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Research Article

Evaluation of Drug Utilization Patterns Using WHO Indicators in Patients with End-Stage Chronic Kidney Disease: A Cross-Sectional Study in Kirkuk, Iraq

Mirna Kifah Faiq*
Department of Pharmacology and Toxicology, College of Pharmacy, University of Kirkuk, Kirkuk, Iraq
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Abstract

Background: Chronic kidney disease (CKD) is a challenging problem. Drug use evaluation is an important issue for the recommended medications. ***Objective***: To assess drug utilization patterns among end-stage CKD patients in Kirkuk, Iraq, based on World Health Organization (WHO) prescribing indicators. ***Methods***: A cross-sectional study was conducted in Kirkuk, Iraq, involving data collection from Al-Amal Centre for Dialysis. A hospital-based convenience sampling technique was used to recruit a total of 314 patients diagnosed with end-stage CKD (stage 5) from October 2025 to January 2026. ***Results***: Most patients were less than 60 years of age (59.24%), with a mean age of 57.1 years, and a male predominance (60.51%). The mean number of comorbidities per patient was 2.9. The encountered comorbidities in CKD patients were hypertension (89%), anemia (88%), and diabetes mellitus (41%). The average number of drugs per prescription was 13, and antibiotics were 42.35%. About 79.96% of drugs prescribed are generics, and injectables represent 82.48%, while the percentage of drugs prescribed according to the essential drug list is 48.76%. ***Conclusions***: There is a critical prevalence of polypharmacy and a dependence on non-essential medications, which significantly increases the risk of severe drug responses and financial burdens for patients with chronic kidney disease. The high incidence of generic prescriptions is a positive step toward lowering costs, but it is overshadowed by the overuse of injectables and antibiotics, as well as the excessive number of medications per prescription.

Keywords: Chronic kidney diseases; Drug utilization; Iraqi patients; Kirkuk; Prescribing patterns; WHO indicators.

تقييم أنماط استخدام الأدوية باستخدام مؤشرات منظمة الصحة العالمية لدى مرضى الكلى المزمن: دراسة مقطعية

الخلاصة

الخلفية: يُعدّ مرض الكلى المزمن مشكلة تتسم بالتحدي. ويُعتبر تقييم استخدام الأدوية مسألة مهمة للأدوية الموصى بها. **الهدف**: تقييم أنماط استخدام الأدوية بين مرضى المراحل النهائية من مرض الكلى المزمن في كركوك، العراق، بناءً على مؤشرات منظمة الصحة العالمية لوصف الأدوية. **الطرائق**: أُجريت دراسة مقطعية في كركوك، العراق، شملت جمع البيانات من مركز الأمل لغسيل الكلى. تمّ استخدام تقنية أخذ العينات الملائمة المستندة إلى المستشفى لتشمل 314 مريضاً تم تشخيص إصابتهم بالمرحلة النهائية من مرض الكلى المزمن (المرحلة 5) في الفترة من أكتوبر 2025 إلى يناير 2026. **النتائج**: كان معظم المرضى أقل من 60 عاماً من العمر (59.24%)، بمتوسط عمر بلغ 57.1 عاماً، مع سيطرة للذكور (60.51%). وبلغ متوسط عدد الأمراض المصاحبة لكل مريض 2.9. وكانت الأمراض المصاحبة التي تم مواجهتها لدى مرضى الكلى المزمن هي ارتفاع ضغط الدم (89%)، فقر الدم (88%)، ومرض السكري (41%). وبلغ متوسط عدد الأدوية لكل وصفة طبية 13، وكانت المضادات الحيوية بنسبة 42.35%. حوالي 79.96% من الأدوية الموصوفة هي أدوية جنيسة (بديلة)، وتمثل الحقن 82.48%، في حين أن نسبة الأدوية الموصوفة وفقاً لقائمة الأدوية الأساسية هي 48.76%. **الاستنتاجات**: هناك انتشار حرج للتعدد الدوائي (الاستخدام المفرط للأدوية) واعتماد على الأدوية غير الأساسية، مما يرفع بشكل كبير من خطر حدوث استجابات دوائية شديدة وأعباء مالية على مرضى الكلى المزمن. إن المعدل العالي لوصف الأدوية الجنيسة يُعد خطوة إيجابية نحو خفض التكاليف، ولكنه يتأثر سلباً بالاستخدام المفرط للحقن والمضادات الحيوية، فضلاً عن العدد الهائل من الأدوية لكل وصفة طبية.

