

Original Article

WHO Prescribing Indicators and AWaRe Classification of Antibiotics in Two Primary Healthcare Centers in Alexandria, Egypt

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Abstract

Background: Irrational drug use is common in developing countries, leading to poor healthcare services. Appropriate use of drugs in five key areas can be measured using the WHO prescribing indicators. Additionally, the WHO developed the AWaRe tool to prevent and monitor inappropriate antibiotic use.

Objective(s): The study aims to assess drug prescribing patterns in Primary Healthcare Centers (PHC) in Alexandria using the WHO prescribing indicators and the AWaRe classification of antibiotics.

Methods: The study was conducted at two PHC in the East and El-Gomrok Districts of Alexandria governorate, Egypt. A cross-sectional study was performed, including all prescriptions written by family physicians in the PHC centers of the East District (1,090 prescriptions) and El-Gomrok District (488 prescriptions) during a one-month period (September 2023).

Results: The average number of drugs per prescription was 2.5 ± 1.08 in both the East and El-Gomrok District centers. The average percentage of prescriptions containing antibiotics was 19.8%, and the percentage containing injections was 12.1%. Almost all prescriptions were written using generic names and included drugs from the Essential Drug List (EDL). El-Gomrok District center had the highest Index of Rational Drug Prescribing (IRDP). The highest consumption of antibiotics was from the "Access" group of the AWaRe classification (antibiotics used as first- and second-line treatments for infections) (85.7% in the East District center and 91.6% in the El-Gomrok District center). No antibiotics were prescribed from the "Reserve" group (antibiotics used for infections resistant to many drugs) or the "Not Recommended" group (antibiotics not supported by evidence or recommended guidelines).

Conclusion: All prescribing indicators, except for the average number of drugs per prescription and the percentage of prescriptions containing injections, were within the optimal value of WHO. The El-Gomrok District center exhibited the highest performance in rational drug use according to the IRDP index. Results revealed adherence to the AWaRe antibiotic classification criteria.

Keywords: Primary healthcare, WHO prescribing indicators, AWaRe classification, Egypt

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INTRODUCTION

The World Health Organization (WHO) defines rational use of medication as providing patients with drugs that are clinically appropriate, in dosages that suit their individual needs, for a sufficient amount of time, and at the lowest possible cost to them and their community.⁽¹⁾ Despite lack of resources, developing countries spend between 25 and 75 percent of their total health expenditures on drugs compared to only 10% in developed countries. This could be an indicator to irrational and inappropriate use of medications in developing countries.⁽²⁾ Using drugs rationally involves typically correct prescribing,

suitable dispensing, and proper patient use of medications for the diagnosis, prevention, alleviation, and treatment of illnesses.⁽³⁾

Developing countries suffer from irrational medication use, resulting in poor and costly services.⁽⁴⁾ According to WHO estimates (2019), irrational prescription and dispensing occur in more than half of all drugs, and there is a lack of adherence of more than fifty percent of patients to the prescribed regimens.⁽⁵⁾ Factors leading to irrational drug use involve nonconformity with clinical guidelines in prescription, lack of necessary medicines, prescribing for a single patient enormous amounts of drugs (polypharmacy), inappropriate antimicrobial and antibiotic use

(overuse, insufficient dose, incorrect duration), excessive injections, wrong self-medication, and defective communication between patients and healthcare professionals. ⁽⁶⁾ Irrational use of medicine has several negative consequences at the patient and health system level. The irrational use of medications leads to decreased effectiveness of pharmacotherapy, elevated treatment expenses, an increased chance of adverse drug reactions, drug interactions, the development of drug resistance, and extended hospital stays. ⁽⁷⁾

