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# Global Point Prevalence Survey in Five Teaching Hospitals in Baghdad, Iraq

Irak'ın Bağdat Şehrindeki Beş Eğitim Hastanesinde Küresel Nokta Prevalans Çalışması

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## Abstract

**Introduction:** One of the crucial steps of the antimicrobial stewardship process is the measurement of antimicrobial usage. This study aims to assess the antimicrobial prescription patterns in Iraqi hospitals by conducting a survey and to determine quality indicators in order to establish an effective antimicrobial stewardship program in Iraq.

**Materials and Methods:** A point prevalence survey (PPS) was undertaken in the five main teaching hospitals in Baghdad, Iraq. The survey included all patients admitted to hospitals on the day of the survey. The study pursued comprehensive data on patients who received antimicrobial therapy on the day of the survey.

**Results:** Among the 808 included inpatients, 66.7% were treated with at least one antimicrobial agent. The neonatal intensive care unit had the highest antimicrobial prescription rate (97.2%), whereas the adult intensive care units had the lowest rate (41.7%). Half of the antibiotics prescribed were used for surgical and medical prophylactic indications. Third-generation cephalosporin, particularly ceftriaxone, was the most commonly used antibiotic (31.5%) for all types of indications, and vancomycin and meropenem were the most prescribed antibiotics in cases of sepsis (32% each). Approximately 98.8% of the prescribed antibiotics were employed for empiric uses. No applied institutional guidelines were applied in the treatment of any indicated infectious diseases. The majority of the antibiotics used were administered parenterally. Culture sensitivity tests were only conducted on 10 (1.2%) patients.

**Conclusion:** The present study revealed several quality indicators that need improvement, including excessive prescription of prophylactic antibiotics in Iraqi hospitals and extremely high empiric use of antibiotics. The Global-PPS tool provides data that will help Iraq's health authorities in designing an action plan to improve the appropriate prescription of antimicrobial agents.

**Keywords:** Antimicrobial stewardship, infectious diseases, Iraq, antibiotic prescription

## Öz

**Giriş:** Antimikrobiyal yönetim sürecinin en önemli adımlarından biri, antimikrobiyal kullanımın ölçülmesidir. Bu çalışma, Irak'ta etkili bir antimikrobiyal gözetim programı oluşturmak için Irak hastanelerindeki antimikrobiyal reçete modellerini bir anket yaparak değerlendirmeyi ve kalite göstergelerini belirlemeyi amaçlamaktadır.

**Gereç ve Yöntem:** Irak'ın Bağdat şehrindeki beş ana eğitim hastanesinde nokta prevalans çalışması (PPS) gerçekleştirildi. Bu anket çalışması, anketin yapıldığı gün hastanelere kabul edilen tüm hastaları içermektedir. Çalışma, anketin yapıldığı gün antimikrobiyal tedavi alan hastalar hakkında kapsamlı verileri takip etti.

**Bulgular:** Yatarak tedavi gören 808 hastanın %66,7'si en az bir antimikrobiyal ajan ile tedavi edildi. Yenidoğan yoğun bakım ünitesi en yüksek antimikrobiyal ilaç reçete oranına (%97,2) sahipken, yetişkin yoğun bakım üniteleri en düşük orana (%41,7) sahipti. Reçete edilen antibiyotiklerin

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yarısı cerrahi ve tıbbi profilaktik endikasyonlar için kullanıldı. Üçüncü kuşak sefalosporin, özellikle seftriakson, tüm endikasyon türleri için en yaygın kullanılan antibiyotikti (%31,5). Sepsisli hastalarda en çok reçete edilen antibiyotikler vankomisin ve meropenemdi (her biri %32). Reçete edilen antibiyotiklerin yaklaşık %98,8'i ampirik olarak kullanıldı. Belirtilen bulaşıcı hastalıkların tedavisinde hiçbir kurumsal rehber uygulanmadı. Kullanılan antibiyotiklerin çoğu parenteral olarak uygulandı. Kültür duyarlılığı testleri sadece 10 (%1,2) hastada yapıldı.

**Sonuç:** Bu çalışma, Irak hastanelerinde profilaktik antibiyotiklerin aşırı reçetelenmesi ve son derece yüksek ampirik antibiyotik kullanımı gibi iyileştirilmesi gereken birkaç kalite göstergesini ortaya çıkarmıştır. Global-PPS, Irak'ın sağlık otoritelerinin, antimikrobiyal ajanların daha uygun olarak reçetelendirilmesi için bir eylem planı tasarlamasına yardımcı olacak veriler sağlamaktadır.

