surgery Department of Sri Ramakrishna Multi-Specialty Hospital, Coimbatore. It followed a prospective observational design over 10 months, involving 110 patients aged 18 years and above diagnosed with Bacterial infection diseases and other co morbid conditions. The sample size was determined using a 95% confidence interval with a 5% margin of error, and data were analyzed using the Chi-square test.

Inclusion criteria included Patients who were 18 year or older initiated on antibiotic therapy during their stay, Patients prescribed antibiotics empirically (before sensitivity testing) and Patients for whom culture and sensitivity testing was performed, Patient diagnosed with microbiological culture results confirming the definite presence of isolated organism bacterial infection and Patients who receive antibiotics for suspected or confirmed infections and are monitored for escalation or de-escalation.

Exclusion criteria involved Patients not prescribed any antibiotics, Patients discharged or expired before culture results were available, Patients with incomplete medical records regarding antibiotic use or microbial sensitivity and Outpatients or day-care cases not requiring hospitalization.
A literature survey was conducted to understand the study of practice of antibiotic escalation and antibiotic de escalation therapy. Data collection tools included a Patient Information Form, Informed Consent Form (in English and Tamil), and a Data Entry Form capturing demographic, clinical, and laboratory details.
Eligible participants were enrolled after obtaining consent, and data were collected from medical records, treatment charts, and direct interviews with patients, caregivers, and healthcare staff. Drug therapy was regularly monitored to identify drug-related problems such as inappropriate medication use, drug interactions, adverse reactions, and noncompliance. Necessary permissions were obtained from the Medical Director (EC/2025/0302/CR-15) and departmental heads. The study aimed is to prospectively evaluate the practices of antibiotic escalation and de-escalation in a tertiary care hospital.

RESULTS

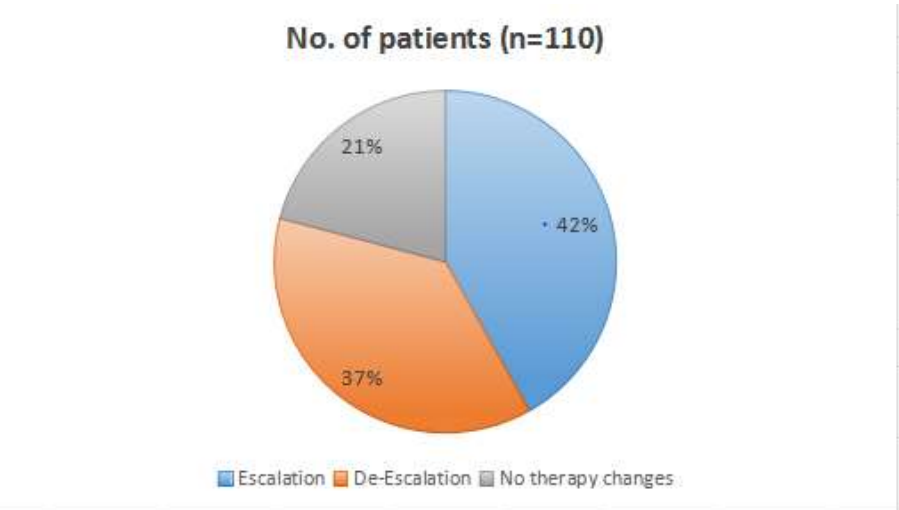
The study was done in the General medicine and Surgery department of a tertiary care teaching hospital. Based on the inclusion and exclusion 110 patients were included in our study. The study is currently being conducted under the phase II as per the proposed methodology so far, there were 110 cases collected and the following result was given. The study revealed that the practice of escalation and de-escalation of antibiotics switch over therapy with the help of culture & sensitivity pattern were observed.

ESCALATION AND DE-ESCALATION CATEGORIZATION

Out of a total of 110 cases, 46 cases (41.81%) involved escalation therapy, while 41 cases (37.27%) involved de-escalation therapy. The remaining 23 cases (20.90%) showed no change in therapy.

TABLE1: ESCALATION AND DE-ESCALATION CATEGORIZATION (n=110)

Category	No. of patients (n=110)	Percentage (%)
Escalation	46	41.81
De-Escalation	41	37.27
No therapy changes	23	20.90



CATEGORIZATION OF THERAPY

GENDER CATEGORIZATION

A total of 110 patients were enrolled in the study of which 64.54% were male (n=71) and 35.45% were female (n=39) population which indicating a higher representation of male patients in the sample.

