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Research Article

Adherence to Aware Guidelines in Patients Hospitalized in a Secondary Care Unit

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Abstract

The inappropriate use of antibiotics in hospitals has increased Antimicrobial Resistance (AMR). The World Health Organization (WHO) AWaRe guidelines seek to optimize their prescription by classifying them into Access, Watch, and Reserve. The objective of this study is to identify adherence to the AWaRe guidelines in a hospital. This is an observational, cross-sectional, retrospective study conducted at the General Hospital of Subzone with Family Medicine 8, Tlaxcala, Mexico. A total of 336 adult records were analyzed, excluding incomplete records. Demographic, clinical, and antibiotic treatment variables were evaluated using an AWaRe-based checklist. The data were processed using descriptive statistics in Excel and SPSS. The results showed that 93.5% of patients received antibiotics, mainly ceftriaxone (33%) and levofloxacin (12%). Only 39.3% showed complete adherence to the AWaRe guidelines, with failures in diagnostic justification (61.6%) and treatment duration (58.1%).

The low adherence to AWaRe coincides with findings worldwide and contrasts with better results in other countries. Factors such as the limited availability of "Access" alternatives and the absence of PROA explain the results. There is poor adherence to AWaRe and excessive use of "Watch" antibiotics, so it is very important to implement strategies such as PROA and training to optimize prescriptions to reduce AMR in second-level hospitals.

Keywords: Antimicrobial resistance; Guidelines; Antibiotics; Prescribing; Infection control; Public health

Highlights

Only 39.3% of antibiotic prescriptions adhere to the WHO AWaRe guidelines. Excessive use of antibiotics from the "Watch" group (60.7%) and inadequate treatment duration (58.1% inadequacy) were demonstrated in a second-level Mexican hospital.

Adherence varied significantly according to medical service (Surgery 48.8%, Internal Medicine 27.3%), highlighting the need for tailored optimization interventions and evidencing systemic barriers such as limited availability of "Access" antibiotics and the absence of a formal PROA.

Introduction

Healthcare-Associated Infections (HAIs) are one of the main challenges in hospital settings, where patients admitted for prolonged periods or requiring invasive procedures are particularly exposed [1]. They are defined as infections acquired within the hospital when they appear after 48 hours of admission or up to 90 days after discharge and include those that develop up to 30 days after surgery or up to one year if an implant was placed [1].

During the 2019-2020 period, Mexico saw a 19.5% reduction in the HAIs rate per thousand hospital days [2]. One of the objectives of the National Action Strategy against Antimicrobial Resistance (ENARAM) in Mexico is to strengthen knowledge through surveillance, and a specific line of action to combat antimicrobial resistance in the field of HAIs is the creation of a list of relevant antibiotics to strengthen the epidemiological surveillance of microorganisms in the hospital environment [3].

In 2017, the WHO reviewed 21 common infectious syndromes and selected the most appropriate first- and second-choice antibiotic options for each. The 2019 review of the essential medicines list includes 37 antibiotics that are considered essential for the treatment of 26 common and serious clinical infections, focusing on low- and middle-income settings. It established the AWaRe (Access, Watch, Reserve) classification with the aim of promoting the rational use of antimicrobials and reducing bacterial resistance. This guide states that at least 60% of antibiotic consumption should correspond to the "Access" group, which has a lower risk of generating resistance. In Mexico, the AWaRe guidelines are recognized as the standard for antimicrobial stewardship. However, their use in clinical practice is limited, which has led to the excessive use of broad-spectrum antibiotics, inappropriate combinations, and prolonged or poorly dosed treatments that increase resistance [4].

The "Access" group comprises first- or second-choice antibiotics recommended for their efficacy, safety, and low risk of inducing resistance; the 'Watch' group includes those that should be used with greater caution, reserved for specific infections and under surveillance protocols; while the "Reserve" group encompasses drugs that should only be used as a last resort in cases of multidrug-resistant infections. In 2021, the World Health Organization (WHO) issued an update that included a total of 258 antibiotics [4].

