Original Article

# Evaluating the Status Quo of Antibiotic Stewardship in Public Hospitals of Hamadan, Iran

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## Abstract

**Background:** Improper use and prescription of antibiotics can lead to numerous adverse consequences and increased costs. Antibiotic stewardship is a crucial global approach for dealing with the risks associated with inappropriate antibiotic therapy. The present study aimed to evaluate the level of public hospitals' adherence to the correct and appropriate implementation of antibiotic stewardship program (ASP) at an international standard level, in Hamadan, Iran.

**Methods:** The required data were collected using the Antibiotic Stewardship Program Assessment Questionnaire prepared by the American Centers for Disease Control and Prevention (CDC), containing 33 questions across 7 dimensions to assess hospitals' antibiotic stewardship activities. Respondents included people responsible for monitoring or directing the implementation of antibiotic stewardship in the respective hospitals. Data analysis included descriptive statistics for respondents' demographics, hospital characteristics, and adherence to each questionnaire item and dimension.

**Results:** The studied hospitals had between 110 and 570 beds. Of the respondents, 86.7% were women, and except for one person, the educational background of the rest of the respondents was in pharmacy or nursing. Regarding antibiotic stewardship, the lowest levels of implementation were found in the dimensions of "Education" (60%) and "Implementing interventions to improve antibiotic use" (75%). The levels of performance for "Senior Managers' Commitment to Antibiotic Stewardship", "Reporting the Antibiotic Consumption and Its Outputs", and "Tracking Antibiotic Consumption and Its Outputs" were 86.7%, 80%, and 77%, respectively. The highest score was 90%, which was obtained for the dimensions of "Accountability" and "Pharmacy Expertise".

**Conclusion:** Results indicated a need to strengthen antibiotic stewardship, especially in the areas of education, the implementation of interventions to improve the use of antibiotics, and the monitoring and reporting of antibiotic use and its outcomes.

**Keywords:** Antibiotic stewardship, Hospital, Survey, Iran

## Introduction

Antimicrobial resistance is a global concern affected by various factors such as limited public awareness, lack of personal and environmental hygiene, especially in hospitals, lack of scientific and financial investment to fight this phenomenon, and lack of adherence to the relevant principles and guidelines. Health professionals responsible for antibiotic therapy are at the forefront of the fight against antibiotic resistance )1). In 2019, a study conducted in the United States showed that about 50% of infected patients are at risk of receiving incorrect antibiotic therapy, despite extensive measures by the Centers for Disease Control and Prevention (CDC) to deal with bacterial resistance in the USA. These actions, which have become a global model for antibiotic stewardship, include endeavors in prevention, identification, treatment, and research (2). The challenge of antimicrobial resistance is not limited to the USA. Generally speaking, human society has yet to resolve this issue, and many countries are seeking better strategies to mitigate it. In Japan, the "JANIS" organization was established to provide antibiotic therapy in hospitals, by collecting required information at the hospital level and guiding national and local efforts to control antibiotic resistance (3). England has prepared a twenty-year vision document to address this issue, with the UK Royal College being commissioned to follow up on its implementation and the related detailed measures (4).

Hospitals play a critical role in the fight against microbial resistance. In 2013, research conducted at an emergency hospital in Tehran, the capital city of Iran found inappropriate experimental prescription of antibiotics in terms of indication, type of drug, dosage, and method of administration. The study recommended measures in terms of implementing relevant training, continuing

education programs, and forming a specialized committee to monitor the rational antibiotic antibiotics (5). A study conducted in 2018 by the Chinese Ministry of Health reported that nearly 50% of 116 tertiary hospitals in China lack correct instructions for antibiotic therapy (6). In 2019, a study in India found that the lack of an appropriate mechanism for the correct implementation of the related international standards has led to increasing antibiotic resistance in the country (7).

Given the importance of understanding the current efforts to prevent antimicrobial resistance and the lack of relevant data on Hamadan city's hospitals, this research aimed to examine the current status of antibiotic stewardship in public hospitals.