In order to assess performance in three general areas pertaining to the prudent use of medications in primary care—prescription, patient care, and facility-specific indicators—WHO/INRUD (International Network of Rational Use of Drugs) created drug use indicators. They are called core drug use indicators. The prescribing indicators measure the performance of healthcare professionals in five crucial dimensions related to the proper drug use in a patient encounter. These indicators are related to polypharmacy, antibiotic use, injection use, generic prescribing and adherence to the essential drugs list. One definition of a patient encounter is "The duration of interaction between patient and health provider." Data from medical records can be used to analyse the interactions retrospectively from the patients' records after the visit, or prospectively, when the patient arrives during the data collection period. WHO has suggested reference values for each of the indicators. The average drugs per encounter, rate of injection use, and rate of antibiotic use are affected by the presenting case mix at a healthcare facility or inside a particular region. ⁽⁸⁾ Research involving the WHO African region utilized systematic review to examine the prescribing patterns in two-time intervals (1995–2005 and 2006–2015). The systematic review comprised 43 studies that were carried out in 11 African countries. These forty-three studies' prescription indicators were derived from 141,323 patient encounters in 572 primary care settings. According to the results of this systematic review, the average number of medications prescribed per patient encounter was 3.1 (IQR 2.3–4.8); 68.0 percent of drugs were prescribed under generic names (IQR 55.4–80.3); antibiotics were prescribed in 46.8 percent of encounters (IQR 33.7–62.8); 25.0% of encounters involved injections (IQR 18.7–39.5); and 88.0 percent of drugs were prescribed from the list of essential drugs (IQR 76.3–94.1). The systematic review concluded significant deviation of prescribing indicators for the African region from the WHO reference values. ⁽⁹⁾

Primary care antibiotic prescriptions can affect a patient's bacterial resistance for up to a year. An increased number or duration of antibiotic courses prescribed in the preceding 12 months enhances the probability of isolating resistant bacteria from that

patient. ⁽¹⁰⁾ Antibiotic resistance takes place as bacteria develop the capacity to bypass the mechanisms that drugs employ against them. Infections caused by antibiotic-resistant pathogens are generally more challenging to treat and can recur and cause serious morbidity and mortality. ⁽¹¹⁾ Reducing irrational antibiotics prescribing is crucial for preserving the effectiveness of antibiotics. Approximately 80% of all antibiotic prescribing takes place in primary care. ⁽¹²⁾ According to the WHO, antibiotics should be prescribed in less than 30% of all prescriptions in general practice. ⁽⁹⁾

The WHO Expert Committee on Selection and Use of Essential Medicines established the Access, Watch, and Reserve (AWaRe) categorization system of antibiotics in 2017, representing a constituent of the antimicrobial stewardship program, which is a systematic approach to enhancing antimicrobial use. ⁽¹³⁾ WHO suggests that policymakers, researchers, and healthcare professionals use the AWaRe classification as a tool to better enhance antibiotic prescribing, monitoring, and stewardship initiatives. The WHO AWaRe framework divides antibiotics into four categories based on activity spectrum and probability of developing resistance. ⁽¹³⁾ Three categories are intended for use in clinical practice and one last category considered as non-recommended category. The Expert Committee suggested in 2019 that the AWaRe classification be adopted for all regularly used antibiotics worldwide, not just those on the WHO Model Lists. Classification of antibiotics was updated several times with last update in 2023. ⁽¹³⁾ Antibiotics used as first- and second-line treatments for infections are included in the "Access" category. The "Watch" category contains broad-spectrum antibiotics more likely to lead to drug resistance. Antibiotics in the "Reserve" group are used to treat infections that are resistant to many drugs and are typically employed as a last resort by medical professionals. ⁽¹⁴⁾ The fixed-dose combinations of several broad-spectrum antibiotics in the "Not-recommended" group are neither supported by evidence nor suggested by reputable international guidelines. WHO advise against using them in clinical practice. ⁽¹³⁾ According to the WHO AWaRe tool, 60% of all antibiotic prescriptions should fall into the "Access" group. ⁽¹³⁾ Subsequently, adhering to the classification of WHO AWaRe prevents the inappropriate use of antibiotics. ⁽¹⁴⁾ A study on patterns of drug and antibiotic use in Egypt is needed to address the growing threat of irrational drug and antibiotic prescription. Therefore, the present study aims to assess drug prescribing pattern in primary healthcare centers in Alexandria, Egypt using the WHO prescribing indicators and AWaRe classification of antibiotics. It will provide valuable insights into the scale of drug and antibiotic misuse; help develop targeted interventions and

improve public health.

