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Original Article

Hospital antibiotic stewardship indicators using days of therapy (DOT) and DOT per 1,000 patient-days in Southeast Iran

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Abstract

Introduction: Days of therapy (DOT) and DOT per 1,000 patient-days are key indicators of hospital antibiotic use and are critical for antimicrobial stewardship. Given the frequent unsupervised use of antibiotics and limited data on these metrics, this study provides insights into hospital antibiotic consumption.

Methodology: A prospective descriptive study was conducted from 23 October to 21 November 2024, at Amir Al-Mo'menin Hospital, Zabol, which is a teaching hospital with multiple clinical wards. All patients receiving at least 1 dose antibiotic were included. Data on demographics, hospital stay, and antibiotic prescriptions were extracted from the hospital information system. DOT and DOT per 1,000 patient-days were calculated for all antibiotics. Statistical analyses were performed using SPSS v25, with quantitative variables reported as mean ± SD and qualitative variables as frequencies and percentages.

Results: Of 3,518 patients, 2,373 (66.2%) received antibiotics. Antibiotics use was highest in the infectious diseases and respiratory wards (100%) and lowest in obstetrics and gynecology (41.2%). Ceftriaxone was the most used antibiotic (DOT 3,118; DOT/1,000 patient-days 256.94); imipenem was the least used (DOT 71; DOT/1000 patient-days 5.85). Duration of antibiotic treatment was highest in the intensive care unit (ICU), neonatal ICU (NICU) and burn wards. Pediatric wards had the highest antibiotic consumption (DOT 3,195; DOT/1000 patient-days 263.3).

Conclusions: Antibiotic use in this hospital was higher than in developed countries, driven by empiric therapy, delayed culture results, and lack of guidelines. Addressing these factors by timely culture diagnostics and local guideline development could optimize use and reduce unnecessary antibiotic administration.

Key words: antimicrobial stewardship; DOT; DOT per 1,000 PD; LMICs.

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Introduction

Antibiotic resistance is one of the most serious public health threats globally. According to a recent analysis by the Global Research on Antimicrobial Resistance (GRAM) project, more than 1 million people worldwide died each year between 1990 and 2021 as a direct result of drug-resistant infections. In 2021 alone, an estimated 1.14 million deaths were directly attributable to bacterial antimicrobial resistance (AMR), whereas 4.71 million deaths were associated with drug resistant infections (i.e., AMR was a contributing factor) [1]. The burden is projected to worsen drastically without effective interventions; annual deaths directly due to AMR could reach 1.91 million by 2050, with as many as 8.22 million deaths per year in which AMR plays at least a contributory role [2]. This growing burden reflects the fact that infections that were once easily treatable—such as lower respiratory tract infections, bloodstream infections, and intra-abdominal infections—now often involve pathogens resistant to standard antibiotics, making treatment more complex, costly, and risky. As a result, hospital stays lengthen, medical costs increase, and the risk of mortality rises [3].

Antimicrobial stewardship programs (ASPs) have emerged as a key strategy in response to this challenge to enhance the quality of antibiotic prescribing and utilization in healthcare settings. These programs represent a systematic and continuous effort by healthcare institutions to optimize antibiotic use in hospitalized patients, aiming to improve clinical outcomes, ensure cost-effective therapy, and reduce the adverse consequences of inappropriate antibiotic use, including the development of AMR [4].

The World Health Organization (WHO) has introduced a comprehensive assessment tool to evaluate the implementation of ASPs in hospitals, structured around 3 main domains: structural, process, and outcome indicators. Among these, the process indicators play a critical role in monitoring the effectiveness of interventions and include components such as regular review of antibiotic prescriptions,

reporting antibiotic consumption (using indicators such as days of therapy (DOT) and defined daily dose (DDD)), and evaluating adherence to clinical guidelines [5].

