

“Analysing Antimicrobial Usage Pattern and MDRO Trends in Intensive Care Units”

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Introduction

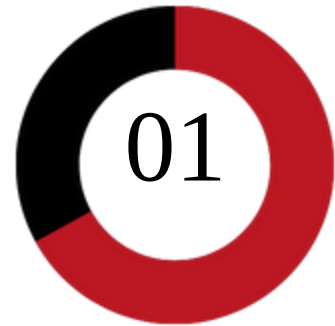
The Escalating Crisis: MDROs in Critical Care

- The Vital Role of ICUs: Intensive Care Units are indispensable for managing severe, life-threatening illnesses, offering advanced life support and specialized expertise to stabilize patients.
- A Paradoxical Threat: Despite their critical function, ICUs are high-risk epicenters for healthcare-associated infections (HAIs), particularly those caused by Multi-Drug Resistant Organisms (MDROs). These formidable pathogens defy multiple antimicrobial agents.
- Devastating Consequences: MDRO infections lead to significantly poorer patient outcomes, including increased treatment failure, prolonged hospital stays, higher morbidity and mortality, and a dramatic escalation in healthcare costs.
- India's Alarming Burden: The Antimicrobial Resistance (AMR) challenge is especially critical in India, driven by factors.

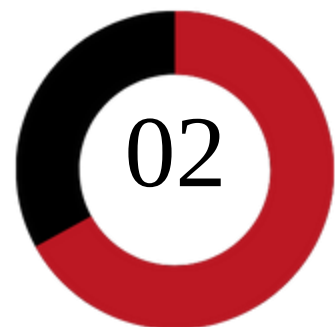


Introduction

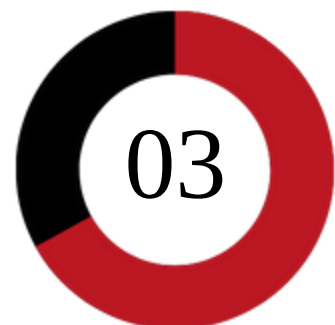
Our Strategic Response: Antimicrobial Stewardship & Dissertation Focus



- Antimicrobial Stewardship Programs (ASPs): Recognized internationally as essential cornerstone strategies, ASPs are structured, coordinated initiatives meticulously designed to optimize antimicrobial use.



- Core ASP Objectives: These programs aim to improve patient outcomes, curtail the emergence and spread of antibiotic resistance.



- Dissertation Focus: This research specifically aims to “Analyze the Antimicrobial Usage Pattern and MDRO Trends in Intensive Care Units in a tertiary care hospital setting.”

Objectives

Assessing ASP Impact on MDRO Control & Antimicrobial Usage:

- To evaluate the direct effect of Antimicrobial Stewardship Programs (ASPs) on reducing the incidence and transmission of multidrug-resistant organisms (MDROs) in the Intensive Care Unit (ICU).
- To analyze how ASPs influence overall antimicrobial usage patterns, promoting targeted, culture-based therapy and reducing broad-spectrum antibiotic use.
- To explore the specific association between ASP implementation and the prevalence of key MDROs like MRSA, VRE, and ESBL-producing organisms.



Methodology

Methodology: Our Study Approach

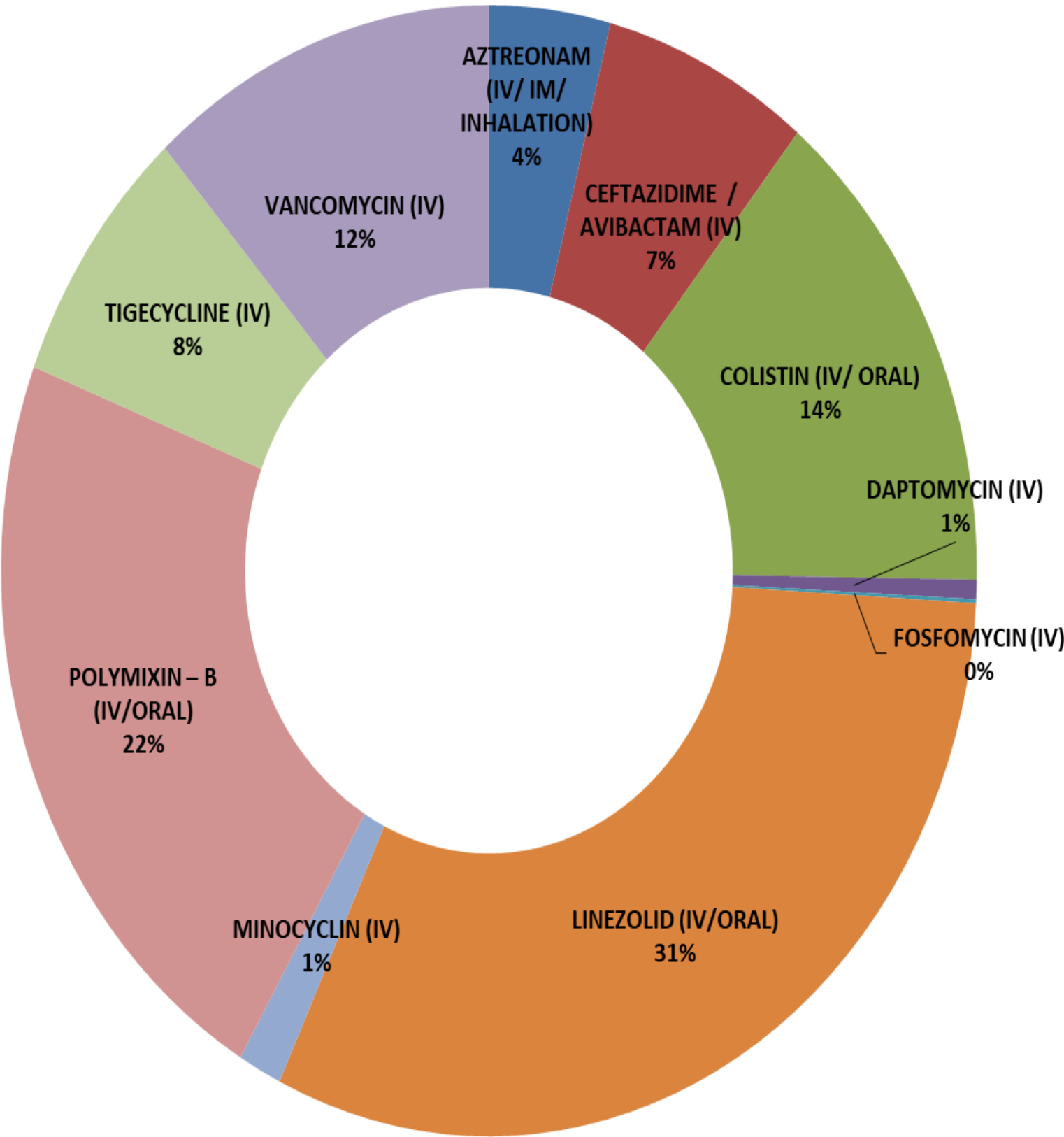
Study Type: Observational (Retrospective & Prospective)
Design: Pre-post analysis using Interrupted Time Series (ITS)
Duration: 3 months
Setting: Intensive Care Units (ICUs) at Mahatma Gandhi Hospital, Jaipur

Methodology: Data & Analysis

Data Sources: Patient electronic records, Antimicrobial Stewardship Program (ASP) records.

