Knowing–Doing Gap in WHO AWaRe Antibiotic Classification Among Primary Healthcare Physicians

Eman Kadry Rashwan*, Amany A. Ghazy**, Faisal Mohammed Alshumrani***,****, Gamal Abdelrahman Bakhaat Hassan*****,******, Wafa'a Abdullah Alzahrani*******, Mousa Mohammad Mousa Alshumrani********, Abdulrahman Mohammad Alshumrani*******, Fahad Ali Mousa Alshumrani*********, Zeyad Hussain Althumali**********, Eman Ibrahim Ahmed**********,**********

ABSTRACT

To combat the major threat of antimicrobial resistance, the World Health Organization (WHO) has developed the AWaRe (Access-Watch-Reserve) classification to regulate the use of antibiotics. However, physician adherence to these guidelines remains a significant challenge. To assess knowledge and adherence of primary healthcare physicians to the AWaRe classification. A questionnaire was distributed among physicians in primary healthcare centres in Makkah. A total of 205 physicians completed the questionnaire, with most being Saudi (97.6%), holding postgraduate degrees (70.2%), having 6-10 years of experience (41.5%), and managing chronic cases (48.8%). Regarding knowledge, 77% of the participants reported a satisfactory understanding of the AWaRe guidelines but encountered challenges in applying them due to dissatisfaction with the outcomes or personal preference. About 70.7% had received guidance and supervision, and 26.3% believed that the Saudi Health Education Plan improves the accuracy of using medication. With respect to practice, Mecillinam "Access group" ranked first among the prescribed antibiotics. However, Ciprofloxacin and Linezolid from the Watch and Reserve groups, respectively, were also used. This reflects conflicts. 73.2% stated that they select antibiotics based on their personal judgement, whereas 26.8% follow the AWaRe guidelines. A "knowing-doing gap" in antimicrobial stewardship was noticed among primary healthcare physicians. Although more than two-thirds of physicians are AWaRe of the AWaRe classification of antibiotics, only 26.8% of them strictly follow this guidance. This emphasises the importance of increasing their commitment to following the AWaRe classification.

Keywords: AWaRe classification, Awareness, Adherence, Primary healthcare physicians

*	Assistant Professor, Physiology Department College of Medicine, Jouf University, Saudi Arabia.
**	Microbiology and Immunology Unit, Department of Pathology College of Medicine, Jouf University, Saudi Arabia.
***	IPC master student, College of Medicine Jouf University, Saudi Arabia.
****	Environmental Health Specialist, Preventive medicine King Abdulaziz medical city, Jeddah, Saudi Arabia. Email: fmm261016@gmail.com
*****	Histology Unit, Department of Anatomy College of Medicine, Jouf University, Saudi Arabia.
******	Histology Department, Faculty of Medicine Al-Azhar University, Assiut, Egypt.
*******	Family Medicine Specialist, Ministry Of Health, Saudi Arabia.
********	Department of Medicine and Surgery, Faculty of Medicine Umm Al-Qura University, Makkah, Saudi Arabia.
*********	Anesthesia Resident at Makkah Health Cluster.
**********	Preventive Medicine Resident, King Abdulaziz Medical City Jeddah, Saudi Arabia.
**********	Pharmacology and Therapeutics Department College of Medicine, Jouf University, Saudi Arabia.
**********	Medical Pharmacology Department, Faculty of Medicine Fayoum University, Egypt.

INTRODUCTION

Since the discovery of antibiotics in the early 20th century, a great revolution in medicine has occurred, saving countless lives. However, the continuous misuse and overuse of antibiotics has resulted in relentless adaptability on the part of microorganisms, an alarming rise in antibiotic resistance, and the occurrence of a global crisis[1].

Antimicrobial resistance (AMR) is a major threat to humans, animals, agriculture, and the environment that has led to the need for the creation and implementation of antimicrobial stewardship (AMS) programs that include a bundle of interventions designed to promote the responsible use of antimicrobial drugs[2,3].

