ejpmr, 2025, 12(6), 400-403

SJIF Impact Factor 7.065

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

IMPACT OF RESTRICTED ANTIBIOTIC PRESCRIPTION PROTOCOLS: A RETROSPECTIVE BEFORE-AND-AFTER STUDY AT PRINCE ALI BIN AL-HUSSEIN MILITARY HOSPITAL

Duha Mansor Helal Dhaisat P. H.*[1], Mohammad Esmail Albdairat P. H.[2], Qais Hesham Alshamaileh P. H.[3], Waseem Kareem Saleem P. H.[4] and Omar Naseem Alzriqat P. H.[5]

[1,2,3,4,5]Pharmacist Royal Medical Services Jordan.

***Corresponding Author: Duha Mansor Helal Dhaisat P. H.**

Pharmacist Royal Medical Services Jordan.

Article Received on 13/04/2025 **Article Revised on 04/05/2025** **Article Published on 25/05/2025**

ABSTRACT

Introduction: Overuse of antibiotics is the primary cause of antimicrobial resistance (AMR), a global health emergency. Healthcare systems fight this by limiting the use of broad-spectrum antibiotics to instances with microbiological confirmation or critical necessity through the implementation of antimicrobial stewardship programs (ASPs). This retrospective study compares the pre- and post-implementation (2022 and 2023) years to assess the effects of restricted antibiotic policies at Prince Ali Bin Al-Hussein Military Hospital in Jordan. **Methodology:** A retrospective before-and-after study that contrasted the prescribing patterns, expenses, and consumption of antibiotics across two 12-month periods (pre- and post-intervention). Adjusted to account for hospital admission rates in order to account for patient volume, Antibiotic prescriptions are documented in pharmacy records together with the quantity administered (in grams or vials, for example), Monthly hospital admissions are documented in order to standardize consumption measures and Antibiotic shopping expenses (in Jordanian dinar, JD). **Objectives:** To determine the difference between pre and post implementing restricted Antibiotic protocol and determine the Total monthly expenditure and cost per admission. **Results:** Colistin: A 21.5% reduction with 1,308.2 JD savings despite a 20% increase in bed occupancy, Meropenem:(500 mg) 14.7% reduction (207.5 JD savings), (1 g) 19.8% reduction (886.7 JD savings), Ertapenem: 7.4% reduction (483.0 JD savings), Imipenem/Cilastatin: 10.3% reduction (1,391.6 JD savings), Total Annual Savings: 4,276 JD, Reductions were highly significant ($p < 0.001$), confirming they were not due to chance. **Conclusion:** our study showed Significant reductions in high-risk antibiotic use (e.g., colistin, meropenem) and measurable cost savings, Alignment with global evidence though stricter interventions are needed for antibiotics like ertapenem.

KEYWORDS: Antimicrobial resistance, stewardship programs, restricted protocols, military hospitals, cost.

1. INTRODUCTION

If current trends continue, antimicrobial resistance (AMR) is predicted to cause 10 million deaths annually by 2050, posing a catastrophic danger to world health. (O'Neill, 2016).

The indiscriminate use of antibiotics, especially in healthcare settings where broad-spectrum drugs are overprescribed, is a major contributor to AMR. (Centers for Disease Control and Prevention [CDC], 2019). Antimicrobial stewardship programs (ASPs), which include restricted antibiotic prescription regimens, have been widely promoted as a solution to reduce antibiotic resistance, rationalize antibiotic use, and enhance patient safety. (Dellit et al., 2007; WHO, 2020).

Before prescribing highrisk antibiotics, prescribers must get permission from infectious disease specialists or pharmacists due to restricted protocols. (e.g., carbapenems). Such strategies have demonstrated success in reducing antibiotic misuse and resistance rates in high-income countries (Baur et al., 2017; Karanika et al., 2016).

Nevertheless, their application in environments with limited resources like as military hospitals in the Middle East, is still uneven and poorly studied. (Al-Taani et al., 2018; Abbara et al., 2021). Because they treat both active-duty members and civilians, military hospitals—like Jordan's Prince Ali Bin Al-Hussein Military Hospital—face particular difficulties. They frequently deal with significant patient turnover and infection control demands. (Al-Azzam et al., 2012).

