



## ANTIBIOTIC USE PATTERNS AMONG INTENSIVE CARE UNIT (ICU) PATIENTS AT PRINCESS HAYA MILITARY HOSPITAL IN THE JORDANIAN ROYAL MEDICAL SERVICES (JRMS): DEPTH ANALYSIS

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### ABSTRACT:

**Introduction:** Optimal antibiotic usage holds paramount significance in the critical care environment, where a profound understanding of prescription trends among Intensive Care Unit (ICU) patients is imperative. Given the significance nature of treatment decisions in this specialized setting, a comprehensive analysis is essential to shed light on prescribing patterns and enhance the efficacy of antibiotic management.

**Objective:** This paper aims to investigate the intravenous antibiotic use patterns at Princess Haya Military Hospital ICU in the Jordanian Royal Medical Services (JRMS) during the years 2020 and 2021. The study utilizes data on the prescription of various antibiotics, including Azithromycin, Ceftriaxone, Ceftazidime, Metronidazole, Cefazolin, Imipenem, Cefoxitin, Amikacin, Piperacillin/ Tazobactam, Levofloxacin, Cefotaxime, Gentamycin, Ciprofloxacin, Ampicillin, Vancomycin, Colistin, Meropenem, Teicoplanin, and Ertapenem, among a total of 2101 and 3045 patients in 2020 and 2021, respectively.

**Methodology:** For this retrospective study, data from the medical records on Hakeem Health System used in JRMS will be extracted for ICU patients at Princess Haya Military Hospital, encompassing the prescription frequency of various intravenous antibiotics during 2020 and 2021. Simple statistical analyses will be used to identify any trends in the use of antibiotics.

**Keywords:** IV antibiotic utilization, Intensive Care Unit, Princess Haya Military Hospital, Healthcare protocols, Jordanian Royal Medical Services.

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## 1. INTRODUCTION:

ICUs, or intensive care units, are critical settings for patient treatment. The intricacies involved in tending to critically sick patients in these environments demand a sophisticated comprehension of therapeutic approaches, specifically with the administration of intravenous (IV) antibiotics. Despite being essential in the fight against diseases, antibiotics can be misused, which increases the risk of antimicrobial resistance (AMR). In the critical years 2020 and 2021, IV antibiotic usage patterns among ICU patients at Princess Haya Military Hospital are examined in detail in this paper<sup>[1,2]</sup>.

The urgency of this investigation lies in the global challenge of AMR, where the efficacy of these valuable drugs is threatened by an over reliance on IV antibiotics without proper stewardship. In the particular setting of Princess Haya Military Hospital, it is critical to comprehend the dynamics of intravenous antibiotic use in the intensive care unit (ICU) in order to improve patient outcomes, prevent the emergence of resistant strains, and harmonize medical procedures with global antimicrobial stewardship programs<sup>[2,7]</sup>.

Because ICU patients are frequently vulnerable and immunocompromised, IV antibiotic therapy are regularly used by clinicians to prevent serious infections<sup>[3]</sup>. However, the use of IV antibiotics inappropriately can lead to increased risks of side effects and greater healthcare expenses, in addition to the development of resistance. In light of these difficulties, this study attempts to provide insight into the prevalent IV antibiotic use patterns, highlighting problem areas and possible directions for development within the particular clinical setting of Princess Haya Military Hospital.

Through examining the intricacies of IV antibiotic prescriptions and the way in which these patterns have changed over a period of two years, this study seeks to provide insightful perspectives to the larger debate around IV antibiotic stewardship. In order to promote a comprehensive understanding of the current state of IV antibiotic utilization in the ICU, the analysis will not only highlight the quantitative aspects of IV antibiotic use but will also address the need for qualitative understanding of the decision-making processes behind IV antibiotic prescription practices.

This study supports the larger global health agenda by highlighting the necessity of careful monitoring and well-informed procedures to maintain the

effectiveness of intravenous antibiotics<sup>[5,7]</sup>. This study acts as a microcosm, highlighting the necessity for regional healthcare organizations to actively participate in evidence-based practices and continuous improvement as the globe struggles with the complex issues brought on by infectious diseases and the threat of AMR. The following parts will discuss the methodology utilized in this investigation and the particular conclusions drawn from the data. Culminating in recommendations that can be implemented immediately to improve IV antibiotic stewardship in the ICU of Princess Haya Military Hospital.

## 2. METHOD:

### 2.1 Participants:

During the crucial years of 2020 and 2021, an extensive cohort of ICU patients admitted to Princess Haya Military Hospital was included in this study. Patients with comprehensive medical records met the selection criteria; cases with insufficient documentation were disqualified. With 5,146 patients in the large dataset, a thorough examination of trends in IV antibiotic use in the ICU setting was possible.

