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Original Article

Physician Awareness of WHO antimicrobial resistance Guidelines and Preferred Strategies for Optimizing Antibiotic Prescribing in Minia, Egypt

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Abstract

Background: Antimicrobial resistance (AMR) poses a global health threat, particularly in low and middle-income countries. Egypt had the 58th highest age-standardized mortality rate associated with AMR. Effective antimicrobial stewardship, supported by WHO guidelines and frameworks such as the AWaRe classification, is essential to promote appropriate antibiotic prescribing. **Aim:** This study aimed to assess physicians' awareness of WHO antimicrobial resistance guidelines and to identify perceived strategies to optimize antibiotic prescribing practices at Minia University Hospitals, Egypt. **Methods:** A cross-sectional study was conducted between October 2024 and May 2025 by interviewing 311 physicians using a structured, pre-tested questionnaire covering socio-demographics, awareness of WHO guidelines, sources of clinical information, and perceived usefulness of 14 strategies to improve prescribing. **Results:** About 65.9% of physicians were residents with a median age of 29 years. While 66.6% correctly identified WHO's Five Moments for Hand Hygiene, only 27.7% were aware of the AWaRe classification. Among those who were aware of the classification, 70.9% reported its influence on their prescribing. Physicians primarily relied on peers (70.7%) and workplace resources (57.9%) for clinical information. Educational sessions (88.1%) and the availability of local/national guidelines (80.7%) were identified as the most helpful strategies to improve prescribing. **Conclusion:** Physicians at Minia University Hospitals showed moderate awareness of WHO infection control guidelines and limited familiarity with the AWaRe classification. Physicians highlighted the value of educational sessions and clear prescribing guidelines, suggesting that aligning interventions with prescriber perceptions may enhance the effectiveness of antibiotic stewardship efforts.

Keywords: Antibiotic stewardship**,** AWaRe classification Guidelines, Antibiotic prescribing**,** Egypt

Introduction:

Antibiotic resistance has become a world health problem (1). Anyone, globally, could be impacted by antibiotic resistance. It happens naturally, but improper and excessive antibiotic usage exacerbates the process (2, 3). Antimicrobial resistance (AMR) has been

estimated to be responsible for million deaths globally (4). In 2019, Egypt had the 58th highest age-standardized mortality rate associated with AMR. The number of AMR deaths in Egypt is higher than deaths from any other communicable and non-communicable causes (5).

AMR arises from multiple contributing factors in low- and middle-income countries, such as lack of diagnostic tools, unrestricted access to antimicrobials without a prescription, shortage of medications, shortage of health care workers (HCWs), improper use of antibiotics in animals, poor sanitation and hygiene, lack of strong regulatory frameworks to control access to antimicrobials, substandard clinical care, and a lack of comprehensive AMR surveillance programs (6-8).

Global guidelines are available to combat AMR. Key tools include the AWaRe classification for guiding antibiotic selection and hand hygiene protocols to reduce infection transmission (9, 10).

The World Health Organization (WHO) developed the AWaRe classification to support antimicrobial stewardship and helps policymakers and prescribers prioritize safer and more effective antibiotic use (11).

It groups antibiotics into three categories: Access, Watch, and Reserve, based on their impact on AMR. "Access" antibiotics have a narrow spectrum of activity, are generally associated with fewer side effects, carry a lower risk of encouraging resistance, and are cost-effective. These drugs are recommended as the first-line treatment for common infections and should be widely accessible (12).

In contrast, "Watch" antibiotics pose a greater risk of driving resistance and are mainly used for treating more serious infections, often in hospital settings.

"Reserve" antibiotics are intended as a last-line defense for life-threatening infections caused by multi drug-resistant bacteria, and should only be used in critical cases. The AWaRe framework emphasizes limiting the use of antibiotics in the Watch and Reserve groups (10, 12).

Another fundamental component of global strategies to combat AMR and protect public health is hand hygiene. Applying proper hand hygiene before and after patient interactions significantly decreases the risk of transmitting bacteria and viruses, including drug-resistant strains. (13).

