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## **Point Prevalence Survey About Antibiotic Use in Basra hospitals**

A graduation project is submitted to Pharmacy College –AL-  
Basra University as partial fulfillment of the requirements for  
the degree of Bachelor's

**Submitted by:**

مصطفى احمد ماجد

سارة عباس عبد الزهرة

زينب ضياء سلمان

**Supervisor:**

م.م. سارة طلال عمران

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بسم الله الرحمن الرحيم

{ يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ }

صدق الله العلي العظيم

(المجادلة:11)

## **Dedication**

To all those who have supported us on this research journey, we dedicate this work to you.

To our families, thank you for your unwavering love and encouragement, for always being there to listen and offer guidance, and for believing in us every step of the way.

To our friends, thank you for your camaraderie and for being a source of inspiration and motivation. Your support and encouragement have been invaluable throughout this process.

To our mentors, and colleagues, thank you for sharing your knowledge, insights, and expertise with us. Your guidance and feedback have been instrumental in shaping our understanding of the subject matter and in refining our research approach.

To all those who have contributed to this work, either directly or indirectly, we are grateful for your contributions and for the role you have played in making this research possible. May this work be a small tribute to the collective effort and collaboration that has gone into it.

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we would also like to acknowledge the support and encouragement of our families and friends, who have provided us with the emotional support and motivation necessary to undertake this research. Your belief in us has been a constant source of inspiration throughout this journey.

Thank you all for your Support

## Abstract

**Introduction:** Antimicrobial stewardship encourages appropriate antibiotic use, the specific activities of which will vary by institutional context. Inappropriate antibiotic prescribing appears to be common worldwide and is contributing to the selection of resistant organisms. Data related to the epidemiology of these infections in Iraq is scarce. The aim of this study is to estimate the prevalence of infections and antimicrobial use in the acute hospital setting in Basra province hospitals.

**Method:** A lot of different hospitals in Basra were visited, checking Patients' illness profile. Information about antibiotics prescription pattern in Basra hospitals had been collected.

**Results:** concluded that 77.7% of inpatients took antibiotics in general, 30.9% of them took Ceftriaxone as their first antibiotics and 23% used Ciprofloxacin as their second antibiotic, while 41.7% of the patients took metronidazole as their third antibiotic.

**Conclusion:** the rate of antibiotic prescription was high and restrictions should be done to reduce antibiotic resistance.

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## Introduction

Antimicrobials (AMs) are the pharmacological health-care standard against infectious diseases. Any usage of antimicrobials, mainly antibacterials (antibiotics) contributes to the selection of antimicrobial resistance (AMR), but their misuse and overuse worsens it.<sup>(1)</sup> Antimicrobial-resistant infections cause serious illnesses and prolonged hospital stays, increasing health-care costs, treatment failures, and morbid-mortality rates.<sup>(2)</sup> A systematic review reported a significantly higher prevalence of antibiotic use in non-European hospital compared with European hospitals.<sup>(3)</sup> Inadequate antibiotic therapies are common in hospitals regarding the agent's selection for microorganism type, routes of administration or treatments duration.<sup>(4)</sup> Thus, the majority of hospitalized patients are exposed either to potentially serious adverse effects or the acquisition of resistant or difficult-to-treat pathogens (ie, *Clostridium difficile*), without any therapeutic benefit.<sup>(5)</sup> Selection of antibiotic-resistant bacteria in hospitals may be aggravated by the frequent extended-spectrum antibiotics usage (eg, cephalosporins and carbapenems), and concentrated in common causal agents of hospital-associated infections (HAIs), such as those of the ESKAPE group (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, and *Enterobacter* spp), driven to a vicious cycle of greater use of extended-spectrum antibiotics.<sup>(6)</sup>

The World Health Organization (WHO) global action plan on AMR seeks to strengthen surveillance and optimize antimicrobial prescribing.<sup>(7)</sup> These actions are promoted in hospitals with antimicrobial stewardship programs (ASPs) through interventions to improve clinical outcomes, ensure the antimicrobial therapy's cost-effectiveness, and reduce unintended use consequences.<sup>(8)</sup> However, the needed effort, coordination, and resources for active monitoring of antimicrobial prescribing behavior in hospitals are high.