DDD, the most commonly accepted metric for measuring drug consumption, is defined by the WHO as "the assumed average maintenance dose per day for a drug used for its main indication in adults." This metric facilitates comparisons of drug use at a population level. However, it has limitations, particularly in failing to account for patient-specific dose variations, especially in specific groups such as children, elderly, and patients with renal impairment, which may reduce its accuracy in clinical studies [6].

In contrast, the DOT metric, introduced in the early 2000s, accurately measures the number of days a patient is exposed to an antibiotic, thereby offering better alignment with real clinical conditions. The DOT per 1000 patient-days (DOT/1000PD) indicator reflects the amount of antibiotic therapy administered per 1000 patient-days in a specific hospital or ward that adjusts for hospital size and patient volume [7]. These metrics are widely used in comparative studies and trend analysis across different hospitals and are considered key indicators in ASP evaluation. Previous studies have demonstrated that DOT not only offers greater accuracy but also provides more up-to-date and clinically relevant information on antibiotic utilization compared to DDD [8,9].

Considering the importance of accurately measuring antibiotic consumption, the present study aimed to evaluate antibiotic usage patterns based on the DOT and DOT/1000PD metrics in Amir Al-Mo'menin Hospital in Zabol during October to November 2024. This study was conducted in different hospital units, including the emergency department and intensive care units (ICUs). The findings of this study can facilitate a better understanding of the current situation by comparison with internationally accepted benchmarks, and support the development of strategies for optimization. Additionally, the results may serve as a representative example of antibiotic use in resource-limited settings.

Methodology

Study design and setting

This prospective descriptive study was conducted across multiple wards of Amir Al-Momenin Hospital, Zabol, during the period from 23 October to 21 November 2024. Amir Al-Momenin Hospital is a teaching hospital affiliated with Zabol University of Medical Sciences with a capacity of 400 beds. The hospital comprises several clinical units, including infectious diseases, obstetrics and gynecology, neonatology, pediatrics, neurology, internal medicine, pulmonology, burn, male surgery, female surgery, emergency, 4 intensive care units (ICUs), and 2 coronary care units (CCUs). The antibiotics included in this study were identified through a review of the hospital formulary. All listed antibiotics, in both oral and injectable dosage forms, were included for analysis. The antibiotics investigated were: ceftriaxone, cefotaxime, vancomycin, metronidazole, amikacin, gentamicin, ceftizoxime, ampicillin, doxycycline, imipenem, meropenem, piperacillin-tazobactam, ciprofloxacin, and cefazolin.

Study population

The study population consisted of all patients who were hospitalized during the study period and had received at least 1 dose of any of the antibiotics under investigation. No one was excluded from the study. The list of eligible patients was obtained through a search of the hospital information system (HIS) using the names of the antibiotics.

Data extraction for calculation of DOT and DOT/1000PD

Data required for calculating DOT and DOT/1000PD were extracted from the medical records of each patient using a pre-structured data collection form. The form included demographic characteristics (age, gender, ward of admission, and length of hospital stay) and antibiotic-related information (names of prescribed antibiotics, duration of use in days, and start and stop dates). Data extraction was performed by the investigator using the reporting section of the HIS.

All medications ordered and delivered from the pharmacy to the various hospital wards were recorded through the HIS. There was no alternative data source for drug distribution in the hospital; thus ensuring that there was no missing data. Since data extraction from the HIS was conducted based on the name of each individual antibiotic, all patients receiving the antibiotic—whether as monotherapy or in combination therapy—were included in the calculations. The included patients were followed until discharge, transfer to other hospitals, or death, during the study period. There were no institutional or unit-specific antimicrobial guidelines implemented during this period. Antimicrobial consumption during the study period was expressed as DOT and DOT/1000PD, as described by Kuper [10]. DOT for each antibiotic was calculated separately as the total number of days on

which a patient received any amount of a specific antimicrobial agent, regardless of dosage or frequency. To determine DOT/1000PD, the total DOT for each antibiotic was divided by the total number of patient-days during the study period and then multiplied by 1,000. Total patient-days were defined as the sum of the lengths of stays for all patients admitted to the different wards during the study period. These metrics were calculated separately for each antibiotic.