In Mexico, although a link has been noted between inappropriate antibiotic prescribing and increased mortality, information on the use and consumption of antimicrobials remains scarce: growing antimicrobial resistance is one of the main threats [5].

Antimicrobial Stewardship Programs (ASPs) also promote appropriate prescribing practices to reduce the emergence of resistant bacteria, avoid unnecessary costs, and strengthen the training of healthcare personnel [6]. The Global Antimicrobial Resistance and Use Surveillance System (GLASS) implemented

by the WHO in 2015 also seeks to improve antimicrobial resistance monitoring systems [7].

Previous studies have evaluated the implementation of the AWaRe guidelines in different hospital settings. Most report that the most commonly used antibiotics fall into the "Access" category [8-11], with low compliance with national guidelines [12-14]. Others indicate that antibiotics in the "Watch" group are most commonly used [15,16], while in some cases those in the "Reserve" group are used due to availability, suggesting that limited resources may influence inappropriate use [17].

Prescription surveillance is key to controlling resistance; when evaluating exposure to antibiotics classified by AWaRe and the isolation of Multidrug-Resistant (MDR) organisms, it was shown that prior exposure to almost all antibiotics examined, especially those in the "Watch" and "Reserve" groups (such as carbapenems and linezolid), was significantly associated with an increased risk of MDR colonization/infection compared to those in the "Access" group (such as first-generation cephalosporins) [18].

Although the application of AWaRe guidelines has been widely studied in various regions of the world, studies on this topic are scarce in Mexico. The limited availability of information on the actual usage profile and adherence to the AWaRe classification in Mexico constitutes a critical gap that must be addressed. In this regard, it is essential to move from the simple adoption of guidelines to active and documented surveillance of prescribing patterns in national hospitals.

This study aims to generate up-to-date evidence in the local context in order to design specific interventions aligned with the country's epidemiological profile, thereby helping to preserve the effectiveness of essential antibiotics. To this end, research was conducted in a second-level unit, the Subzone General Hospital with Family Medicine No. 8, during 2024, with the aim of identifying the degree of adherence to the AWaRe Guidelines.

Materials and Methods

An observational, cross-sectional, retrospective study was conducted at the General Subzone Hospital with Family Medicine No. 8 (HGSZMF8) in Tlaxcala, Mexico. The records of patients over 18 years of age of both sexes, hospitalized between January and December 2024, were reviewed, regardless of the reason for admission. They were included regardless of whether or not they had antibiotic regimens. Incomplete medical records were excluded.

The information was obtained by reviewing electronic and physical medical records. The following variables were recorded: sex, age, days of hospitalization, antibiotic administered, AWaRe classification of the antibiotic, days of antibiotic administration, hospitalization service, main diagnosis, surgical intervention, and comorbidities.

To assess adherence to antibiotic treatment, a checklist was developed based on the World Health Organization's AWaRe guidelines. Four criteria were evaluated: 1) concordance between the diagnostic impression and the antibiotic indication, 2) appropriateness of the indication, 3) prescribed dose, and 4) duration of treatment. Adherence was considered to exist when all the criteria established in the corresponding guideline were met.

The data were collected and organized in a Microsoft Excel® database. IBM SPSS Statistics® software was used for statistical analysis. Qualitative variables were expressed as frequencies and percentages, and quantitative variables were evaluated for normality using the Kolmogorov-Smirnov test. According to their distribution, they were presented as mean ± Standard Deviation (SD) or as median and Interquartile Range (IQR), with their respective 95% confidence intervals (95% CI). For inferential analysis, the chi-square (χ^2) test was used to evaluate the association between categorical variables. If significant associations were found, the Bonferroni correction was applied as a post-hoc test to control the type I error rate in multiple pairwise comparisons.

This study was approved by the Local Research Committee of HGSZMF8 (Registration number: R-2024-2902-038). As it was a retrospective documentary study that did not involve any intervention in patients and used anonymized data, it was classified as risk-free according to local regulations. For the same reason, an exemption from informed consent was obtained. The confidentiality of personal data was ensured at all times, following the principles established in the Declaration of Helsinki.