What We Measured:

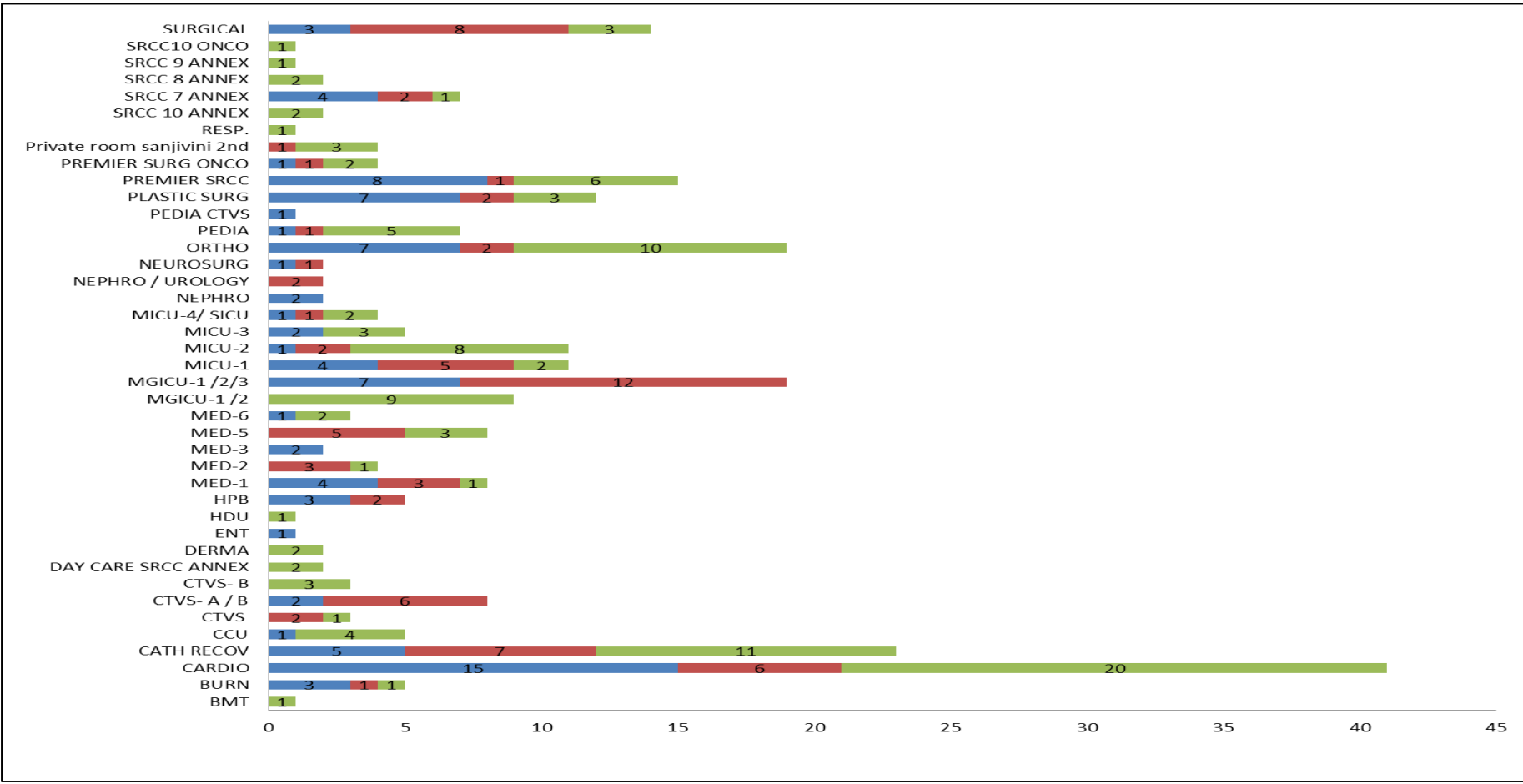
- Rates of multi-drug resistant organisms (MDROs)
- Antibiotic consumption
- Patient outcomes
- ASP intervention observations