Aim of the study

Objectives:

The study aims to assess drug prescribing pattern in primary healthcare centers in Alexandria, Egypt using the WHO prescribing indicators and AWaRe classification of antibiotics.

METHODS

Study Setting and design:

The study was conducted at two primary healthcare (PHC) centers in Alexandria governorate, Egypt. These centers are affiliated to Ministry of Health and Population. Selection of the centers was based on convenience sampling technique. Both centers serve non-emergency patients only, serving 8 hours daily, six days a week starting on Saturdays and ending on Thursdays. The working hours are from 8:00 AM – 2:00 PM daily. The first center is located in the East District. The center contains 11 clinics (family medicine, general medicine, pediatrics, gynecology, dentistry, adolescent medicine, dermatology, nutrition, ophthalmology, otolaryngology, and physiotherapy) and a laboratory, X-ray unit, pharmacy, drug information center department, and breast-feeding consultation committee. The average frequency of patients per month is 23,250 and the average population the clinic serves is about 237627 citizens. The second center is located in El-Gomrok District. It contains three clinics (general internal medicine clinic, family medicine and gynecology clinic, dentistry clinic) and a laboratory. The average frequency of patients per month is 2262 and the average population the clinic serves is about 10811 citizens.

A cross-sectional study was conducted in the two PHC centers. The target population consisted of prescriptions allocated from medical records of patients at the two PHC centers. All prescriptions written by family physicians in the PHC centers of the East District (1090 prescription) and El-Gomrok district (488 prescription) for one month duration (September 2023) were included in the study.

Data Collection

An abstraction sheet (prescribing indicator form) was used to abstract the data from each prescription.⁽⁸⁾ For every patient encounter, the information needed to measure the prescribing indicators was captured and entered into the prescribing indicator form. Data collection from the PHC centers followed the WHO guidelines and methodology to ensure reliability of data collection. The prescribing indicator form consisted of the following variables: demographic variables; age and sex, drug related variables such as:

number of drugs, number of drugs written using the generic name, presence of injections in the prescriptions (0 = no, 1= yes), number of drugs on essential drug list (EDL), and presence of antibiotics in the prescription (0=no, 1= yes).

For prescription with antibiotics, additional variables were included: number of antibiotics written in the prescription, number of treatment days with antibiotics (DOTs), and AWaRe classification.⁽¹³⁾ According to WHO AWaRe classification, the prescribed antibiotic was classified and coded into 1,2,3,4 where 1 referred to “Access” group, 2 referred to “Watch” group, 3 referred to “Reserve” group and 4 referred to “Not recommended” group.⁽¹³⁾

Data Analysis

Data entry and analysis were conducted using Statistical Package for Social Sciences (SPSS) version 21. The mean and standard deviation were employed as descriptive statistics for quantitative variables. Frequencies and percentages described categorical data. WHO prescribing indicators for drug use were calculated. Standardized methods described by WHO and INRUD were used to calculate indicators.⁽⁸⁾ Afterwards, the corresponding value of each indicator was compared with the standard value recommended by WHO. Five drug use prescribing indicators were described by WHO/INRUD. The average number of medications prescribed per contact is the first indicator. It is employed to measure polypharmacy levels. It was computed by dividing the total number of different medications prescribed by the number of contacts surveyed. Optimal value of this indicator is suggested by WHO to be ≤ 2 . The second indicator, the percentage of drugs prescribed by generic name, is calculated to measure the liability of prescribing based on the medicine’s generic or international nonproprietary name (INN). The formula for calculation of this indicator is dividing the number of drugs prescribed by generic name by the total prescribed and multiplying by 100. Prescribing 100% of drugs by generic name is the ideal recommended value.^(8, 15)