Continuous data collection on antibiotic prescribing is not easy due to the high work- load and level of resources needed.<sup>(9)</sup> A viable alternative is to collect data at a specific point in time, which can be done by using the point prevalence survey (PPS) methodology. This type of survey permits (i) the measurement of antimicrobial use along time, assessing changes in prescribing trends (ii) the identification of targets for quality improvement in different hospital wards; and (iii) the evaluation of the effectiveness of interventions implemented in response to indicators identified during previous surveys.<sup>(10)</sup>

PPS evidence supports improvement of antibiotic stewardship; the surveillance of hospital-acquired infections (HAIs) informs the need to improve infection prevention and control, which are the foundations to tackle AMR in healthcare facilities.

Point prevalence surveys (PPSs) are a useful method to study the antimicrobial prescription patterns in order to identify objectives for optimization on antibiotic use.<sup>(11)</sup> Therefore, the Global-PPS initiative and WHO (WPPS) have proposed standardized methodologies to conduct PPSs in hospitals.<sup>(12)</sup> The aim of this study is to describe the antimicrobial use in four care hospitals in Albasrah by means of PPSs.

## Methodology

As a starting point, The participated hospitals in this point prevalence study in Basra Governorate( specifically Albasrah general teaching hospital , Al-Faihaa General Hospital, Al-Sadr Teaching Hospital, Albasrah Hospital for gynecology and pediatrics, Almawane General Hospital ). The Hospital provides

Health care services in variety of specialties. Departments of internal medicine, pediatrics medicine, surgery, gynecology, critical care unit (CCU), as well as ear, nose, and throat (ENT) were visited to collect information about antibiotics prescription pattern from inpatient medical reports. All inpatients were included whether they took antibiotics or not in order to calculate the rate of prescribed antibiotics on condition that these patients were in the wards before 8 am. Names of the hospitals, and the visited wards had been written down in order to highlight the most of them that prescribe antibiotics.

Patients' demographic data like (name, age and gender) were written down. Information about whether patient had undergone catheterization or intubation were recorded too. The main question for patients was whether or not they took antibiotics.

If the antibiotic was prescribed information about name and number of prescribed antibiotics, route of administration, dose, reason for use, indications for community-acquired infections (CAIs), or hospital acquired infections (HAIs), medical prophylaxis (MP) and type of treatment received (empirical, definitive treatment and prophylactic). If the therapy was definitive treatment, the causative organism was recorded, if available. Data were recorded in a paper-based worksheet prior to entering them into an online spreadsheet.

Antibiotics in this survey include any antibiotics administered via IV, oral or intramuscular routes. On the other hand, topical antibiotic agents, antifungals and antivirals were excluded.

Approximately 480 patient files were collected within 3 weeks. It was investigated whether the antibiotic was the primary treatment or was taken as a preventive measure. It was also determined whether antibiotics were prescribed to the patient at admission or a few days after admission, indicating that the infection for which the antibiotic was prescribed was either hospital acquired or given as a precaution to prevent hospital acquired infection.

## Results

As showed in the table 1, the most Hospital to have patients under goes antibiotic medication is Specifically AlBasrah General Teaching Hospital, Al-Sadr Teaching Hospital, Alfaihaa General Hospital, Ibn Ghazwan Hospital.

**Table (1):  
Percentage of Antibiotics' usage among 4 main basrah hospitals**

| Name of Hospital                   | Number of all patient | umber of patien take A | of patient that take AB from same gro | of patient that take AB from all patie |
|------------------------------------|-----------------------|------------------------|---------------------------------------|----------------------------------------|
| Basra General Hospital Al-Faiha ,  | 81                    | 56                     | 69.1%                                 | 15.1%                                  |
| Al-Sadr Teaching Hospital          | 121                   | 96                     | 79.3%                                 | 25.9%                                  |
| Ibn Ghazwan                        | 65                    | 61                     | 93.8%                                 | 16.4%                                  |
| Albasrah general teaching hospital | 209                   | 157                    | 75.1%                                 | 42.2%                                  |
| Total                              | 476                   | 370                    | 77.7%                                 | 77.7%                                  |

According to table (1) the most hospital that used antibiotics for their inpatients was Specifically Ibn Ghazwan Hospital 93.8% followed by Al-Sadr Teaching Hospital by 79.3%. while AlBasrah General Teaching Hospital recorded 75.1%. While Al-Faiha General Hospital recorded the lowest percentage of prescribing antibiotics to their inpatients 69.6%.