Sampling Strategy & Data Collection

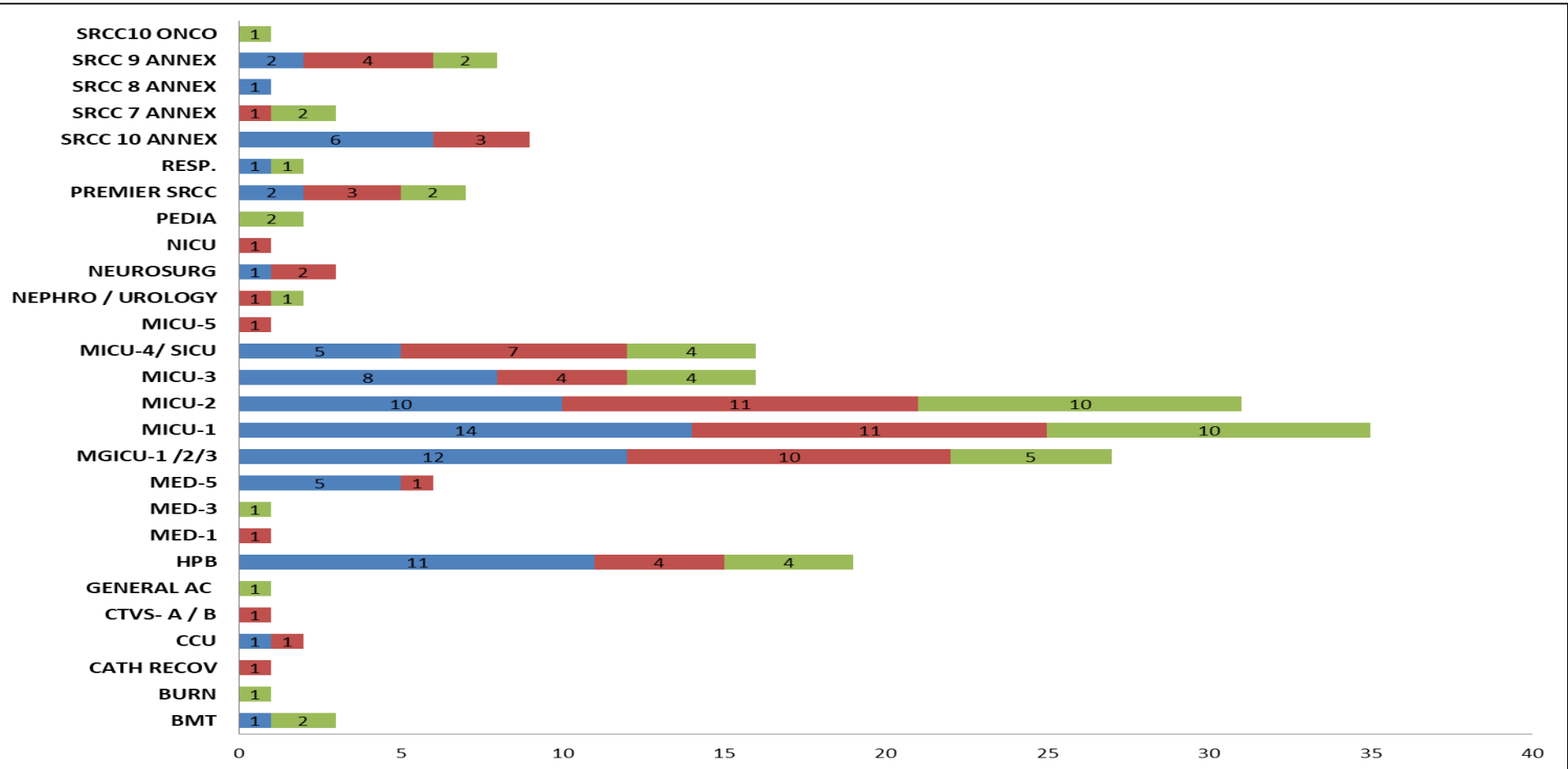
- **Sampling Strategy:**
- All patients consecutively admitted to the ICUs at Mahatma Gandhi Hospital during the 3-month study period.
- **Inclusion Criteria:** Patients requiring critical care management and receiving antimicrobial therapy.
- **Exclusion Criteria:** Patients with an ICU stay of less than 24 hours, those transferred from other ICUs with ongoing antimicrobial therapy, or individuals with incomplete medical records.
- **Data Collection:**
- Data was collected retrospectively and prospectively.
- **Tools:** Information was extracted using standardized data collection forms and by accessing the hospital's electronic health records.
- **Key Data Points Collected:**
 - Patient Details: Demographics and clinical severity scores.
- **Antibiotic Use:** Specifics of prescribed antibiotics (drug, dose and indication) in intensive care units.

PATIENTS GIVEN NUMBER OF RESTRICTED ANTIBIOTICS				
	NOVEMBER	DECEMBER	JANUARY	TOTAL
TOTAL PATIENTS OBSERVED	246	214	322	
1 MEROPENEM (IV/ IM/ INHALATION)	21	4	11	36
2 CEFTAZIDIME / AVIBACTAM (IV)	26	11	25	62
3 COLISTIN (IV/ ORAL)	54	20	55	129
4 DAPTOMYCIN (IV)	1	1	3	5
5 FOSFOMYCIN (IV)	0	0	1	1
6 LINEZOLID (IV/ORAL)	87	76	117	280
7 MINOCYCLIN (IV)	0	2	11	13
8 POLYMICIN – B (IV/ORAL)	80	68	53	201
9 CLINDAMYCINE (IV)	25	15	28	68
10 VANCOMYCIN (IV)	5	30	69	104
TOTAL RESTRICTED	299	227	372	

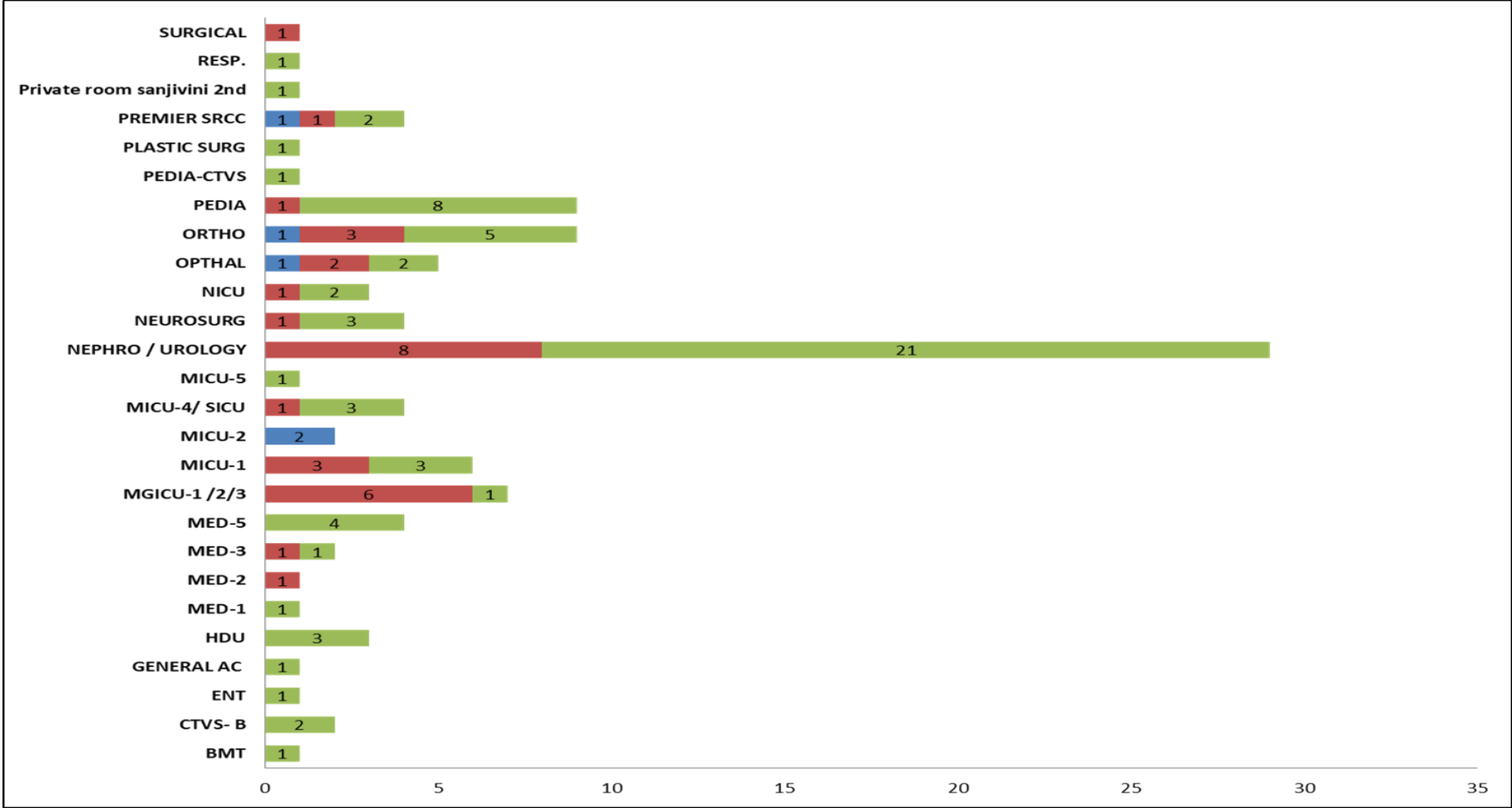


LINEZOLID Usage (31%)