TABLE 2: GENDER CATEGORIZATION (n=110)

Gender	No. of Patients (n=110)	Percentage(%)
Male	71	64.54
Female	39	35.45

AGE CATEGORISATION

The age categorization studies revealed that among the 110 patients studied, the majority were in the **late adulthood** age group (66–96 years), comprising **41.81%** of the sample (n=46). This was followed by the **adulthood** group (51–65 years) with **29.09%** (n=32), **young adulthood** (36–50 years) with **20.09%** (n=22), and **early adulthood** (18–35 years) with the smallest proportion of **9.09%** (n=10).

TABLE 3: AGE CATEGORISATION (n=110)

Category (Age in Years)	No. of Patients (n=110)	Percentage(%)
Early adulthood (18-35)	10	9.09
Young Adulthood (36-50)	22	20
Adulthood (51-65)	32	29.09
Late Adulthood (66-96)	46	41.81

CO-MORBIDITY DISEASES

Among the 110 patients assessed, a wide range of co-morbid conditions was observed. The most prevalent co-morbidity was **Chronic Kidney Disease (CKD)**, affecting **19 patients (17.27%)**, followed by **Urinary Tract Infections (UTI)**, reported in **12 patients (10.90%)**. **Lower Respiratory Tract Infections (LRTI)** were also relatively common, present in **10 patients (9.09%)**.

Left Leg Cellulitis was noted in **7 patients (6.36%)**, while **Cerebrovascular Accidents (CVA)** were reported in **6 patients (5.45%)**. **Right diabetic foot ulcers** affected **5 patients (4.54%)**, and several conditions—such as **Acute Myeloid Leukemia**, **Infected Wound Right Lateral Malleolus**, **Chronic Obstructive Pulmonary Disease (COPD)**, and **Right Lower Limb Cellulitis & Ulcer**—each affected **4 patients (3.63%)**.

Less common conditions, each affecting 1–3 patients (under 3% each), included **Type 1 Respiratory Failure (2.72%)**, **Typhoid Fever (2.72%)**, **Acute Kidney Injury (2.72%)**, and **Left Foot Vascular Ulcer With Klebsiella (1.81%)**. Several rare conditions, such as **Tuberculosis Empyema**, **Bronchial Asthma**, **Pulmonary Embolism**, **Acute Gastroenteritis**, and **Community Acquired Pneumonia**, were seen in only **1 patient each (0.90%)**.Overall, the data indicate that **renal and urinary tract disorders**, followed by **respiratory and infectious diseases**, are the most common co-morbidities in this patient population.

TABLE: 4 CO-MORBIDITY DISEASES (n=110)

Comorbidity	No. of Patients (N=110)	Percentage (%)
Acute Myeloid Leukemia	04	3.63

Infected Wound Right Lateral Malleolus	04	3.63
Severe Pulmonary Edema	01	0.90
Type 1 Respiratory Failure	03	2.72
Type 2 Respiratory Failure	01	0.90
Tuberculosis Empyema	01	0.90
Acute Pulmonary Edema	01	0.90
Lower Respiratory Tract Infection	10	9.09
Chronic Obstructive Pulmonary Disease	04	3.63
Typhoid Fever	03	2.72
Left Leg Cellulitis	07	6.36
Systemic Lupus Erythematosus	01	0.90
Right Pleural Based Lesion	01	0.90
Tubular Bronchiectasis	01	0.90
Interstitial Lung Disease	02	1.81
Acute Hypoxic Respiratory Failure	01	0.90
Urinary Tract Infection	12	10.90
Left Lung Consolidation	01	0.90
Bilateral Breast Lump	01	0.90
Acute Cough	01	0.90
Chronic Kidney Disease	19	17.27
Post Cbd Calculi Removal	01	0.90
Bronchial Asthma	01	0.90
Fever Decresed Evaluation	01	0.90
Community Acquired Pneumonia	01	0.90
Left Foot Vascular Ulcer With Klebsiella	02	1.81
Pulmonary Embolism	01	0.90
Right diabetic foot ulcer	05	4.54
Cerebrovascular accident (CVA)	06	5.45
TB meningitis	01	0.90
Right lower limb cellulitis & ulcer	04	3.63
Infective myopathy with paraplegia	01	0.90
Chronic liver diseases	01	0.90
Road traffic accident	02	1.81
Acute kidney injury	03	2.72
Acute gastroenteritis	01	0.90