Statistical analysis

Data analysis was performed using SPSS version 25 (IBM Corp, Armonk, NY, USA) and Microsoft Excel. Quantitative variables were presented as mean ± standard deviation (SD), and qualitative variables were reported as frequency and percentage. DOT values were calculated using Microsoft Excel.

Ethical considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the national guidelines for biomedical research. Ethical approval was obtained from the Research Ethics Committee of Zabol University of Medical Sciences (ethics code: IR.ZBMU.REC.1403.036).

Results

A total of 3,518 patients were admitted in different wards of the hospital during the study period and screened for study eligibility, and 2,373 (66.2 %) patients met the inclusion criteria (received at least 1 dose of antibiotic). The demographic characteristics of these patients are described in Table 1. The infectious diseases and respiratory wards had the highest antibiotic utilization percentage, with 100% of admitted patients receiving antimicrobial therapy. This was followed, in descending order, by the ICU (95.41%), pediatrics (90.2%), neonatal intensive care unit (NICU) (89.74%) and internal medicine (88.94%). Obstetrics and gynecology had lowest percentage of antibiotic administration (41.2%), followed by neurology (44.4%) (Table 2). The mean duration of antibiotic treatment was highest in the ICU, NICU, and burn wards (Table 1). The male surgery ward exhibited the highest mean number of antibiotics prescribed per patient (Table 1).

Ceftriaxone, a third-generation cephalosporin, ranked highest across all evaluated metrics, including total DOT, DOT/1000PD, percentage of use, percentage of total consumption, and number of treatment courses. In contrast, imipenem had the lowest values for all these parameters (Table 3). Ceftriaxone, meropenem and cefazoline had the highest DOT/1000PD (Table 3). It is noteworthy that during the study period, the hospital experienced a temporary shortage of piperacillin for approximately 2 weeks. This

Table 2. Absolute and relative frequency of antibiotic recipients by hospital wards.

Name of hospital ward	Total patients (n)	Patients receiving antibiotics n (%)
Emergency	702	409 (58.2)
CCU	158	103 (65.18)
ICU	143	135 (95.41)
Male surgery	340	266 (78.23)
Female surgery	240	165 (68.75)
Internal medicine	199	177 (88.94)
Respiratory	63	63 (100)
Burn	9	6 (66.66)
Neurology	70	31 (44.2)
Infectious diseases	107	107 (100)
Obstetrics and gynecology	820	338 (41.2)
Pediatrics	492	433 (90.2)
PICU	50	39 (78.0)
NICU	38	34 (89.47)
Neonatology	100	82 (82.0)

CCU: coronary care unit; ICU: intensive care unit; PICU: pediatric intensive care unit; NICU: neonatal intensive care unit.

Table 1. Demographic data of the study population.