Regarding the hospitals wards, pediatric ward in All hospitals recorded the highest value in antibiotics' prescription 95.1%, followed by the ENT ward 93.4%, as shown in table (2).

**Table (2):  
Antibiotics 'usage among different hospitals 'wards**

| Ward            | Number of all patient | umber of patien take A | of patient that take AB from same gro | of patient that take AB from all patien |
|-----------------|-----------------------|------------------------|---------------------------------------|-----------------------------------------|
| Surgical        | 124                   | 94                     | 75.8%                                 | 25.4%                                   |
| Medical         | 115                   | 65                     | 56.5%                                 | 17.5%                                   |
| Pediatric       | 82                    | 78                     | 95.1%                                 | 21.3%                                   |
| CCU             | 11                    | 8                      | 72.7%                                 | 2.1%                                    |
| ENT             | 46                    | 43                     | 93.4%                                 | 11.6%                                   |
| Gyaenocological | 98                    | 82                     | 83.6%                                 | 22.1%                                   |
| Total           | 476                   | 370                    | 77.7%                                 | 77.7%                                   |

Table (2) displayed that medical wards had the lowest value in antibiotics' prescription 56.5%.

**Table (3)**

**Antibiotics' prescrtbion among inpatient different gender**

| Gender | Number of all patient | umber of patien take A | of patient that take AB from same gro | of patient that take AB from all patien |
|--------|-----------------------|------------------------|---------------------------------------|-----------------------------------------|
| Male   | 166                   | 154                    | 92.7%                                 | 41.6%                                   |
| Female | 310                   | 216                    | 69.6%                                 | 58.3%                                   |
| Total  | 476                   | 370                    | 77.7%                                 | 77.7%                                   |

Table 3 showed that 92.7% of inpatient males were took antibiotics while only 69.6% of inpatient females were took antibiotics.

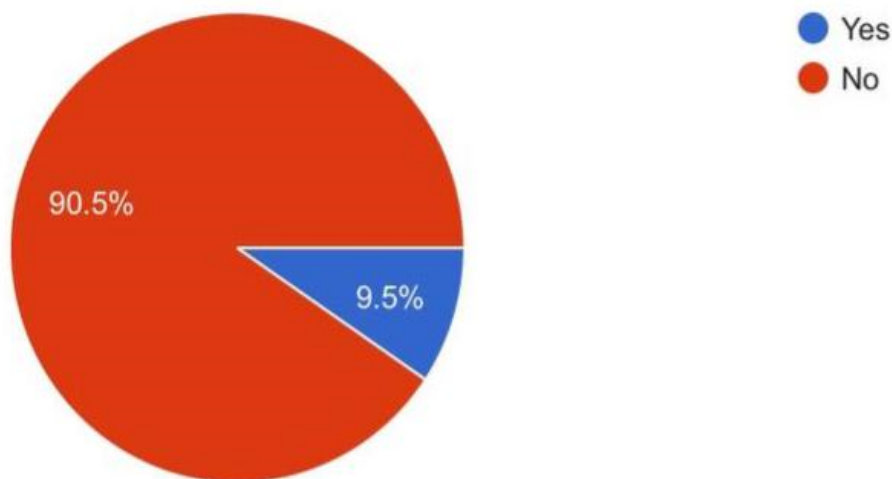
**Table (4)**

**Antibiotics' prescription among inpatient different age group**

| Age              | Number of all patient | umber of patien take A | of patient that take AB from same gro | of patient that take AB from all patien |
|------------------|-----------------------|------------------------|---------------------------------------|-----------------------------------------|
| 18-65 y          | 295                   | 217                    | 73.5%                                 | 59.6%                                   |
| 5-17 y           | 63                    | 50                     | 79.3%                                 | 13.7%                                   |
| Less than 1 year | 51                    | 40                     | 78.4%                                 | 10.9%                                   |
| More than 65     | 42                    | 34                     | 80.9%                                 | 9.3%                                    |
| 1-4 y            | 25                    | 23                     | 92%                                   | 6.3%                                    |
| Total            | 476                   | 364                    | 68%                                   | 68%                                     |

Table (4) showed that 92% of inpatients aged 1-4 years were prescribed antibiotics, while only 73.5% of inpatient aged 18-25 years were prescribed antibiotics.

