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ORIGINAL RESEARCH ARTICLE

Prescribing Pattern and Associated Factors in Community Pharmacies: A Cross-Sectional Study Using AWaRe Classification and WHO Antibiotic Prescribing Indicators in Dire Dawa, Ethiopia

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Abstract

Background Antimicrobials are drugs that are more likely to trigger the development of resistance naturally. Thus, they need to be prescribed, dispensed, and administered with greater caution. To underline the significance of their proper usage, antibiotics are divided as AWaRe: Access, Watch, and Reserve. Timely evidence on medicine use, prescribing patterns, and the factors affecting prescribing of antibiotic and their use percentage from AWaRe classification would help decision-makers to draft guidelines that can enable more rational use of medicines.

Methods Prospective and cross-sectional study was conducted among seven community pharmacies in Dire Dawa to assess current prescribing practices related World Health Organization (WHO) indicators and AWaRe classification including antibiotic use and associated factors. Using stratified random sampling techniques, 1200 encounters were reviewed between 1 October and 31 October 2022, and SPSS version 27 was used for the analysis.

Results The average of medications per prescription was 1.96. Antibiotics were included in 47.8% of encounters, while 43.1% were prescribed from the Watch groups. In 13.5% of the encounters, injections were administered. In multivariate models, patient age, gender, and the number of medications prescribed were significantly associated to prescription of antibiotics. Antibiotics were about 2.5 times more likely to be prescribed to patients under the age of 18 years than to subjects 65 years and older [adjusted odds ratio (AOR): 2.51, 95% confidence interval (CI): 1.88–5.42; $P < 0.001$]. Men were also more likely than women to receive an antibiotic prescription (AOR: 1.74, 95% CI: 1.18–2.33; $P = 0.011$). Subjects who received more than two drugs were 2.96 times more likely to receive an antibiotic drug (AOR: 2.96, 95% CI: 1.77–6.55; $P < 0.003$). The probability of prescribing antibiotics was increased by 2.57 for every one-unit increase in the number of medications [crude odds ratio (OR): 2.57; 95% CI: 2.16–3.47; $P < 0.002$].

Conclusion According to the present study, the amount of prescriptions with antibiotics at community pharmacies is much higher than the WHO standard (20–26.2%). The antibiotics prescribed from Access group were 55.3%, which is slightly lower than WHO recommended level (60%). The prescribing of antibiotics was significantly correlated to the patient's age, gender, and number of medications.

The preprint version of the present study is available on Research Square with the following link: https://doi.org/10.21203/rs.3.rs-2547932/v1.

1 Background

Rational use of medications is defined by the World Health Organization (WHO) as providing the appropriate medication to the appropriate patient at the appropriate dose for the appropriate length of time and at the least expense possible to community [1, 2]. The use of medications in a way that is inconsistent with rational drug use is referred to as irrational use. It is frequently described in terms of polypharmacy, inappropriate antibiotic usage, excessive injectable

Key Points

1. The result of this study indicates that the trend of antibiotics prescribing and use patterns at community pharmacies deviates from the WHO's recommended standards.
2. The prescribing pattern of antibiotics by AWaRe classification in community pharmacies shows access groups are less than 60% of the WHO recommended level.
3. Antibiotic prescriptions were significantly associated with the patient age, gender, and quantity of drugs prescribed.

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use, noncompliance with clinical prescription recommendations, and inappropriate self-medication, frequently including prescription-only drugs [3, 4]. Medicines have a crucial role in both the prevention and treatment of disease, and they significantly contribute to human health and well-being [5]. By 2023, the global cost of pharmaceuticals is anticipated to surpass $1.5 trillion [6].

Recently, up to 50% of prescribed medications are incorrectly supplied or administered [7, 8]. Furthermore, numerous studies have supported the link between growing antibiotic overuse and the creation and spread of bacteria that are resistant to treatment [7–15]. The availability, equal access, and appropriate or sensible use of critical medications at an affordable price are very difficult to achieve globally, especially in low- and middle-income nations, due to the rare nature of a resource related to income needed to buy and use medication as per guidelines. Hence, the spending on drugs is related to the number of individuals per capita [8, 16, 17].