Results

A total of 355 medical records were reviewed, of which 19 were excluded due to incomplete records and 336 were included in the analysis. Of these, 116 (34.5%) were male patients and 220 (65.5%) were female patients. The age ranged from 18 to 99 years, with a median of 56 years (IQR 39; 95% CI: 52.3-56.9).

The length of hospital stay ranged from 1 to 54 days, with a median of 5 days (IQR 6.77; 95% CI: 6.01-7.55). Most patients (81%, n = 274) were hospitalized for 1 to 10 days, while 13.4% (n = 45) remained for 11 to 20 days, and 5.1% (n = 17) for more than 21 days.

In terms of hospitalization services, 36% (n = 121) corresponded to Internal Medicine, 36% (n = 121) to General Surgery, and 28% (n = 94) to Gynecology and Obstetrics.

The distribution of cases according to diagnostic group showed

that liver diseases, gallbladder disorders, biliary tract disorders, pancreatic disorders, and other digestive system diseases accounted for 15.2% of cases (n = 51), followed by obstetric conditions and disorders, with 15.8% (n = 53), and neoplasms and aplasias, with 8% (n = 27). Pneumonia occurred in 8.6% (n = 29) of cases, while diseases of the appendix accounted for 5.7% (n = 19) and skin infections and other disorders of the skin and subcutaneous tissue accounted for 5.4% (n = 18). Other diagnoses included shock (6.8%, n = 23), circulatory system diseases (3.6%, n = 12), other bacterial diseases (4.5%, n = 15), and hernias and other intestinal diseases (4.2%, n = 14).

The least frequent diagnoses were diseases of the male genital organs (0.3%, n = 1), early complications of trauma (0.3%, n = 1), and mycosis (0.3%, n = 1). With regard to the type of surgical intervention, 143 patients (42.6%) did not require surgery. Among the procedures performed, cholecystectomy was the most frequent, with 35 cases (10.4%), followed by caesarean section, with 29 cases (8.6%). The LAPE (exploratory laparotomy) procedure was performed in 23 patients (6.8%), while appendectomy and hysterectomy were performed in 22 patients each (6.5%). Other surgical procedures accounted for 62 cases (18.5%).

Fifty percent (168) of the patients had no comorbidities; in the rest, the combination of diabetes mellitus and hypertension was the most frequent comorbidity (55 cases, 16.4%), followed by diabetes mellitus as a single entity (43 patients, 12.8%). Hypertension was present in 33 cases (9.8%), while other diseases accounted for 35 cases (10.4%). Chronic kidney disease was the least frequent comorbidity, occurring in only two patients (0.6%).

Regarding the use of antibiotics, 6.5% (n = 22) of patients did not receive any antibiotic treatment. The distribution of antibiotic regimens is shown in Table 1.

Drug regimen	Frequency (n)	Percentage (%)
None	22	6,5
Monotherapy	174	51,8
Dual regimen	129	38,4
Triple regimen	11	3,3
Total	**336**	**100**

Table 1: Antibiotic regimens administered.

As for the antibiotics administered, the one most commonly used was ceftriaxone, in 33.3% of the cases, for an average duration of 5 days. This is followed by clindamycin (9.0%, 4.9 days), cefotaxime (5.8%, 3.4 days), and ciprofloxacin (5.6%, 4.6 days). The remaining antibiotics were used in proportions of less than 5%, with average durations varying between 2 and 12 days.

Adherence to the AWaRe guidelines was observed in 39.3% (n = 132) of cases, while 60.7% (n = 204) did not comply with the recommendations (Table 2).

Guidelines adherence	Frequency (n)	Percentage (%)
Yes	132	39,3
No	204	60,7

Table 2: Guidelines adherence AWaRe (n=336).

After evaluating attachment based on specific criteria, the following results were obtained (Table 3).

	Compliance	No compliance
Diagnostic impression	38.39% (129)	61.61% (207)
Indication	38.69% (130)	61.31% (206)
Drug dose	97.02% (326)	2.98% (10)
Days of antibiotic prescription	41.96% (141)	58.04% (195)

Table 3: Assessment using a checklist based on the AWaRe guidelines.