ANTIBIOTICS PRESCRIBED (n=110)

It may divided into two types such as

- Antibiotics Prescribed Before Sensitivity Testing (APBS)
- Antibiotics Prescribed After Sensitivity Testing (APAS)

Antibiotics Prescribed Before Sensitivity Testing (APBS)

Among the 110 patients, the most commonly prescribed empirical antibiotics were **Piperacillin and Taz-**

obactam (21.81%), Meropenem (19.09%), and **Doxycycline (16.36%),** indicating a preference for broad-spectrum coverage. **Ceftriaxone (11.81%)** and **Clindamycin (10%)** were also frequently used. Other antibiotics such as **Cefoperazone-Sulbactam (8.18%), Linezolid (2.72%),** and various others were used in smaller proportions. This pattern reflects the empirical use of broad-spectrum agents prior to sensitivity test results.

TABLE 5: ANTIBIOTICS PRESCRIBED BEFORE SENSITIVITY TESTING (EMPERICAL THERAPY)

Antibiotic Drugs	No. of Patients (n=110)	Percentage (%)
Piperacillin and Tazobactum	24	21.81
Meropenem	21	19.09
Doxycycline	18	16.36
Ceftriaxone	13	11.81
Clindamycin	11	10
Cefoperazone and Sulbactam	09	8.18
Linezolid	03	2.72
Teicoplanin	02	1.81
Cefixime	02	1.81
Ofloxacin	02	1.81
Amikacin	02	1.81
Gentamicin	01	0.90
Azithromycin	01	0.90
Aztreonam	01	0.90

Antibiotics Prescribed After Sensitivity Testing (APAS)

Following sensitivity testing, **Meropenem** emerged as the most frequently prescribed antibiotic, used in **36 patients (32.72%),** followed by **Piperacillin-Tazobactam (20.90%)** and **Cefoperazone-Sulbactam (9.09%).** Other commonly used antibiotics included **Ceftriaxone (8.18%), Doxycycline (7.27%),** and **Amikacin (4.54%).** Less frequently prescribed agents included **Linezolid, Cefixime, Clindamycin,** and **Levofloxacin,** each used in under 3% of cases. These findings reflect targeted antibiotic use based on susceptibility profiles

TABLE 6: ANTIBIOTICS PRESCRIBED AFTER SENSITIVITY TESTING

Antibiotic Drugs	No. of Patients (N=110)	Percentage (%)
Meropenam	36	32.72
Piperacillin and Tazobactum	23	20.90
Cefoperazone and sulbactum	10	9.09
Ceftriaxone	09	8.18

Doxycycline	08	7.27
Amikacin	05	4.54
Cefpodoxime Proxetil	04	3.63
Linezolid	03	2.72
Cefixime	02	1.81
Clindamycin	02	1.81
Ofloxacin	02	1.81
Levofloxacin	02	1.81
Teiciplanin	02	1.81
Cefuroxime Axetil	01	0.90
Aztreonam	01	0.90

MOST ANTIBIOTICS PRESCRIBED IN ESCALATION THERAPY

The analysis of antibiotic use in escalation therapy (n=46) revealed that **Piperacillin–Tazobactam** was the most commonly prescribed antibiotic, accounting for **41.30%** of cases. This was followed by **Meropenem** in **30.43%** of cases, reflecting the frequent need for broad-spectrum coverage in severe infections. **Ceftriaxone** was used in **8.69%** of patients, while **Cefoperazone–Sulbactam** and **Cefpodoxime proxetil** were each prescribed in **6.52%** of cases. **Linezolid**, **Cefixime**, and **Cefuroxime Axetil** were less commonly used, each representing **2.17%** of prescriptions. Overall, the data indicate a predominant use of broad-spectrum β-lactam antibiotics in escalation therapy.

