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ANTIBIOTIC RESTRICTION POLICIES: A COMPARATIVE STUDY OF IMPLEMENTATION AND OUTCOMES AT PRINCE ZAID BIN AL-HUSSEIN MILITARY HOSPITAL AND PRINCE ALI BIN AL-HUSSEIN MILITARY HOSPITAL

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ABSTRACT

Introduction: A major threat to global health, antimicrobial resistance (AMR) raises hospital stays, costs, and mortality rates, Applying restrictive antimicrobials policies in hospitals, where certain high-risk antibiotics need special authorization before usage, stays an important strategy to fight AMR. Although many Jordanian hospitals have implemented such rules, the majority of research to far has concentrated on individual hospitals rather than comparing practices across hospitals, these results in a lack of knowledge regarding the actual implementation of policies and their efficacy in various contexts. In order to close that gap, this study compares the antibiotic restriction policies of Prince Zaid bin Al-Hussein military Hospital and Prince Ali bin Al-Hussein military Hospital, two of Jordan's large military hospitals. **Methodology:** The essential method involves a comparative analysis of restricted antibiotic use between the two military hospitals, Data on the total consumption of targeted antibiotics and the corresponding total patient-days (calculated from admissions and bed occupancy) will be collected then This will allow for the calculation and comparison of a standardized consumption rate (using the metric DDD/100 patient-days) for each institution, In parallel, the total acquisition cost for these drugs will be compiled and compared, The analysis will then integrate these findings, examining the relationship between consumption rate and financial cost to provide a clear, brief evaluation of both usage patterns and economic outcomes. **Results:** Imipenem/Cilastatin (1 g) was the most dispensed restricted antibiotic in both hospitals, Ali Hospital had higher annual bed occupancy 49,802 bed-days compared to Zaid Hospital 14,601 bed-days, After standardizing consumption, the rates of antibiotic use per 100 bed-days were similar between the two hospitals. The financial analysis revealed the cost per DDD is identical for each antibiotic in both hospitals, but Imipenem/Cilastatin representing the highest cost driver, Zaid Hospital established higher costs per 100 bed-days for all antibiotics. **Conclusion**: Although Ali Hospital dispensed a higher number of restricted antibiotic vials, the adjusted consumption rates and associated costs per 100 bed-days were very similar between Ali and Zaid hospitals. Imipenem/cilastatin was the most frequently used restricted antibiotic and the major contributor to financial burden in both institutions; these findings indicate comparable prescribing patterns.

KEYWORDS: Antibiotics, restricted antibiotics, antimicrobials, cost.

INTRODUCTION

The rise of antimicrobial resistance (AMR) remains the most critical worldwide health tasks in this time (World Health Organization, 2021), (AMR) were determined by the abuse and misuse of antibiotics in healthcare locations, this making common infections harder to treat

and increase antibiotics resistant, so healthcare institutions worldwide are approving (ASPs), which are corresponding interferences aimed to decrease the inappropriate use of antibiotics resistance, (Salam; et, al, 2023).

A effective ASPs is the implementation of antibiotic restriction policies, because These policies aim to guide prescribers towards more evidence-based use of critical antibiotics, Typically this involves requiring authorization from an infectious disease specialist or a designated pharmacist before these restricted agents can be dispensed, (Barlam et al., 2016). The most important outcomes are improving patient safety by reducing adverse drug events, slowing the appearance and spread of bacterial resistance, and optimizing healthcare resources (Karanika et al., 2016).

But success is not sure just because a restriction policy is in place, the effectiveness is heavily influenced by how it is implemented, Factors such as institutional culture, the design of the authorization process, staff engagement, and the availability of real-time data and feedback are crucial determinants of its acceptance and impact (Howard et al., 2015), Studies show that while well-implemented stewardship interventions, including restriction, can significantly improve prescribing patterns and clinical outcomes, the "how" is just as important as the "what" (Schuts et al, 2016; Davey et al, 2017).