Ward	n	Female, n (%)	Age, mean (SD)*	Length of antibiotic therapy, mean (SD)**	Average number of antibiotics per patient, mean (SD)
Emergency	409	154 (37.7)	42.5 (20.4)	3.62 (3.20)	1.58 ± 0.83
CCU	103	60 (58.2)	55.9 (19.3)	2.51 (2.60)	1.32 ± 0.49
ICU	125	60 (48.0)	57.9 (20.7)	6.41 (2.95)	1.54 ± 0.71
Male surgery	267	0 (0.0)	32.2 (17.3)	3.32 (2.52)	2.83 ± 1.32
Female surgery	165	165 (100.0)	31.1 (22.3)	4.17 (3.00)	1.37 ± 0.62
Medicine	177	86 (48.6)	55.5 (17.1)	3.95 (2.54)	1.68 ± 0.84
Respiratory	63	34 (54.0)	60.6 (16.9)	4.02 (2.70)	1.87 ± 0.73
Burn	6	1 (16.7)	30.0 (8.7)	6.75 (3.20)	2.83 ± 1.33
Neurology	31	19 (61.3)	55.6 (16.7)	7.45 (8.30)	1.52 ± 0.62
Infectious diseases	107	63 (58.9)	57.2 (17.4)	4.22 (2.39)	2.06 ± 0.89
Obstetrics & gynecology	338	338 (100.0)	27.9 (7.4)	1.84 (0.92)	1.43 ± 0.78
Pediatrics	427	183 (42.8)	45.3 (44.2)	3.68 (1.92)	1.98 ± 0.81
PICU	39	16 (41.0)	6.0 (5.8)	5.22 (7.56)	1.41 ± 0.64
NICU	34	12 (35.2)	11.0 (13.4)	6.07 (5.10)	2.17 ± 0.94
Neonatology	82	38 (46.3)	10.0 (11.4)	3.13 (1.79)	2.02 ± 0.38

CCU: coronary care unit; ICU: intensive care unit; PICU: pediatric intensive care unit; NICU: neonatal intensive care unit. *Age in months for pediatrics; days for PICU, NICU and neonatology; all other wards report age in years. **Mean length of antibiotic therapy regardless of type or number of antibiotics.

Table 3. DOT and DOT/1000 patients' days of each antibiotic (regardless of ward).

Class	Number of courses	% use[†]	DOT	DOT/1000PD[‡]	% consumption[#]
Ceftriaxone	980 (1)	25.12 (1)	3118 (1)	256.94 (1)	25.67 (1)
Cefazoline	573 (2)	14.68 (2)	1335 (3)	110.01 (3)	10.99 (3)
Clindamycin	361 (3)	9.25 (3)	1096 (5)	90.32 (5)	9.02 (5)
Cefotaxime	317 (4)	8.12 (4)	1060 (6)	87.35 (6)	8.73 (6)
Vancomycin	275 (5)	7.05 (5)	1185 (4)	97.65 (4)	9.76 (4)
Meropenem	272 (6)	6.97 (6)	1478 (2)	121.80 (2)	12.17 (2)
Metronidazole	248 (7)	6.36 (7)	613 (8)	50.52 (8)	5.05 (8)
Piperacillin	187 (8)	4.79 (8)	280 (11)	23.07 (11)	2.31 (11)
Ciprofloxacin	185 (9)	4.74 (9)	707 (7)	58.26 (7)	5.82 (7)
Ampicillin	163 (10)	4.18 (10)	436 (9)	35.93 (9)	3.59 (9)
Amikacin	126 (11)	3.23 (11)	425 (10)	35.02 (10)	3.50 (10)
Gentamicin	101 (12)	2.59 (12)	152 (13)	12.53 (13)	1.25 (13)
Azithromycin	98 (13)	2.51 (13)	189 (12)	15.57 (12)	1.56 (12)
Imipenem	16 (14)	0.41 (14)	71 (14)	5.85 (14)	0.58 (14)

DOT: days of therapy; PD: patient days; [†]number of courses per class × 100/total courses of therapy (3902); [‡]DOT/1000PD: days of therapy per 1000 patient days (12135); [#](DOT/1000PD per class × 100)/aggregate DOT/1000PD of all antimicrobials (1000.8); ranks are shown in parentheses; 1 = highest value).

interruption may have influenced the findings related to this agent and should be taken into consideration when interpreting the results.

Analysis of antibiotic consumption across hospital wards revealed that ceftriaxone had the highest DOT/1000PD in the female surgery ward (478), cefazolin was most frequently used in the male surgery ward (618), and meropenem had the highest DOT/1000PD in the infectious disease ward (446). These findings highlight differences in antibiotic utilization patterns across hospital wards. As shown in Table 4, the ICUs had the longest mean hospital stay, indicating prolonged and resource-intensive patient management. In contrast, the pediatric ward with highest patients-days, reflect a higher patient turnover. The mean length of hospital stay was generally comparable between the overall patient population and those receiving antibiotic therapy (Table 4) reflecting high percentage of patients receiving antibiotic therapy.