The WHO claims that antibiotic resistance is a serious public health issue that needs immediate response. The fact that antimicrobial resistance (AMR) is currently thought to be a factor in more than 700,000 deaths annually and that it is anticipated to claim 10 million lives and cost $100 trillion by 2050 is not surprising [18, 19]. Conscious antibiotic use in the ambulatory setting contributes to the rational use of antibiotics generally since community-based antibiotic use represents a sizable portion of overall antibiotic use [20].

The WHO expert committee on the selection and use of essential medicines created the new classification of antibiotics in 2017 to underline the significance of their proper usage. The classification is termed as AWaRe, in which the antibiotics are divided into three categories—Access, Watch, and Reserve—as a tool to enhance antibiotic stewardship activities at the local, national, and global levels [21, 22]. These categories take into account the effects of various antibiotics and antibiotic classes on antimicrobial resistance [23]. According to this classification, antibiotics have been classified into three groups based on whether they need to be generally accessed, carefully watched, or only reserved for special situations [24]. A country-level goal of using Access-group antibiotics for at least 60% of all antibiotic usage is included in the WHO recommendations [23]. The new 2021 categorization was employed in the current investigation. A total of 258 antibiotics are included in the 2021 update of the AWaRe classification, up from 78 previously unclassified medications.

At different points in the drug use cycle, a variety of circumstances can promote irrational pharmaceutical usage. The most significant ones include lack of prescription control and regulation, unrestricted access to medications, procurement and distribution of medications not based on the Essential Medicines List (EML), financial incentives from pharmaceutical companies, inappropriate medication promotion, skewed information, and lack of appropriate knowledge and skills on the part of patients and providers [15, 25, 26].

Low and middle income countries (LMIC) struggle with an increased prevalence of infectious diseases, a scarcity of medicines, and a paucity of qualified medical personnel. When there is a lack of medications, doctors are more inclined to make illogical prescriptions [27, 28]. Low-income nations have greater rates of antimicrobial resistance than high-income nations, and developing nations have higher rates of irrational medication usage than the developed world [8, 29–31]. To assess the use of antibiotics in healthcare institutions, WHO and the International Network of Rational Medicine Use (INRMU) have developed a set of indicators. Prescription indicators, facility indicators, and patient care indicators make up the three key indicators. To support the implementation of Antibiotic Stewardship Program (ASP) in healthcare settings including communities pharmacies, these indicators could be utilized as standards [31–33].

The main causes of the irrational use of medicine are also likely to alter over time; therefore, policymakers must stay informed of the most recent developments [13, 25]. For any involved stakeholders to take the necessary action, a frequent and timely examination of the prescribing pattern of medicines as part of rational usage is essential. There is insufficient recent evidence of prescribing pattern in community pharmacies at Dire Dawa. Although a study on Ethiopian public facilities shows a problem in the prescribing pattern and the AWaRe percentages, extrapolating the evidence to community pharmacies may not be possible due to coverage and service level difference [3, 5, 34–39].

Furthermore, the present study was aimed at evaluating the community pharmacies' prescribing patterns using AWaRe classification and WHO prescribing indicators with their associated factors in a cross-sectional design at Dire Dawa, Ethiopia, and it may help to promote a better prescribing habit from the public and private health facilities to community pharmacies by providing important, timely information for all interested stakeholders.

2 Methods

2.1 Study Design

A descriptive, cross-sectional study was conducted prospectively in community pharmacies at Dire Dawa using a quantitative approach to assess prescribing pattern and factors associated with antibiotic prescribing by AWaRe classification and antibiotics prescribing indicators.

2.2 Study Setting and Period

The study was conducted in community pharmacies in the Dire Dawa City Administration from 1 October to 31 October 2022. Dire Dawa is one of the two chartered cities in Ethiopia (the other being the capital, Addis Ababa) with a population of 521,000. The administrative council consists of the city of Dire Dawa and the surrounding rural areas. The council has no administrative zones but has functional woredas (districts) for health-related activities. It is found at a road distance of 515 km from Addis Ababa. The city has a total of 2 public hospitals, 5 private hospitals, 15 health centers, 16 different level clinics, 31 community pharmacies, and 13 drug shops [38]. Nine community pharmacies representing the majority of the population were chosen for the study using the cluster sampling method based on their functional locations, or woredas. The majority of patients who cannot find their medicines inside the outpatient pharmacy departments of hospitals or health centers get their medicines from these community pharmacies. A "prescriber" in the context of the study and this article primarily refers to medical doctors, nurses, health officers, midwives, and psychiatric nurses who may prescribe depending on the setting and their profession.