## Materials and Methods

This study employed a cross-sectional descriptive study with a quantitative approach. Data were collected from March to September of 2022 in public hospitals located in Hamadan. The target population consisted of all individuals responsible for antibiotic stewardship in the five hospitals under study. Due to the small size of the target population, a census sampling method was used.

Data were gathered using a questionnaire, containing 41 items related to antibiotic stewardship, along with some questions about the characteristics of the respondents and the studied hospitals. The questionnaire was based on the 2019 version of a tool developed by the CDC of America (8). Questionnaires were distributed and collected in person by one member of the research team.

Data analysis, consisting of descriptive statistics to examine the distribution and percentage of responses and hospitals in terms of the implementation of various items and dimensions, was conducted using SPSS 16 software.

## Results

This research aimed to evaluate the current state of antibiotic stewardship in public hospitals in Hamadan. The obtained data included several aspects, including information about the respondents and the involved hospitals, as well as findings related to antibiotic stewardship items and dimensions. Tables 1 and 2 provide detailed descriptions of the hospitals and respondents' characteristics, respectively.

As shown in Table 1, most respondents were female (86.7%), with most holding degrees in nursing or pharmacy. Their education level was mostly either bachelor's degrees and doctoral degrees or higher. The

**Table 1.** The Characteristics of the Studied Hospitals

| Hospital | Age (year) | Number of Beds |
|---|---|---|
| A | 99 | 200 |
| B | 8 | 220 |
| C | 24 | 200 |
| D | 15 | 570 |
| E | 48 | 110 |

two most prevalent job positions were supervisors of the infection departments and pharmacists.

Table 3 summarizes the findings related to the implementation of antibiotic stewardship in the studied hospitals. The 41 items in this section were divided into 7 categories. For each item, "Yes" means that the item was implemented in the studied hospital, while "No" indicates that the item was non implemented in that hospital.

Regarding the 7 questions asked about the "Hospital leadership commitment", out of the total 105 responses provided by 15 participants, 14 responses (13.3%) indicated non-compliance with some of the mentioned items.

In terms of the "Accountability" dimension, the relevant tool included 2 items, resulting in 30 responses. Of these, 3 responses (10%) indicated the non-implementation of the related items. The same result was obtained for the "Pharmacy Expertise" dimension with 2 items.

With respect to the "Implementation of Interventions to Improve Antibiotic Use" category with 13 items, 48 out of 195 possible responses (25%) demonstrated the non-implementation of the suggested interventions. "Outpatient Parenteral Antibiotic Therapy" (OPAT) showed a remarkably low rate of implementation, with only 4 out of 15 hospitals having implemented it.

In the case of "Tracking Antibiotic Use and Outcomes", 45 responses (23%) indicated non-compliance. Regarding the "Reporting Antibiotic Use and Outcomes" dimension, the proportion of responses displaying non-adherence to the items was lower (20% of the 45 responses) than responses showing adherence to the items.

Finally, in t the "Education" dimension, 12 out of 30 possible responses (40%) indicated that the two proposed items were not implemented, which was higher than the number observed in the other 6 areas.

## Discussion

Antibiotic stewardship is one of the crucial global

**Table 2.** Participants' Demographics

| Variable | Category | Frequency | Percent |
|---|---|---|---|
| Gender | Female | 13 | 86.7 |
| | Male | 2 | 13.3 |
| Age group (y) | 20-30 | 3 | 20 |
| | 30-40 | 4 | 26.6 |
| | 40-50 | 6 | 40 |
| | <50 | 2 | 13.3 |
| Job position | Infection department supervisor | 7 | 46.7 |
| | Pharmacist | 7 | 46.7 |
| | Head of laboratory | 1 | 6.7 |
| Education | Bachelor | 6 | 40 |
| | Master | 2 | 13.3 |
| | Ph. D and above | 7 | 46.7 |
| Major | Nursing | 7 | 46.7 |
| | Pharmacist | 7 | 46.7 |
| | Laboratory sciences | 1 | 6.7 |