### 2.2 Data Collection:

Information on IV antibiotic prescriptions was carefully taken from the electronic medical records system used in JRMS, Hakeem Health System. This included details on the different types of IV antibiotics that were prescribed. The data gathering procedure placed a high priority on accuracy and completeness due to the crucial nature of ICU treatment. It also underwent frequent quality checks to minimize any potential inaccuracies. To guarantee consistency and dependability, cross-referencing with pharmacy records was necessary.

### 2.3 Data Analysis:

Microsoft Excel Spreadsheets 2010 and IBM SPSS Statistics version 26 were used for a thorough statistical analysis of the extensive dataset. Comparative studies between 2020 and 2021 were carried out using the relevant statistical tests, such as t-tests when applicable, to determine the significance of the observed changes.

The data collection method was conducted with ethical considerations at its very foundation. The JRMS's institutional review board (IRB) granted the required approvals for the study, which complied with all applicable ethical standards and the strict maintenance of patient confidentiality was achieved by use of anonymization procedures.

Because of its thorough approach to data collection and analysis, the study is well-positioned to provide a comprehensive understanding of patterns of IV antibiotic usage in ICU settings. The data will be examined in more detail in the next sections, which will provide a comprehensive picture of the IV antibiotic environment in the ICU at Princess Haya Military Hospital.

As shown in Table 1, the use of IV antibiotics by Princess Haya Military Hospital's intensive care unit (ICU) patients in 2020 and 2021 indicated some interesting tendencies. This dataset, which includes 5,146 patients in total, was thoroughly analyzed to give a complete picture of the trends of IV antibiotic administration in this critical care environment.

### 3. RESULTS:

**Table 1: The use of IV antibiotics by Princess Haya Military Hospital's intensive care unit (ICU) patients**

Drug	2020	2021
Azithromycin	5	10
Ceftriaxone	358	698
Ceftazidime	81	136
Metronidazole	146	197
Cefazolin	8	18
Imipenem	358	410
Cefoxitin	24	18
Amikacin	41	81
Piperacillin/Tazobactam	229	366
Levofloxacin	18	23
Cefotaxime	94	141
Gentamycin	211	208
Ciprofloxacin	1	2
Ampicillin	211	213
Vancomycin	265	359
Colistin	34	48
Meropenem	11	58
Teicoplanin	5	56
Ertapenem	1	3
Total patients :	2101	3045
	5146	

#### 3.1 IV Antibiotic Utilization Trends:

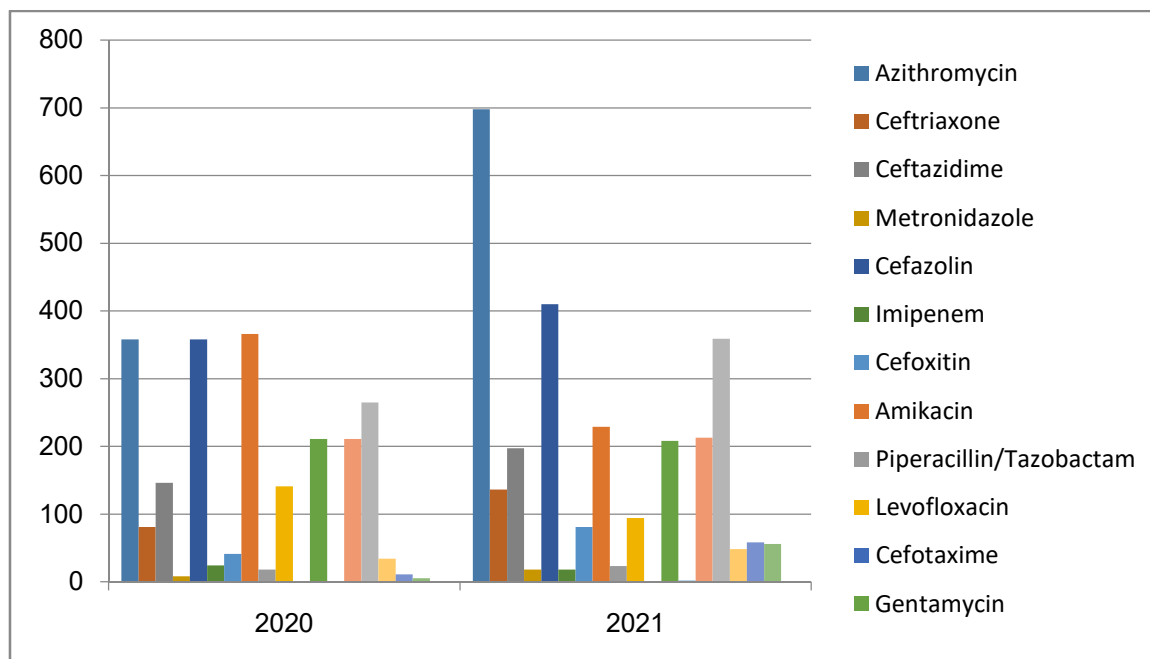
In 2020, IV Ceftriaxone emerged as the most frequently prescribed antibiotic, with a total of 358 administrations. This trend experienced a significant uptick in 2021, reaching 698 instances, signifying a substantial increase in usage. Colistin and Teicoplanin IV antibiotics usually used to treat drug-resistant infections<sup>[4]</sup> showed a substantial increase in their use during the study periods. Similarly, IV Piperacillin/Tazobactam, another prominent broad-spectrum antibiotic, saw a