2.3 Sample Size and Sampling Technique

The WHO recommends including at least 600 encounters when examining a facility's present prescribing practices. The selection was done with a stratified random sample. The community pharmacies were categorized as strata, which was based on each functional district of the city administration. Random sampling was applied systematically within strata. Due to high service level, 1200 encounters were selected and then distributed proportionately. The total number of prescriptions from the community pharmacies in the study period was 27,920. Then, it was divided into 1200, and the 23rd prescription was chosen, and if the chosen prescription did not fulfill the inclusion criteria, the process continued to make the necessary number of samples.

2.4 Selection Criteria

The study only included prescriptions that contained at least one medicine; those that simply contained medical supplies or had illegible handwriting were disregarded from the inclusion. Eliminating prescriptions that were difficult to read helped to guarantee that only correct and trustworthy data were used in the assessment.

2.5 Data Collection Procedure

Three health professionals used prescription assessments to prospectively collect data. Data was collected from each prescription sent to community pharmacies per patient during the study period. The WHO standard prescription indicator collecting form was then filled out with all the information needed to measure the prescription indicators. A previously established definition by the WHO was used to avoid ambiguities in the terminologies [2, 3]. Data reliability was ensured by according to rules and procedures with a customized observational checklist that was prepared using prescribing manuals of the Ethiopian FDA and WHO [22, 40].

2.6 Data Quality Control

The principal investigators trained data collectors and supervisors, and the data collection checklist was pretested at a community pharmacy not in study before the actual data collection began. Data cleaning includes removal of prescriptions with only medical supplies and illegible hand writing. Following pilot results, necessary changes were made. Data were cleaned on a daily basis to remove inconsistencies and missing values.

2.7 Data Processing and Statistical Analysis

For statistical analysis, the gathered data were imported into the Census and Survey Processing System, CSPro version 7.7.0, and exported to SPSS version 27. To create descriptive summaries of the sociodemographic data, the mean and standard deviation were employed. The logistic regression method was used to investigate the relationship between antibiotic prescribing and its predictive factors. The variables used for binary regression were also used for the bivariate analysis. To do the multivariate analysis, variables were categorized according to age, gender, and the number of drugs. In all logistic regression analyses, the odds ratio with a 95% confidence interval was shown. P-values < 0.05 were considered significant in the study's analyses.

3 Results

3.1 Sociodemographic Information

In terms of encounters per patient, a total of 1200 were included in the study, of which 54.7% of the patients were female and 45.3% were male with a median age of 29 years and 5 months [interquartile range (IQR): 40 years]. The age classification was based on the children and adults level by using $\leq$ 18, 19–64, and $\geq$ 65 years of age. The majority of

patients, 737 (61.4%), were in the adult classification range. There was no age description written on 7.5% the prescriptions (Table 1).

3.2 Drug-Related Information

There were a total of 2354 individual drugs prescribed, with an average of 1.96 (0.32) medicines per prescription. The vast majority of medicines prescribed (99.2%) were on the Ethiopian essential medicine list. A large proportion of prescription papers contained one drug (31.5%), two drugs (38.4%), and three drugs (15.1%).

The use of standard prescriptions with an identification card number that is legally registered in Ministry of Health documentation of records among community pharmacies was 82.8%. The name (98.3%), gender (94%), and age (92.5%) of the patient were the most commonly recorded patient-related information, while the patient's weight (14.3%) and address (11.8%) were the least recorded patient-related information (Table 2).

The frequency of administration (96.1%), dose (85.5%), and method of medication administration (84.6%) were the most often listed drug-related details on prescriptions. The class of medications that were most frequently administered was antimicrobials (35.3%), followed by cardiovascular medications (24.1%) and analgesics (16.5%).

3.3 WHO Prescribing Indicators

The assessment of prescribing pattern using the WHO prescribing indicators revealed that the percentage of encounters with antibiotics was 47.8% and the percentage of injectable was 13.5%. From injectable, analgesics were the most commonly prescribed, and ceftriaxone was the most common antibiotic prescribed as an injection. The percentage of drugs prescribed with a generic name was 87.3% and from the Ethiopian EML was 99.2%. The total number of antibiotics prescribed was 832 (35.3%) of all prescribed medications (Fig. 1).