This retrospective before-and-after study examines the impact of restricted antibiotic protocols implemented at

Prince Ali Bin Al-Hussein Military Hospital in 2022. By comparing data from 2021–2022 (pre-intervention) and 2022–2023 (post-intervention).

The primary goal was to assess changes in antibiotic con sumption, expenditures, and prescription trends while cor recting for hospital admission rates.

2. METHODOLOGY

2.1. Study Design

- At Prince Ali Bin Al-Hussein Military Hospital, a retrospective before-and-after comparison research was carried out to assess the effects of restricted antibiotic prescription policies, Two 12-month periods were compared in the study:
- Pre-intervention: 12 months before protocol implementation.
- Post-intervention: 12 months after protocol implementation.

2.2 Data Sources

The manual or electronic records of every antibiotic pres cription written during the study periods are known as ph armacy ledgers.

- Hospital Admission Records: Monthly total of inpati ent admissions to standardize the volume of patients receiving antibiotics.
- Financial Reports: Antibiotic procurement expenses (in Jordanian denar).

2.3 Inclusion Criteria

- All systemic restricted antimicrobial prescribed for inpatients during the study periods.

2.4 Exclusion Criteria

- Non restricted antibiotics.

3. VARIABLES AND MEASUREMENTS

3.1 Primary Outcomes

1. **Antibiotic Consumption**
   - Measured as total quantity dispensed (e.g., grams, vials, tablets) for each antibiotic.
   - Normalized by number of admissions:

Consumption per 100 admissions
=Total quantity dispensed\Total admissions×100

2. **Cost Analysis**
   - Total monthly expenditure on antibiotics (in JD).
   - Cost per admission:

Cost per admission=Total antibiotic cost\Total admissions

4. Statistical Analysis

Unpaired t-test to compare Mean antibiotic consumption per 100 admissions (pre vs. post intervention) and Mean monthly antibiotic costs (pre vs. post intervention).

5. Ethical Considerations

- Approved by the royal medical services Ethics Committee.
- Data anonymized to protect patient and prescriber confidentiality.

6. RESULTS

Table 1: Summary of Dispensed Drug Quantities (Before vs. After).

Restricted Antibiotics	Dosage	Before	After	Absolute Difference	Percentage Change (%)
Colistin	2million	289	227	+62	↓ 21.5%
Meropenem	500 mg	617	526	+91	↓ 14.7%
Ertapenem	500 mg	311	288	+23	↓ 7.4%
Meropenem	1 g	1,739	1,394	+345	↓ 19.8%
Imipenem/Cilastatin	1 g	5,529	4,961	+568	↓ 10.3%

Table 2: Hospital Bed Occupancy Calculation.

Metric	Before (average)	After (average)
Daily Occupancy Rate	50% (100/200)	60% (120/200)
Monthly (30 days):		
- Occupied Bed-Days	3,000 bed-days	3,600 bed-days
Annually (365 days):		
- Occupied Bed-Days	36,500 bed-days	43,800 bed-days

Table 3: Antibiotic Consumption Rate per 100 Bed-Days.

Restricted Antibiotic	Dosage	Total DDDs (Before)	DDD/100 bed-days (Before)	Total DDDs (After)	DDD/100 bed-days (After)	Reduction (%)	P-value*
Colistin	–	289	9.63	227	6.31	↓34.5%	0.012
Meropenem	500 mg	617	20.57	526	14.61	↓29.0%	0.003
Ertapenem	500 mg	311	10.37	288	8.00	↓22.9%	0.042
Meropenem	1 g	1,739	57.97	1,394	38.72	↓33.2%	<0.001
Imipenem/Cilastatin	1 g	5,529	184.30	4,961	137.81	↓25.2%	0.008
DDD= Defined Daily Dose							

7. Financial Savings Calculation

Savings = (DDDs Before−DDDs After)×Cost per DDD

Table 4: Financial Savings.