* ***Corresponding author***: Mirna K. Faiq, Department of Clinical Pharmacy, College of Pharmacy, University of Kirkuk, Kirkuk, Iraq; Email: mirnakifah@uokirkuk.edu.iq
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INTRODUCTION

Chronic kidney disease (CKD) is a global public health problem due to its increased risk of major noncommunicable diseases like cardiovascular disorders [1]. Due to the prescription of numerous medications, patients with CKD are more likely to have drug-related problems [2]. Pre-existing CKD difficulties can be greatly worsened by comorbid illnesses such as hypertension, diabetes mellitus, coronary artery disease, and infection, as well as the prescription of various drugs for these conditions [3]. An average of 12 medications is administered to patients with CKD undergoing maintenance hemodialysis, and these patients are more likely to have adverse drug reactions [4]. Drug prescription pattern evaluation, a part of the clinical review that serves as an indicator of the level of care provided to the patient and helps improve patient care by making the required modifications, is an essential part of patient care [5,6]. The World Health Organization (WHO) defines a drug utilization study (DUS) as "the marketing, distribution, prescription, and use of drugs in society, with a focus on the resulting medical, social, and economic consequences" [7]. The following are some advantages of conducting DUS regularly: firstly, it will provide a general overview of the real drug usage pattern for a specific disease condition in a given population over a given period of time. Second, it will help identify early indicators of

unreasonable drug usage. Thirdly, these studies can enhance long-term drug use. Fourthly, it will also contribute to quality control in drug usage [8]. Various studies were conducted to evaluate drug utilization patterns among patients with CKD in accordance with WHO prescribing patterns, and the results varied. Prescribing indicators include the number of pharmaceuticals prescribed per visit, the percentage of generic prescriptions, the frequency of injectable encounters, the percentage of antibiotic prescriptions, and the percentage of medications indicated on the essential drug list (EDL) [9]. Usually widespread and complex, irrational drug use has an impact on the patient, the community, the physician, the dispenser, and the health system [10]. Drug use in Iraq has been the subject of numerous studies on various demographics and in different contexts. However, CKD patients in hospitals had not been the focus of any of these studies. Based on WHO prescribing indicators, this study aimed to evaluate drug use patterns among end-stage CKD patients in Kirkuk, Iraq.

METHODS

Study design and setting

The present investigation was a cross-sectional study conducted in Kirkuk, Iraq. It involved collecting data from the Al-Amal Centre for Dialysis, including 314 patients with end-stage CKD (stage 5) who were over 18 years of age and of either gender. Patients with acute kidney injury, patients with CKD from outside the Kirkuk governorate, cancer patients, and pregnant females were excluded from the study.

Sampling technique

A hospital-based convenience sampling technique was used to recruit a total of 314 patients diagnosed with end-stage CKD from Al-Amal Centre for dialysis. This strategy was used in order to guarantee the inclusion of patients who are currently receiving pharmacological therapy and specialist clinical care in these primary healthcare centers. For a simple random sample, the following formula (Cochran formula) [11] was used:

$$n = \frac{z^2.p(1-p)}{E^2}$$

Here, n stands for sample size, z for Z-value (e.g., 1.96 for 95% confidence), p for estimated proportion (0.5 if unknown), and E for margin of error (e.g., 0.06). The calculated number equals 267 patients. A margin of error of 0.06 was selected for this study to obtain representative results with a manageable sample size while balancing practicality and accuracy.

WHO core drug use: Prescribing indicators

The WHO Core Drug Use Prescribing Indicators are calculated using the following equations [12]:

$$\text{Average No. of drugs/encounter} = \frac{\text{Total No.of drugs}}{\text{Total No.of the prescription}}$$

$$\%\ \text{drugs by generic name} = \frac{\text{Prescribed by generic name}}{\text{Total drugs prescribed}} \times 100\%$$

$$\%\ \text{encounter with antibiotic} = \frac{\text{Prescription with antibiotic}}{\text{Total prescription}} \times 100\%$$

$$\%\ \text{injection prescribed} = \frac{\text{Prescription with injection}}{\text{Total prescription}} \times 100\%$$

$$\%\ \text{prescribed from EML or formulary} = \frac{\text{Prescribed from EML}}{\text{Total drugs}} \times 100\%$$