A total of 13,129 DOT was recorded during the study period. The pediatric ward had highest antibiotic use, with 3,195 DOT and DOT/1000PD of 263, reflecting both a high number of admitted patients as well as high antibiotic administration in this group of patients, which may serve as early warning for emergence of AMR in this vulnerable group. In contrast, the burn unit had the lowest antibiotic consumption, with 107 DOT and 8.8 DOT/1000PD, consistent with the comparatively small number of admitted patients in this ward (Table 5).

Discussion

In this study, antibiotic consumption was evaluated in October–November 2024 in different wards of Amir Al-Momenin Hospital in Zabol and the DOT and DOT/1000PD indicators were analyzed. The findings revealed that the rate of oral antibiotics administration was extremely low, indicating that nearly all administered antibiotics were in injectable form. Moreover, this study demonstrated that the pattern and extent of antibiotic use varied considerably across different hospital departments.

When compared to healthcare centers in other countries, the results indicated a substantially higher

Table 4. Patient days (PD), mean length of stay, and mean length of stay in patients receiving antibiotic treatment by hospital wards.

Department	Patient days (PD)	Mean length of stay (SD)	Mean length of stay in patients receiving antibiotic treatment (SD)
Emergency	1136	1.5 (0.6)	1.5 (0.6)
CCU	736	4.5 (3.2)	6.3 (4.3)
ICU	980	12.5 (15.9)	12.4 (12.1)
Male surgery	1047	3.2 (3.2)	3.5 (3.1)
Female surgery	602	2.5 (1.6)	2.9 (1.7)
Internal medicine	1081	5.4 (3.5)	5.4 (3.7)
Respiratory	438	7.5 (4.5)	7.5 (4.5)
Burn	201	22.3 (31.9)	31.5 (36.4)
Neurology	326	4.79 (2.74)	7.88 (5.11)
Infectious diseases	630	6.79 (3.39)	6.79 (3.39)
Obstetrics & gynecology	1660	2.18 (1.3)	2.12 (1.2)
Pediatrics	2424	5.05 (2.73)	5.2 (2.36)
PICU	273	7.4 (6)	10.5 (10.3)
NICU	193	11.3 (10.4)	10.9 (8.9)
Neonatology	408	4.34 (3.94)	4.39 (3.05)
Total	12135	7.898667	

CCU: coronary care unit; ICU: intensive care unit; PICU: pediatric intensive care unit; NICU: neonatal intensive care unit.