Antibiotic	Dosage	DDDs Before	DDDs After	Cost per DDD (JD)	Savings (JD)
Colistin	–	289	227	21.1	1,308.2
Meropenem	500 mg	617	526	2.28	207.5
Ertapenem	500 mg	311	288	21	483.0
Meropenem	1 g	1,739	1,394	2.57	886.7
Imipenem/Cilastatin	1 g	5,529	4,961	2.45	1,391.6
Total Savings					4,276.0 JD

Table 5: Statistical Significance Analysis.

Restricted Antibiotic	Rate Before	Rate After	p-value	Significance (α=0.05)
Colistin	0.0079	0.0052	<0.0001	Yes
Meropenem (500 mg)	0.0169	0.0120	<0.0001	Yes
Ertapenem (500 mg)	0.0085	0.0066	.0009	Yes
Meropenem (1 g)	0.0476	0.0318	<0.0001	Yes
Imipenem/Cilastatin	0.1515	0.1133	<0.0001	Yes

8. DISCUSSION

8.1. Comparison with Previous Studies

- A. Colistin: In our study we find 21.5% (289 to 227 DDDs) | Savings: 1,308.2 JD, Colistin showed the second-highest percentage reduction, Similar studies in the Middle East reported 15–30% reductions post-ASP implementation, driven by pre-authorization requirements and clinician education (WHO, 2020). Notably, Chaudhary et al. (2019) observed an 18% reduction in India, emphasizing that stricter controls (e.g., daily audits) are needed for reductions exceeding 25%,The observed 21.5% decline falls within the global range, indicating effective stewardship despite a 20% rise in bed occupancy.

B. Meropenem: We find (500 mg) 14.7% reduction (Savings: 207.5 JD) and (1 g) 19.8% reduction (Savings: 886.7 JD). Tamma et al. (2017) in the U.S. found a 22% reduction in carbapenem use after pre-authorization mandates, closely matching the 1 g results, and (Baur et al., 2017) showed smaller reductions (12–18%) for carbapenems with passive interventions (e.g., prescribing guidelines) so The higher reduction for 1 g meropenem (19.8%) may reflect stricter enforcement (e.g., mandatory consults) compared to passive strategies, The lower savings for 500 mg (2.28 JD/DDD vs. 2.57 JD/DDD) may reflect its use in shorter courses or less severe infections.

C. Ertapenem: We find 7.4% reduction (Savings: 483.0 JD), A Brazilian study (Zavascki et al., 2016) observed minimal reductions (5–10%) for ertapenem without strict controls, as it is often reserved for abdominal infections and CDC (2019) highlighted that ertapenem use rarely declines significantly without targeted restrictions, So The 7.4% reduction is consistent with moderate interventions but suggests a need for stricter criteria (e.g., indication-based approval).

D. Imipenem/ Cilastatin: We find in our study 10.3% reduction (Savings: 1,391.6 JD) Aldeyab et al. (2018) in the UK reported an 8–12% reduction after educational workshops, aligning with our findings, A meta-analysis (Clinical Microbiology and Infection, 2021) concluded that >15% reductions require structured interventions (e.g., real-time prescription tracking), So The 10.3% reduction reflects moderate success, advocating for enhanced tools like automated alerts to prescribers.

8.2. Economic and Clinical Significance

- **Cost Savings**: Total savings of **4,276 JD/year** demonstrate the financial viability of ASPs, The reductions were statistically significant ($p <$ 0.001 for all antibiotics), reinforcing that declines were not due to chance.

9. Strengths

- Simple, reproducible methodology using pharmacy ledger data.
- Normalization by admissions accounts for changes in patient volume.

10. Limitations

- **Intervention Design**: Most studies combined restrictions with education, while this intervention may rely solely on dispensing controls.
- **Short-Term Data**: The current analysis reflects immediate post-intervention effects, whereas long-term sustainability requires monitoring (e.g., Dellit et al., 2007).
- **Confounding Factors**: A 20% rise in bed occupancy could mask intervention efficacy, though statistical adjustments (Z-tests) confirmed significance (p < 0.001).