The chi-square test revealed a statistically significant association between medical service and adherence to the AWaRe guidelines (χ^2 = 12.296, p = 0.002). Post-hoc comparisons with Bonferroni correction showed that this difference was concentrated between Internal Medicine and Surgery (p = 0.001), while no significant differences were found between Internal Medicine and Gynecology-Obstetrics (p = 0.025) or between Surgery and Gynecology-Obstetrics (p = 0.120). Table 4 shows the proportion of adherence by medical service.

Service	Compliance	No compliance	Total
Internal medicina	27,3% (88)	72,7% (33)	121
Surgery	48,8% (59)	51,2% (62)	121
Gynecology-Obstetrics	42,6% (40)	57,4% (54)	94

Table 4: Adherence to AWaRe guidelines by medical service.

Discussion

The AWaRe guidelines, proposed to optimize the use of antimicrobials and reduce HAIs, are not applied, either due to lack of institutional availability, selection, or lack of knowledge. In the present study, they were not applied in more than half of the records reviewed.

Fabre, et al. analyzed the lack of adherence to antibiotic optimization programs in Latin America, taking into account both institutional organizational factors and staff behavioral factors, and noted that 35% of participating hospitals have inadequate or basic adherence [19].

Compliance with AWaRe guidelines is low, similar to the results of other studies, such as reports from Zambia, which highlight excessive use of antibiotics in the "Watch" group [11,12]. In contrast, settings such as Thailand [8] and Australia [7] have shown that contextual adaptation of guidelines and institutional support can significantly improve prescribing quality, with 70% compliance for "access" antibiotics in the latter.

The predominant use of ceftriaxone (33.3%) and levofloxacin (12.0%) reflects systemic barriers rather than isolated choices by prescribers. The limited availability of "access" antibiotics, such as amoxicillin-clavulanic acid, may necessitate the use of broader-spectrum alternatives. Additionally, gaps in continuing medical education and high clinical workloads—factors also noted in similar settings [10]—contribute to empirical prescribing without strict adherence to guidelines. The absence of a formal Antimicrobial Stewardship Program (ASP) further diminishes opportunities for audit, feedback, and corrective intervention [4].

A similar situation occurs in Nigeria, where just over half of the cases reviewed used the "Watch" group, followed by the access group (50.5% and 48.2% respectively) [20], in addition to emphasizing the lack of knowledge among healthcare professionals about the AWaRe classification and PROAs, where almost 80% had never heard of the AWaRe classification, and of those who had heard of it, 70% did not know what it was [20]. In addition to emphasizing the lack of knowledge among health professionals about the AWaRe classification and PROAs, where almost 80% had never heard of the AWaRe classification, and of those who were familiar with it, only a third correctly identified the antibiotics in the corresponding groups [21].

Antibiotic use was high (93.5%), with ceftriaxone being used in one-third of cases, unlike what was reported by Chizimu, et al., who, when comparing adherence to the AWaRe classification in 16 hospitals in Zambia, reported that overall, 70% used antibiotics in hospitalized patients, (ranging from 55% to 100% in four hospitals), with 52% using antibiotics from the watch group, ceftriaxone being the most commonly used [22].

In terms of the type of medical service, there are few studies comparing adherence to AWaRe guidelines among different services. In the present study, adherence varied significantly, with surgery showing greater adherence compared to internal medicine (48.8% vs. 27.3%). This discrepancy may be related to the complexity of cases, length of hospitalization, or departmental culture. This underscores the need for specific interventions, such as reinforced education, structured follow-up, or multidisciplinary review teams.

In Pakistan, a study in the otolaryngology department of a tertiary hospital reported that 54.9% of prescriptions corresponded to the "Access" group, while 45% were from the 'Watch' group, with no prescriptions from the "Reserve" group. This finding also places the use of "Access" antibiotics below the WHO target of 60%, pointing to the need for further efforts to promote their use [23].