The frequency of antibiotic prescriptions by PHC clinicians is the third indicator, which is the percentage of encounters with an antibiotic prescription. The equation for calculating the indicator is to divide the number of patient encounters in which one or more antibiotics were prescribed by the total number of encounters and multiply by 100. According to WHO, the optimum value is $\leq 30\%$. The next indicator is the percentage of encounters with injections prescribed. It measures the expensive and overused forms of drugs. The formula for this indicator is dividing the number of patient encounters with prescribed injections by the total number of encounters surveyed and multiplying by 100. The

recommended value is $\leq 10\%$. Calculation of this index does not include immunizations, as they are not considered injections. The last indicator is the percentage of drugs prescribed from the essential drugs list (EDL). A copy of the national Egyptian reference EDL was obtained from which comparisons of prescribed medicines were made. The number of drugs prescribed from EDL was divided by the total number of drugs prescribed, and the result was multiplied by 100 to determine the percentage. This indicator is employed to estimate the degree to which practices adhere to a national drug policy. All drugs prescribed at PHC facilities should be from the EDL, so the ideal value of this indicator is 100%.^(8,16) Standard optimal values of indicators were recommended by WHO and used in previous studies.^(8, 15,16)

Rational drug used was evaluated using Index of Rational Drug Prescribing (IRDP).⁽¹⁷⁾ Five indicators are utilized to calculate the IRDP. The optimum index for indicators is set as 1. When values approach 1, this demonstrates higher rational drug use. As a result, the optimal level of IRDP is five. The following formula was used to calculate rational antibiotic use and safe injection indices: index equals to optimal value divided by observed value.⁽¹⁶⁾ The index for the rational use of antibiotics was determined by dividing the ideal level (30%) by the proportion of prescriptions that included an antibiotic. The index for safety injection was measured by dividing the ideal level (10%) by the proportion of prescriptions

containing an injectable drug.^(18,19) The index of non-polypharmacy was measured by the percentage of non-polypharmacy prescriptions. In this study, any prescriptions containing fewer than four drugs were identified as non-polypharmacy. Index of generic name and index of EDL were calculated by the percentage of drugs prescribed by generic name and the percentage of drugs prescribed from the national EDL.⁽²⁰⁾ For those two indices, the index equals to the observed value divided by optimal value. The IRDP was ultimately computed by compounding all five prescribing indices.^(16, 18-20)

Ethical considerations:

This study has been approved by the High Institute of Public Health's Ethics Committee at Alexandria University (IRB number: 00013692).

RESULTS

Results shows that about two third of the prescriptions were belonging to females in the two PHC centres (64.41% in East District centre and 71.93% in El-Gomrok District centre). The highest percentage of prescriptions in both centers were belonging to patients in the age category (18-<50) (41.19% in East District centre and 39.75% in El-Gomrok District centre), with a mean age of 46.19 years (SD 21.02) in East District centre and 47.82 years (SD 17.74) in El-Gomrok District centre (Table 1).

Table (1): Distribution of prescriptions according to the age and sex of patients attending the two primary healthcare centers in Alexandria, 2023

Patient characteristic	East District center (n= 1090)		El-Gomrok District center (n= 488)		Total (n=1578)	
	No.	%	No.	%	No.	%
Sex						
Male	388	35.59	137	28.07	525	33.27
Female	702	64.41	351	71.93	1053	66.73
Age						
<18	132	12.11	37	7.58	169	10.71
18-	449	41.19	194	39.75	598	37.89
50-	282	25.87	85	17.41	367	23.25
≥ 65	227	20.83	151	30.94	378	23.95
Mean \pm SD	46.19 \pm 21.02		47.82 \pm 17.74		47 \pm 19.38	

SD = standard deviation

Table 2 shows WHO drug prescribing indicators for drug use in the two PHC centers. Both centers in East and El-Gomrok Districts were comparable in average number of drugs per prescription, and both exceeded the optimal levels (2.8 ± 1.21 , 2.3 ± 0.96 ,

respectively). However, the centre located in East District was five times higher than the center located in El-Gomrok District in the percentage of prescriptions with 4 and more drugs (28.8% versus 5.9%, respectively) and exceeded the optimal level

recommended by WHO (<20%). El-Gomrok District center was higher in percentage of prescriptions containing antibiotics than the East District center (24.3% compared to 15.3%, respectively). Almost all prescriptions were prescribed by generic name and from EDL in both centers. This indicates that both

centers met the reference value recommended by WHO in these two indicators. East District center was four times higher than El-Gomrok District center in the percentage of prescriptions containing injections (19.5% compared to 4.7%, respectively) as well as surpassed the ideal value of 10.