Table 1 Sociodemographic characteristics of the study population in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

Patient characteristics	Frequency	Percent
Age (years)		
≤ 18	373	31.1%
19–64	566	47.2%
≥ 65	171	14.3%
Gender		
Male	511	45.3%
Female	617	54.7%

3.4 Healthcare-Professional-Related Information

From the 1200 encounters assessed, 934 (77.8%) contained the prescriber's name, while 997 (83.1%) contained the prescriber's signature. The dispensers' names were available in 416 (34.7%), and signatures were available in 752 (62.7%) prescription papers (Fig. 2).

3.5 AWaRe Classification

Access groups cover 55.3% of prescribed medications, Watch groups cover 43.1%, and Reserve groups cover 1.7%. Amoxicillin (47.2%), amoxicillin–clavulanic acid (13.3%), and metronidazole (10.7%) were the most regularly administered antibiotics from Access group, whereas ciprofloxacin (54.2%) and ceftriaxone (34.4%) were the most commonly prescribed antibiotics from Watch group. Two medications, meropenem and vancomycin, that were observed in the prescriptions were classified as Reserve group (Table 3).

3.6 Antibiotic Prescribing Predictors

Age ($P < 0.001$), gender ($P < 0.003$), and number of medications ($P = 0.011$) were significant predictors of antibiotic prescribing, according to bivariate analysis of the significance of each variable effect. Antibiotic prescriptions were 2.5 times more likely to be given to people under the age of 18 years than to people 65 years and older (AOR: 2.51, CI: 1.88–5.42). Similarly, men received antibiotic prescriptions more frequently than women (AOR: 1.74; CI: 1.18–2.33). Patients who took three or more medications were prescribed 3 times as many antibiotics as those who only received one or two medications (AOR: 2.96, CI: 1.77–6.55) (Table 4).

A model fitness test was performed to confirm its suitability, and the analysis model containing all predictors was found to be statistically significant [χ^2 (5, $N = 1200$) = 63.291, $P < 0.001$], which indicated that the model was able to distinguish between the respondents who had been prescribed antibiotics and those who had not. Hosmer and Lemeshow's test supported the model's fitness [$\chi^2 = 12.523$, degrees of freedom (df) = 7, $P = 0.572$]. The model successfully identified 73.3% of those who got an antibiotic prescription and explained between 55.3% (Cox and Snell R squared) and 76.6% (Nagelkerke R squared) of the variance in antibiotic prescriptions.

The model's sensitivity test revealed that it properly recognized 64.2% of the group with an antibiotic prescription, and the specificity was 69.8%. After correcting for relevant confounders with multivariate logistic regression, age ($P < 0.001$), gender ($P = 0.011$), and number of drugs prescribed ($P < 0.017$) remained substantially linked with antibiotic prescribing (Table 5). With an increase in the number of drugs prescribed, there is a significant rise in

Table 2 Patient- and drug-related information on the prescriptions in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

Patient-related information ($N = 1200$)			Number of drugs per prescription ($N = 1200$)		
Information	Encounter	Percentage	Information	Encounter	Percentage
Standard prescription	994	82.8%	One	378	31.5%
Date	630	52.5%	Two	461	38.4%
Name	1179	98.3%	Three	181	15.1%
Age	1110	92.5%	Four	134	11.2%
Gender	1128	94%	Five and above	46	3.8%
Weight	171	14.3%	Average number of drugs per encounter (1.96 ± 0.32)		
Address	142	11.8%			
Diagnosis	582	48.5%			
Drug-related information on prescription ($N = 2354$)			Class of drugs prescribed ($N = 2354$)		
Dose	2012	85.5%	Antimicrobials	832	35.3%
Strength	348	14.8%	Analgesics	568	24.1%
Dosage form	447	18.9%	Cardiovascular	319	13.6%
Route	1992	84.6%	GI drugs	207	8.8%
Frequency	2262	96.1%	Vitamins	183	7.8%
Duration	1769	75.2%	Antidiabetics	94	3.9%
Quantity	602	25.6%	Others	151	6.4%

GI gastrointestinal, *N* number of encounters and drugs prescribed

antibiotic prescribing ($P < 0.002$). For every unit increase in the number of drugs provided, the probabilities of prescribing antibiotics increased by 2.57 units (crude OR: 2.57; 95% CI: 2.16–3.47).