Data collection

Between October 2025 and January 2026, information was gathered from Al-Amal Dialysis Center. As part of the data-gathering process, thorough patient profiles were obtained, which included demographic data such as age, gender, occupation, and educational level. Lifestyle factors that were also gathered included comorbidities; clinical and anthropometric data, including body mass index (BMI); and diet and smoking habits. The number of injectable formulations, the total number of prescriptions written for each patient, and the usage of generic drugs were among the pharmacological details. To investigate how CKD patients took medications based on WHO characteristics, medications were further categorized according to their pharmacological classifications and anatomical therapeutic chemical categorization (ATC).

Ethical considerations

This investigation was conducted in accordance with the Declaration of Helsinki and the principles of excellent clinical practice [13]. Additionally, the protocol was authorized by the University of Kirkuk-College of Pharmacy's Ethical Committee, given the number RECAUKCP4, and approved by the CKD facility while maintaining patient privacy.

Statistical analysis

Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, N.Y., USA). Descriptive statistics were expressed as frequencies and percentages (n, %) for categorical variables and as (mean±SD) for continuous variables. Inferential analyses were applied to evaluate statistical associations across patient characteristics: an independent samples A t-test was used to compare continuous data across two-group variables, while one-way ANOVA (or Welch's test if variances were unequal) was employed for multi-group comparisons, followed by Tukey's HSD post-hoc test for significant findings. Additionally, a chi-square test was performed to determine the statistical associations between demographic variables and the categorical outcomes of antibiotic and injection utilization. Statistical significance was defined as $p< 0.05$.

RESULTS

Of the 314 patients studied, 190 (60.51%) were males, and 124 (39.49%) were females. The majority of patients were less than 60 years of age (59.24%), with a mean age of 57.1 years. A highly significant difference in the total number of prescribed drugs was observed across age groups ($p< 0.001$), with patients aged ≥ 60 receiving more medications (14.80 ± 3.25) than those < 60 years (11.95 ± 2.85). Post-hoc analysis further revealed that the mean number of prescribed drugs was significantly higher in ex-smokers compared to current smokers ($p= 0.018$), in unemployed patients compared to employed patients ($p= 0.010$), and in illiterate patients compared to both primary education ($p= 0.016$) and graduate-level individuals ($p= 0.024$). No statistically significant association was found between any of the analyzed demographic or lifestyle variables and the frequency of antibiotic prescription ($p> 0.05$). Highly significant associations were found between injection utilization and both educational status ($p< 0.001$) and BMI ($p< 0.001$), with the highest rate of injection use observed among patients with a primary level of education (89.8%) and individuals with a BMI ≥ 25 (88.3%), as illustrated in Table 1.

Table 1: Socio-demographic Characteristics of the patients and their association with drug utilization indicators.

Variables		Result	Total drugs prescribed	*p*-value	Antibiotics used n(%)	*p*-value	Injectables used	*p*-value
Gender	Male	190(60.51)	12.85±3.1	0.104	78(41.1)	0.563	156(82.1)	0.827
	Female	124(39.49)	13.51±3.25		55(44.4)		103(83.1)	
Age interval	< 60	186(59.24)	11.95±2.85	<0.001*	78(41.9)	0.856	157(84.4)	0.279
	≥ 60	128(40.76)	14.8±3.25		55(43)		102(79.7)	
Educational status	Illiterate	98(31.21)	14.82±3.3	0.006*	47(48.5)	0.683	71(73.2)	<0.001
	Primary	99(31.52)	13.04±3.1		42(42.9)		88(89.8)	
	Secondary	51(16.24)	12.44±2.95		20(39.2)		49(96.1)	
	Undergraduate	6(1.91)	11.5±2.6		2(33.3)		6(100)	
	Graduate	57(18.15)	11.08±2.5		21(35.6)		42(71.2)	
	Postgraduate	3(0.96)	11±2.4		1(33.3)		3(100)	
Social habit	Current smoker	21(6.69)	12.2±2.85	0.02*	9(42.9)	0.174	18(85.7)	0.726
	Ex-smoker	67(21.34)	14.3±3.35		35(52.2)		57(85.1)	
	Never smoking	226(71.97)	13.2±3.1		89(39.4)		184(81.4)	
Family history	Present	86(27.39)	13.65±3.3	0.054	44(51.2)	0.052	73(84.9)	0.492
	Absent	228(72.61)	12.78±3.05		89(39)		186(81.6)	
Occupation	Employed	55(17.52)	11.1±2.65	0.012*	23(41)	0.977	50(89.3)	0.218
	Unemployed	197(62.74)	13.78±3.25		84(42.6)		162(82.2)	
	Retired	62(19.75)	12.75±3.1		26(42.6)		47(77)	
Dietary pattern	Mixed diet	310(98.73)	10.45±3.07	0.85	130(41.9)	0.184	255(82.3)	0.354
	Vegetarian	4(1.27)	10.75±6.99		3(75)		4(100)	
BMI	18.5-22.9	18(5.73)	11.05±2.6	0.23	9(50)	0.094	11(61.1)	<0.001
	23-24.9	73(23.25)	12.28±3.0		23(31.5)		51(69.9)	
	≥25	223(71.02)	13.49±3.25		101(45.3)		197(88.3)	