Table (2): Distribution of prescriptions according to the WHO drug prescribing indicators in the two primary healthcare centers in Alexandria, 2023

WHO prescribing indicator	Calculated Value of indicator (observed level)				Average	Optimal levels of WHO drug use indicators
	East District center (n= 1090)		El- Gomrok District center (n= 488)			
	No.	%	No.	%		
Average number of drugs per prescription (Mean ± SD)	2.8 ± 1.21		2.3 ± 0.96		2.5 ± 1.08	≤ 2 (1.6–1.8)
% of prescription with 4 and more drugs	314	28.8%	29	5.9%	17.3%	<20%
% of prescriptions containing antibiotics	167	15.3%	119	24.3%	19.8%	≤30%
% of drugs prescribed by generic name	1085	99.5%	487	99.9%	99.7%	100%
% of drugs prescribed from Egyptian essential drug list	1090	100%	482	98.8%	99.4%	100%
% of prescriptions containing injections	213	19.5%	23	4.7%	12.1%	≤10

SD = standard deviation

Table 3 shows index of IRDP in the two PHC centers. El-Gomrok District center had a higher rank of IRDP compared to East District center (4.93,4.21, respectively). Consequently, El-Gomrok District center

exhibited the greatest performance regarding rational drug use. The difference between the two centers were mainly in non-polypharmacy and safe injection indicators.

Table (3): Distribution of prescriptions according to the Index of Rational Drug Prescribing (IRDP) in the two primary healthcare centers in Alexandria, 2023

Index ^a	East District Center (n= 1090)	El- Gomrok District Center (n= 488)
Non-Polypharmacy index	0.71	0.94
Safe injection index	0.51	1
Rational use of antibiotics index	1	1
Generic name index	0.99	1
Essential drug list index	1	0.99
Total (IRDP)^b	4.21	4.93
Rank	2	1

^aOptimal index= 1, ^bmaximum IRDP=5

Table 4 shows antibiotics consumption according to WHO AWaRe antibiotic groups, estimated by antibiotic encounters and DOTs in the two PHC centers. The highest number of antibiotics consumptions was from “Access” group in both centers (85.71% in East District centre compared to 91.60% in El-Gomrok District centre), with a mean number of antibiotics per prescription of 0.16 (SD 0.21) in East District center and a mean

of 0.24 (SD 0.42) in El-Gomrok District centre. Percentage of antibiotics prescribed from the “Access” group categorization of WHO met the WHO criteria of the optimal value (Optimal value ≥ 60%), while “Watch” group antibiotics were prescribed in lesser percentage of patients and also met the WHO criteria (optimal value of “Watch” and “Reserve” groups together is ≤ 40%). No antibiotics were prescribed from “Reserve” and

“Not recommended” groups in both centers. Days of treatment (DOTs) was higher in East District

centre than El-Gomrok District centre (977 days, 586 days, respectively).

Table (4): Distribution of prescriptions according to the WHO AWaRe antibiotic groups, estimated by antibiotic encounters and days of treatment (DOTs) in the two primary healthcare centers in Alexandria, 2023

Antibiotic encounters ^a	East District Center (n=175)		El- Gomrok District Center (n=119)		Optimal level (WHO criteria)
	No.	%	No.	%	
Access group	150	85.71	109	91.60	≥ 60%
Watch group	25	14.29	10	8.40	≤ 40% (Watch +Reserve)
Reserve group	0	0	0	0	
Not recommended	0	0	0	0	
Average number of antibiotics per prescription Mean ± SD	0.16 ± 0.21		0.24 ± 0.42		
DOTs	Days	%	Days	%	
Access group	880	90.07	541	92.32	
Watch group	97	9.93	45	7.68	
Reserve group	0	0	0	0	
Not recommended	0	0	0	0	
Total	977 days		586 days		

^a% calculated from prescriptions with antibiotics, SD: standard deviation

DISCUSSION

The appropriate use of medicines is a critical component of providing high-quality medical care and health services to patients and communities. (8) Irrational medication use is a major issue on a global scale. The excessive, insufficient, or improper utilization of medications leads to the squandering of limited resources and extensive health risks. (1) The results showed that all prescribing indicators, except average number of drugs per prescription and percentage of prescriptions containing injections, were within the optimal percentage according to WHO reference values in both centres. Almost all prescriptions were prescribed by generic name and from EDL in both centres. The highest number of antibiotics consumptions was from “Access group” in both centers.