4 Discussion

4.1 Prescribing Pattern Indicators

In the current study, the patient's name, age, and gender were mentioned in more than 89% of the prescription papers included in the study. It is expected that all prescription papers should bear all these components for rational dispensing, but these variables were not mentioned in a complete way in the study of the prescription papers. The percentage of prescription papers on which the date was written was 81.2%; when compared with studies done in Ethiopia and other parts of the world, this was relatively higher than some findings [42–44], which were 73.9–77.3%, lower than findings from some previous similar studies [45, 46], which were 83.1–93.5%, and comparable to the study done by Gashaw et al. [47], which was 81.3%.

To underline the significance of their proper usage, antibiotics are divided into three categories—Access, Watch, and Reserve—as per WHO Expert Committee on the Selection and Use of Essential Medicines [21, 22]. These categories take into account the effects of various antibiotics and antibiotic classes on antimicrobial resistance. A total of 258 antibiotics are included in the 2021 update of the AWaRe classification, up from 78 previously unclassified medications. Hence, it is a helpful instrument for keeping tabs on antibiotic usage, setting goals, and assessing the results of stewardship programs that are intended to maximize antibiotic use and reduce antimicrobial resistance. In the present study, 55.3% of the antibiotics prescribed were from the Access group, which is lower than the study carried out in Eritrea, which was 71.9% [12]. In addition, 43.1% of the antibiotics were in the Watch group, and 1.68% were in the Reserve group. The Reserve group drugs were specifically vancomycin and meropenem. The result of this study is higher than the Watch group and Reserve group percentages in the aforementioned study [12], which were 22.1% and 0%, respectively. From all medications used in the Watch category, 54.2% were ciprofloxacin, while 34.4% were ceftriaxone. This drugs use must therefore be closely monitored both in the community and in public facilities.

All prescription papers needs to have a date on them for both retrieval and legal reasons. In this study, 98.3% of the prescription papers contained the patient's name, which is greater than the results from comparable studies carried out in Dessie, Harar, and Jimma, Ethiopia, which reported 94.7%, 93.3%, and 93.9%, respectively [46–48]. It falls short of research done in Gondar and Dilla, Ethiopia, where the results were 99.8% and 99.7%, respectively [42, 45]. To identify patients during the dispensing process, prescribers should be aware of the significance of writing the patient's name on each and every prescription paper. The percentage of prescription papers with age of patients written in the

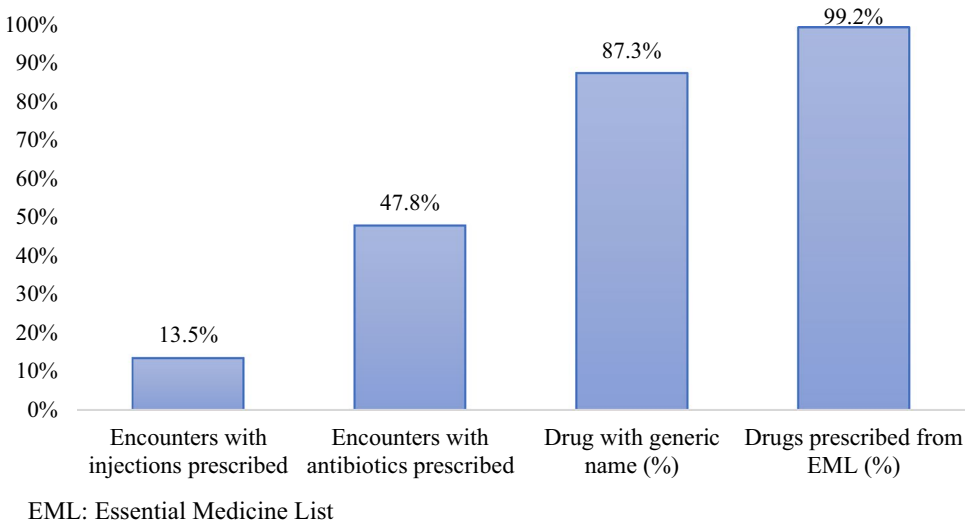

Fig. 1 Percentages for prescribing indicators in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