noteworthy surge from 229 administrations in 2020 to 366 in 2021.

Analyzing the data shows that IV antibiotic use is a complicated field. Some IV antibiotics were administered more frequently, although others showed fluctuations or stayed mostly constant. Interestingly, there were only slight increases observed for IV antibiotics such as IV Metronidazole, IV Imipenem, and IV Gentamycin, indicating a complex reaction to the current clinical circumstances.

**Table 2: patterns of using IV antibiotics**

Drug	2020	2021	Growing Percentage
Azithromycin	5	10	100.00%
Ceftriaxone	358	698	94.97%
Ceftazidime	81	136	67.90%
Metronidazole	146	197	34.93%
Cefazolin	8	18	125.00%
Imipenem	358	410	14.53%
Cefoxitin	24	18	-25.00%
Amikacin	41	81	97.56%
Piperacillin/Tazobactam	229	366	59.83%
Levofloxacin	18	23	27.78%
Cefotaxime	94	141	50.00%
Gentamycin	211	208	-1.42%
Ciprofloxacin	1	2	100.00%
Ampicillin	211	213	0.95%
Vancomycin	265	359	35.47%
Colistin	34	48	41.18%
Meropenem	11	58	427.27%
Teicoplanin	5	56	1020.00%
Ertapenem	1	3	200.00%
<b>Total patients :</b>	2101	3045	
	5146		



**Figure 1: comparative use of antibiotics in 2021 and 2022**

### 3.2 Comparative Analysis:

A comparative study between the two years was conducted in order to put these changes into context. Statistical tests, including t-tests, were

employed to identify significant differences in IV antibiotic utilization. The increase in IV antibiotics prescriptions was found to be statistically significant ( $p < 0.05$ ), underscoring the importance of these findings (Table 3).

**Table 3: Comparative analysis of using antibiotics in 2021 and 2023**

Paired Samples Test								
	Paired Differences					t	df	Sig.(2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
2020-2021	-47.25000	78.10376	17.46453	-83.80369	-10.69631	-2.705	19	.014

The increase in IV Ceftriaxone use warrants more investigation into the possible causes of this surge. Does this suggest that patient demographics are shifting, that patterns of microbial resistance are changing, or that therapeutic practices are changing? This emphasizes how important it is to conduct a qualitative analysis in addition to the quantitative data in order to create a more thorough insight.

### 3.3 Antibiotic Resistance Profiles:

Further analysis of the data allowed for an examination of potential shifts in IV antibiotic resistance profiles over the two years. Although a thorough resistance study is outside the purview of this work, a quick review suggests that continuous surveillance is necessary to identify new resistance patterns and modify treatment plans accordingly.

The subsequent section will provide an in-depth discussion of these findings in the context of antimicrobial stewardship and patient care.

## 4. DISCUSSION:

The investigation of IV antibiotic use patterns in the ICU of Princess Haya Military Hospital in 2020 and 2021 revealed complex patterns and intricate relationships that require careful analysis. The implications of the results are examined in detail, along with how they fit into the larger picture of antimicrobial stewardship and possible ways to improve the sensible use of IV antibiotics in critical care settings.

### 4.1 The Surge in IV Ceftriaxone and IV Piperacillin/Tazobactam Utilization:

The significant rise in prescriptions for IV Piperacillin/Tazobactam and Ceftriaxone necessitates investigation to determine the

underlying causes of this trend. The statistical significance of these increases raises questions about possible changes to patient demographics, treatment practices, or infection epidemiology. Because both antibiotics are effective against a wide variety of diseases and are known for their broad-spectrum activity<sup>[9]</sup>, they are frequently selected empirically in patients who are critically ill. But given the size of the increase, one would wonder if such a spike was really necessary.