The "Five moments for hand hygiene" model has been developed by WHO to address global needs for training, observation, and performance reporting related to hand hygiene across all healthcare settings (9).

Developing facility-specific antibiotic treatment protocols, aligned with available formulary options and endorsed by the infection prevention and control (IPC) team is also proved to help clinicians in choosing the most appropriate agent and treatment duration for commonly encountered infections and thus help in combating AMR (14).

Improving antibiotic prescribing practices among physicians is a key component in combating AMR (15). Physicians are primarily responsible for the rational use of antibiotics (16).

Several strategies have been identified to promote rational use of antibiotics, including the implementation of clinical guidelines, regular audits with feedback, continuing medical education, and the use of clinical decision support tools (14, 17, 18). However,

the effectiveness of such strategies depends greatly on physicians' engagement and perceptions. Understanding what physicians consider helpful allows for the development of tailored interventions that are more likely to be adopted and sustained in daily practice (19, 20). Exploring their perceptions of helpful interventions is crucial to ensure that any proposed measures are both practical and acceptable.

Despite the availability of these tools, there is little evidence from Egypt regarding physicians' awareness and use of WHO antimicrobial guidelines, particularly the AWaRe classification.

This study therefore aims to assess physicians' awareness and use of WHO antimicrobial guidelines and to determine which strategies they believe are most helpful in promoting rational antibiotic prescribing.

Subject and method

Study design

This observational analytical cross-sectional study was conducted at Minia University Hospitals, Minia Governorate, Egypt, from October 2024 to May 2025.

Study population

The study included 311 physicians from all specialties working at Minia University Hospitals who prescribe antibiotics as part of their clinical practice (e.g. internal medicine, pediatrics, surgery, gynecology, cardiology, and others)

Exclusion Criteria

- Other healthcare workers (e.g., nurses, pharmacists).
- Medical and nursing students.
- Physicians who do not prescribe antibiotics (e.g., radiologists, clinical pathologists, phoniatricians, audiologists, rheumatologists).

Sample size calculation:

The sample size was calculated by Epi info calculator v 7.2.5.

Based on data from previous study in which 78.5% of respondents were unaware of the WHO AWaRe classification (21), assuming 5% margin of error and 95% confidence level and by adding 20% non-response rate, the required sample size was 311 physicians.

Sampling technique

A stratified random sampling technique was used. The sample was stratified by the departments of Minia University Hospitals. A list of doctors' names was obtained from each department, and participants were randomly selected using an online random number generator. Non-responding doctors were excluded, and the random selection process was repeated to obtain the sample size.

Data collection technique

Data were collected through structured, face-to-face interviews using a pre designed questionnaire consisted of two sections.

Section I: contained questions about the socio-demographic data of the studied physicians (such as age, gender, etc.).

Section II: questions assessing awareness of WHO guidelines and IPC, information about the sources physicians relies on for their clinical practice and 14 options of perceived strategies to improve antimicrobial prescribing. were adopted from a previously validated questionnaire by ***Orubu et al.*** Responses were recorded on a 5-point Likert scale ("very helpful" to "very unhelpful"). It was transformed into a three-scale for analysis. "Very helpful" and "helpful" were aggregated into a single "helpful" category, while "unhelpful," and "very unhelpful" were grouped as "unhelpful" and neutral in between, with aggregate scores > 90%

assessed as the best, option(s); > 80% to 90% as acceptable; and 70% to 80% as good (22).

Each participant was interviewed in private settings to ensure privacy and minimize bias. Prior to data collection, participants were informed about the purpose of the study, and informed consent was obtained. All collected data were handled confidentially.

Statistical analysis

Organizing, tabulation, presentation and analysis of data were performed using SPSS, version 26. Numerical data was presented as median. Categorical data was be presented as numbers and percentages.

Ethical considerations

Ethical approval was taken from the Ethical committee at faculty of Medicine, Minia University, Egypt (IRB No 1275/09/2024). An informed consent was taken from all participants after providing comprehensive information about the aim and the nature of the study. Data was collected anonymously with respect of privacy and confidentiality of participants.