**Anahtar Kelimeler:** Antimikrobiyal yönetim, enfeksiyon hastalıkları, Irak, antibiyotik reçetesi

## Background

The world is facing a significant dilemma represented by antimicrobial resistance (AMR). Antimicrobial resistance is a leading cause of serious health and economic problems. High morbidity and mortality rates, prolonged hospital stays, and the high cost of treatment are the main difficulties associated with antibiotic resistance<sup>[1]</sup>. One of the fundamental causes of AMR is related to the irrational or excessive use of antibacterial medications at the hospital and community levels<sup>[2]</sup>. The World Health Organization (WHO) has set in place a protective plan to face this growing problem by adopting antimicrobial stewardship to decrease the rate of emergent bacterial resistance in health facilities. Many other governmental institutions and universities have attempted to determine suitable management programs to optimize the use of antibiotics. The WHO encourages developing countries to establish a national action plan to decrease antibiotic use<sup>[3]</sup>. One of the stewardship action plans includes the assessment of an antibiotic prescription paradigm<sup>[4]</sup>. A cross-sectional survey at a definite point in time, called a point prevalence survey (PPS), can be used instead of collecting continuous data on antibiotic prescription, which requires a huge amount of work and human resources. Many institutes have utilized PPS in antibiotic monitoring in many hospitals around the world<sup>[5]</sup>. In line with this, Iraqi health authorities have attempted to launch an actual plan to combat AMR<sup>[6]</sup>. To achieve this goal, a reliable database on antimicrobial prescription, which represents a wide range of health facilities, should be established to create a good strategy. In addition, quality indicators should be identified to help Iraqi authorities to recognize the benchmarks for tackling AMR<sup>[7]</sup>. Iraqi researchers have published some articles regarding the emergence of bacterial resistance in local hospitals; however, few studies have assessed antimicrobial utilization in Iraq<sup>[8-10]</sup>. Furthermore, these studies may have evaluated antimicrobial prescription in only a few wards or in a single hospital<sup>[11,12]</sup>. Thus, the present study aimed to improve the database of antibiotic prescription patterns in Iraq through a multicenter evaluation of antimicrobial prescription in five main teaching hospitals in Baghdad.

## Materials and Methods

In this study, a cross-sectional multicenter PPS ([www.global-pps.com](http://www.global-pps.com)) was conducted using the standardized methodology of Global-PPS<sup>[13]</sup>. Five teaching hospitals in three directorates of Baghdad were the focus, namely Baghdad General Hospital, Al-Kindi General Hospital, Al-Elwiya Hospital for Obstetrics and Gynecology, Ibn Al-Nafees Hospital for Cardiovascular Diseases and Al-Yarmouk General Hospital. The Baghdad General Hospital is a part of the directorate of Baghdad Medical City. Al-Kindi General Hospital, Al-Elwiya Hospital for Obstetrics and Gynecology, and Ibn Al-Nafees Hospital for Cardiovascular Diseases are part of the Al-Rasafa Health Directorate. Al-Yarmouk General Hospital is under the Al-Karkh Health Directorate.

All inpatients in the hospital wards before 08:00 a.m. on the day of the survey were included and categorized as denominator data. Detailed data on patients who were receiving one or more antimicrobial agents (antibiotics, antifungals, antivirals, and antimycotics) on the day of the survey were collected. The study excluded external or vaginal treatments. Dialysis and short-stay patients, outpatients, and inpatients admitted after 08:00 am were excluded.

Data were collected from January 2019 to April 2019. This study was conducted at four different levels using standardized paper data collection forms. At the hospital level, the hospital name, service level, departments, total number of available beds, and total number of admitted patients were collected. At the ward level, the data included the ward activity, total bed capacity, and total number of admitted patients. Patient-level data included the patient's gender, age, diagnosis, and indication. The diagnostic classification of antimicrobials was determined by either the site of infection or the prophylactic use. The indication was classified into community/hospital-acquired infection or surgical/medical prophylaxis. On each patient's form, information regarding the prescribed antibiotic was collected, including the name, dosage form, single dosage, and frequency. Quality assessment for antimicrobial prescription included documentation of the reason for prescribing, guideline adherence, whether a stop/review date was written in the notes, and whether the treatment was empiric or targeted. The form also requested information regarding

culture sensitivity testing for the targeted antibiotic, type of bacterial resistance, and the presence of a specific biomarker test (e.g., C-reactive protein) to support the antimicrobial prescription decision. All collected data were input in an Internet-based system (designed by the University of Antwerp in Belgium) for anonymized data entry, validation, and reporting. The system classified antimicrobials according to the Anatomical Therapeutic Chemical classification system of the WHO<sup>[14]</sup>.