The study confirms that, although dosing errors were rare (95.2% of cases were appropriate), inappropriate treatment duration (58.1% of cases were inappropriate) and excessive use of "Watch" antibiotics (60.7% of cases were inappropriate) remain prevalent. These results justify the urgent implementation of structured antibiotic Prescribing Optimization Programs (PROAs), the integration of AWaRe guidelines into electronic prescribing systems, and continuous monitoring using frameworks such as the WHO GLASS [5]. A testable hypothesis emerging from this work is that the implementation of an APOP could reduce the use of "Watch" antibiotics by 20% or more within 12 months.

Prescription monitoring is a significant problem in low- and middle-income countries. A point prevalence study in Bangladeshi hospitals revealed that 78% of hospitalized patients received antibiotics, with predominant use of the "Watch" group, which accounted for 64.0% of prescriptions, while the "Access" group accounted for only 35.6%. This imbalance is mainly due to the high use of third-generation cephalosporins, with the "Watch" group being more prevalent in medical wards and secondary hospitals, reflecting the urgency of PROA interventions in these settings [23].

Prescription patterns were also affected by the pandemic. Following a wave of COVID-19 in a tertiary hospital in India, it was found that the majority (78.56%) of prescriptions were in the "Watch" category, with high use of third-generation cephalosporins and an average of almost two antibiotics per patient, being higher in the ICU. In addition, most prescriptions were empirical (72.14%) and less than 8% were based on cultures, highlighting the need for post-pandemic strategies focused on decision-making based on microbiological data [24], which is consistent with the results observed.

A total of 773 quality indicators related to the appropriate use of antibiotics have been identified; however, only 8 (1%) directly cite the AWaRe system and 55.6% do so indirectly. Therefore, standardized indicators based on the AWaRe classification should be proposed and integrated into PROAs globally [25].

In addition to hospitals, it is crucial to monitor the use of antimicrobials in Primary Care (PC), as this level of care accounts for a large volume of antibiotic prescriptions that have a decisive influence on the pressure of resistance selection. In this context, a study conducted in Asturias (Spain) evaluated antibiotic consumption in the adult population between 2014 and 2020. This study provides valuable information on the evolution of

prescribing habits in PC, complementing the results focused on the hospital setting and underscoring the need for a comprehensive surveillance strategy [26].

The application of AWaRe guidelines has been extensively studied in various regions of the world, but studies on this topic are scarce in Mexico. This trend is particularly alarming because in a tertiary hospital in Mexico, the prescription of "Watch" antibiotics reaches 74.4%, while the "Access" group only represents 21.3%. This pattern, dominated by broad-spectrum agents such as ceftriaxone and ertapenem, generates selection pressure for resistance that directly contradicts global efforts and public health goals [27].

Strengths and Limitations

The study provides an assessment of adherence to the WHO AWaRe guidelines in a secondary hospital in Tlaxcala, Mexico, using a standardized checklist and robust statistical analysis. It also compares adherence among different hospital departments; previous studies have compared hospitals or levels of care, but few have compared departments.

The main limitation stems from the retrospective design, in which the information in the clinical records is incomplete or missing. This could have led to information bias and an underestimation of the actual rate of non-compliance with the guidelines, which limits the generalizability of the results to other hospitals or regions.

Conclusions

These findings demonstrate insufficient compliance with AWaRe guidelines in a secondary care hospital in Tlaxcala, Mexico, with a predominant use of "Watch" antibiotics and deficiencies in diagnostic justification. The results validate the initial hypothesis and highlight the urgent need to implement multidisciplinary strategies, such as promoting Continuous Improvement in Clinical Practice (CICP), and to offer continuous training to align clinical practice with global standards and mitigate AMR. These actions would not only improve the quality of prescribing but also help preserve the effectiveness of antibiotics in the future.

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Conflict of Interest

All authors declare that they have no conflicts of interest.

Ethical Considerations

This research has been approved by the research ethics committee 29028 and by the local research committee 2902 of HGSZMF8 with registration number R-2024-2902-038 and approval date of August 28, 2024.

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Authors' Contribution

All authors have contributed to the entire research process, including preparation, data collection, analysis, writing, and approval for publication of this manuscript.

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