Because of the severity and variety of infections that are seen in an intensive care unit, it is often necessary to start effective treatment as soon as possible, which is why broad-spectrum choices are preferred. It is a delicate act to achieve a balance between the need for quick action and careful use of antibiotics, and the trends that have been seen highlight the necessity of continuing to assess prescribing procedures<sup>[6,8]</sup>.

### 4.2 Implications for Antimicrobial Stewardship:

A crucial component of the ongoing battle against antibiotic resistance is antimicrobial stewardship. The results of this investigation highlight the complex connection between clinical urgency and the selection of broad-spectrum IV antibiotics. Although these drugs are essential for treating serious illnesses, misuse greatly accelerates the emergence of resistance strains. Therefore, it becomes essential to develop techniques to maximize IV antibiotic administration without jeopardizing patient care<sup>[2]</sup>.

A relationship between the selection of IV antibiotics and microbiological data highlights how crucial diagnostic data is in directing treatment choices. Using fast diagnostics to better customize IV antibiotic therapy may prove to be a beneficial strategy. A more focused and wise use of IV

antibiotics can also be achieved by promoting a culture of routine review and de-escalation of these drugs based on microbiological data<sup>[2, 6, 8]</sup>.

#### 4.3 The Role of Resistance Surveillance:

A brief analysis of IV antibiotic resistance profiles points to a dynamic interaction between resistance patterns and antibiotic use. A more thorough resistance analysis is necessary in order to spot new patterns and modify treatment plans appropriately. Routine monitoring ensures that resistance patterns are continuously examined and allows for timely interventions to address developing concerns. This is why it should be incorporated into the institutional antimicrobial stewardship program<sup>[2]</sup>.

#### 4.4 Strengthening Guidelines and Protocols:

The current standards and regulations governing antibiotic usage in the ICU need to be reevaluated in light of the increase in IV antibiotic prescriptions. It is imperative that these recommendations be strengthened in order to take into account the most recent research and comply with international best practices for antimicrobial stewardship. A culture of safe IV antibiotic usage can be fostered by incorporating regular education and training programs for healthcare providers, which can further improve adherence to these procedures<sup>[6]</sup>.

#### 4.5 Considerations for Future Research:

The use of IV antibiotics in intensive care units is complicated, and more research is necessary to fully understand its complexities. Future research may examine how the choice of IV antibiotic affects patient outcomes, looking at things like length of hospital stay, death rates, and the emergence of antibiotic-related problems. Studies that follow patterns of resistance over time and evaluate the success of stewardship initiatives may yield important information for maintaining and enhancing present procedures.

#### 4.6 Limitations and Considerations:

It is critical to acknowledge the limitations of this study. There are obvious limitations to the retrospective nature of the investigation, and the conclusions can only be applied to a specific hospital. Because of the potential for inaccurate or missing data due to the use of electronic medical records, careful interpretation is necessary. Furthermore, the study did not examine particular

patient diagnoses or severity indices, which are variables that may affect the use of IV antibiotics and should be taken into account in subsequent research.

#### 5. CONCLUSIONS:

The review of IV antibiotic usage trends among ICU patients at Princess Haya Military Hospital in 2020 and 2021 offers important new perspectives on the challenges associated with antibiotic prescription in critical care environments. Important questions about the responsible use of antibiotics in the intensive care unit are brought up by the increase in IV prescriptions for Ceftriaxone and Piperacillin/Tazobactam. The main conclusions are outlined in this section, along with practical suggestions for future procedures and an emphasis on how they may affect patient care and antimicrobial stewardship.

The study's analyses provided insight into the reason for the considerable rise in IV Piperacillin/Tazobactam and Ceftriaxone use. Although these broad-spectrum antibiotics play a key role in treating serious illnesses, the rate at which they are being used calls for a careful analysis of current prescribing policies. The research highlights the intrinsic conflict between the necessity of prompt intervention and the prudent use of IV antibiotics.

This study focuses on the relationships that exist between the selection of IV antibiotics and microbiological testing, as well as the significance of diagnostic data in directing treatment choices. Utilizing fast diagnostics and promoting a culture of routine evaluation and de-escalation of IV antibiotics based on microbiological evidence should be the main goals of antimicrobial stewardship initiatives. Aligning practices with evidence-based principles necessitates strengthening standards and protocols in addition to providing healthcare practitioners with educational initiatives.

#### CONFLICT OF INTEREST:

There were no conflicts of interest that would have affected the study's research, analysis, or reporting of its findings. The authors were motivated only by academic and clinical concerns, and the only goal of this research was to advance our understanding of IV antibiotic consumption patterns in the Princess Haya Military Hospital ICU.



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