Official legislative approval was obtained from the National Center for Training and Human Development, Iraqi Ministry of Health (ref. number 608 on 3/4/2019) to conduct this study according to the requirements of the Iraqi authorities. An endorsement from each directorate was obtained after confirmation, from the technical affairs management, issued from each hospital to access patients' records (Ref. Nos. 35842, 15023, and 37405). The Ministry of Health did not require ethical committee approval or consent from each patient.

### Statistical Analysis

Data analysis was conducted using the latest versions of Microsoft Excel and SPSS Statistics, version 22 (IBM Corp; Armonk, NY). Descriptive statistics (frequency, percentages, mode, and medians) were used in categorical variables.

## Results

This study surveyed five teaching hospitals with a total of 1644 beds. Among the 808 admitted patients, 66.71% were

treated with at least one antimicrobial agent (Table 1). The highest antibiotic prevalence was observed among neonatal intensive care units (number of admitted patients=36, 97.2%) followed by adult surgical wards (69.9%), adult medical wards (65.2%), and adult intensive care units (41.7%). Among the 993 antimicrobials prescribed, 51.1% were used for prophylaxis, half of which were utilized for medical prophylaxis. Approximately 39.6% were prescribed to treat community-acquired infections, and 2.8% were used to treat hospital-associated infections (Table 2).

Approximately 98% of antibiotics were used empirically, and culture sensitivity tests were conducted for only 10 patients. Forty-six types of antimicrobials were utilized, 85.6% of which were antibacterial agents. A total of 244 patients were treated with more than one antibiotic. National or institutional antimicrobial guidelines were not available. A stop or review note was documented in only four patients.

Overall, ceftriaxone was the most frequently used antibiotic (31.5%), followed by metronidazole (20.9%) and meropenem (10.1%) (Table 3). Azithromycin was the major antibiotic used for pneumonia, whereas vancomycin and meropenem were the top prescribed antibiotics for the treatment of sepsis cases. Approximately 65.5% of surgical and medical prophylactic antibiotics were used for more than one day, especially ceftriaxone (Table 4).

**Table 1. Distribution of beds, patients, wards, and antimicrobials**

	Baghdad Teaching Hospital No. (%)	Al-Kindi General Hospital No. (%)	Al-Yarmouk General Hospital No. (%)	Ibn Al-Nafees Hospital Cardiovascular Diseases No. (%)	Al-Elwiya Hospital O&G No. (%)	Total No. (%)
Number of available beds	657 (39.9)	282 (17.2)	389 (23.6)	163 (9.9)	153 (9.3)	1644 (100)
Number of admitted patients	402 (61.1)	133 (47.1)	139 (35.7)	75 (46.0)	59 (38.5)	808 (49.1)
Number of treated patients	266 (66.1)	89 (66.9)	102 (73.3)	36 (48.0)	46 (77.9)	539 (66.7)
Number of wards	15 (25.0)	14 (23.3)	13 (21.7)	10 (16.7)	8 (13.3)	60 (100)
Number of prescribed antibiotics						
Ward activity						
- Surgical activity	199 (37.2)	56 (40.0)	73 (44.5)	15 (30.6)	42 (40.0)	385 (38.8)
- Medical activity	309 (57.8)	76 (54.3)	63 (38.4)	30 (61.2)	12 (11.4)	490 (49.3)
- Intensive care activity	27 (5.0)	8 (5.7)	28 (17.1)	4 (8.2)	51 (48.6)	118 (11.9)
Male	108 (40.6)	36 (40.4)	45 (44.1)	16 (44.4)	13 (28.3)	218 (40.4)
Female	158 (59.4)	53 (59.6)	57 (55.9)	20 (55.6)	33 (71.7)	321 (59.6)
Route of administration						
- Oral	143 (72.2)	11 (5.6)	16 (8.1)	12 (6.1)	16 (8.1)	198 (19.9)
- Parenteral	392 (49.3)	129 (16.2)	148 (18.6)	37 (4.7)	89 (11.2)	795 (80.1)
Empirical use of antibiotics	526 (98.3)	137 (97.9)	184 (100)	49 (100)	105 (100)	981 (98.8)
Targeted use of antibiotics	9 (1.7)	3 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)	12 (1.2)