TABLE: 7 MOST ANTIBIOTICS PRESCRIBED IN ESCALATION THERAPY

Antibiotic Drugs	**Escalation therapy (no=46)**	**Percentage (%)**
Piperacillin and Tazobactum	19	41.30
Meropenem	14	30.43
Ceftriaxone	4	8.69
Cefoperazone and Sulbactam	3	6.52
Cefpodoxime proxetil	3	6.52
Linezolid	1	2.17
Cefixime	1	2.17
Cefuroxime Axetil	1	2.17

MOST ANTIBIOTICS PRESCRIBED IN DE ESCALATION THERAPY

The analysis of antibiotics prescribed in de-escalation therapy (n=41) showed that **Meropenem** remained the most frequently used agent, accounting for **31.70%** of prescriptions. This was followed by **Doxycycline** in **19.51%** of cases, suggesting its role as a preferred narrower-spectrum alternative after initial broad-spectrum coverage. **Amikacin** was used in **9.75%** of patients, while **Linezolid** and **Ceftriaxone** were each prescribed in **7.31%** of cases. **Clindamycin**, **Levofloxacin**, and **Teicoplanin** were each used in **4.87%** of cases, indicating selective use based on culture sensitivity results. Less commonly

used antibiotics included **Cefpodoxime proxetil**, **Cefoperazone–Sulbactam**, **Ofloxacin**, and **Cefixime**, each accounting for approximately **2.43%** of prescriptions. Overall, the pattern reflects a strategic shift toward narrower or more targeted antibiotics during de-escalation therapy to promote rational antimicrobial use.

TABLE: 8 MOST ANTIBIOTICS PRESCRIBED IN DE ESCALATION THERAPY

Antibiotic Drugs	**De escalation therapy (no=41)**	**Percentage (%)**
Meropenam	13	31.70
Doxycycline	8	19.51
Amikacin	4	9.75
Linezolid	3	7.31
Ceftriaxone	3	7.31
Clindamycin	2	4.87
Levofloxacin	2	4.87
Teiciplanin	2	4.87
Cefpodoxime Proxetil	1	2.43
Cefoperazone and sulbactum	1	2.43
Ofloxacin	1	2.23
Cefixime	1	2.43

MOST ANTIBIOTICS PRESCRIBED IN NO THERAPY CHANGES (Maintain same empirical therapy)

The analysis of cases with **no therapy changes** (n=23), where the same empirical antibiotic regimen was maintained, revealed that **Meropenem** was the most commonly continued antibiotic, prescribed in **39.13%** of cases. This was followed by **Cefoperazone–Sulbactam** in **21.73%** and **Piperacillin–Tazobactam** in **13.04%** of patients, indicating sustained use of broad-spectrum β-lactam combinations. **Ceftriaxone** accounted for **8.69%** of prescriptions, while **Sulbactam**, **Ofloxacin**, **Amikacin**, and **Aztreonam** were each maintained in **4.34%** of cases. Overall, the findings suggest that empirical broad-spectrum antibiotics were frequently continued without modification, possibly reflecting stable clinical response or limited microbiological justification for therapy adjustment.

TABLE: 9 MOST ANTIBIOTICS PRESCRIBED IN NO THERAPY CHANGES (Maintain same empirical therapy)

Antibiotic Drugs	**No therapy (no=23)**	**Percentage (%)**
Meropenem	9	39.13
Cefoperazone and Sulbactam	5	21.73
Piperacillin and Tazobactam	3	13.04
Ceftriaxone	2	8.69

Sulbactam	1	4.34
Ofloxacin	1	4.34
Amikacin	1	4.34
Aztreonam	1	4.34

BIOLOGICAL SAMPLES FOR CULTURE TEST

Among 110 patients, blood culture (30%) and urine culture (29.09%) were the most common, followed by pus culture (20%) and sputum culture (12.72%). Tracheal (3.63%) and tissue bit cultures (1.81%) were less frequent, while wound, CSF, and drain cultures each accounted for 0.90%. These findings highlight blood and urine as predominant sources of isolates, with other sample types contributing comparatively fewer cases.

TABLE: 10 BIOLOGICAL SAMPLES FOR CULTURE TEST

Culture test	No. of Patients (N=110)	Percentage (%)
Blood culture	33	30
Urine culture	32	29.09
Pus culture	22	20
Sputum culture	14	12.72
Tracheal culture	04	3.63
Tissue bit culture	02	1.81
Wound culture	01	0.90
CSF culture	01	0.90
Drain culture	01	0.90

ISOLATED ORGANISM THROUGH CULTURE TEST (GNB and GPB)

In Isolated organism testing, among the 110 patients, **Gram-negative bacteria** were the most commonly isolated organisms, identified in **81.81%** of cases, while **Gram-positive bacteria** were isolated in **18.18%** of cases. This indicates a predominance of Gram-negative pathogens in the study population.