Results:

Table (1) shows that the median age of the studied physicians was 29 years (IQR: 27–30), with a range from 26 to 51 years. About half of the physicians were females while 49.8% were males. Most physicians (71.7%) lived in urban areas. As regarding medical specialty, the majority (58.2%) were non-surgical specialists while 41.8% were surgical specialists. Residents constituted a larger share in the study (65.9%) than staff physicians (34.1%).

As shown in table 2 that only 66.6% could list WHO's five Moments for Hand Hygiene. About 28% knew about the AWaRe antibiotic classification system, and 70.9% of them stated that the classification affected their prescription. The majority (80.7%) performed hand hygiene even if they have used gloves in contact with patients or biological material, but 12.5% didn't.

Fig (1) shows that the majority of physicians (70.7%) depended on their colleagues or peers as primary source of their information on proper antibiotic prescribing. The workplace resources were also a major source for clinical information (57.9%), followed by conferences (45.3%) and scientific organizations (43.7%). Only 36.7% of physicians reported relying on training courses. Using published guidelines was only reported by 22.8%, followed by professional media (12.9%) and government policy (12.2%).

Table (3) illustrates a clear preference among physicians for supportive and educational strategies over restrictive measures. Educational sessions on prescribing and the availability of updated local or national guidelines were the most acceptable measures, followed closely by advice from senior colleagues, access to resistance data, and the availability of infection control teams, which were perceived as good strategies for prescribing. Broad restrictive measures as restriction of all antibiotics received lower acceptance.

Table (1): Socio-demographic characteristics of physicians of Minia University Hospitals, 2024/2025.

Variable		Frequency (n=311)	Percentage 100%
Age (years)	Median (IQR)	29(27-30)	
	Range	(26-51)	
Gender	Male	155	49.8
	Female	156	50.2
Residence	Rural	88	28.3
	Urban	223	71.7
Medical Specialty	Non-surgical	181	58.2
	Surgical	130	41.8
Job Position	Residents	205	65.9
	Staff	106	34.1

Table (2): Awareness of physicians towards Infection prevention control measures and WHO guidelines in Minia University Hospitals, 2024/2025

Variable		Frequency (n=311)	Percentage 100%
Able to list the WHO's 5 moments of hand hygiene	No	44	14.1%
	Yes	207	66.6%
	Unsure	60	19.3%
Know the AWaRe classification	No	225	72.3%
	Yes	86	27.7%
Prescription affected by AWaRe classification (n=86)	No	25	29.1%
	Yes	61	70.9%
Perform hand hygiene after glove use	No	39	12.5
	yes	251	80.7
	unsure	21	6.8