**Figure (1): percent of Catheterization**



As noted in Figure (2), only 9.5% of overall inpatients who underwent catheterization compared to 90.5% who did not undergo catheterization.

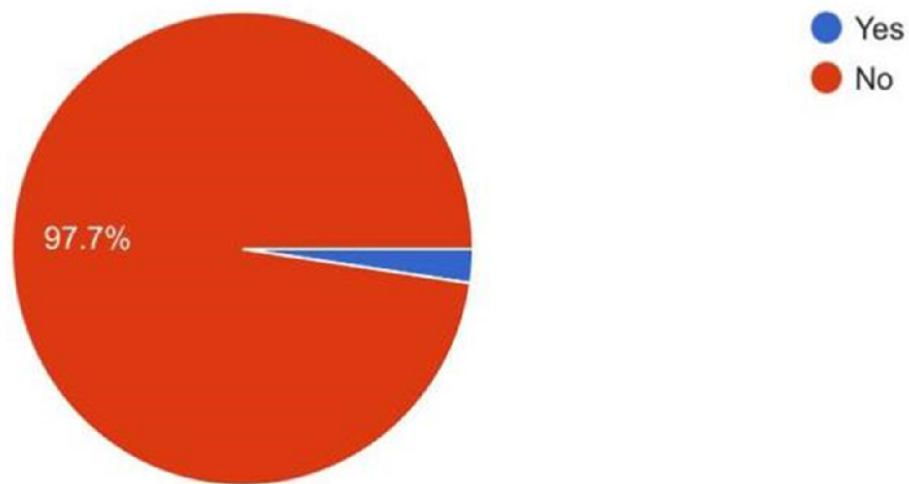
**Table (5)**

**Antibiotics' prescription among catheterized inpatient**

| Catheterization | Number of all patient | umber of patien take A | of patient that take AB from same gro | of patient that take AB from all patien |
|-----------------|-----------------------|------------------------|---------------------------------------|-----------------------------------------|
| Yes             | 45                    | 39                     | 86.6%                                 | 10.3%                                   |
| No              | 431                   | 338                    | 78.4%                                 | 89.6%                                   |
| Total           | 476                   | 377                    | 79.2%                                 | 79.2%                                   |

Table (5) showed that 86.6% of catheterized inpatient had been prescribed antibiotics.

**Figure (2): percent of Intubation among inpatients**



It was noted that inpatients who underwent intubation are only 2.3%, while those who did not undergo intubation are 97.7%.

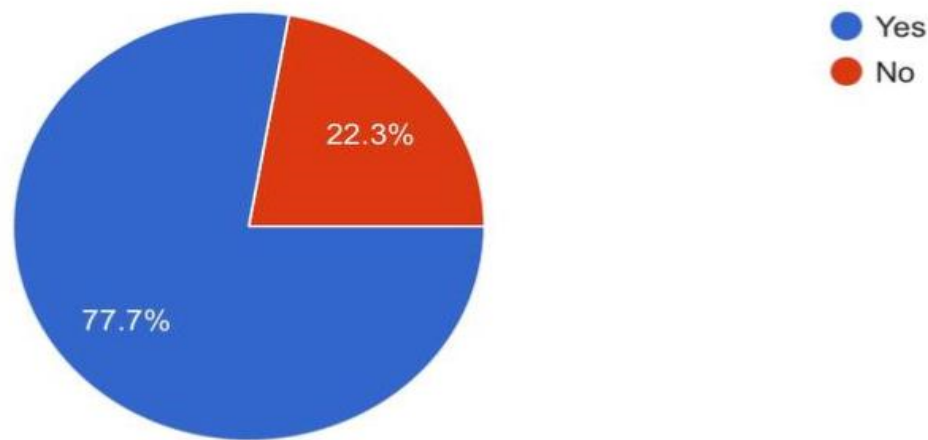
**Table (6)**

**Antibiotics' prescription among intubated inpatient**

| Intubation | Number of all patient | umber of patien take A | of patient that take AB from same gro | of patient that take AB from all patien |
|------------|-----------------------|------------------------|---------------------------------------|-----------------------------------------|
| Yes        | 11                    | 10                     | 90.9%                                 | 2.6%                                    |
| No         | 465                   | 366                    | 78.7%                                 | 97.3%                                   |
| Total      | 476                   | 376                    | 78.9%                                 | 78.9%                                   |