TABLE: 11 ISOLATED ORGANISM THROUGH CULTURE TEST (GNB and GPB)

ISOLATED ORGANISM	No. of Patients (N=110)	Percentage (%)
Gram negative bacteria	90	81.81
Gram positive bacteria	20	18.18

Isolated Gram-Negative Bacteria (GNB)

Among the 90 patients with Gram-negative bacterial infections, ***Escherichia coli*** was the most frequently isolated organism, identified in **33 patients (36.66%),** followed by ***Klebsiella pneumoniae*** **(30%)** and ***Pseudomonas aeruginosa*** **(18.88%).** Less common isolates included ***Acinetobacter baumannii*** **(3.33%),** ***Salmonella Typhi*****,** and ***Enterobacter cloacae*** (2.22% each). Rare isolates such as ***Proteus mirabilis,***

Morganella morganii, and others were found in only **1.11%** of patients each. The data indicates that ***E. coli, Klebsiella***, and ***Pseudomonas*** were the predominant Gram-negative pathogens.

TABLE: 12 ISOLATED GRAM NEGATIVE BACTERIA

ISOLATED ORGANISM (GNB)	No. of Patients (N=90)	Percentage (%)
Escherichia Coli	33	36.66
Klebsiella Pneumoniae	27	30
Pseudomonas Aeruginosa	17	18.88
Acinetobacter baumannii	03	3.33
Enterobacter cloacae	02	2.22
Salmonella Typhi	02	2.22
Moraxella catarrhalis	01	1.11
Proteus mirabilis	01	1.11
Citrobacter koseri	01	1.11
Stenotrophomonas maltophilia	01	1.11
Morganella morganii	01	1.11
Enterobacter Aerogenes	01	1.11

Isolated Gram-Positive Bacteria (GPB)

Among the 20 patients with Gram-positive bacterial infections, *Staphylococcus aureus* was the most commonly isolated organism, accounting for **55%** (n=11) of cases. This was followed by *Streptococcus pneumoniae* at **20%** (n=4), *Streptococcus agalactiae* at **15%** (n=3), and *Enterococcus faecalis* at **10%** (n=2)

TABLE: 13 ISOLATED GRAM POSITIVE BACTERIA

ISOLATED ORGANISM (GPB)	No. of Patients (N=20)	Percentage (%)
Staphylococcus Aureus	11	55
Streptococcus pneumoniae	04	20
Streptococcus Agalactiae	03	15
Enterococcus faecalis	02	10

Therapeutic Categories of Drugs Concomitantly Prescribed With Antibiotics

Among 659 concomitant medications prescribed with antibiotics, cardiovascular drugs were most common (17%), followed by respiratory (11.8%), antihypertensives (10.6%), and antidiabetics (9.3%). Other frequently used classes included CNS drugs (8.3%), renal (6.7%), gastrointestinal (6.4%), multivitamins (6.1%), corticosteroids (5.2%), hematologic (5.6%), and cerebrovascular medications (4.7%), indicating diverse comorbidity management.

TABLE 14: THERAPEUTIC CATEGORIES OF DRUGS CONCOMITANTLY PRESCRIBED WITH ANTIBIOTICS

Different class of drugs	Number of drugs (N=659)	Percentage (%)
Drugs acting on cardiovascular system	112	16.99
Drugs acting on gastrointestinal system	42	6.37
Drugs acting on kidney diseases	44	6.67
Drugs acting on CNS	55	8.34
Drugs acting on blood & blood forming drugs	37	5.61
Drugs acting on respiratory system	78	11.83
Anti hypertension drugs	70	10.62
Drugs acting on CVA	31	4.70
Anti diabetic drugs	61	9.25
Analgesics	29	4.40
Anti emetic drugs	26	3.94
Corticosteroids	34	5.15
Multivitamin drugs	40	6.06

Total Days of Hospital Stay of Patients

Among the 110 patients, the majority stayed in the hospital for 4 to 6 days (46.36%), followed by 7 to 8 days (32.72%). A smaller proportion of patients had hospital stays of exactly 9 days (9.09%) and 10 days (7.27%), while only 4.54% of patients stayed for more than 10 days. This indicates that most patients had a relatively short hospital stay of under one week.