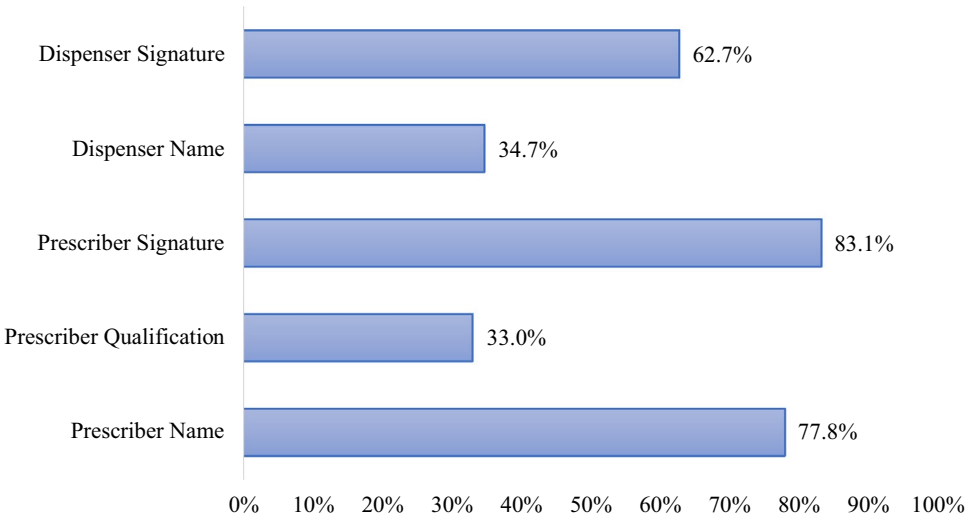

Fig. 2 Information on prescribers and dispensers in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

current study was 92.4%, which is consistent with a study conducted in Bahir Dar and Dessie, Ethiopia, where 92.6% and 93.5% were reported [43, 46]. The result is lower than previous studies conducted in Mekelle (96.7%) [37] and Dilla (95.4%) [45], and greater than study findings from Gondar (86.6%) [42], Khartoum (78.0%) [49], and Western India (74.6%) [50]. Age has a key role in dosage estimations and the selection of appropriate dosage forms, especially for the pediatric population. About 89.9% of prescription papers in the current study have gender indicated; this result was greater than that of similar studies done India (72.4%) [50], Gondar (64.6%) [42], Eastern Ethiopia (67.9%) [47], and lower than that of similar studies done in Ethiopia: Bahir Dar (92.1%) [43], Dilla (99.6%) [45] and Dessie (95%) [46]. If prescribers fail to include diagnoses on prescription documents, pharmacy staff will be unable to analyze prescription orders. Therefore, to promote the best possible treatment results for patients, they should include diagnoses on every single prescription paper.

Drug doses were recorded on 85.5% of prescription papers, which is greater than many findings from studies performed similarly in Ethiopia, Sudan, and India, which indicated a range between 27.4% and 82.9%, but lower than those from Dilla and Jimma, whose results were 94.9% and 89.8%, respectively [42–44, 46, 47, 49, 51]. The type of dosage form was disclosed on 437 (18.9%) prescription papers, which is comparable with research from Dessie (17.6%) and Mizan, Ethiopia (17.9%) [46, 51]. The result, however, is lower than that of the study conducted in Harar (32.7%) and higher than those from Bahir Dar (8.3%) and Jimma (11.45%) in Ethiopia [44, 47, 48]. The method of drug administration was noted on 84.6% of prescription papers in the current study, which is roughly equivalent to

Table 3 Classification of the antibiotics types using the AWaRe methodology [41] in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

AWaRe classification					
Access % ($N = 460$)		Watch % ($N = 358$)		Reserve % ($N = 14$)	
Amoxicillin	47.2%	Ciprofloxacin	54.2%	Vancomycin	78.6%
Amoxicillin/clavulanic acid	13.3%	Ceftriaxone	34.4%	Meropenem	21.4%
Metronidazole	10.7%	Clarithromycin	5.9%		
Cloxacillin	8.3%	Cefepime	3.1%		
Doxycycline	6.7%	Ceftazidime	2.5%		
Tinidazole	5.0%				
Others*	4.6%				
Gentamicin	2.0%				
Norfloxacin	1.5%				
Cotrimoxazole	0.9%				

*Sulfadiazine, nitrofurantoin, cefazolin, and ampicillin

findings from Harar (81.8%) [47] and Dessie (82.2%) [46] in Ethiopia, but less than previous studies of a comparable studies that reported between 88.1% and 93.1% [45, 48, 51].