rate of antibiotic consumption in this hospital. The results were comparable to those reported in other low- and middle-income countries (LMICs); however, when compared with data from high-income and well-resourced settings, the differences were substantial, with noticeably higher antibiotic use observed in this hospital. For example, a very high proportion of patients in the pediatrics and neonatal units received at least 1 antibiotic during hospitalization—90% and 82%, respectively. In comparison, a study conducted by Ambarin *et al*. in Pakistan reported that 92% of pediatric patients and 99% of neonatal patients received antibiotics [11]. The results for the pediatric ward were relatively similar, while the rate in the neonatal ward was higher than in the present study. Additionally, Wang *et al.* conducted a study in China and reported that the antibiotic prescription rates in pediatrics and neonates were 66% and 59%, respectively [12], both of which are significantly lower than the findings of the current study. Nearly half of the patients in the obstetrics and gynecology ward received antibiotics, primarily for surgical prophylaxis. Thomas *et al*. conducted a study in India in 2020 and reported that the proportion of antibiotics use among hospitalized women was 25% [13], which is lower than the rate observed in the present study. In the present study, 68% and 78% of patients in the male and female surgical wards of the hospital, respectively, received at least 1 antibiotic. In comparison, an Indian study reported substantially lower proportions—29% in male surgical wards and 25% in female surgical wards, primarily attributed to perioperative prophylaxis [13]. A multicenter study conducted in Ghana (2019) reported an antibiotic utilization rate of 70.7% in surgical wards [14], which is closely aligned with the findings of the present study and highlights the high prevalence of antibiotic prescribing in resource-limited healthcare settings. Approximately 89% of hospitalized patients in the internal medicine ward, received at least 1 antibiotic. This is consistent with the findings of Abdalla *et al*., who reported an antibiotic use rate of 82% in the internal medicine ward of a teaching hospital in Sudan in 2016 [15]. The similarity between these results suggests that high antibiotic consumption in internal medicine wards may be a common pattern across hospitals in low- and middle-income countries. A high proportion of neonates in the NICU in this study were antibiotic recipients (89%). In contrast, a large investigation conducted by Flannery *et al*. involving about 1.4 million neonates admitted to NICUs across the United States between 2009 and 2021, reported that 44.8% of NICU patients received antibiotics during hospitalization. The rate was 54.8% in 2009 and gradually declined to 35.9% in 2021, representing an overall reduction of approximately 34% over the study period [16]. Several factors may explain the higher rates of antibiotic use observed in low-income settings compared with high-income countries, including, limited access to diagnostic facilities, higher burden of infectious diseases, and weaker antimicrobial stewardship and infection-control infrastructures, which often lead clinicians to rely more heavily on empirical broad-spectrum therapy.

Table 5. Total DOT and total DOT/1000 patient days by ward (regardless of antibiotic type).

Department	Total DOT	Total DOT/1000 patient days
Emergency	1055	86.9
CCU	586	48.3
ICU	1165	96.0
Male surgery	1421	117.1
Female surgery	660	54.4
Internal medicine	1208	99.5
Respiratory	477	39.3
Burn	107	8.8
Neurology	288	23.7
Infectious diseases	969	79.9
Obstetrics and gynecology	745	61.4
Pediatrics	3195	263.3
PICU	318	26.2
NICU	393	32.4
Neonates	542	44.7

DOT: days of therapy; CCU: coronary care unit; ICU: intensive care unit; PICU: pediatric intensive care unit; NICU: neonatal intensive care unit.

Regarding DOT/1000PD, ceftriaxone, meropenem, and cefazolin ranked first, second, and third, respectively. This pattern suggests a high reliance on broad-spectrum antibiotics that are commonly used as empiric treatment within the hospital. Similarly, a study by Baggs *et al*. conducted across 700 hospitals in the United States from 2012 to 2017 reported that, the most commonly used antibiotics were third- and fourth-generation cephalosporins (134 DOT/1000PD), glycopeptides, and beta-lactam/beta-lactamase inhibitor combinations [17]. It is evident that the values noted in this study are substantially higher than those reported in the literature. Previous studies have documented that increased antibiotic consumption may also impose an additional economic burden per patient, an aspect that is often overlooked [18].

A prospective observational study conducted in 28-bed adult medicine wards (2 male and 1 female) of a publicly funded tertiary care teaching hospital in India reported that metronidazole had the highest DOT/1000PD, while ceftriaxone ranked second with 169 DOT/1000PD—substantially lower than the values observed in the present study. The differences in antibiotic utilization and patterns of administration