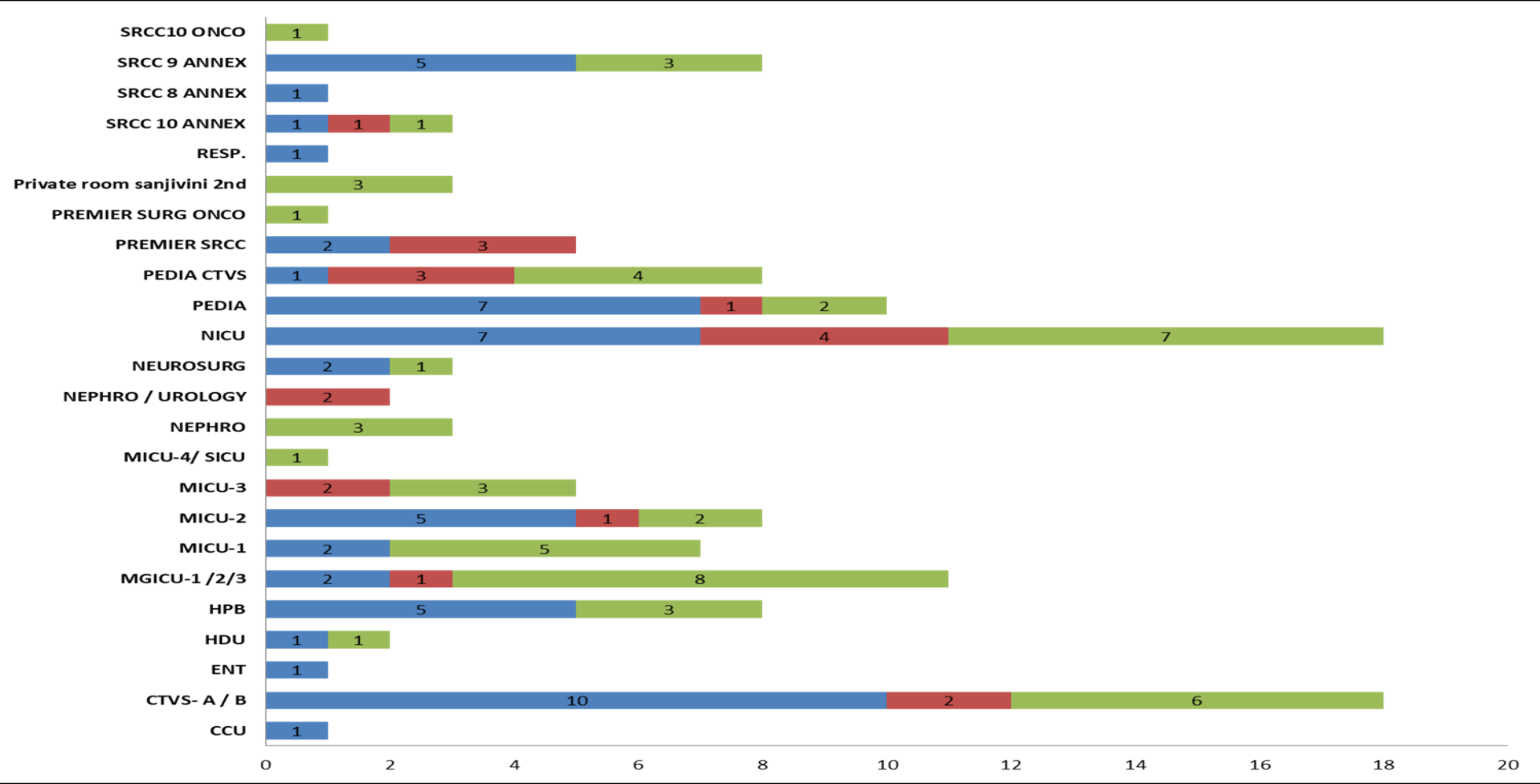
SAMPLE DISTRIBUTION



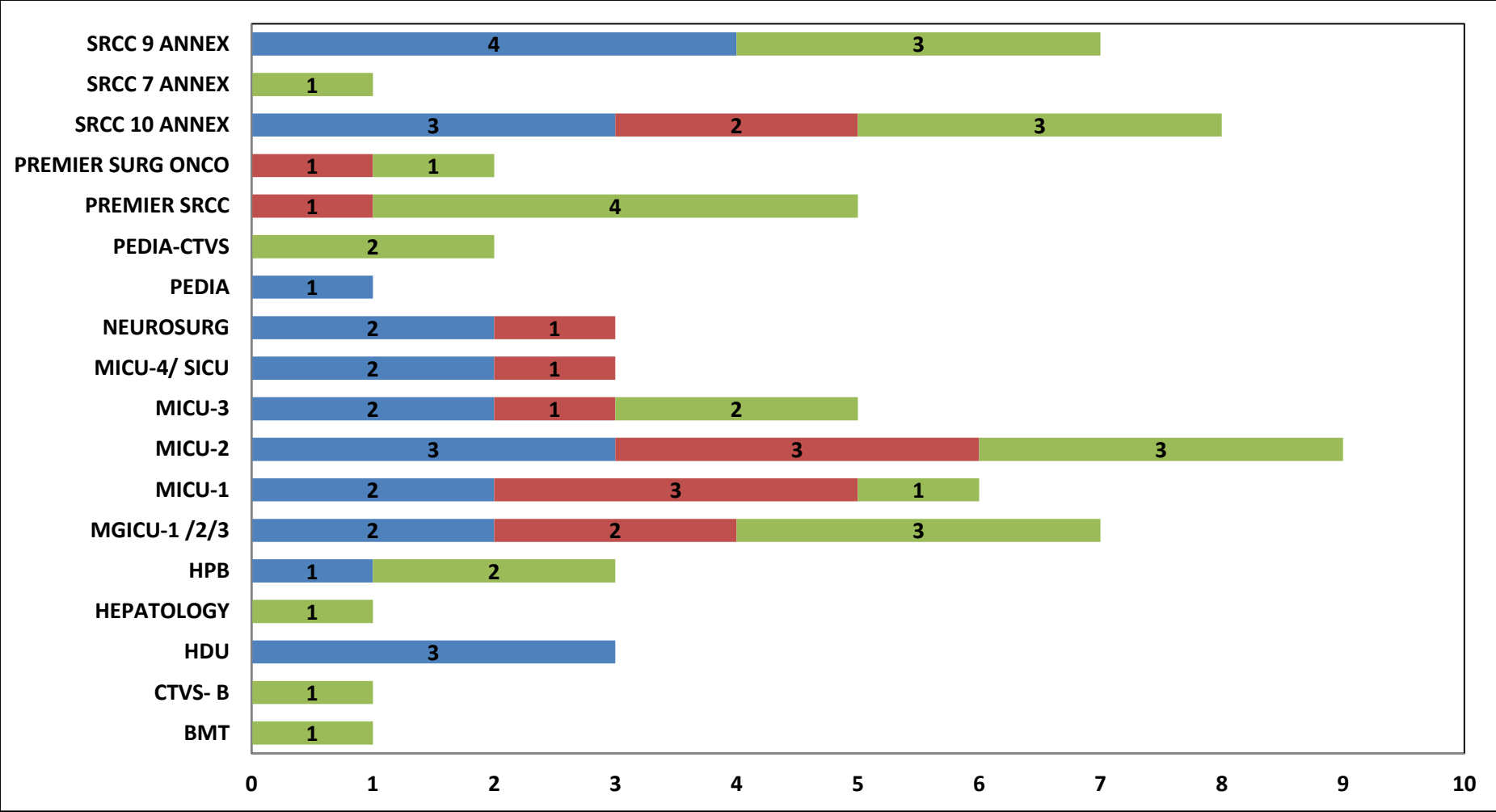
POLIMIXIN-B Usage (22%)