**Table 2. Rate of indications for the prescribed antimicrobials**

Indication	Number of prescribed antibiotics (%)
Community-acquired infection	393 (39.6)
Hospital-associated infection	28 (2.8)
Prophylactic:	
- Surgical prophylaxis	258 (25.9)
- Medical prophylaxis	249 (25.1)
Unknown indication	63 (6.3)
Non-specified site	2 (0.2)

**Table 3. Top 15 antibiotics prescribed**

Antibiotics	Number (%)
Ceftriaxone	313 (36.7)
Metronidazole	170 (19.9)
Meropenem	100 (11.7)
Ciprofloxacin	43 (5.0)
Vancomycin	34 (4.0)
Azithromycin	33 (3.9)
Amikacin	32 (3.8)
Ampicillin	21 (2.5)
Gentamicin	16 (1.9)
Levofloxacin	16 (1.9)
Amoxicillin	11 (1.3)
Piperacillin and enzyme inhibitor	10 (1.2)
Sulfamethoxazole and trimethoprim	7 (0.8)
Ceftazidime	6 (0.7)
Lincomycin	6 (0.7)

## Discussion

To establish an effective antimicrobial stewardship program, the prescription situation of antibiotics in Iraqi hospitals should be understood, and the indicators of imprudent antimicrobial prescription practice should be determined. This study surveyed the prescription pattern in five main teaching hospitals in Baghdad.

The results showed that 66.71% of all inpatients were treated with at least one antimicrobial agent, which exceeded the overall rate utilized in the rest of the world and North America (34.4% and 38.6%, respectively). This rate is above the maximum percentage reported in European countries (55.0% in Greece) [15,16] but lower than the documented rate in Nigeria and Pakistan (78.2% and 77.6%, respectively) [17,18]. In a previous study on acute care patients in Baghdad, which was conducted with an unclear methodology, the prescription rate was 88.5% [12].

In a Jordanian specialty hospital, the rate at which patients received at least one antimicrobial was 78.2%, whereas the

**Table 4. Top 15 diagnoses for antibiotic prescription**

Diagnosis	Number (%)
Proph OBGY	106 (12.4)
Other	101 (11.8)
MP-GEN	96 (11.3)
UNK	68 (8.0)
Proph GI	66 (7.7)
PUO-HO	62 (7.3)
SST	55 (6.4)
NEO-MP	46 (5.4)
Pneu	37 (4.3)
GI	34 (4.0)
Sepsis	33 (3.9)
BJ	19 (2.2)
Proph BJ	18 (2.1)
IA	17 (2.0)
CNS	16 (1.9)

CNS: Infection of the central nervous system, Pneu: Pneumonia or lower respiratory tract infection, GI: Gastrointestinal infections, IA: Intra-abdominal sepsis, SST: Skin and soft tissue, BJ: Bone/joint infections, OBGY: Obstetric/gynecological infections, PUO-HO: Fever syndrome in non-neutropenic hematology-oncology patient, Other: Non-specified site of infection, MP-GEN: Medical prophylaxis, UNK: Unknown use of antibiotics, Proph: Surgical prophylaxis, NEO-MP: Neonate medical prophylaxis

average rate of 26 hospitals in Saudi Arabia was 46.9%. The rate in the present study was very similar to that of a study conducted in 16 Iranian pediatric hospitals (66.6%) [19-21]. Iraqi records are similar to the national records of Brazil and Botswana, 62.0% and 70.6%, respectively [22,23].

The first quality indicator is excessive use of antibiotics, which has a serious impact on the emergence of multidrug bacterial resistance. It is considered one of the significant reasons for the increase in antibacterial resistance in many countries [24]. This increased total rate of antibacterial prescription is due to the high rates of prophylactic use for medical and surgical activities (25% each), which may be related to two main causes: first, a perception on the part of healthcare providers of poor hygiene in public hospitals and second, the absence of or neglect in following therapeutic guidelines or treatment strategies.