Results of the present study revealed that the average number of drugs per encounter is 2.5 ± 1.08 which is higher than the WHO optimal value (≤ 2 , 1.6–1.8). Besides, 17.3% of prescriptions contained four or more drugs. This result is almost the same as the study conducted in PHC facilities in Alexandria, Egypt in 2013 (2.5 ± 0.8). (15) This may be interpreted by a tendency of family physicians in PHCs to overprescribe or by characteristics of patient population in PHCs (around half of the sampled population in both centers are 50 years or more, table 1). These results were similar to the results documented in a study in public health centers of Dessie, North-East Ethiopia where the average number of drugs per prescription were 2.1, (21) in PHC centers in Surabaya, East Java, Indonesia (2.21), (22) and in emergency department of a public hospital in Pakistan

(2.3). (23) Other studies reported a lower number of drugs per encounter, for example, 1.76 in community pharmacies, Eritrea, (24) and 1.9 in urban and rural PHC settings, Mansoura, Dakahlia Governorate, Egypt. (25) On the other hand, a study conducted at PHC centers in Bahawalpur, Pakistan (2016) demonstrated higher results (3.4). (18) In addition, Uganda, (26) Nigeria, (27) and Tanta (Egypt) (28) reported higher drugs per encounter (3.2, 2.8 and 3.14, respectively). Research shows that a higher number of medications prescribed can increase the likelihood of drug interactions, adverse drug reactions, and greater healthcare expenses. (29)

In the current study, almost all drugs were prescribed by the generic name and from the EDL (99.7% and 99.4%, respectively). This result is similar to the result of the study conducted at PHCs in Alexandria, Egypt in 2013 where 95.4% of prescriptions were prescribed by the generic name and from the EDL. (15) On the contrary, only 51.9% of PHC facilities in Mansoura governorate, Egypt (2023), prescribed medications by generic names (72). In Tanta, Egypt (2017), 50% of prescriptions in PHC centers were in generic names. (28) In PHC settings in Alexandria governorate, there is local policies that enforce physicians to use the generic names in prescribing. As a safety measure for patients, the WHO strongly advises prescription drugs by their generic names since this makes it easier for healthcare providers to communicate with one another, clearly identify the drug, and exchange information. (30) This highlights the importance of unifying this policy throughout PHC facilities in Egypt so that other governorates achieve the same percentage of generic prescription as PHC facilities in Alexandria. One

study conducted at PHC centers in Indonesia (2024) revealed similar result to current study. ⁽²²⁾ Percentage of drugs prescribed by generic name was 99.6 % and drugs prescribed from the Indonesian National EDL was 76.8 %. ⁽²²⁾ On the contrary, a study in PHC facilities in three districts in Libya (2022) revealed different result to the present study. Only 28.6% of drugs prescribed by their generic name and 82.8% were retrieved from the EDL. ⁽³¹⁾