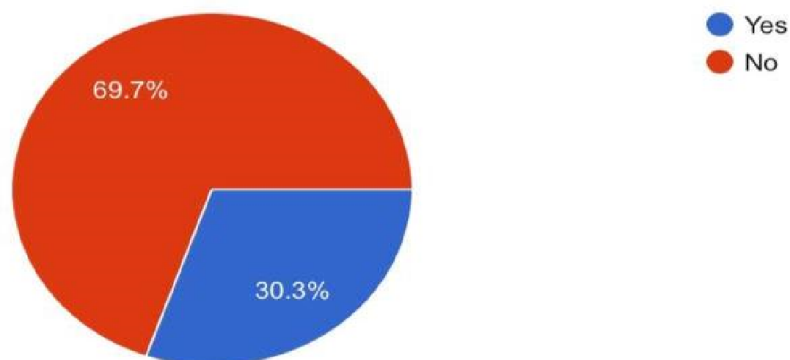
Table (6) showed that 90.9% of intubated inpatient had been prescribed antibiotics.

**Figure (3): percentage of antibiotics' prescription among inpatients**



77.7% of inpatients have been prescribed antibiotics while only 22.3% of inpatients were not.

**Figure (4): Culture sensitivity test for inpatients**



As showed in figure 4 only 30.3% of inpatients that prescribed antibiotics has undergoes to this test while 69.7% did not.

**Table (7): Diagnosis for which antibiotics was prescribed**

| Diagnosis                  | Number of patien | %     |
|----------------------------|------------------|-------|
| Community aq infection     | 170              | 45.4% |
| Hospital aquired infection | 9                | 2.4%  |
| Medical prophylaxis        | 15               | 4%    |
| Surgical prophylaxis       | 176              | 47.5% |

As showed in table (7) the most cause for antibiotics prescription was Community acquired infection 47.6% or hospital acquired infection 2.4%. On the other hand antibiotics were prescribed to inpatients for prophylaxis purposes too. The percentage of antibiotics prescription for medical prophylaxis cases was 4% and 47.5% for surgical prophylaxis.

**Table (8)**

**Causes of antibiotic prescription for inpatients**

| Dx                             | Number of patien | %     |
|--------------------------------|------------------|-------|
| Pneumonia                      | 17               | 9.5%  |
| Bronchitis                     | 52               | 29.2% |
| Tonsilits                      | 15               | 8.4%  |
| Otitis                         | 2                | 1.1%  |
| Enteritis                      | 30               | 16.8% |
| TB                             | 5                | 2.8%  |
| Sepsis                         | 10               | 5.6%  |
| Leg fracture                   | 10               | 5.6%  |
| Diabetic foot                  | 8                | 4.4%  |
| COPD                           | 5                | 2.8%  |
| Colinitis                      | 2                | 1.1%  |
| Axillary nerve swelling        | 1                | 0.5%  |
| UTI                            | 5                | 2.8%  |
| nephrotitis                    | 10               | 5.6%  |
| Chronic kidney failur          | 4                | 2.2%  |
| Inflammation after surgery ope | 20               | 11.2% |
| Blood transfusion              | 3                | 1.6%  |
| Hepatitis                      | 2                | 1.1%  |
| Remove strange body from ear   | 2                | 1.1%  |
| Bed sore                       | 2                | 1.1%  |
| Nasal siunoscopy               | 2                | 1.1%  |
| Splenomegaly                   | 1                | 0.5%  |
| Encephalopathy                 | 1                | 0.5%  |

Table (8) displays that the master cause of antibiotic prescription for inpatients was bronchitis 29.2%. While the less causes for antibiotic

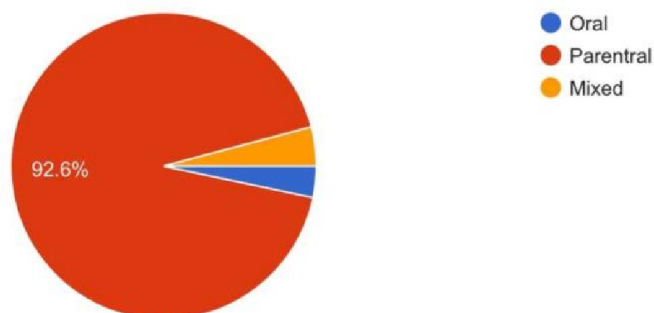
prescription were splenomegaly, encephalopathy and axillary nerve swelling by only 5%.