AWaRe: Access, Watch and Reserve

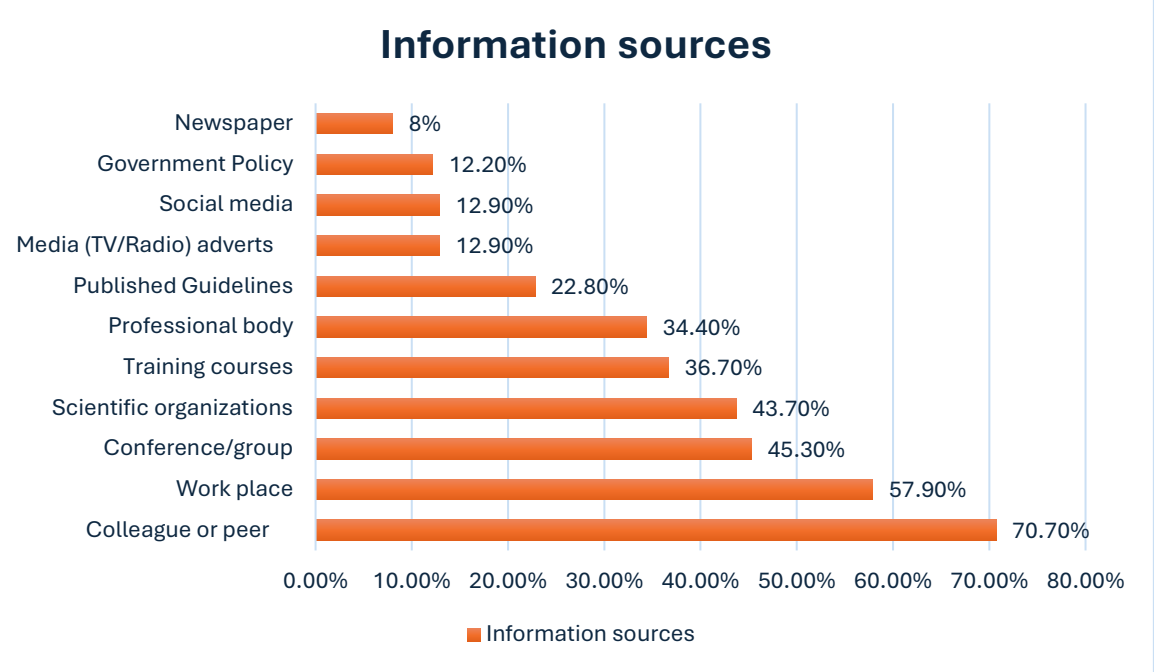

Fig (1) Sources of information physicians rely on for clinical practice in Minia university hospitals, 2024/2025.

Table (3): Perceived strategies to improve prescription by physicians in Minia University Hospitals, 2024/2025.

Strategies	Un helpful	Neutral	Helpful
Educational sessions on prescribing	5 (1.6%)	32 (10.3%)	274 (88.1%) *
Availability of local / national/guidelines / policies / protocols	7 (2.3%)	53 (17%)	251 (80.7%) *
Advice from senior colleagues	27 (8.7%)	44 (14.1%)	240 (77.2%) **
Availability of local/national resistance data	18 (5.8%)	59 (19%)	234 (75.2%) **
Readily accessible advice from infection control team	25 (8%)	67 (21.5%)	219 (70.4%) **
Readily accessible advice from Infectious Disease physician	15 (4.8%)	84 (27%)	212 (68.2%)
Readily accessible microbiological advice	19 (6.1%)	94 (30.2%)	198 (63.7%)
Regular audit and feedback on antibiotic prescribing in your PHC	20 (6.4%)	95 (30.5%)	196 (63%)
Restriction of prescription of certain antibiotics	31 (10%)	87 (28%)	193 (62.1%)
Readily accessible advice from a pharmacist	42 (13.5%)	77 (24.8%)	192 (61.7%)
Presence of an antimicrobial management team	29 (9.3%)	96 (30.9%)	186 (59.8%)

Speaking to a pharmaceutical representative	34 (10.9%)	91 (29.3%)	186 (59.8%)
Computer aided prescribing	40 (12.9%)	91 (29.3%)	180 (57.9%)
Restriction of prescription of all antibiotics	60 (19.3%)	118 (37.9%)	133 (42.8%)

*Acceptable perceived strategy, **Good perceived strategy.

Discussion

Our study was conducted among 311 physicians working at Minia University Hospitals, Minia governorate. The median of age was 29 years. Males and females' proportion were nearly equal to each other. The majority was from urban residence.

Most of respondents of our study were resident physicians. other similar studies that were conducted in university hospitals in Egypt also showed that residents constituted between 54 to 64% of respondents (23, 24). This could be attributed to the heavy workload and clinical responsibilities of staff members, which often limit their availability to participate in surveys or research activities.

1: Awareness of WHO recommendations (Five Moments, AWaRe)

Our study demonstrated that only 66% of physicians were aware of the WHO's Five Moments for Hand Hygiene. Despite relatively poor awareness, 80% of the physicians affirmed performing hand hygiene if gloves were used in contact with patient or biological material.

Our results were in line with ***Ashiru-Oredope et al.,*** which found that about half of respondents stated that they could list the five moments for hand hygiene (25). However, Our results were lower than that reported by ***Orubu et al.***, who conducted a study in primary health care centers in Jordan and showed that there 97% of physicians were aware about the Five Moments for Hand Hygiene (22).