between that setting and the present study suggest variations in the underlying infection profiles, prescribing practices, or stewardship strategies [19]. A retrospective surveillance study from the Canadian Nosocomial Infection Surveillance Program (CNISP) analyzed antimicrobial use in acute-care adult hospitals between 2009 and 2016, using DDD/1000 patient-days as the primary metric. ICU-specific data from 2016 showed that piperacillin-tazobactam (188 DDD/1000PD), vancomycin (183 DDD/1000PD), cefazolin (152 DDD/1000PD), ceftriaxone (119 DDD/1000PD), and meropenem (118 DDD/1000PD) were the most frequently used agents [20]. These differences likely reflect variations in case mix, infection epidemiology, and antimicrobial stewardship practices across settings. The relatively low use of piperacillin-tazobactam in the present setting may reflect differences in local prescribing practices, and, more importantly, a temporary shortage of this agent during the study period. When comparing DOT/1000PD across different hospital wards, cefazolin demonstrated the highest utilization in surgical wards. This elevated DOT and DOT/1000PD reflects its extensive use for surgical prophylaxis in the present hospital, which is consistent with its role as a first-line agent for perioperative infection prevention. A retrospective study conducted in the surgical ward of a governmental hospital in the Riyadh region reported data on antibiotic prophylaxis extracted from electronic medical records. The most frequently prescribed agents were ceftriaxone (28.44%) and metronidazole (26.36%), which contrasts with the findings of the present study. This difference may reflect variations in local prescribing practices, antimicrobial stewardship policies, or the types of surgical procedures performed in the two settings [21].

The pediatric ward demonstrated the highest total antibiotic consumption based on the DOT and DOT/1000PD indexes (3195 and 263.3, respectively). This reflects not only a higher proportion of patients receiving antibiotics, but also a longer duration of therapy, more frequent use of combination regimens, a greater number of multiple daily-dose antibiotics, and a longer length of stay in this ward. Together, these factors indicate increased antimicrobial use, possibly associated with the higher burden of infectious diseases among pediatric patients. A study conducted by de Barros Fernandes *et al*. (2018–2020) analyzed antimicrobial use among 1,020 hospitalized pediatric patients across 5 Brazilian hospitals in different regions and reported that DOT/1000PD varied between 278 and 517 [22]. The findings indicate that in some hospitals, these values are up to twice as high as those observed in the present hospital. Another study conducted in South Africa by Koopmans in 2015 reported that overall, 904 antimicrobials were prescribed in the ward, generating 4079 DOT and a usage rate of 1137 DOT/1000PD; substantially higher that that observed in the present study [23].

Conclusions

This study demonstrates that the rate of antibiotic use in the hospital exceeded the rates typically reported in developed countries. This finding may be partly explained by resource limitations, including diagnostic delays and limited microbiology laboratory capacity, as well as a high burden of surgical infections and the frequent use of prophylactic antibiotics. In addition, higher levels of AMR in the community—potentially driven by unsupervised antibiotic use—may contribute to increased prescribing. The pattern of antibiotic utilization differed from that reported in other centers, which may reflect differences in drug availability and local hospital practices. Addressing these challenges requires prioritizing the development and implementation of standardized protocols for antibiotic prescribing, particularly for surgical prophylaxis. Additionally, strengthening infection prevention and control practices—such as adherence to hand hygiene and aseptic techniques—along with improving timely access to reliable blood cultures and antimicrobial susceptibility testing, may reduce reliance on empirical broad-spectrum therapy. Collectively, these measures could contribute to optimizing antibiotic use and minimizing unnecessary administration.

This study has several limitations. First, it was conducted over a single month during the autumn season, which may not adequately capture temporal fluctuations in antimicrobial use; extending the study period would likely provide a more representative assessment of hospital prescribing patterns, particularly in settings where intermittent drug shortages occur. Second, the analysis was restricted to a single hospital, limiting the generalizability of the findings. Inclusion of data from additional hospitals within the region would strengthen the external validity of the results. Finally, the use of a single stewardship metric may not fully reflect antimicrobial utilization. Incorporating additional indicators, such as DDD, would offer a more comprehensive evaluation of prescribing practices.

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Authors' contributions

Both authors contributed substantially to the conception and design of the study, data collection, and analysis and interpretation of the results. Both authors were involved in drafting and critically revising the manuscript, approved the final version for publication, and agree to be accountable for all aspects of the work.

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Conflict of interest

No conflict of interest is declared.

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