**Table (9)**

**Number of prescribed antibiotics**

| Number of antibiotic given to patient | Number of patient |
|---------------------------------------|-------------------|
| One                                   | 170(46.2%)        |
| Tow                                   | 185(50.3%)        |
| Three                                 | 11(3%)            |
| More than three                       | 2(0.5)            |

**Figure (5): Route of administration**



Most inpatients as shown in table (9) had been prescribed 2 antibiotics 50.3% and there is inpatients how take only 1 antibiotic 46.2%. The most route of administration was found to be Parenteral 92.6%.

**Table (10)**

**Name of antibiotic use**

| Name of antibiotic | Number of patient | %     |
|--------------------|-------------------|-------|
| Ceftriaxone        | 287               | 77.7% |
| Meropenem          | 19                | 5.1%  |
| Vancomycin         | 27                | 7.3%  |
| Amoxicillin        | 42                | 11.3% |
| Amickacin          | 22                | 5.9%  |
| Ciprofloxacin      | 11                | 2.9%  |
| Gentamicin         | 4                 | 1.1%  |
| Cefotaxime         | 3                 | 0.8%  |
| Cefixime           | 3                 | 0.8%  |
| Rifaximin          | 3                 | 0.8%  |
| Azithrimycin       | 10                | 2.7%  |
| Cefuroxime         | 1                 | 0.2%  |
| Metronidazole      | 140               | 37.9% |
| Ampcillin          | 2                 | 0.5%  |
| Co-Amox            | 3                 | 0.8%  |
| Ceftazidime        | 1                 | 0.2%  |

Table (10) displays that the most antibiotics that has been prescribed was ceftriaxone 77.7% followed by metronidazole 37.9% and amoxicillin 11.3%.

**Figure (6): Information about day on/off AB**

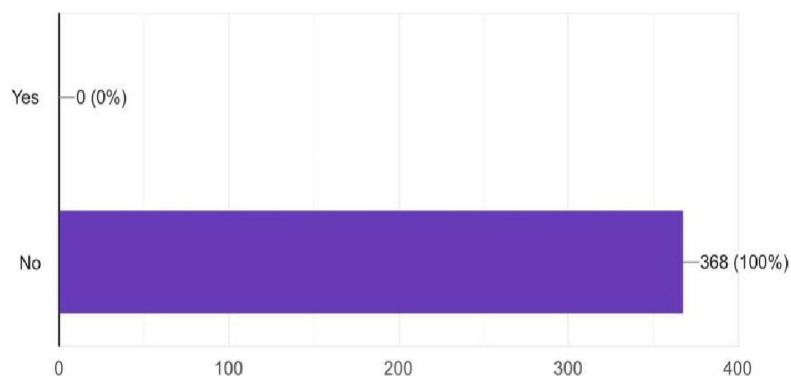


Figure (6) showed that no inpatient was told when to stop use the prescribed antibiotic.

## 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 four main teaching hospitals in Basra.

The results showed that 77.7% 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)<sup>13</sup> but lower than the documented rate in Nigeria (78.2%)<sup>14</sup> The prevalence of antibiotic prescribed varied across different countries due to factors such as CAI and HAI rates, resistance patterns, lack of standard treatment guidelines and adherence by clinicians, and lack of effective feed-back to the clinicians pertaining to antibiotic use.<sup>15</sup>

Pediatric wards had the highest percentage of antibiotic prescription compared to other wards (95.1%), in contract the medical wards recorded the lowest percent of antibiotic prescription (56.5%) this may be due to high incidence of infection among pediatric age group while patients enter medical wards to be treated from diseases other than infections like hypertension, diabetes mellitus, renal problems, etc. this pattern of results agree with the results of antibiotic prescription in Nigeria hospitals.<sup>16</sup> Surgical ward have high percentage (75.8%) of antibiotic prescription from four hospitals that because antimicrobial agents are administered in three types of situation: as prophylaxis, as an adjunct to operative treatment, and as therapy. Prophylactic antibiotics are given preoperatively before performing surgery to help decrease the risk of postoperative infections (reduce the incidence of surgical site infection). Gyaenocological wards antibiotic prescription was also high (83.6%) due to; infections, such as bacterial vaginosis, pelvic inflammatory disease, and sexually transmitted infections, that may require treatment with antibiotics. As well as during labor and delivery to prevent infections in the mother or the baby. ENT ward antibiotic prescription was also high (93.4%), this may be attributed to the fact that most ENT ward inpatient have been admitted to undergo surgical intervention like tonsillitis or other. In the case of the ICU, patients are usually under close observation and treatment plans are tailored to their specific conditions, which may not always involve the use of antibiotics.