2: Sources of clinical information and gaps in guideline use

Limited knowledge among healthcare workers, along with misconceptions about hand hygiene and infection control practices, may contribute to poor compliance. Such issues are often linked to facility-related factors, including inadequate resources for hand hygiene, insufficient supervision, lack of proper training, and the absence of effective role models (26).

Our study also revealed that 72.3% of participants had not previously know about AWaRe antibiotic classification . Similar findings were reported by ***Abu-Ajaleh et al.,*** in a study conducted in Amman, Jordan, which found that 78.5% of respondents were unaware of the WHO AWaRe classification (21).

In line with this, ***Akpan et al.*** also observed that the majority of participants were unaware of this classification. This lack of awareness increases the risk of unnecessary prescribing of 'Watch' and 'Reserve' antibiotics, which should be limited to specific infections and carefully defined clinical scenarios.

As regard to the main source of clinical information, our study showed that a substantial majority (70.7%) reported relying primarily on colleagues or peers as the source of clinical information. This highlighting the critical role of peer consultation and workplace culture in shaping clinical decision-

making. However, this reliance may reflect a lack of accessible, up-to-date formal resources or limited confidence in using them efficiently under time constraints.

Alarmingly, fewer than a quarter of respondents reported using published guidelines as a source of information. This indicates a gap between evidence-based recommendations and clinical practice, potentially due to limited access, awareness, or perceived practicality of guidelines in daily work.

Previous studies also revealed that the advice from senior peers was one of the main sources of information on AMR (27, 28). These results indicate a clear need to reinforce the role of IPC teams in educating healthcare workers, motivating prescribers to adhere to best practices, and making sure that relevant policies and guidelines are easily available to everyone involved in patient care.

3: Perceived strategies to improve prescribing

In term of strategies to improve prescribing practice as perceived by physicians, the most highly rated strategy was educational sessions on prescribing, which 88.1% of physicians found helpful. This overwhelming agreement demonstrates that physicians recognize continuous education as essential for improving prescribing competence and staying updated on evolving resistance trends and treatment protocols. This strong preference aligns with global evidence showing that regular training significantly enhances rational prescribing and boosts confidence in clinical decision-making (29).

Similarly, the availability of local or national guidelines, policies, or protocols (80.7%) rated as another top priority. This shows that physicians see clear, accessible guidance as foundational for good antimicrobial stewardship. When protocols are evidence-based and adapted to local contexts, they help standardize practice, minimize uncertainty, and reduce the need for defensive prescribing.

Advice from senior colleagues was also highly supported, with 77.2% rating it as helpful. This underlines the importance of informal, day-to-day mentorship particularly for less experienced prescribers who may feel pressured by diagnostic uncertainty or patient expectations. Availability of local/national resistance data was also found to be helpful by 75.2% of physicians. Access to current resistance patterns enables more targeted, rational antibiotic selection, which directly supports efforts to contain antimicrobial AMR.

Also, readily accessible advice from infection control teams was found to be helpful too by 70.4% of the participants. This finding shows that prescribers see immediate expert guidance as essential when facing complex treatment decisions or multi-drug-resistant infections.

Unlike the results of ***Orubu et al.*** study, 74% of participants in primary health care facilities considered the availability of local or national guidelines, policies, or protocols as the most helpful strategy to improve prescribing. This was followed by access to local or national resistance data (74%) and, finally, educational sessions on prescribing (71%) (22).This difference could be attributed to variability in geographical location and the type of workplace, whether a primary health care facility or a large hospital and work place policies can influence which strategies physicians find most useful.

Conclusion and recommendations

This study highlights important gaps in physician awareness regarding WHO antimicrobial resistance guidelines, particularly the AWaRe classification. Despite this gap, physicians demonstrated a strong interest in strategies to improve antibiotic prescribing, especially educational sessions and access to clinical guidelines. These findings underscore the importance of targeted interventions that address both knowledge gaps and system-level barriers to optimal prescribing.

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List of abbreviations:

Abbreviation	Full Term
AMR	Antimicrobial Resistance
AWaRe	Access, Watch, and Reserve
WHO	World Health Organization
IPC	Infection Prevention and Control
HCWs	Healthcare Workers

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