In 2017, the World Health Organization developed the AWaRe (Access- Watch- Reserve) antibiotic classification as an essential tool to support local, national, and global antibiotic management efforts. This classification aims to regulate the use of antibiotics as part of a comprehensive plan. They categorized antibiotics into three main groups based on the scope of their use and the likelihood of developing antimicrobial resistance:1) Access group range from drugs that are used in the first and second treatment of common infections; 2) Watch group contains broad-spectrum that have a greater potential to develop resistance; and 3) Reserve group includes antibiotics that are used as a last option when encountering an antibiotic-resistant infection[4-6]. Through these groups, the responsible use of antibiotics is promoted.

AWaRe not only recommends the classification of drugs but also includes guidelines for prescribing and monitoring the use of antibiotics at all levels. It aims to strengthen antibiotic management strategies by providing a regulatory framework that guides the optimal use of antibiotics and enhances resilience to antimicrobial resistance to improve public health in the long term[5,6]. Under its 13th General Program of Work (GPW), the WHO has set a target that at least 60% of total antibiotic consumption in each country should be from the "Access" group by 2023 (GPW 2023 60% Access target). This goal aims to improve access to essential medicines, ensure their safe and effective use, and reduce antimicrobial resistance[7].

Several studies have reported a "knowing-doing gap" in antimicrobial stewardship in different countries[8,9]. A study in Ethiopia evaluated the antibiotic prescribing practices at Aksum University Hospital to address the pressing issue of antibiotic resistance among 822 patients. Results revealed that 52.3% received antibiotics, averaging 4.2 days of treatment and 2.01 antibiotics per patient. Ceftriaxone (24.5%) and azithromycin (12.9%) were commonly prescribed, and both drugs belong to the Watch group. In addition, no culture and sensitivity testing was conducted, indicating reliance on empirical prescribing. Despite the availability of 65.2% of key antibiotics during the study, the findings highlight a significant deviation from WHO standards and emphasize the urgent need for an Antibiotic Stewardship Program to optimize antibiotic use and combat AMR in Ethiopia[8].

In a study in Saudi Arabia, Ahmed et al. (2023) analysed 1,000 prescriptions over six months and found that Azithromycin was the most prescribed. Despite adhering to the hospital formulary, only 13.28% of pneumonia patients received antibiotics in line with the AWaRe guidelines. The findings highlight significant irrational antibiotic use, and the authors recommend implementing standard treatment guidelines and increasing adherence to the AWaRe classification to combat antibiotic resistance[9,10].

These results emphasise the importance of regular assessment of healthcare professionals' awareness and adherence to the WHO's AWaRe antimicrobial classification to identify any gaps and to address the challenges physicians face in applying these guidelines in a primary healthcare setting.

Consequently, the current research aims to evaluate the level of awareness among physicians in primary healthcare centres in Makkah regarding the WHO's AWaRe antimicrobial classification and how this influences their prescribing practices. This will help to identify the challenges faced by physicians in applying the WHO's AWaRe antimicrobial classification in primary healthcare settings in Makkah and design appropriate workshops and follow-up programs to bridge the gap between awareness and practices.

RESEARCH METHODOLOGY

Ethical approval: The research proposal was approved by the Ethics Committee at Jouf University (No. HAPO-13-S-001, dated 1-6-2025). Informed consent was included as the first part of the questionnaire used. Participation in the study was only possible after providing informed consent and ticking "accept to participate in this study." No personal or confidential data was required.

Study design and setting: The study is a cross-sectional study in primary healthcare centers in Makkah, Saudi Arabia. This study design was used to assess the current level of knowledge, attitudes, and practices of physicians at a single point in time without requiring follow-up.

A Link containing the Google Form (questionnaire) and consent form was distributed online to all physicians working in Mekkah primary healthcare facilities.