Values are expressed as n(%) and mean±SD. Independent samples t-test/ANOVA was used for continuous mean comparison, while the Chi-square test was used for categorical proportion comparisons.

In the current study, the mean number of comorbidities per patient was 2.9. Hypertension (89%) and anemia (88%) were the most common co-morbidities among CKD patients, followed by diabetes mellitus (41%), heart disease (29%), hyperlipidemia (25%), thyroid disorder (19%), stroke (6%), and other co-morbidities (4%), as illustrated in Figure 1.

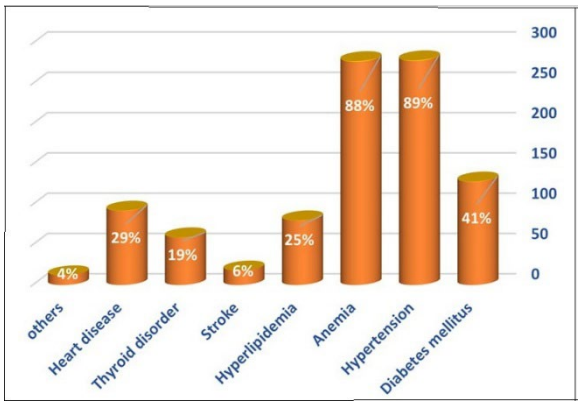

Figure 1: Co-morbid diseases reported in CKD patients.

In the study, 4116 medications were prescribed in total. There were 13 medications on average per prescription. 79.96% of patients received prescriptions for generic medications, 82.48% received prescriptions for injections, 48.76% received prescriptions from the essential medicine list, and 42.35% received prescriptions for antibiotics, as illustrated in Table 2. The current study showed that, according to the ATC classification of drugs, the drugs belonging to the class of alimentary tract and metabolism were the most commonly prescribed (31.12%), followed by drugs belonging to the class of blood and blood-forming products (24.76%) and cardiovascular system (CVS) drugs (18.10%). As illustrated in Table 3. Vitamins and minerals were commonly prescribed (18.45%), followed by hematopoietic agents (16.13%), antihypertensives (15.72%), and phosphate binders (12.59%), as illustrated in Table 4.

DISCUSSION

Studies on drug usage have a big influence on health policy and quality improvement [14]. In this study, about 190 (60.51%) of the 314 patients were males, and 124 (39.49%) were females. This result is consistent with those of Kamath *et al*. [8] and Ahlawat *et al*. [15]. Males have a higher prevalence of renal risk factors and may have easier access to medical care [16]. According to demographic analysis, the highest percentage of patients are less than 60 years (59.24%) and had a mean age of 57.1, which is comparable to the mean age of 55.8 years in the study by Harshita *et al*. [17].