The second quality indicator is the high rate of prophylactic use of antimicrobials. Approximately 51% of prescribed antibiotics were used for prophylaxis, especially among obstetrics and gynecology wards. This rate is lower than that of Pakistan (57.4%) and Egypt (61.4%) and higher than that in China (28%) and Europe (29.1%) [15,18,25,26]. The proportion of antimicrobial usage for community-acquired infections was only 39.1% of the total usage, which is similar to that found in a 2016 study conducted in Ghana (40.1%) [27]. In contrast to reports from high-income countries, PPS of pediatric hospitals in the UK, USA, and Northern Ireland reported antimicrobial usage rates of 59.1%,

77.5%, and 71.1%, respectively, reflecting the inappropriate prescription practices of antimicrobials in Iraqi hospitals<sup>[19,28,29]</sup>.

This study showed extremely high usage of empirical antibiotic treatment (98.8%), which was in stark contrast to the reports of Global-PPS in 2015 (80.2%). This result is consistent with those from Pakistan (96.2%) and Iran (95.2%)<sup>[18,21]</sup>. This factor may be considered as the third quality indicator<sup>[16]</sup>. This indicates the insufficient role of medical laboratories in conducting culture sensitivity tests to achieve targeted treatments. Bacterial sensitivity tests were only performed in 10 inpatients. This excessive use of empirical antibiotics may be due to the attitude of Iraqi physicians, who rely on clinical evaluation to make a decision regarding antibiotic prescriptions, which leads to the lack of orders for culture sensitivity tests.

The fourth quality indicator was the lack of national or institutional guidelines for antibiotic prescription in the investigated Iraqi health institutes, despite the requirement that the Directorate of Technical Affairs/Iraqi Ministry of Health provide therapeutic strategies for the treatment of many diseases. This poor coordination between the authorities and the clinical practice team might be related to previous accumulations, including a fragmented health policy and the continuing insecure situation in Iraq, especially the war against ISIS<sup>[30]</sup>. This lack of a guideline is not only prevalent in Iraq but also in Pakistan and Iran<sup>[18,31]</sup>.

Not only are the poor quality indicators for antibiotic prescription related to the lack of therapeutic guidelines, but they are also associated with the documentation of stop/review notes, which is considered as the fifth quality indicator. The current study reported documentation with stop/review notes for only four patients<sup>[16,32]</sup>.

The present study found that third-generation cephalosporins, particularly ceftriaxone, were the most commonly used antimicrobials for overall and prophylactic indications. Although this type of antibiotic is used against a wide range of bacterial infections, the excessive use of broad-spectrum antibiotics, instead of treatment targeted to the specific location and severity of infection, may be leading to an increased emergence of bacterial resistance<sup>[33]</sup>. This factor is considered as the sixth quality indicator.

As the seventh indicator, the results showed that 80.1% of the antimicrobials employed were administered parenterally, in close agreement with many previous studies in Asia, Europe, and Latin America (80%). Exchanging the route of medication administration from parenteral to oral is a crucial step in the attempt to exercise antimicrobial stewardship<sup>[16,25,34]</sup>.

The study has some limitations that must be mentioned. Although the research was conducted at five main teaching hospitals in Baghdad city, it could not include other provinces;

therefore, we cannot generalize the results to all of Iraq. Although government hospitals are dominant in the Iraqi health system, this study concentrated on antimicrobial prescription practices in the governmental sector without including any data from the private sector.

## Conclusion

This cross-sectional survey of five teaching hospitals in Baghdad found that several quality indicators need improvement, including the relatively high prevalence of antibiotic use among inpatients. The use of antibiotics, particularly parenteral ceftriaxone, for empirical treatment and medical and surgical prophylaxis is high. This finding is a clear expression of the inappropriate use of antimicrobial agents. A strong action plan toward implementing an active antimicrobial stewardship program should be established by the health authority in Iraq. It should concentrate on working to reduce the improper use of antibiotics by disseminating knowledge and influencing the attitudes of healthcare providers toward antibiotic prescription and hospital hygiene, and medical laboratories should conduct antibacterial susceptibility and sensitivity tests.

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## Ethics

**Ethics Committee Approval:** Approval was obtained from the National Center for Training and Human Development, Iraqi Ministry of Health (ref. number 608 on 3/4/2019).

**Informed Consent:** The ministry of health did not require each patient consent.

**Peer-review:** Externally and internally peer-reviewed.

## Authorship Contributions

Clinical Pharmacy Practice: M.Y., J.M.K., Z.A., Concept: A.H., A.V., I.P., H.G., J.M.K., Design: A.V., I.P., H.G., Data Collection or Processing: M.Y., Z.A., J.M.K., Analysis or Interpretation: A.V., I.P., H.G., J.M.K., Literature Search: J.M.K., A.H., Writing: M.Y., J.M.K., A.H., Z.A.

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