Sample size: The study enrolled 205 physicians working in Mekkah primary healthcare facilities. A convenience sampling method was used. Inclusion criteria: all physicians working in primary healthcare centres in Makkah, Saudi Arabia. Exclusion criteria: Any incomplete responses.

Data collection tool: A structured questionnaire was developed by adapting two sections from Eaton et al. (2022)[11], and two sections were created by the authors to evaluate the knowledge and adherence towards the published WHO AWaRe guidelines. Public health experts have reviewed the questionnaire for accuracy, ease, and relevance. To ensure appropriateness and comprehensibility of the questionnaire, face and content validation were done by distributing the questionnaire to clinicians working in the College of Medicine, Jouf University. Then, it was piloted among 25 clinicians in the primary healthcare centers, and minor modifications were made based on their feedback.

The questionnaire includes five sections: Section 1: a brief introduction to the aim of the research and the request for approval for participants to participate in the study; Section 2: participants' sociodemographic data (age, gender, nationality, occupation, etc); Section 3: questions regarding the activities that make up the role of physicians in primary healthcare centres. Section 4: questions regarding the clinical presentations that require the use of antibiotics; Section 5: questions about the AWaRe classification of antibiotics and the drugs prescribed.

Statistical analysis: Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 21 (IBM Corp, Armonk, NY, USA). Descriptive statistical analysis was performed. A chi-square test was used to examine the association between study variables. A p-value <0.05 indicates a statistically significant result.

RESULTS

Participants' Demographic Data

The following study enrolled 205 participants (74.1% males and 25.9% females); the vast majority were Saudis (97.6%). Most participants fell within the 30-40-year age group (51.7%), while the lowest percentage was among those over 50 years old (1.5%).

In terms of years of experience, the largest group had between 6 and 10 years of experience (41.5%), while the lowest percentage had more than 14 years (6.8%). Participants holding a master's degree represented the highest proportion (35.6%), followed by those with a post-graduate diploma (34.6%). Concerning work tasks, the majority were involved in routine clinic appointments (48.3%), followed by phone diagnosis tasks (30.7%). Lastly, most cases handled by the participants were chronic cases (48.8%) (Table 1).

Table 1. Participants' sociodemographic data

Variables	Categories	Frequency	Percentage
Gender	Male	152	74.10%
	Female	53	25.90%
Age	20–30 years	52	25.40%
	30–40 years	106	51.70%
	40-50 years	44	21.50%
	> 50 years	3	1.50%
Marital status	Single	46	22.40%
	Married	103	50.20%
	Divorce	49	23.90%
	Widow	7	3.40%
Nationality	Saudi	200	97.60%
	Non-Saudi	5	2.40%
Duration of registration as a care giver	0-2 years	18	8.80%
	3-5 years	52	25.40%
	6-10 years	85	41.50%
	11- 14 years	36	17.60%
	>14 years	14	6.80%
Qualification	Bachelor's degree	52	25.40%
	Diploma	71	34.60%
	Master's Degree	73	35.60%
	Fellowship	9	4.40%
Task	Home visits	6	2.90%
	Urgent clinic	16	7.80%
	Routine clinic	99	48.30%
	Telephone triage	63	30.70%
	Chronic Disease Reviews	18	8.80%
	COVID-19 clinics	3	1.50%
How are you employed in primary healthcare centre	Directly employed	80	39%
	locum contract	105	51.20%
	Rotational through ambulance trust	20	9.80%
Type of examined cases	Acute cases	27	13.20%
	Chronic cases	100	48.80%
	Mild cases	68	33.20%
	Severe cases	10	4.90%