TABLE 15: DURATION OF HOSPITAL STAY OF PATIENTS (IN DAYS)

TOTAL HOSPITAL STAY (IN DAYS)	No. of Patients (N=110)	Percentage (%)
4-6 days	51	46.36
7-8 days	36	32.72
9 days	10	9.09
10 days	08	7.27
More than 10 days	05	4.54

DISCUSSION:

The present study was conducted in a 1000-bedded multi-specialty private tertiary care hospital in South India to evaluate patterns of antibiotic escalation and de-escalation among inpatients from the General Medicine and Surgery departments over a ten-month period. A total of 110 patients were included, and the analysis focused on demographic characteristics, co-morbidities, microbiological findings, antibiotic prescribing trends, and duration of hospital stay. The findings offer important insights into current antimicrobial stewardship practices in a real-world hospital setting.

A key finding of the study was that antibiotic escalation (41.81%) was slightly more common than de-escalation (37.27%), while 20.9% of patients experienced no change in therapy. This reflects the frequent need for treatment intensification in response to clinical deterioration or inadequate empirical coverage. At the same time, the substantial proportion of de-escalation cases indicates growing adherence to stewardship principles, where therapy is narrowed based on culture and sensitivity results and clinical improvement.

Demographic analysis revealed a predominance of male patients and a higher representation of elderly individuals, particularly those aged 66 years and above. This is clinically relevant, as older patients often have reduced physiological reserves, multiple co-morbidities, and increased susceptibility to severe infections, all of which influence antibiotic selection and monitoring. Chronic Kidney Disease emerged as the most common co-morbidity, underscoring the importance of careful antibiotic dosing and avoidance of nephrotoxic agents in this population.

Empirical antibiotic prescribing showed a preference for broad-spectrum agents such as piperacillin–tazobactam and meropenem, reflecting the need for rapid and effective coverage in hospitalized patients. Following culture and sensitivity testing, antibiotic therapy was appropriately modified, demonstrating the role of microbiological data in guiding targeted treatment. Gram-negative organisms predominated, with *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa* being the most frequently isolated pathogens, highlighting the ongoing challenge posed by Gram-negative infections in tertiary care hospitals.

Blood cultures were the most commonly collected samples, indicating a strong emphasis on diagnosing systemic infections. Most patients had relatively short hospital stays, suggesting timely diagnosis and effective antibiotic management. Overall, the study emphasizes the importance of culture-guided therapy, rational antibiotic use, and continuous stewardship efforts to optimize patient outcomes and limit the progression of antimicrobial resistance.

CONCLUSION:

This study highlights the effective implementation of antibiotic escalation and de-escalation practices in a tertiary care hospital, with a slightly higher reliance on escalation during empirical therapy. The frequent use of broad-spectrum antibiotics reflects the need for prompt management of severe infections, while subsequent culture-guided de-escalation demonstrates adherence to antimicrobial stewardship principles. The predominance of elderly patients with multiple co-morbidities and Gram-negative infections underscores the complexity of antibiotic decision-making in hospital settings. Consistent use of culture and sensitivity testing and relatively shorter hospital stays indicate effective clinical management. Strengthening antimicrobial stewardship through surveillance, early de-escalation, and continuous prescriber education remains essential to optimize antibiotic use and curb antimicrobial resistance.

FUTURE OUTLOOKS:

The findings of this study highlight important opportunities for strengthening antimicrobial stewardship in tertiary care hospitals. Future efforts should focus on early and consistent implementation of antibiotic de-escalation strategies guided by timely culture and sensitivity results. The incorporation of rapid diagnostic tools and biomarkers can support faster clinical decision-making and reduce unnecessary exposure to broad-spectrum antibiotics. Continuous surveillance of local antimicrobial resistance patterns is essential to guide appropriate empirical therapy and limit overuse of high-end agents such as

carbapenems. Strengthening multidisciplinary antimicrobial stewardship teams, including infectious disease specialists and clinical pharmacists, can improve prescription audits, feedback, and adherence to treatment guidelines. Special attention should be given to elderly patients and those with chronic kidney disease through individualized dosing and close monitoring to minimize adverse effects. Additionally, future multicenter studies with larger sample sizes are needed to validate these findings and support the development of standardized stewardship protocols to improve patient outcomes and curb antimicrobial resistance.