In our study, we focus on two military hospitals in Jordan, Prince Zaid bin Al-Hussein Military Hospital and Prince Ali bin Al-Hussein Military Hospital, Both hospitals serve as key healthcare providers and have established antibiotic restriction protocols, however, the specific strategies and supporting resources likely differ so we aims measure outcomes associated with these policies, including antibiotic consumption patterns and costs and compare with it.

METHODOLOGY

Study design

Our study a retrospective, observational, comparative study.

Study setting

We conducted this study at Prince Zaid Military Hospital and Prince Ali Bin Al Hussein Military Hospital; we obtained data from the pharmacy dispensing records of both hospitals.

Study period

We collected data for a one-year period, from 1 Jan 2024 to 31 Dec 2024.

Study population

We included all dispensing records of restricted antibiotics in the two hospitals during the study period.

Inclusion criteria

1- All restricted antibiotics dispensed to inpatient wards according to the hospital policy.

Exclusion criteria

1- Cancelled dispensing orders or missing dispensing records.
2- Medications not listed as restricted medications.

Data sources

Data will be extracted from.

The electronic pharmacy information system and official paper-based pharmacy records, if applicable.

Measurement of drug consumption

Drug consumption will be measured as: At both hospitals Data- on the total consumption of targeted antibiotics and the corresponding total patient-days (calculated from admissions and bed occupancy) -was collected, then calculation and comparison of a standardized consumption rate (using the metric DDD/100 patient-days) for each institution.

The total procurement cost for these drugs was compiled and compared, and then we analyzed these findings and examining the relationship between consumption rate and financial cost to provide a clear evaluation of both usage patterns and economic outcomes.

Ethical considerations

The royal medical services Ethics Committee approved our study.

RESULTS

Table 1: Summary of Dispensed restricted antibiotics Quantities.

Antibiotics	Dosage	Ali hospital(vials)	Zaid hospital(vials)
Colistin	2million	277	82
Meropenem	500 mg	526	184
Ertapenem	500 mg	288	102
Meropenem	1 g	1394	491
Imipenem/Cilastatin	1 g	4961	1669

Table 2: Hospitals Bed Occupancy Calculation.

Metric	Ali hospital	Zaid hospital
Monthly :		
- Occupied Bed/Days	3810	1205 bed/days
Annually :		
- Occupied Bed/Days	49802	14601 bed/days

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

Restricted Antibiotic	Dosage	Total DDDs (Zaid hospital)	DDD/100 bed-days (Zaid hospital)	Total DDDs (Ali hospital)	DDD/100 bed-days (Ali hospital)
Colistin	2Milion	82(vials)	6.7	227(vials)	6.11
Meropenem	500 mg	184(vials)	15.58	526(vials)	14.21
Ertapenem	500 mg	102(vials)	8.89	288(vials)	7.65
Meropenem	1 g	491(vials)	39.6	1,394(vials)	38.32
Imipenem/Cilastatin	1 g	1669(vials)	139.25	4,961(vials)	131.81
DDD defined daily dose					

Financial cost Calculation

Table 4: Financial cost.

Antibiotic	Dosage	Cost per DDD (JD)	DDDs/100 bed-days (Zaid hospital)	DDD/100 bed-days (Ali hospital)	Cost /DDDs/100 bed-days (Zaid hospital)	Cost /DDDs/100 bed-days (Ali hospital)
Colistin	2million	21.1	6.7	6.31	141.93	123.141
Meropenem	500 mg	2.28	15.58	14.61	35.54	32.31
Ertapenem	500 mg	21	8.89	8.00	186.69	164
Meropenem	1 g	2.57	39.6	38.72	101.77	99.11
Imipenem/Cilastatin	1 g	2.45	139.25	137.81	341.81	327.63
DDD defined daily dose						

DISCUSSION

Table 5: Comparison of restricted antibiotic consumption between Ali and Zaid hospitals.