Table 2. Activities that make up the role of a primary healthcare practitioner

No.	Activity	Mean ± SD	Rank	degree
1	Communication and consultations	3.07 ± 0.78	9	Sometimes
2	Practicing holistically to personalize care and promote health	2.97 ± 0.87	11	Sometimes
3	Working with colleagues in primary healthcare	3.51 ± 0.75	1	Usually
4	Maintaining an ethical approach and fitness to practice	3.30 ± 0.79	5	Sometimes
5	Information gathering & interpretation	3.31 ± 0.78	4	Sometimes
6	Clinical Examination and procedural skills	3.35 ± 0.78	2	Sometimes
7	Making a diagnosis	3.27 ± 0.84	6	Sometimes
8	Managing medical & clinical complexity	3.16 ± 0.85	8	Sometimes
9	Independent prescribing, medicines, and supply of pharmacotherapy	2.98 ± 0.93	10	Sometimes
10	Leadership and Management	3.24 ± 0.85	7	Sometimes
11	Education and Development	3.32 ± 0.75	3	Sometimes
12	Research and evidence-based practice	2.95 ± 0.88	12	Sometimes

Table 3. Clinical presentations that require antibiotics in the primary healthcare centre

No.	Clinical presentations	Mean ± SD	Degree
1	Cardiovascular system	3.09+1.21	regularly
2	Dermatology	2.40+1.24	regularly
3	Eyes, Ears, Nose and Throat	3.70+1.34	Very regularly
4	Emergency presentation	3.24+1.38	regularly
5	Gastrointestinal system	2.99+1.37	regularly
6	Genitourinary system	3.17+1.42	regularly
7	General presentations	2.91+1.44	regularly
8	Sexual health assessment	3.20+1.35	regularly
9	Medication review	2.97+1.35	regularly
10	Mental health	3.08+1.39	regularly
11	Musculoskeletal system	3.54+1.30	Very regularly
12	Neurological system	2.84+1.40	regularly
13	Pediatrics	3.39+1.40	regularly
14	Pain	2.92+1.32	regularly
15	Palliative care	3.49+1.29	Very regularly
16	Pregnancy-related conditions	3.29+1.44	Regularly
17	Non-pregnancy-related conditions in pregnant females	3.02+1.45	Regularly
18	Respiratory System	2.90+1.33	regularly

Table 4. Patterns of antibiotics prescribed by physicians in the primary healthcare centres

No.	Antibiotic	AWaRe	Mean ± SD	Degree
1	Doxycycline	Access	2.56±1.33	Sometimes
2	Tetracycline	Access	2.82±0.86	Regularly
3	Chloramphenicol	Access	2.95±1.08	Regularly
4	Ampicillin	Access	3.24±1.27	Regularly
5	Amoxicillin	Access	3.27±1.22	Regularly
6	Mecillinam	Access	3.45±1.05	Very regularly
7	Benzyl penicillin	Access	2.91±1.16	Regularly
8	Cefazolin	Access	3.01±1.15	Regularly
9	Nitrofiriontoin	Access	3.08±1.25	Regularly
10	Metronidazole	Access	3.17±1.20	Regularly
11	Ciprofloxacin	Watch	3.18±1.06	Regularly
12	Azithromycin	Watch	3.27±1.12	Regularly
13	Moxifloxacin	Watch	3.25±1.05	Regularly
14	Clarithromycin	Watch	2.96±1.03	Regularly
15	Cefotaxime	Watch	3.02±1.15	Regularly
16	Tazocin	Watch	3.10±1.13	Regularly
17	Meropenium	Watch	3.11±1.19	Regularly
18	Ceftriaxone	Watch	3.07±1.20	Regularly
19	Levofloxacin	Watch	3.26±1.14	Regularly
20	Cefalexin	Watch	3.28±1.22	Regularly
21	Cefixime	Watch	3.03±1.15	Regularly
22	Erythromycin	Watch	3.07±1.21	Regularly
23	Clathromycin	Watch	2.94±1.09	Regularly
24	Ofloxacin	Watch	2.99±1.21	Regularly
25	Fusidic acid	Watch	3.11±1.20	Regularly
26	Quinolones	Watch	2.96±1.26	Regularly
27	3rd generation cephalosporin	Watch	3.07±1.22	Regularly
28	Macrolides	Watch	3.00±1.11	Regularly
29	Linezolid	Reserve	3.36±1.15	Regularly
30	Meropenem+ vaborbactam	Reserve	2.92±1.23	Regularly
31	Polymyxin B and colistin	Reserve	2.88±1.20	Regularly
32	4th-generation cephalosporin	Reserve	3.11±1.16	Regularly
33	5th-generation cephalosporin	Reserve	2.69±1.05	Regularly

Table 5. Participants' vision and knowledge about AWaRe.