REFERENCES

1. Fleming A. On the antibacterial action of cultures of a Penicillium, with special reference to their use in the isolation of *Bacillus influenzae*. Br J Exp Pathol. 1929;10(3):226–36.
2. World Health Organization. *Global Action Plan on Antimicrobial Resistance.* Geneva: World Health Organization; 2015. p. 1–28.
3. Greenwood D, Slack R, Peutherer J, Barer M. *Medical Microbiology.* 17th ed. Edinburgh: Churchill Livingstone; 2007. p. 125–190, 205–215.
4. Madigan MT, Martinko JM, Bender K, Buckley D, Stahl D. *Brock Biology of Microorganisms.* 14th ed. Boston: Pearson; 2014. p. 401–450, 463–490.
5. Katzung BG. *Basic and Clinical Pharmacology.* 14th ed. New York: McGraw-Hill Education; 2018. p. 735–820, 821–870.
6. Walsh C. *Antibiotics: Actions, Origins, Resistance.* Washington (DC): ASM Press; 2003. p. 1–460.
7. Mandell GL, Bennett JE, Dolin R. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases.* 8th ed. Philadelphia: Elsevier; 2014. Vol. 1. p. 279–330, 1335–1400.
8. Cunha BA. *Antibiotic Essentials.* 15th ed. New Delhi: Jaypee Brothers Medical Publishers; 2017. p. 1–210.
9. Centers for Disease Control and Prevention. *Infection Control Basics.* Atlanta (GA): CDC; 2020. p. 5–25.
10. Ventola CL. The antibiotic resistance crisis. Part 1: Causes and threats. P T. 2015;40(4):277–83.
11. Fischbach MA, Walsh CT. Antibiotics for emerging pathogens. Science. 2009;325(5944):1089–93.
12. O'Neill J. *Tackling Drug-Resistant Infections Globally: Final Report and Recommendations.* London: Review on Antimicrobial Resistance; 2016. p. 1–84.
13. Kumar A, Roberts D, Wood KE, et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in septic shock. Crit Care Med. 2006;34(6):1589–96.
14. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an antibiotic stewardship program: Guidelines by the IDSA and SHEA. Clin Infect Dis. 2016;62(10):e51–77.
15. Paul M, Shani V, Muchtar E, et al. Systematic review and meta-analysis of the efficacy of appropriate empiric antibiotic therapy for sepsis. Antimicrob Agents Chemother. 2010;54(11):4851–63.
16. Rhodes A, Evans LE, Alhazzani W, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock. Intensive Care Med. 2017;43(3):304–77.
17. Garnacho-Montero J, Gutiérrez-Pizarraya A, Escoresca-Ortega A, et al. De-escalation of empirical therapy is associated with lower mortality in severe sepsis and septic shock. Intensive Care Med. 2014;40(1):32–40.
18. Tamma PD, Cosgrove SE. Antimicrobial stewardship. Infect Dis Clin North Am. 2011;25(1):245–60.