Restricted antibiotic	DDD/100 bed-days (Ali)	DDD/100 bed-days (Zaid)	Rate ratio (Ali / Zaid)	p-value
Colistin	6.31	6.70	0.92	0.533
Meropenem 500 mg	14.61	15.58	0.95	0.573
Ertapenem 500 mg	8.00	8.89	0.94	0.599
Meropenem 1 g	38.72	39.60	0.93	0.294
Imipenem/Cilastatin 1 g	137.81	139.25	0.91	0.745

Our study compared the utilization patterns and financial cost of selected restricted antibiotics between two military hospitals in Jordan.

Ali Hospital had about three times the occupied bed-days compared with Zaid Hospital (43,802 vs. 14,601 bed-days) but the adjusted consumption rates expressed as DDDs per 100 bed-days were remarkably similar for all evaluated agents.

After standardization for hospital activity, no -statistically significant- differences were detected in the consumption rates of the restricted antibiotics between two hospitals (all p-values > 0.05); this indicates that the higher quantity of dispensed vials in Ali Hospital reflects its larger patient volume rather than differences in prescribing behavior or antimicrobial policy.

The agreement in DDD/100 bed-days for colistin, meropenem, ertapenem, and imipenem/cilastatin suggests a high degree of similarity in antimicrobial prescribing practices between the two hospitals.

The identical ranking of restricted antibiotics according to consumption intensity in both hospitals this supports the presence of comparable treatment approaches and local clinical practices.

Imipenem/cilastatin demonstrated the highest utilization rate, followed by meropenem 1 g, meropenem 500 mg, ertapenem, and colistin, This pattern reflects strong evidence that broad-spectrum carbapenems is the cornerstone of therapy for severe infections In both hospitals.

Such a profile is observed in hospitals managing a high burden of significantly unwell patients or diseases caused by resistant organisms.

Imipenem/cilastatin accounted for the highest proportion of restricted antibiotic consumption in both hospitals,

this extremely high rate compared with other agents highlights that this antibiotic represents the main driver of overall restricted antibiotic exposure, this finding is particularly important; any effort to optimize restricted antibiotic use would likely have the greatest impact if focused primarily on imipenem/cilastatin prescribing.

The crude number of dispensed vials was higher in Ali Hospital for all antibiotics, however, when consumption was standardized to hospital activity, the apparent differences disappeared, and this clearly demonstrates the importance of using activity-adjusted indicators such as DDDs per 100 bed-days in inter-hospital comparisons.

Financial burden

The cost analysis showed the cost per 100 bed-days was higher in Zaid Hospital for all restricted antibiotics; this difference was driven by the marginally higher DDDs per 100 bed-days.

Despite cost differences, the overall cost pattern mirrored the same utilization pattern; Imipenem/cilastatin represented the largest antibiotic-related expenditure in both hospitals, followed by meropenem 1 g and ertapenem, consequently.

The absence of statistically significant differences between hospitals indicates that restricted antibiotic use is comparable between two hospitals; this finding may reflect similar prescribing culture and clinical pathways.

So, we should be emphasized that similarity between hospitals does not necessarily imply optimal use; the high reliance on carbapenems in both hospitals suggests that further evaluation of prescribing appropriateness is warranted.

The interventions could be designed and implemented in a unified manner because the similarity of prescribing patterns across two hospitals suggests that.

Study limitations

1- We did not asses of patient-level factors, clinical indications, severity of illness, or microbiological results, consequently, adjustment for clinical complexity was not possible.
2- the study relied on pharmacy dispensing data rather than actual administration records, which may slightly overestimate true patient exposure.
3- DDD methodology may not accurately reflect dosing practices in special populations, such as patients with renal impairment or that requiring dose optimization in critical care settings.

CONCLUSIONS

although Ali Hospital dispensed a higher number of restricted antibiotic vials, the adjusted consumption rates and associated costs per 100 bed-days were very similar between Ali and Zaid hospitals.

Imipenem/cilastatin was the most frequently used restricted antibiotic and the major contributor to financial burden in both institutions.

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