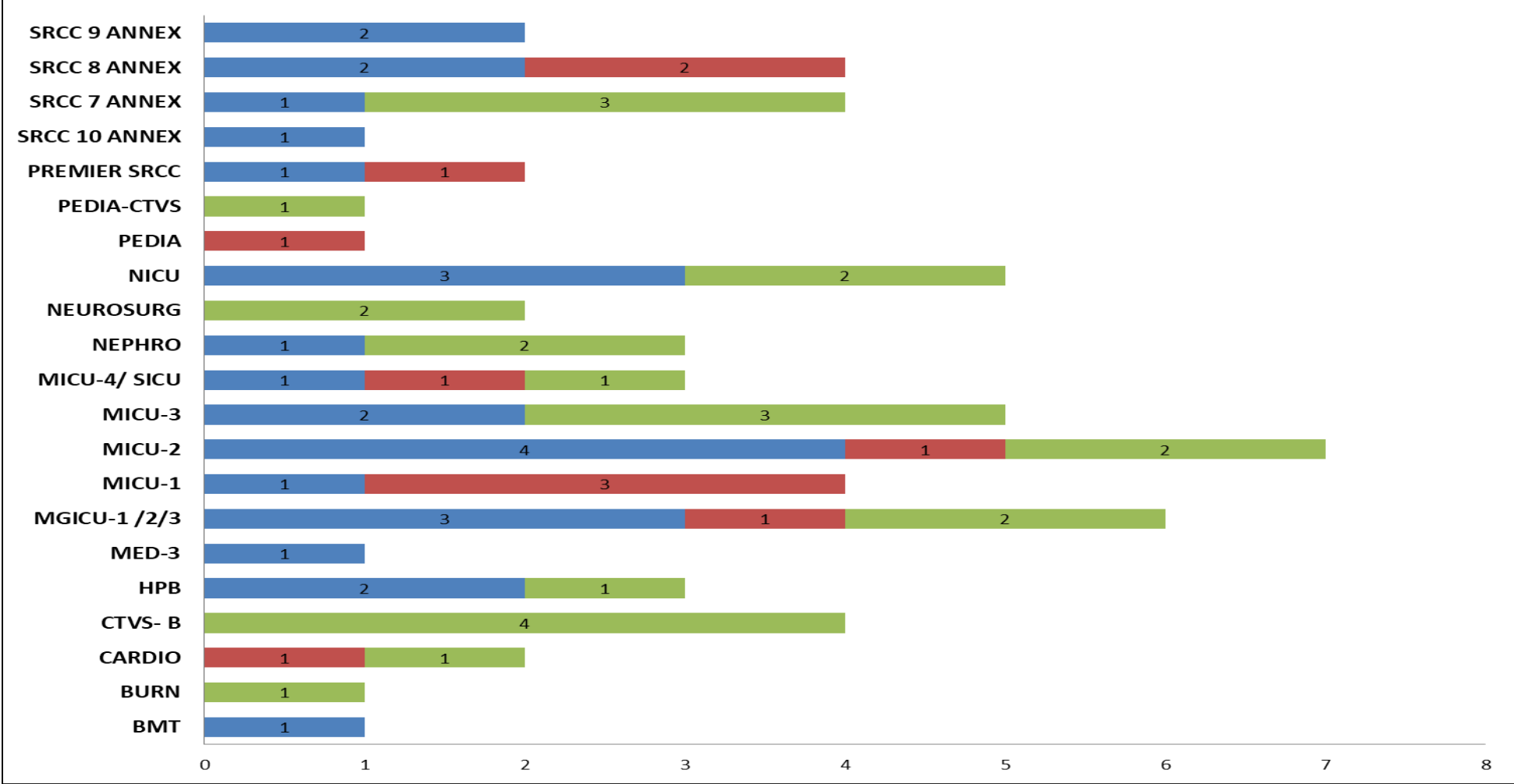
VANCOMYCIN USAGE (12%)