In table(4) showed that infants less than 1 year have the rate of 78.4% to be given an antibiotics compared to 73.5% in age group (18-65), and that may be because of their immature immune system<sup>17</sup> which is not yet fully developed, and they may have a higher risk of developing adverse reactions to antibiotics. Additionally, many of the common childhood illnesses that are treated with antibiotics, such as ear infections, are less common in infants. Finally, healthcare providers may be more cautious about prescribing antibiotics to infants, as they are more vulnerable to the effects of medication and may require more careful monitoring.

There could be several reasons why the age group between 1-4 years has a higher chance of being prescribed antibiotics compared to infants. One possible reason is that children in this age group are more likely to be exposed to bacterial infections in settings such as kindergarten or daycare centers, where they may come into contact with a large number of other children. This increases the likelihood of contracting infections and subsequently being prescribed antibiotics. Additionally, as children in this age group are more active and engage in physical activities, they may be more susceptible to injuries that can become infected and require antibiotics for treatment.

While the age group use antibiotics in value of 80.9 % was ( $\geq 65$ ) years. One possible reason is that this age group may have a higher incidence of conditions or illnesses that require treatment with antibiotics, such as respiratory tract infections, urinary tract infections, and skin infections. Additionally, this age group may be more likely to seek medical care for their illnesses and receive prescriptions for antibiotics. Other factors that could contribute to higher antibiotic use in this age group include higher prevalence of chronic health conditions that may require treatment with antibiotics.<sup>18</sup>

Respiratory tract infections (bronchitis) were the most common indications for definitive therapy in either acute or long-term care patients. Therefore, antimicrobial stewardship initiatives targeting these indications may have the greatest potential to impact on patient care, antimicrobial use, incidence of nosocomial infections (i.e. *Clostridium difficile*), and resistance. This result is similar to the result of Colin Lee and his colleagues in Canadian hospitals.<sup>19</sup>

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<sup>20</sup>. The second quality indicator is the high rate of prophylactic use of antimicrobials. Approximately 51.5% of prescribed antibiotics were used for prophylaxis, especially among surgical and gynecology wards. This rate is lower than that of Pakistan<sup>21</sup> (57.4%) and Egypt<sup>22</sup> (61.4%) and higher than that in China<sup>23</sup> (28%) and

Europe<sup>24</sup> (29.1%). This indicates the insufficient role of medical laboratories in conducting culture sensitivity tests to achieve targeted treatments. Bacterial sensitivity tests were only performed in 30.3% 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 lack of routine culture sensitivity testing in some cases may be due to various factors, including lack of resources, cost- effectiveness, and clinical judgment<sup>25</sup>

In contrast, hospital-acquired infections may be less common due to improved infection control measures in hospitals, leading to lower use of antibiotics for this indication .<sup>26</sup>

The results showed that 92.6% 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>27</sup>. Because it can provide faster and more effective delivery of the drug directly into the bloodstream. This is particularly important for critically ill patients or those with infections that require immediate treatment. Moreover, some antibiotics have poor oral bioavailability and may not be as effective when taken orally <sup>28</sup>. However, the use of parenteral antibiotics should be balanced with the risk of complications such as catheter-related infections or antibiotic- associated diarrhea<sup>29</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>30</sup>.

Regarding Flagyl, it is a commonly prescribed antibiotic for the treatment of various infections caused by anaerobic bacteria, such as gastrointestinal and gynecologic infections, as well as some protozoal infections, such as giardiasis and amebiasis. It works by disrupting the DNA synthesis of bacteria and protozoa, leading to their death. It is also available in both oral and parenteral formulations, making it a versatile choice for treating different patient populations and disease severities.<sup>31</sup> The study has some limitations that must be mentioned. Although the research was conducted at four main teaching hospitals in Basrah 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 four teaching hospitals in Basra 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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