**Table 3.** The Level of Adherence to Each Item of the Antibiotics Stewardship

| Issue | | Yes | No | Total |
|---|---|---|---|---|
| **Hospital Leadership Commitment** | | | | |
| 1. | Stewardship program leader(s) have dedicated time to manage stewardship program and interventions. | 15 | 0 | 15 |
| 2. | Stewardship program leaders have needed resources. | 13 | 2 | 15 |
| 3. | A senior executive serves as a point of contact to help ensure the provision of the needed resources and support | 13 | 2 | 15 |
| 4. | Stewardship program leader(s) hold regular meetings with facility leadership and/or the hospital board. | 15 | 0 | 15 |
| 5. | Facility leadership ensures that relevant staff have sufficient time to contribute. | 10 | 5 | 15 |
| 6. | Antibiotic stewardship is integrated into other patient safety and quality improvement activities. | 11 | 4 | 15 |
| 7. | Managers support enrollment and reporting into national programs and systems. | 14 | 1 | 15 |
| **Accountability** | | | | |
| 8. | Specific leader/co-leaders are responsible for program and outcomes management. | 14 | 1 | 15 |
| a. | A physician is specified as the point of contact and support for the non-physician leader. | 12 | 2 | 14 |
| **Pharmacy Expertise** | | | | |
| 9. | A pharmacist(s) is responsible for leading the implementation of antibiotic use improvements. | 14 | 1 | 15 |
| 10. | The leading pharmacist(s) has specific training and/or experience. | 13 | 2 | 15 |
| **Implementation of Interventions to Improve Antibiotic Use** | | | | |
| 11. | Prospective audit and feedback for specific antibiotics are conducted. | 13 | 2 | 15 |
| 12. | Preauthorization id required for specific antibiotics. | 10 | 5 | 15 |
| 13. | Specific recommendations for antibiotic selection are based on national guidelines and local pathogen susceptibilities. | 13 | 2 | 15 |
| 14. | Specific interventions ensure optimal use of antibiotics in: | | | |
| a. | "Community-acquired pneumonia' | 11 | 4 | 15 |
| b. | "Urinary tract infections" | 11 | 4 | 15 |
| c. | "Skin and soft tissue infections" | 11 | 4 | 15 |
| 15. | Specific interventions ensure optimal use or stopping unnecessary use of antibiotics in: | | | |
| a. | "Sepsis" | 12 | 2 | 14 |
| b. | "Staphylococcus aureus infection" | 13 | 2 | 15 |
| c. | "New cases of *Clostridioides difficile* infection" | 10 | 3 | 13 |
| d. | "Culture-proven invasive infections" | 13 | 2 | 15 |
| e. | "Outpatient parenteral antibiotic therapy" | 4 | 11 | 15 |
| 16. | Prescribers are required to document the indication, dose, and duration of antibiotics. | 11 | 4 | 15 |
| 17. | Prescribers are required to conduct timeout. | 12 | 3 | 15 |
| **Tracking Antibiotic Use and Outcomes** | | | | |
| 18. | Antibiotic use is documented and submitted to a national system. | 7 | 8 | 15 |
| 19. | Antibiotic prescriptions are monitored. | 13 | 2 | 15 |
| 20. | Insured antibiotics are monitored. | 13 | 1 | 14 |
| 21. | Clinical guidelines for antibiotics exist. | 15 | 0 | 15 |
| 22. | Adherence to the hospital guidelines on antibiotics is monitored. | 10 | 5 | 15 |
| 23. | Adherence to documentation of antibiotic prescriptions (dose, duration, and indication) is monitored. | 13 | 2 | 15 |
| 24. | Monitoring of antibiotic timeouts includes: Frequency of timeouts | 11 | 4 | 15 |
| a. | Use of opportunities to improve antibiotic consumption during timeouts | 11 | 4 | 15 |
| 25. | Routine evaluations of medications are conducted to select antibiotics and/or infections and identify opportunities to improve consumption | 11 | 4 | 15 |
| 26. | Frequency of discharging patients on the correct antibiotics and for the recommended duration is evaluated. | 10 | 5 | 15 |
| 27. | Antibiotic resistance is tracked and reported to national systems. | 10 | 5 | 15 |
| 28. | Clinical documentation improvement is tracked in the context of antibiotics. | 10 | 5 | 15 |
| 29. | An antibiogram is conducted in this hospital | 15 | 0 | 15 |
| **Reporting Antibiotic Use and Outcomes** | | | | |
| 30. | Overall or prescriber-specific reports on antibiotic use are shared with prescribers. | 10 | 5 | 15 |
| 31. | Reports on guideline adherence are shared with prescribers. | 11 | 4 | 15 |
| 32. | The antibiogram is commonly used. | 15 | 0 | 15 |
| **Education** | | | | |
| 33. | Education is provided on antibiotics optimal prescribing, adverse reactions, and antibiotic resistance. | 10 | 5 | 15 |
| 34. | Prescribers are provided with education as part of the audit and feedback process (handshake stewardship). | 8 | 7 | 15 |