11. CONCLUSIONS

- **Alignment with Evidence**: Reductions (**7.4–21.5%**) mirror global trends, validating the intervention's effectiveness.

12. Recommendations

1. Enhance Interventions: Integrate education and real-time feedback to boost reductions (e.g., for ertapenem).
2. Monitor Resistance: Track microbial resistance patterns to assess long-term clinical impact.
3. DDD Benchmarking: Compare hospital DDD/100 bed-days to WHO or national standards to identify further opportunities.

REFERENCES

1. Abbara, S., Al Iman, R., Al Khalil, S., & Al Masri, I., Antimicrobial stewardship in the Eastern Mediterranean Region: A systematic review. *Journal of Infection and Public Health*, 2021; *14*(5): 621–628.
2. Al-Azzam, S. I., Al-Husein, B. A., Alzoubi, F., Masadeh, M. M., & Al-Horani, M. A. S. Self-medication with antibiotics in Jordanian population. *International Journal of Occupational Medicine and Environmental Health*, 2012; *25*(1): 75–87.
3. Aldeyab, M. A., et al. Antibiotic prescribing practices in a UK hospital. *Journal of Antimicrobial Chemotherapy*, 2018; *73*(2): 511–514.
4. Al-Taani, G. M., Karasneh, R. A., Al-Azzam, S., Bin Shaman, M., Khader, Y., & Gould, I. M. Knowledge, attitudes, and practices of physicians and pharmacists toward antimicrobial stewardship in Jordan. *American Journal of Infection Control*, 2018; *46*(12): 1417–1421.
5. Baur, D., Gladstone, B. P., Burkert, F., Carrara, E., Foschi, F., Döbele, S., & Tacconelli, E. Effect of antibiotic stewardship on the incidence of infection and colonisation with antibiotic-resistant bacteria and *Clostridium difficile* infection: A systematic review and meta-analysis. *The Lancet Infectious Diseases*, 2017; *17*(9): 990–1001.
6. Centers for Disease Control and Prevention (CDC). (2019). *Core elements of hospital antibiotic stewardship programs*.
7. Dellit, T. H., Owens, R. C., McGowan, J. E., Gerding, D. N., Weinstein, R. A., Burke, J. P., Hooton, T. M. Infectious Diseases Society of America and Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clinical Infectious Diseases*, 2007; *44*(2): 159–177.
8. Karanika, S., Paudel, S., Grigoras, C., Kalbasi, A., & Mylonakis, E. Systematic review and meta-analysis of clinical and economic outcomes from the implementation of hospital-based antimicrobial stewardship programs. *Antimicrobial Agents and Chemotherapy*, 2016; *60*(8): 4840–4852.
9. Moghnieh, R., Siblani, L., Ghadban, D., El Mchad, H., Zeineddine, R., Abdallah, D., ... Araj, G. F. Extensively drug-resistant *Acinetobacter baumannii* in a Lebanese intensive care unit: Risk factors for acquisition and determination of a colonization score. *Journal of Global Antimicrobial Resistance*, 2017; *8:* 122–129.
10. O'Neill, J. (2016). *Tackling drug-resistant infections globally: Final report and recommendations*. The Review on Antimicrobial Resistance.
11. Tamma, P. D., et al. Association of adverse events with antibiotic use in hospitalized patients. *JAMA Internal Medicine*, 2017; *177*(9): 1308–1315.
12. World Health Organization (WHO). *Global antimicrobial resistance and use surveillance system (GLASS) report*, 2020.
13. Zavascki, A. P., et al. The impact of antimicrobial stewardship programs on resistance in Gram-negative bacteria. *Brazilian Journal of Infectious Diseases*, 2016; *20*(1): 54–58.
14. Zowawi, H. M., Harris, P. N. A., Roberts, M. J., Tambyah, P. A., Schembri, M. A., Pezzani, M. D., Paterson, D. L. The emerging threat of multidrug-resistant Gram-negative bacteria in urology. *Nature Reviews Urology*, 2015; *12*(10): 570–584.