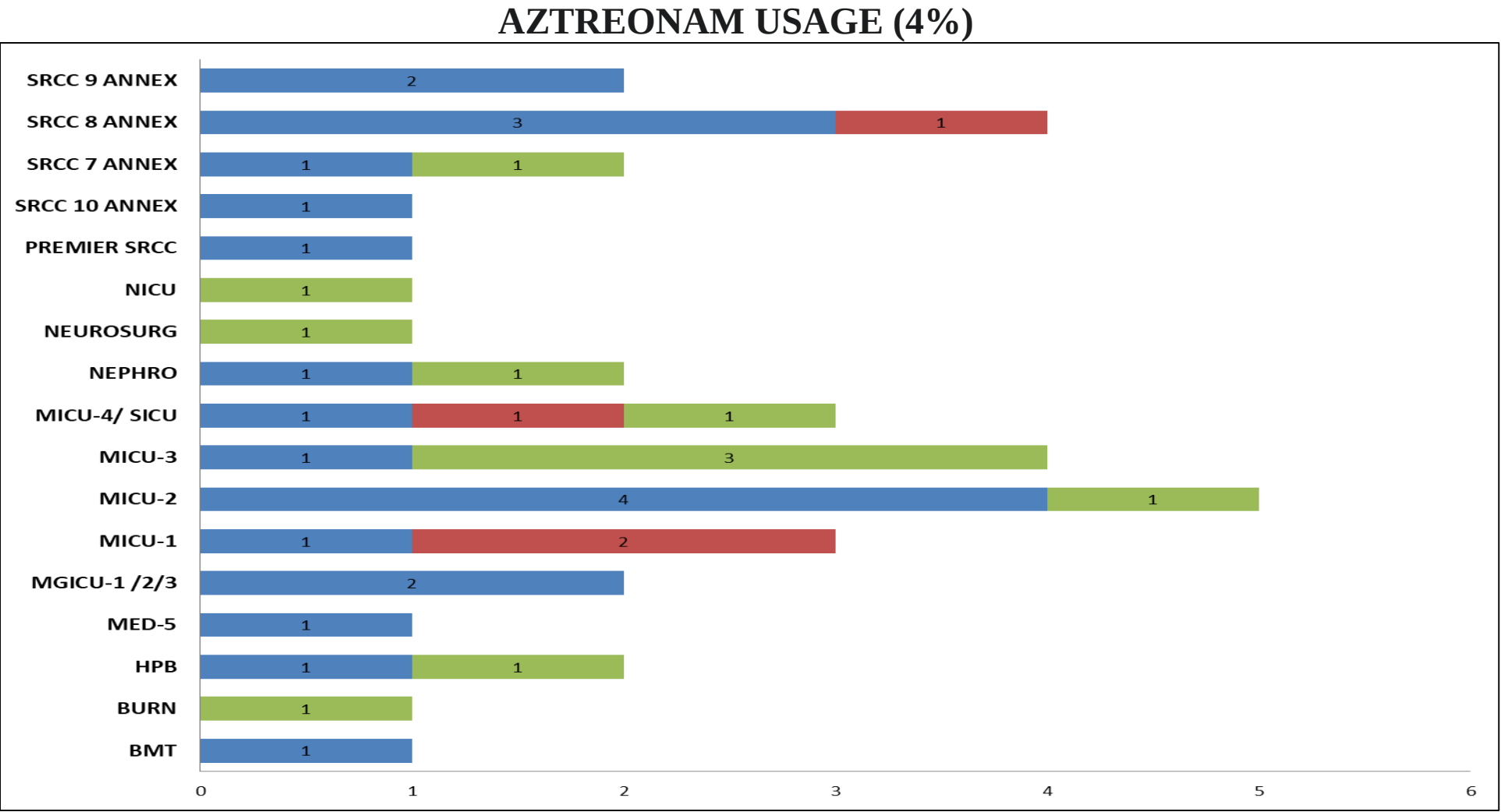
COLISTIN USAGE (14%)



TIGECYCLINE Usage (8%)



CEFTAZIDIME + AVIBACTAM Usage (7%)



AZTREONAM USAGE (4%)

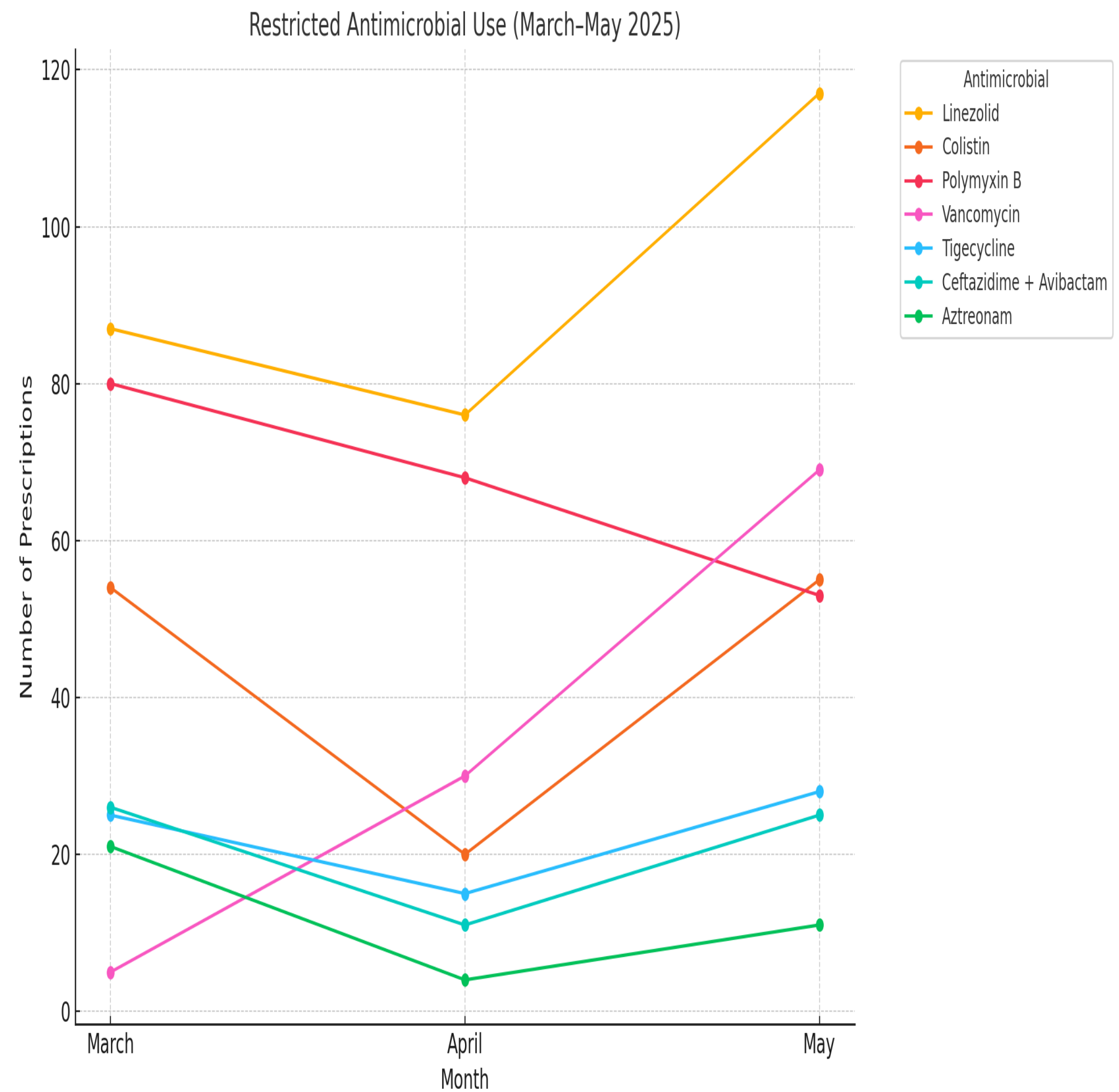
Analysis

Restricted Antimicrobial Appropriateness:

Detailed assessment of drugs like Linezolid, Polymyxin-B, Colistin, Vancomycin, Tigecycline, Ceftazidime + Avibactam, and Aztreonam showed varying levels of appropriate use across different ICU units and wards. Fluctuations in the consumption of restricted antimicrobials, such as Vancomycin, underscore the need for ongoing surveillance.