Table 2: The World Health Organization drug prescribing indicators

WHO prescribing indicators	n(%)	WHO reference values [14]
Total number of drugs prescribed	4116	-----
Average number of drugs per prescription	13	1.6-1.8
Percentage of drugs prescribed by generic name	3291(79.96)	100%
Percentage of patients with an injection prescribed	259(82.48)	13.4-24.1%
Percentage of Drugs prescribed from the essential drug list	2007(48.76)	100%
Percentage of patients prescribed an antibiotic	133(42.35)	20-26.5%

Table 3: Drug classification according to ATC classification

ATC Class code	ATC class	n(%)
A	Alimentary tract and metabolism	1281(31.12)
B	Blood and blood-forming products	1019(24.76)
C	Cardiovascular system	745(18.1)
D	Dermatology system	151(3.67)
G	Genitourinary system and sex hormones	7(0.17)
H	Systemic hormonal preparation	91(2.21)
J	Anti-infectives for systemic use	133(3.23)
L	Anti-neoplastic and immunomodulatory agents	2(0.05)
M	Musculoskeletal system	15(0.36)
N	Nervous system	235(5.71)
R	Respiratory system	145(3.52)
S	Sensory organ	24(0.58)
V	Various	268(6.51)

Table 4: Therapeutic class-wise drug distribution

Drug Class		n(%)
Antihypertensive		647(15.72)
	Alpha blockers	6(0.93)
	ACE inhibitors	29(4.48)
	ARBs	73(11.28)
	Beta blockers	87(13.45)
	CCB	149(23.03)
	Diuretics	166(25.66)
	Combination	137(21.17)
Anti-dyslipidemia		95(2.31)
	Statins	88(92.63)
	Fibrate	7(7.37)
Drugs for GIT		144(3.50)
	PPI	112(77.78)
	H2 blockers	6(4.17)
	Miscellaneous used for heartburn	26(18.06)
Anti-diabetic drugs		130(3.16)
	Insulin	98(75.38)
	Oral hypoglycemic agents	32(24.62)
Hematopoietic agents		664(16.13)
	Iron	244(36.75)
	Folic acid	165(24.85)
	Erythropoietin/darbepoetin alfa	255(38.40)
Antiplatelet agents and		66(1.60)
	Aspirin	50(75.76)
	Clopidogrel	16(24.24)
Anticoagulant agents		286(6.95)
Phosphate binders		518(12.59)
	Calcium carbonate	260(50.19)
	Calcium acetate	1(0.19)
	Sevelamer acetate	256(49.42)
	Magnesium salts	1(0.19)
Vitamins and minerals		769(18.45)
	Vitamin D3	11(1.43)
	Calcitriol	8(1.04)
	Alfacalcidol (One-alpha)	237(30.81)
	Multivitamins and multimineral	513(66.71)
Herbal drugs		13(0.32)

These results imply that the fifth and sixth decades of life are associated with an increased risk of chronic renal disease. The results of the current study regarding family history showed that 27.39% of patients had a family history of kidney disease, while the vast majority (72.61%) did not, which is consistent with the findings of Demir *et al*. (2024) [18], who found that only 14.3% of dialysis patients and 17.2% of CKD patients had a family history of kidney disease. This suggests that environmental factors are more likely to be the primary cause of disease in developing populations. The current study confirms that hypertension, anemia, and diabetes are the most prevalent comorbidities for CKD. These results were consistent with those of Kamath *et al*. and Ahlawat *et al*. [8,15]. The current study found that 48.76% of the drugs given were on the essential medicine list. This is higher than the 33.98% found by Memon et al. [3] and the 42% found by Bajait *et al*. [19]. However, it is less than 65.8% found in the study by Kamath *et al*. [8]. The rationale behind essential medicines is that, despite the abundance of registered and accessible pharmaceuticals, it is mandatory to apply caution to guarantee the safety, efficacy, and affordability of these medications while also taking into consideration the medical requirements of the vast majority of the population [14]. Physicians sometimes have to consider the risk-benefit ratio for complicated illnesses at clinics, which may need the use of medications in addition to the standard EDL to ensure