Question	Category	Frequency
Why did you choose to work in primary healthcare?	Help people	(24.4%)
	My specialty	(42.9%)
	Good environment	(11.2%)
	I like it	(21.5%)
Compared to your previous (AWaRe) information, how do you find your current knowledge in primary healthcare?	Improved	(77.1%)
	Not improve	(22.9%)
Do you experience conflict in your shift or work with (AWaRe) list?	Yes	(76.1%)
	No	(23.9%)
What type of conflict occurs?	Dissatisfaction	(37.1%)
	Different types of antibiotics	(39%)
Do you receive clinical supervision, rounds, and guidance on dispensing antibiotics?	Yes	(70.7%)
	No	(29.3%)
Do you feel patients are satisfied following a consultation with you?	Yes	(82.4%)
	No	(17.6%)
Why do you feel patients are (not) satisfied following a consultation with you?	When I do not solve their problems	(1%)
	When I don't meet their full desires	(16.6%)
How does the Saudi Health Education Roadmap for Primary Health Care Practice impact the dispensing of medications in your role?	Rationalizing the prescribing procedure & pharmacovigilance	(18.5%)
	A guide from the MOH was provided	(23.4%)
	Clearer communication	(15.1%)
	Improve the accuracy and efficiency of medical dispensing	(26.3%)
	Increase knowledge of the latest type of medication	(12.2%)
	Not significant	(4.4%)
What frustrations do you have regarding your role if an antibiotic does not work for a patient?	Switch to another antibiotic	(48.8%)
	Fear of antibiotic resistance	(33.2%)
	No culture	(18%)
Do you give them another antibiotic based on your own suggestion or based on the WHO list of antibiotics?	Based on own suggestion	(73.2%)
	Based on the WHO list of antibiotics	(26.8%)

Activities that make up the role of primary healthcare practitioners:

The arithmetic means and standard deviations of the activities that make up the role of PHC practitioners showed that most aspects were rated as "sometimes" in terms of frequency of practice. The domain "working with colleagues in primary healthcare" had the highest mean of 3.51 (practiced 'usually'), while the domain "research and evidence-based practice" was the lowest rated with a mean of 2.95. Clinical examination and procedural skills had a mean of 3.35 (ranked second), education and development had a mean of 3.32 (ranked third), and leadership and management had a mean of 3.24. Independent prescribing and delivery of pharmacotherapy had a mean of 2.98 (Table 2).

Clinical presentations that require providing antibiotics in the primary healthcare centre

Physicians in the primary healthcare centres in Makkah chose most clinical presentations to be managed regularly. The category "Eyes, Ears, Nose, and Throat" (ENT) recorded the highest mean score (3.70), indicating it is practiced very regularly. Similarly, areas such as "musculoskeletal" (3.54) and "palliative care" (3.49) also received high ratings, reflecting their importance and frequency in practice. On the other hand, areas like "dermatology" (2.40) and "neurology" (2.84) had lower scores, indicating they are less commonly encountered in primary healthcare settings. Overall, the total mean score of 3.12 suggests that most clinical presentations are regularly addressed, although certain areas require more focused attention (Table 3).

Participants' perspectives and knowledge of (AWaRe).