Factors Influencing Usage:

Antimicrobial usage patterns were influenced by specific surgical procedures (e.g., CABG, Cesarean Sections, Renal Transplants) and medical specialties (e.g., Urology, General Surgery, Neurosurgery), indicating areas for targeted stewardship.



Analysis

Restricted Antimicrobial Appropriateness

•Detailed analysis was done for restricted drugs: **Linezolid**, **Polymyxin-B**, **Colistin**, **Vancomycin**, **Tigecycline**, **Ceftazidime + Avibactam**, and **Aztreonam**.

Appropriateness varied across departments and ICUs.

- For example, **Linezolid** was often used inappropriately in the **Cath Recovery Ward**.
- **Polymyxin-B** and **Colistin** showed high usage but good compliance in most ICUs.

• The **top three drugs**—**Linezolid**, **Polymyxin-B**, and **Colistin**—make up **67%** of all restricted antibiotic prescriptions.

• This aligns with the **MDRO burden observed in the ICU**, dominated by MRSA, VRE, and carbapenem-resistant Gram-negatives.

• The presence of drugs like **Ceftazidime+Avibactam** and **Aztreonam** shows a **careful, tiered approach** to handling specific resistance patterns and patient allergies.

Antimicrobial	Total Prescriptions	% of Total	Primary MDRO Targeted
Linezolid	280	31%	MRSA, VRE
Polymyxin-B	201	22%	Carbapenem-resistant GNB (e.g., K. pneumoniae)
Colistin	129	14%	XDR Acinetobacter, Pseudomonas
Vancomycin	104	12%	MRSA
Tigecycline	68	8%	MDR Enterobacteriaceae
Ceftazidime + Avibactam	62	7%	CRE
Aztreonam	36	4%	β-lactam allergic patients

Interpretation

1. Antimicrobial Usage Patterns

- **Significant month-wise decline** in the use of restricted antimicrobials (Linezolid, Polymyxin B, Colistin), reflecting improved adherence to ASP protocols.
- **Top 3 antibiotics** (Linezolid, Polymyxin B, Colistin) accounted for ~67% of restricted use, indicating high burden of MRSA, VRE, and CRE in ICUs.

2. Appropriateness of Use

Linezolid showed some **misuse**, especially in the Cath Recovery ward.

3. MDRO Trend Correlation

- ASP implementation **correlated with reduced incidence** of MRSA, CRE, and VRE colonization.
- ICUs with strong ASP practices saw **notably fewer MDRO infections**, showing program effectiveness.

4. ASP Compliance Trends

- Compliance with stewardship guidelines **steadily improved**, reaching over **91.5%** by May 2025.
- Reflects growing acceptance of ASP recommendations like de-escalation, dose adjustment, and audit feedback.
- Colistin and Polymyxin B generally used appropriately, aligning with ICU infection profiles.

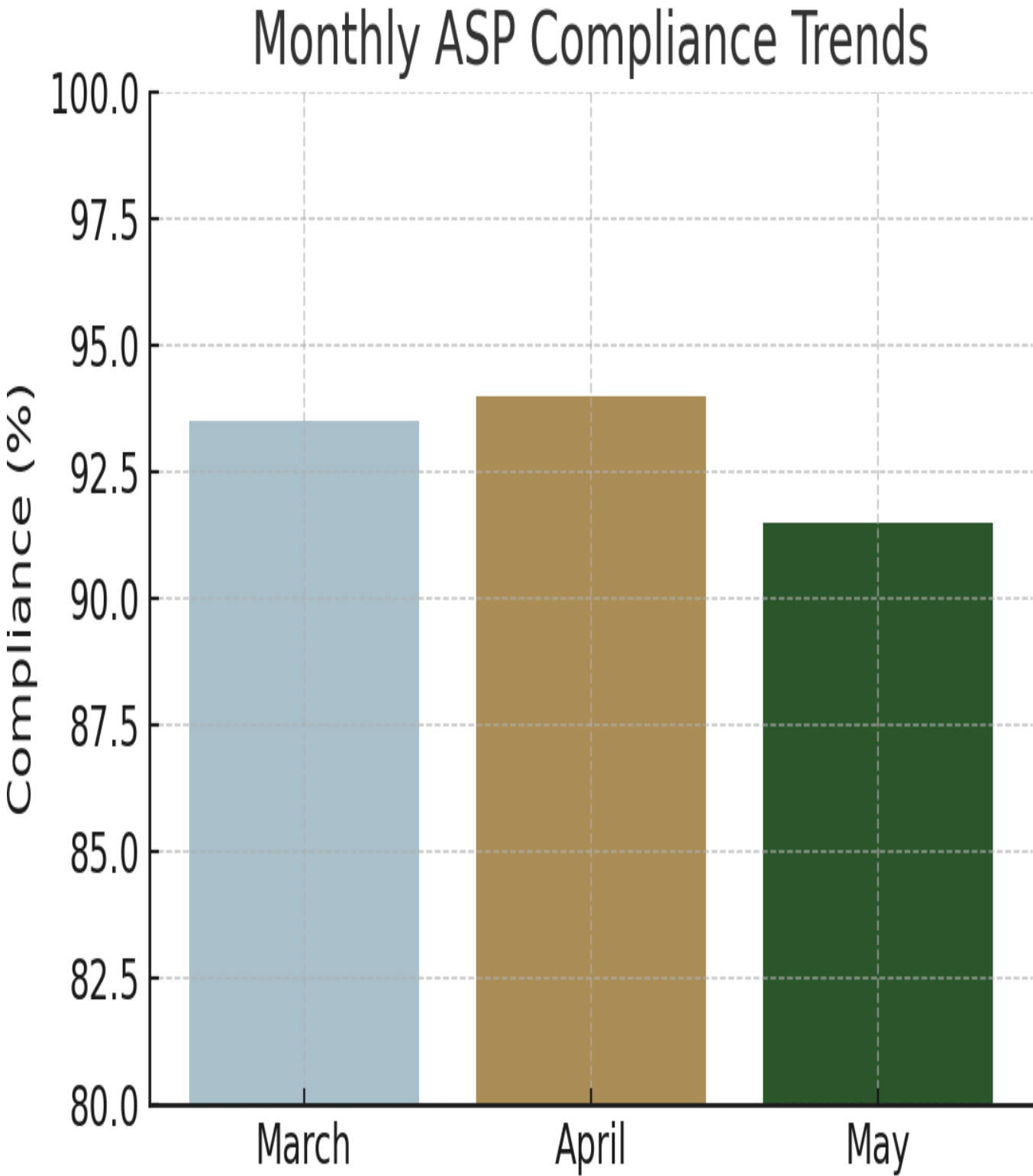
Results

Antimicrobial Usage:

- A significant month-wise decline was observed in restricted antimicrobial usage, indicating increased adherence to ASP guidelines.
- The most commonly used restricted antimicrobials were Linezolid, Polymyxin B, and Colistin, reflecting a high prevalence of Gram-positive and Gram-negative MDROs.
- Compliance with ASP recommendations steadily improved, reaching over 75% by January 2025 (with monthly actual rates around 91.5-94% against a 100% target), driven by continuous audits and interdepartmental collaboration.