appropriate therapy. The mean number of medications per prescription was found to be 13, compared to previous studies by Alruqayb *et al*. (11.09) [20], Sangeetha *et al*. (7.6) [21], and Al-Jabri *et al*. (5.3) [12]. This phenomenon may be due to the high number of comorbidities among stage 5 patients over 60 ($p < 0.001$). Polypharmacy is generally considered improper, although for some severe chronic illnesses, such treatment may be acceptable [22]. For example, polypharmacy may be useful in CKD to treat comorbidities such as anemia, CVD, and metabolic and bone problems, as well as prevent disease progression [23, 24]. There may be a need for new indicators that take into account the characteristics of CKD and other conditions that require the use of multiple medications to prevent progression and control comorbidities, as the WHO prescribing indicators do not distinguish between appropriate and inappropriate polypharmacy [20]. The alimentary tract and metabolism (group A) were the most frequently prescribed drug group in this study (31.12%), followed by blood and blood-forming products (group B) at 24.76% and the cardiovascular system (group C) at 18.10%. The alimentary tract and metabolism (category A), cardiovascular system (group C), and blood and blood-forming products (group B) were the most frequently recommended, according to previous studies [1,8,20,21]. This high usage of group A in this study is due to the fact that all patients are in stage 5. Patients with advanced CKD (stage 5) may need vitamin D therapy and phosphate-binding agents to manage hyperphosphatemia and secondary hyperparathyroidism (KDIGO, 2009) [25]. The WHO set a goal of 100% for the percentage of medications prescribed under generic names; the current analysis found a percentage of 79.96%. This is a respectable number that is greatly above the 30% reported by Kamath *et al*. (2019) [8]. This increase shows that Kirkuk's healthcare providers somehow comply with and adhere to the WHO's recommendations regarding generic medications. According to our analysis, 82.48% of patients received at least one injection. In comparison to the WHO's reference value of less than 20%, the 16.6% reported by Kamath *et al*. (2019) [8] and the 64% reported by Rakshana and Selva (2019) [26] indicate that this percentage is relatively high. The exact reason for this high percentage in our study is that all patients are in stage 5 and are receiving IV drugs, including iron infusions, heparin, and erythropoietin inducers, during dialysis sessions. Furthermore, this study indicated that individuals with inadequate health literacy might end up in the hospital at a later, more severe phase of illness, requiring more intravenous or injectable interventions ($p< 0.001$). Furthermore, different studies indicated that high BMI is strongly associated with metabolic syndrome and serious CVD [27-29]. The Asia-Pacific BMI classification was used in this study [30]. Parenteral therapies, such as insulin therapy, anticoagulants, or extensive analgesic management, are often required for these disorders, which is consistent with this study, where there is a significant association between high BMI and the use of injections ($p< 0.001$). Globally, antibiotic resistance is becoming a bigger problem that could cause issues with infection treatment or even death [31]. The current study found that 42.35% of prescriptions contained antibiotics, which is significantly more than the WHO recommended of 20–26.5%. This number is close to the 48% found by Rakshana and Selva (2019) [26]. High rates of antibiotic prescriptions may be a rising worldwide health issue that may result in hospitalization, further kidney damage, or higher healthcare costs [20]. A total of 4116 medications were prescribed in the current study, with antihypertensive medications being the most recommended (15.72%) and herbal medications being provided less frequently (0.32). Diuretics (25.66%) and calcium channel blockers (23.03%) were the most frequently used medications in the cardiovascular class in the current study, which is consistent with the findings of Ahlawat *et al*. [15]. Similar to Kamath *et al*. and Kanjariya *et al*. [8,7], calcium carbonate was more frequently prescribed as a phosphate binder (50.19%), followed by sevelamer acetate (49.42%). Calcium-containing phosphate binders can also be used as a calcium supplement because they are less expensive for many patients than lanthanum carbonate and sevelamer hydrochloride [4].

Study Limitations

Most of the data were collected from the AL-Amal dialysis center in Kirkuk. The results may not fully reflect drug use patterns in all healthcare sectors, despite the facility's size. A significant obstacle is the center's frequent absence of thorough lists of medications used to treat co-occurring chronic conditions. Recalling bias may have been introduced because patient interviews were required to fill in the gaps caused by some participants' lower educational attainment.

Conclusion

The study found that patients with chronic renal disease had a critical prevalence of polypharmacy and a dependence on non-essential medications, which significantly increases the risk of severe drug reactions and financial burden. The overuse of injectables and antibiotics, as well as the excessive number of medications per prescription, overshadows the high rate of generic prescriptions, which is a significant step toward reducing costs. Future qualitative research is therefore necessary to assess particular antibiotic subclasses, therapeutic indications, and the use of empirical versus culture-guided prescribing trends at this hospital.

Conflict of interests

The authors declared no conflict of interest.

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The authors did not receive any source of funds.

Data sharing statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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