approaches to combat the risks caused by antibiotic resistance. This study aimed to evaluate the adherence of hospitals in Hamadan to international standards of antibiotic stewardship. In this section, the obtained findings are discussed and compared with the relevant previous studies.

In the present study, the lowest levels of adherence to the assessment tool were related to the "Education" and "Implementation of Interventions to Improve Antibiotic Use" categories. At the individual item level, the lowest adherence rates belonged to the review of planned OPAT (26.7%), documenting of antibiotic use track by submitting to a national system (46.7%), and "Handshake Stewardship" (53.3%).

In 2013, a study in Iran investigated the implementation of antibiotic stewardship program (ASP) standards in hospitals in northern Iran. The study was carried out at 23 hospitals with 260 people. The findings indicated that although the implementation of these standards has reached a significant and effective percentage, the full implementation of ASP remained incomplete, largely due to the lack of a specific expert group for antibiotic therapy stewardship (9).

It can be useful to compare Iran with Turkey in terms of their cultural and population similarities. Although Turkey has made many efforts since 2003, this country has the highest rates of antibiotic resistance in the European Union after Romania (10). A paper published in 2019 reported that the OECD organization in Turkey is dedicated to ASP according to European standards, highlighting the need to follow up on ASP as much as possible (10).

In 2016, a study conducted in top US hospitals collected data from 101 completed questionnaires (11). Given that the instrument applied in the present study addressed similar ASP principles, the general results of this study can be compared with those of the US. In the present study, 79% of responses confirmed adherence to antibiotic stewardship, while 83% of the 101 hospitals in the US had active ASPs at the time of the study, and 59% had active ASPs for the last five years (11).

Overall, while hospitals may demonstrate strong capabilities to deal with infections, there is insufficient attention to antibiotic stewardship at the level of global standards. It is worth noting that in Hamadan hospitals, antibiotics were prescribed without the supervision of a clinical pharmacist in most cases. One reason is the lack of human resources such as clinical pharmacists at the time of the study, leading to their limited availability in hospitals. The other probable reason, which is significantly affected by the first reason, is the physicians' insufficient awareness of services provided by the clinical pharmacists.

This research faced several limitations that must be considered when interpreting the findings. First, the small population size and number of participants prevented performing statistical analyses such as comparisons between hospitals. Second, data collection was done via a survey. Therefore, the findings were obtained from subjective measures that may cause bias or reduce the precision of the results. Finally, the obtained findings cannot be generalized to the entire country.

## Conclusion
Based on the results, the highest adherence levels belonged to the "Accountability" and "Pharmacy Expertise" dimensions. In contrast, the lowest levels of performing antibiotic stewardship were reported in the three areas of "Education", "Implementation of Interventions to Improve Antibiotic Use", and "Monitoring and Reporting of Antibiotic Prescribing and Its Outputs". Therefore, strengthening the performance of hospitals in these areas is crucial. Enhancing the involvement of clinical pharmacists, as health professionals with expertise in rational prescribing and medication optimization, can be beneficial.

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