Percentage of prescriptions containing antibiotics in the current study is 19.8%, which is almost half that of a study conducted at PHC centers in Alexandria, Egypt in 2013 (39.2%). ⁽¹⁵⁾ Both centres in the present study were within the optimal level of WHO antibiotic prescription indicator ($\leq 30\%$). El- Gomrok District center had higher antibiotic prescription compared to East District center (24.3%, 15.3%, respectively). This can be attributed to differences in patient population. In a study conducted in PHC facilities in Mansoura (2023),⁽²⁵⁾ and Tanta in Egypt (2017), ⁽²⁸⁾ 40.9 % and 31.9 % of prescriptions contained antibiotics, respectively. This improvement in the percentage of prescription of antibiotics can be attributed to the policies in PHC facilities in Alexandria governorate, Egypt limiting their prescription. Several studied in PHC facilities in other developing countries revealed higher results than current study. ^(19,21,31,32) Percentages of prescriptions containing antibiotics were 44% in Ethiopia, ⁽²¹⁾ 54.71% in Sudan, ⁽³²⁾ 30.45 in Libya, ⁽³¹⁾ 32.2 % in Saudi Arabia, ⁽¹⁹⁾ and 52.1% in Iran. ⁽²⁰⁾ However, a study conducted in PHC centers in Indonesia reported lower result than current study (15.7%). ⁽²²⁾

Average percentage of prescriptions containing injections in the current study was 12.1% which is slightly higher than optimal value recommended by WHO (10%) (Table 2). East District center had a higher percentage compared to El-Gomrok District center (19.5%, 4.7%, respectively). Due to the higher cost of the medications, using injections excessively when oral therapy may be more suitable is an irrational use of drugs. Furthermore, using non-sterile injections can spread blood-borne illnesses like hepatitis and HIV/AIDS. In countries where chronic HCV viral infection is endemic, this problem is crucial. ^(1, 25, 28) Two studies conducted at PHC facilities in Alexandria and Tanta, Egypt revealed lower result than the current study (9.9%, 5.23%, respectively), ^(15, 28) while a recent study in Mansoura, Egypt (2023) reported extremely higher result (46.7%). ⁽²⁵⁾ Studies in Sudan, ⁽³²⁾ Libya, ⁽³¹⁾ and Ethiopia ⁽²¹⁾ revealed nearly similar results to the present study (12.84%, 10.5%,13.9%, respectively). Mean rate of injection prescribing was extremely lower than present study in PHC centers of Saudi Arabia (2%), ⁽¹⁹⁾ and Indonesia (1.67%) ⁽²²⁾.

El-Gomrok District center recorded an IRDP of 4.93 compared to optimal level of 5 and ranked first among the two PHC centers in the study. In contrast, the East District center had an IRDP of 4.21, placing it second. This indicates more rational drug prescribing in El-Gomrok District center. The Indices of IRDP in both centers were comparable to those documented in various studies. The IRDP in a study conducted in Saudi Arabi among 10 PHC centers ranged from 4.37 to 5.00. ⁽¹⁹⁾ In a study conducted among 10 PHC centers in Alexandria, Egypt in 2013, the IRDP ranged from 3.92 to 4.88. ⁽¹⁵⁾ In Pakistan, the IRDP ranged from 3.38 to 4.27 in 10 PHC centers in Bahawalpur district. ⁽¹⁸⁾ Several studies reported lower IRDP than the current study. The overall IRDP was 3.91 in Lybia, ⁽³¹⁾ 3.39 in Sudan, ⁽³²⁾ 3.70 in Iran, ⁽²⁰⁾ and 3.32 in china. ⁽¹⁶⁾

The higher IRDP indices in the PHC centers in the current study reflects optimum prescription indicators. This indicates clear and strict drug use policies applied in the two PHC centers. El-Gomrok District center had IRDP higher than East District center. This can be interpreted by the higher safe injection index in El-Gomrok District center compared by East District center (1,0.51, respectively). This could be explained by the difference in patient case mix between centers or it can be interpreted by the irrational prescription of injections in East District center. Non-polypharmacy index was the second lowest index of rational prescribing indices and was the second reason for difference in IRDP between the two centers. Non polypharmacy was more evident in El-Gomrok District center compared to East District center (0.94, 0.71, respectively). Polypharmacy may result in an increase in adverse drug effects, reduced patient satisfaction, and increased risk of drug interactions. This can lead to prolonged therapy or discontinuation of treatment. ⁽¹⁸⁾ The average number of medications per prescription is influenced by severity of illnesses, absence of clinical practice guidelines, financial motivation for prescribers, inadequate training and ongoing medical education for health professionals, incompetence of physicians, and cultural factors. ⁽³³⁾