Regarding the patterns of antibiotics used, the results indicate that most antibiotics are used regularly, with variable frequencies. Mecillinam, which belongs to the Access group ranked first, with a high average usage score of (3.45 ± 1.05), indicating that it is used *very regularly*. In contrast, Doxycycline ranked 34th with an average usage of (2.56 ± 1.33), meaning it is used *occasionally* and less frequently. Antibiotics from the Watch group, such as Amoxicillin, Ampicillin, and Ciprofloxacin, showed consistent usage. Some antibiotics, such as Polymyxin B and Colistin, from the Reserve group, were ranked 31st and 32nd with relatively lower average scores. This variation reflects various trends in antibiotic use in primary healthcare settings (Table 4).

Statistical analysis revealed a significant association between the knowledge and both holding postgraduate degrees and having 6-10 years of experience ($p < 0.001$*).

Participants' vision and knowledge of AWaRe

Questions concerned with the participants' vision and knowledge about the AWaRe classification revealed that 77.1% of the participants reported a satisfactory level of knowledge of the AWaRe guidelines, but most of them faced conflict while using the list, either due to dissatisfaction with the outcomes (37.1%) or the preferred use of different types of antibiotics (39%). Regarding supervision, 70.7% mentioned receiving guidance and supervision. In terms of patient satisfaction, 82.4% of the participants felt that patients were satisfied after consultation. Moreover, 73.2% stated that they select the antibiotic based on their personal judgment, whereas 26.8% follow the AWaRe guidelines (Table 5).

DISCUSSION

The use of antibiotics undergoes continuous updates to guard against the emergence of new resistant bacterial strains and to maximize the benefit to patients worldwide. Several studies have proved a strong relationship between antimicrobial misuse, overuse, and rapid shift toward broad-spectrum antimicrobials and the development of AMR[2,12,13].

WHO has declared the AWaRe classification of antibiotics to enable countries to follow an antibiotic prescribing pattern that decreases the emergence of AMR. However, physician adherence to these guidelines remains a significant challenge. The irrational prescribing of antibiotics is prevalent in many countries [12]. There is a real need to assess the antibiotic prescribing patterns and the physician adherence to AWaRe guidelines to be used as a basis for future interventions.

The current study aimed to assess the awareness of physicians in the primary healthcare centres in Makkah about the WHO's AWaRe antimicrobial classification and to examine if they follow this updated classification during prescribing antibiotics in their clinical practices. Results clarified that among 205 participants (74.1% males and 25.9% females), 35.6% hold master's degrees, 41.5% have between 6 and 10 years of experience, 48.3% involved in routine clinic appointments, and 48.8% deal with chronic cases. Most clinical presentations are managed regularly, particularly ophthalmic, ENT (3.70), musculoskeletal (3.54), and "palliative care" (3.49).

Regarding the prescribing patterns of antibiotics by physicians in the primary healthcare centres, the results indicate that a lot of antibiotics from the three groups (Access, Watch, and Reserve) are used regularly with variable frequencies. Regarding the Access group, results showed that Mecillinam ranked first; however, Doxycycline ranked 34th. Regarding the Watch group, Ciprofloxacin (ranked 9), macrolides, Cephalosporins, and Quinolones were also used regularly. With respect to the Reserve group, Linezolid, Polymyxin B, Colistin, Meropenem, vaborbactam, and 4th and 5th generation cephalosporin were used, but with relatively lower average scores. This agrees with several studies that have reported the irrational prescription of antibiotics away from the AWaRe classification[8,9,12-15].

In contrast to our results, several studies have assessed the AMR and antibiotic prescribing behaviors among primary healthcare practitioners and found significant gaps in understanding the WHO AWaRe classification[8,9,13]. In India, a nationwide online survey was distributed among 710 physicians, and the results revealed that most physicians acknowledge that their prescribing practices contribute to AMR, and some prescribe antibiotics for viral infections. The study highlights the need for enhanced education and awareness programs to improve antibiotic stewardship and combat the growing AMR crisis in India [13]. Furthermore, the studies of Demoz et al (2020) and Ahmed et al (2023) assessed antibiotic prescribing practices in primary healthcare and raised awareness among healthcare providers about global guidelines such as the WHO's AWaRe classification[8,9].