MDRO Trends:

- ASP implementation correlated with a significant reduction in MRSA and CRE infections.
- ICUs with comprehensive ASPs had a significantly lower usage of **Ceftazidime+Avibactam antimicrobials** compared to those with basic or no formal ASPs.



Discussion and Implications

Positive ASP Impact on Antibiotic Use & MDRO Trends

Antimicrobial Stewardship Programs (ASPs) led to a significant reduction in the usage of last-line antibiotics like Colistin, Polymyxin-B, and Linezolid. This was accompanied by a notable decline in MDRO-related infections, particularly MRSA and CRE, confirming the program's success in both optimizing prescribing behaviors and curbing resistance.

Need for Targeted & Specialty-Specific Interventions

Despite high compliance (>91.5%), **gaps remained**, particularly in areas like **renal transplants and surgical prophylaxis**. These findings emphasize the need for **procedure-specific ASP modules** and **continuous training**, especially for high-risk departments, to ensure uniformity in stewardship practices.

Sustainable ASP Integration & Future Directions

The study highlights the need for **long-term ASP implementation** across departments, backed by **real-time data dashboards** and **MDRO surveillance systems**. These steps will help hospitals maintain high compliance, prevent resistance resurgence, and **serve as a scalable model for other Indian healthcare institutions**.

The study reinforces the critical role of ASPs in combating MDROs, even in resource-limited settings. It provides empirical support for establishing and strengthening institutional ASPs in India, offering a practical model for other healthcare facilities.

Conclusions

Overall Conclusion:

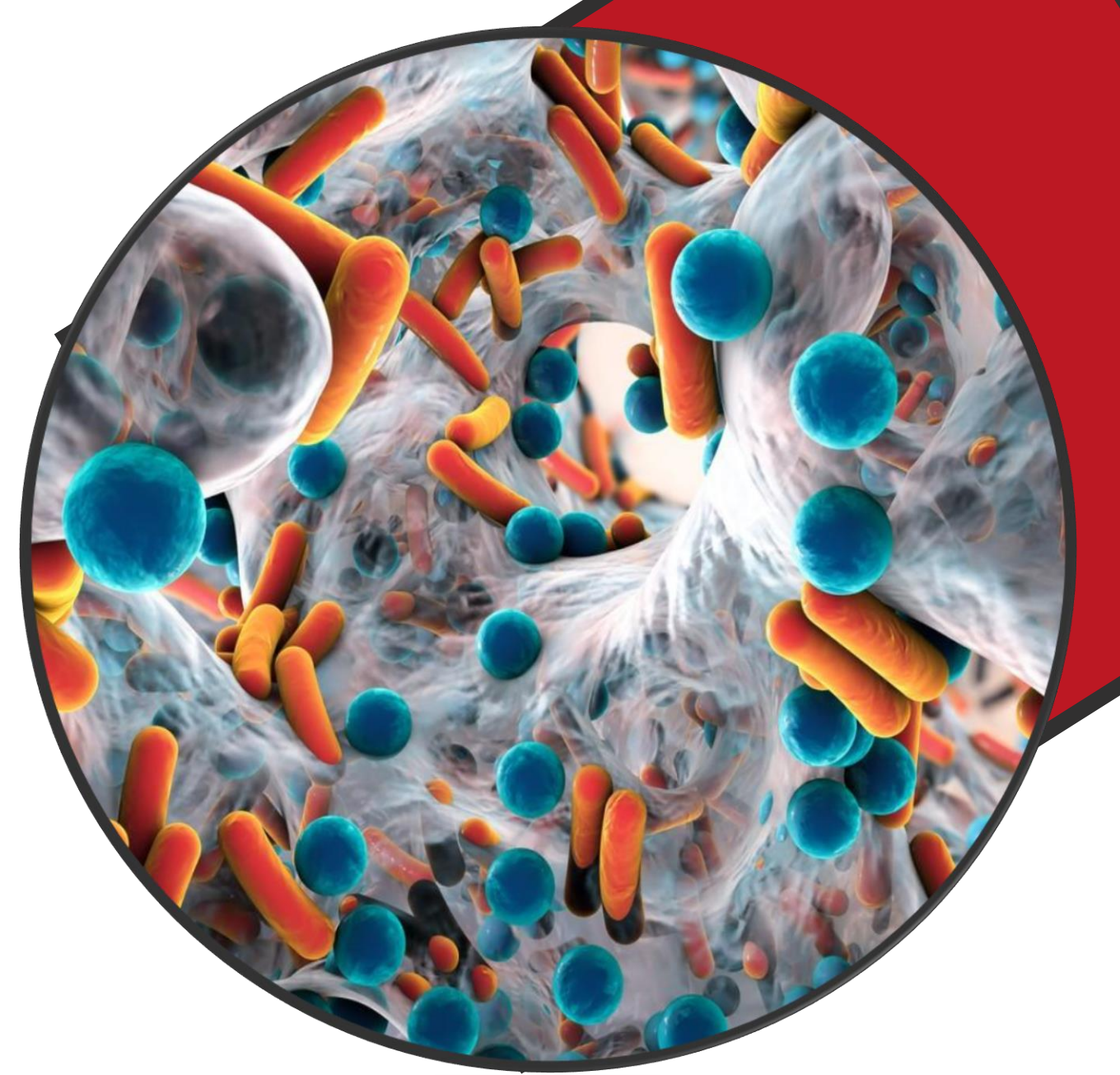
Well-structured ASPs significantly optimize antimicrobial use and reduce the burden of MDROs in ICUs, even in resource-constrained settings like India. These findings reinforce the necessity of integrating stewardship with real-time data monitoring, prescriber education, and multidisciplinary collaboration.

Preserving Antimicrobial Efficacy:

Improvements in compliance and reduced reliance on last-line antibiotics underscore the ASP's role in preserving antimicrobial efficacy.

Future Directions & Recommendations:

Broader hospital-wide ASP adoption.
Inclusion of real-time dashboards for continuous monitoring.
Long-term colonization surveillance to enhance sustainability and effectiveness.
Mahatma Gandhi Hospital's ASP serves as a replicable model for other tertiary care centers in India.



Thank you very much!