Regarding WHO AWaRe classification of antibiotics, 85.71% and 91.60% of the prescriptions in East District centre and El-Gomrok District center, respectively belonged to the "Access group" of antibiotics and the complementary percentage from the "Watch group" (14.29%, 8.40%, respectively) with no antibiotics from the "Reserve" or the "Not recommended group". This result was much more favourable than the results in other countries. This study was carried out in PHC facilities, while the settings of the other studies were hospitals or community pharmacies, reflecting difference in

severity of cases and organizational structure. In a study conducted among 7 community pharmacies in Ethiopia (2022), the antibiotics prescribed from “Access” group were 55.3%, 43.1% were prescribed from the “Watch” group and “Reserve” group covered 1.7%.⁽³⁴⁾ In six community pharmacies in Eritrea (2019), 71.9% of the antibiotics belonged to the “Access” group, 22.1% were in the “Watch” group and no antibiotics were from the “Reserve” group.⁽²⁴⁾ In 5 hospitals in Okinawa, Japan, 43.1% of 559 antibiotics were categorized as “Access” drugs, 54.4% were “Watch” drugs, and 2.1% were “Reserve” drugs.⁽³⁵⁾ A study conducted in teaching hospital of Faisalabad, Pakistan (2018) revealed that percentage of antibiotics prescribed from the “Access” group amounted to only 25%, while “Watch” group was predominantly prescribed in 72.5% patients and only 1.8% of antibiotics were from “Reserve” group.⁽³⁶⁾ Another study conducted in Shalamar Hospital Lahore, Pakistan (2021) reported that over 50% of the antibiotics (54.9%) belonged to the “Access” category while no antibiotics were prescribed from the “Reserve” or “Not recommended” categories.⁽³⁷⁾

According to the WHO AWaRe framework for antibiotic stewardship, $\geq 60\%$ of prescribed antibiotics should belong to the “Access group” while $\leq 40\%$ belong to “Watch” and “Reserve” groups.^(13, 36) The findings of the current study revealed adherence to the criteria of antibiotic prescriptions. However, the percentage of antibiotics prescribed in “Access” group is much exceeded. This can be explained by the fact that antibiotics of “Watch” and “Reserve” groups were not available in the drug list in the pharmacies of both PHC facilities. Healthcare providers depend on “Access” group of antibiotics and limited prescriptions with “Watch” group of antibiotics. This is evident in DOTs of antibiotics which were 90.07 % and 92.32% for the “Access” group in East District and El-Gomrok District centres, respectively. The present study showed that total DOTs were 977 days in East District center and 586 days in El-Gomrok District center. In consistent with the current study results, a study conducted in Vitenam (2018) reported that the total DOTs with antibiotics was 5889, of which 3484 (59.2%) belonged to “Access” antibiotics, 2293 (38.9%) belonged to “Watch” antibiotics and 112 (1.9%) were “Not-recommended” antibiotics.⁽³⁸⁾

Limitations of the study

The current research was limited to only one month thus, we can't generalize the results all over the year. Also, two PHCs were sampled in two administrative, out of seven, regions in Alexandria governorate. Thus, the results cannot be generalized to all centers in Alexandria.

CONCLUSION AND RECOMMENDATIONS

All WHO drug prescribing indicators, except average number of drugs per prescription and percentage of prescriptions containing injections were within the optimal value set by WHO in East District and El-Gomrok PHC centers. El-Gomrok District center demonstrated higher performance regarding rational drug use. East District and El-Gomrok centers demonstrated adherence to the criteria of AWaRe antibiotic classification.

It is recommended that healthcare providers in PHC facilities should perform frequent monitoring across time and make trend analysis to ensure that data and indicators will stay on their optimal levels. It is important to provide training to family physicians so that they can prescribe medications in line with established guidelines. This approach will lead to a decrease in the total number of medications prescribed, which will further diminish the chances of drug-related health hazards. Additionally, family physicians should be educated about the risks of polypharmacy and overuse of injections. Similar research will be needed on other administrative regions in Alexandria to be able to generalize the results to all PHC facilities in Alexandria governorate.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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