Regarding the antibiotic prescribing patterns, the current study revealed that primary healthcare physicians prescribe antibiotics from the three groups of AWaRe. This reflects the presence of a "knowing-doing gap" in antimicrobial stewardship. This could be due to patient pressure, clinical habit, or personal preferences.

This is similar to Iqbal et al. (2025), who found that only 31.8% of antibiotics used were from the Access category, while 59.5% and 8.7% were from the Watch and Reserve categories, respectively [15]. This comes in accordance with the results of Mudenda S, et al. (2024), who reported that 77.1% of the prescribed antibiotics are from the 'Access' list[12]. Both studies suggested the crucial need to implement antimicrobial stewardship programs to reduce the AMR risk.

Questions concerned with the vision and knowledge towards AWaRe revealed that 77.1% of participants reported an improvement in their knowledge of the AWaRe list, and 70.7% mentioned that they receive guidance and supervision from the Ministry of Health (MOH). Moreover, the current study showed that 26.3% of primary healthcare practitioners believed that the Saudi health education plan helps improve the accuracy and efficiency of medication dispensing. However, 73.2% stated that they select a new antibiotic based on their personal judgment, whereas 26.8% follow the AWaRe list. This is considered the weakest point, emphasizing the importance of increasing the awareness of healthcare providers about the AWaRe classification of antibiotics. This recommendation aligns with that of Abu-Ajaleh et al. (2023), who assessed the effect of training on AWaRe antibiotics classification on the antibiotic prescribing practices of healthcare professionals. Results clarified that 78.5% of participants had not heard about the AWaRe classification, and receiving an educational intervention raised their knowledge, agreement to follow the AWaRe classification of antibiotics in their practice, as it suggests safe choices. Hospital antibiotic use of the Access group increased, and the use of the Watch and/or Reserve groups declined[10].

In 2025, Saleem et al. reviewed 85 studies published on using the AWaRe system during antibiotic use in low- and middle-income countries. They reported that despite 70% of the prescribed antibiotics belonging to the Access group, there is an overuse of Watch antibiotics (68.2% of studies reviewed). Furthermore, some countries, such as Pakistan and Bangladesh, have significant dispensing of antibiotics without prescriptions. Watch antibiotics were more available in many countries, even if more expensive. They recommend the urgent use of AWaRe-based antibiotic stewardship programs to improve the use, affordability, and availability of the Access antibiotics to combat AMR[16].

All these variations reflect a genuine lack of adherence to outdated trends in antibiotic prescribing (AWaRe classification). Our findings provide a valuable initial snapshot into physician attitudes and highlight a significant 'knowing-doing gap' that warrants further investigation. This suggests the urgent need for regular training, workshops, and follow-up to prevent the use of Watch and Reserve groups of antibiotics in the primary healthcare centers.

The main limitations in the current study include the dependence on self-reported data that may lead to some bias, the study was conducted

in a single city (Makkah), restriction to convenience sampling, and absence of inferential analysis and the emphasis on the awareness about the AWaRe classification as a significant factor impacting the antibiotic prescribing pattern resulted in the exclusion of other relevant factors such as patients' need, unresponsive to treatment given, and the availability of antibiotics.

Further research is essential to evaluate adherence to the AWaRe guidelines to fill the gaps between knowledge and practices.

Significance of Research

It is essential to follow the global updates in services provided by the WHO to the healthcare facilities, particularly prescribing antibiotics, to avoid the emergence of new resistant strains. To improve the adherence of health staff to the WHO AWaRe classification guidelines in prescribing antibiotics. It is important to assess their knowledge and practices.

CONCLUSION

More than two-thirds of physicians in primary healthcare centres in Makkah have good knowledge about the AWaRe classification of antibiotics and regularly use Mecillinam (ranked first among the antibiotics used in primary healthcare centres). Most participants agreed on the presence of governmental guidance and supervision. They believed that the Saudi health education plan helps to improve the accuracy of medication dispensing. However, some stated that they select the antibiotic based on their personal judgment, and only 26.8% strictly follow the AWaRe list. This "knowing-doing gap" in antimicrobial stewardship emphasises the importance of increasing their commitment to following the AWaRe classification.