19. Lessa FC, Mu Y, Bamberg WM, et al. Burden of *Clostridium difficile* infection in the United States. N Engl J Med. 2015;372(9):825–34.
20. Roberts RR, Hota B, Ahmad I, et al. Hospital and societal costs of antimicrobial-resistant infections in a Chicago teaching hospital. Clin Infect Dis. 2009;49(8):1175–84.
21. Arulappen AL, Khan AH, Danial M, Hasan SS, Chow TS, Ahmed NJ, Long CM. Baseline predictors of antibiotics de-escalation from empirical therapies in an intensive care unit: a five-year retrospective study. *BMC Infect Dis.* 2025;25:369. doi:10.1186/s12879-025-10752-6.
22. Bono R, Sapienza G, Tringali S, Rotolo C, Santoro A, Di Noto L, et al. The antibiotic de-escalation strategy in patients with multidrug-resistant bacterial colonization after allogeneic stem cell transplantation. *Front Microbiol.* 2025;15:1487617. doi:10.3389/fmicb.2024.1487617.
23. Tanzarella ES, Cutuli SL, Lombardi G, Cammarota F, Caroli A, Franchini E, et al. Antimicrobial de-escalation in critically ill patients. *Antibiotics (Basel).* 2024;13(4):375. doi:10.3390/antibiotics13040375.
24. Huo X, Liu P. An agent-based model on antimicrobial de-escalation in intensive care units: implications on clinical trial design. *PLoS One.* 2024;19(4):e0301944. doi:10.1371/journal.pone.0301944.
25. Alanazi A, Almuhaya R, Almohaimeed M, Alahmari N, Abdulrahim N, Basyouni M, et al. Impact of antibiotic de-escalation on antibiotic consumption, length of hospitalization, mortality, and cost: a systematic review and meta-analysis. *Pharmacoepidemiology.* 2023;2(4):289–306. doi:10.3390/pharma2040025.
26. Aldardeer N, Qushmaq I, AlShehail B, Ismail N, AlHameed A, Damfu N, et al. Effect of broad-spectrum antibiotic de-escalation on critically ill patient outcomes: a retrospective cohort study. *J Epidemiol Glob Health.* 2023;13:444–52. doi:10.1007/s44197-023-00124-1.
27. Baghdadi JD, Goodman KE, Magder LS, Heil EL, Claeys K, Bork J, et al. Clinical, contextual and hospital-level factors associated with escalation and de-escalation of empiric Gram-negative antibiotics among US inpatients. *JAC Antimicrob Resist.* 2023;5(3):dlad054. doi:10.1093/jacamr/dlad054.
28. Vallicelli C, Minghetti M, Sartelli M, Coccolini F, Ansaloni L, Agnoletti V, et al. Antibiotic de-escalation in emergency general surgery. *Antibiotics (Basel).* 2022;11(9):1148. doi:10.3390/antibiotics11091148.
29. Corcione S, Mornese Pinna S, Lupia T, Trentalange A, Germanò E, Cavallo R, et al. Antibiotic de-escalation experience in the setting of emergency department: a retrospective, observational study. *J Clin Med.* 2021;10(15):3285. doi:10.3390/jcm10153285.
30. Moehring RW, Dodds Ashley ES, Davis AE, Dyer AP, Parish A, Ren X, et al. Development of an electronic definition for de-escalation of antibiotics in hospitalized patients. *Clin Infect Dis.* 2021;73(11):e4507–14. doi:10.1093/cid/ciaa932.
31. Deshpande A, Richter SS, Haessler S, Lindenauer PK, Yu PC, Zilberberg MD, et al. De-escalation of empiric antibiotics following negative cultures in hospitalized patients with pneumonia: rates and outcomes. *Clin Infect Dis.* 2021;72(8):1314–22. doi:10.1093/cid/ciaa212.
32. Mathieu C, Pastene B, Cassir N, Martin-Loeches I, Leone M. Efficacy and safety of antimicrobial de-escalation as a clinical strategy. *Expert Rev Anti Infect Ther.* 2019;17(9):673–84. doi:10.1080/14787210.2019.1561275.

33. Paul M, Dickstein Y, Raz-Pasteur A. Antibiotic de-escalation for bloodstream infections and pneumonia: systematic review and meta-analysis. *Clin Microbiol Infect.* 2016;22(11):960–7. doi:10.1016/j.cmi.2016.05.023.
34. Guo Y, Gao W, Yang H, Ma C, Sui S. De-escalation of empiric antibiotics in patients with severe sepsis or septic shock: a meta-analysis. *Heart Lung.* 2016;45(6):505–10. doi:10.1016/j.hrtlng.2016.06.001.
35. Moraes RB, Guillén JAV, Zabaleta WJC, Borges FK. De-escalation, adequacy of antibiotic therapy and culture positivity in septic patients: an observational study. *Rev Bras Ter Intensiva.* 2016;28(3):315–22. doi:10.5935/0103-507X.20160044.
36. De Bus L, Denys W, Catteeuw J, Gadeyne B, Vermeulen K, Boelens J, et al. Impact of de-escalation of beta-lactam antibiotics on the emergence of antibiotic resistance in ICU patients: a retrospective observational study. *Intensive Care Med.* 2016;42(4):538–48. doi:10.1007/s00134-016-4301-z.