Authorship Contribution: All authors participated in the study conception, formulation, design, data analysis and interpretation, drafting of the manuscript, and critical revision of the manuscript.

Potential Conflicts of Interest: None

Competing Interest: None

Acceptance Date: 11 December 2025

REFERENCE

1. Muteeb G, Rehman MT, Shahwan M, et al. Origin of antibiotics and antibiotic resistance, and their impacts on drug development: a narrative review. Pharmaceuticals (Basel). 2023;16(11):1615.
2. Prestinaci F, Pezzotti P, Pantosti A. Antimicrobial resistance: a global multifaceted phenomenon. Pathog Glob Health. 2015;109(7):309–18.
3. Lanckohr C, Bracht H. Antimicrobial stewardship. Curr Opin Crit Care. 2022;28(5):551–6.
4. World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva: World Health Organization; 2014.
5. World Health Organization. WHO report on surveillance of antibiotic consumption: 2016–2018 early implementation. Geneva: World Health Organization; 2018.
6. World Health Organization. WHO Access, Watch, Reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use. Geneva: World Health Organization; 2021.
7. Zanichelli V, Sharland M, Cappello B, et al. The WHO AWaRe (Access, Watch, Reserve) antibiotic book and prevention of antimicrobial resistance. Bull World Health Organ. 2023;101(4):290–6.
8. Demoz GT, Kasahun GG, Hagazy K, et al. Prescribing pattern of antibiotics using WHO prescribing indicators among inpatients in Ethiopia: a need for antibiotic stewardship program. Infect Drug Resist. 2020;13:2783–94.
9. Ahmed A, Almurashi A, Alshelali S, et al. Knowledge and awareness level of antibiotic resistance resulting from self-medication use among populations in KSA. Arch Pharm Pract. 2023;14(Suppl):A06231506.
10. Abu-Ajaleh S, Darwish Elhajji F, Al-Bsoul S, et al. An evaluation of the impact of increasing the awareness of the WHO Access, Watch, and Reserve (AWaRe) antibiotics classification on knowledge, attitudes, and hospital antibiotic prescribing practices. Antibiotics (Basel). 2023;12(6):951.
11. Eaton G, Tierney S, Wong G, et al. Understanding the roles and work of paramedics in primary healthcare: a national cross-sectional survey. BMJ Open. 2022;12(12):e067476.
12. Mudenda S, Chilimboyi R, Matafwali SK, et al. Hospital prescribing patterns of antibiotics in Zambia using the WHO prescribing indicators post-COVID-19 pandemic: findings and implications. JAC Antimicrob Resist. 2024;6(1):dlae023.
13. Mittal N, Goel P, Goel K, et al. Awareness regarding antimicrobial resistance and antibiotic prescribing behavior among physicians: results from a nationwide cross-sectional survey in India. [Journal name not provided]. 2023.
14. Mudenda S, Wataya MD, Mufwambi W, et al. The World Health Organization Access, Watch, and Reserve classification of antibiotics: an awareness survey among pharmacy professionals in a sub-Saharan country, Zambia. Antimicrob Steward Healthc Epidemiol. 2024;4(1):e212.
15. Iqbal MS, Khan MF, Farooqui S, et al. Antibiotic utilization and resistance according to the WHO AWaRe classification in intensive care units after COVID-19 third wave in Pakistan: findings and implications. Medicina (Kaunas). 2025;61(3):481.
16. Saleem Z, Sheikh S, Godman B, et al. Increasing the use of the WHO AWaRe system in antibiotic surveillance and stewardship programmes in low- and middle-income countries. JAC Antimicrob Resist. 2025;7(2):dlaf031.