The frequency of drug administration was disclosed on prescription papers in about 96.1% of encounters, which is greater than the percentage reported in other research of a similar nature done in various regions of Ethiopia, which ranged from 6.4% to 93.3% [42–48, 52]. The proportion of prescription papers that specified the length of the therapy was 75.2%, which is comparable to findings from a study in Bahir Dar (74.61%) [43], but lower than those studies done in Dessie (80.1%) and Gondar (82%), Ethiopia [42, 46]. However, compared with other research findings, which range from 20% to 74.6%, this figure is higher [44, 45, 47, 50, 51]. Prescribers should be curious enough to write an entire pharmacotherapy regimen so that pharmacy professionals can assess the appropriateness of therapeutic orders. As a result, optimal therapeutic patient outcomes are significantly influenced.

In the current study, some reasons why prescribers might not have written every part of a typical prescription order may include patient load, a failure to see the value of doing so, neglect, and/or the lack of a measuring device nearby. Even though each element of a prescription paper might not have the same function, it is still a professional necessity to write down every single piece of information. To ensure the accuracy of every prescription paper, all stakeholders, including pharmacy staff, should be included, in addition to the prescriber's own obligation.

For the 1200 patients with prescriptions that visited the community pharmacy in Dire Dawa as part of the current study, a total of 2354 individual medications were prescribed, resulting in an average of 1.96 prescriptions prescribed each encounter, which is slightly higher than the WHO standard (1.6–1.8) [2], as well as results from the comparable investigations carried out across Ethiopia, which revealed an average of 1.64–1.90 medications per encounter [1, 36, 42–45, 53, 54]. However, compared with several other study results from Ethiopia, Sudan, India, and Saudi Arabia, which found an average value of 2.02–4.2 medicines per encounter, this number is lower [31, 32, 46, 47, 49, 50, 55–65]. Prescribers should restrict medicine prescriptions to only those that are absolutely essential

Table 4 Predictors of antibiotics prescribing in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

Variables	Antibiotic prescribed				Bivariate analysis	
	No	Percent	Yes	Percent	COR (95% CI)	*P*-value
Age (years)						< 0.001
≤ 18	146	25.7%	206	36.8%	2.22 (1.54–5.20)	< 0.001
19–64	321	56.4%	282	50.5%	1.01 (0.54–1.46)	0.645
≥ 65	102	17.9%	71	12.7%	Ref.	
Gender						
Male	227	42.7%	284	47.6%	1.96 (1.27–2.78)	0.003
Female	305	57.3%	312	52.4%	Ref.	
Number of medication prescribed						0.011
One	265	42.3%	113	19.7%	Ref.	
Two	273	43.6%	188	32.8%	0.69 (0.24–1.23)	0.132
Three	52	8.3%	129	22.5%	2.48 (0.39–24.21)	0.002
Four	32	5.1%	102	17.8%	3.25 (0.51–33.46)	0.002
Five or above	4	0.6%	42	7.3%	8.02 (0.79–46.84)	0.017

COR crude odds ratio; *CI* confidence interval

*$P < 0.05$ was considered significant

Table 5 Multivariate analysis of predictors of antibiotics in community pharmacies of Dire Dawa, Ethiopia, from 1 to 31 October 2022

Variable	Multivariate analysis	
	COR (95% CI)	*P*-value
Age (years)		< 0.001
≤ 18	2.51 (1.88–5.42)	< 0.001
19–64	1.23 (0.79–1.98)	0.442
≥ 65	Ref.	
Gender		
Male	1.74 (1.18–2.33)	0.011
Female	Ref.	
Number of medication prescribed		0.017
One/two	Ref.	
Three/four	2.96 (1.77–6.55)	0.003
Five or above	7.02 (0.98–37.56)	0.112

COR crude odd ratio; *CI* confidence interval

*$P < 0.05$ was considered significant

because polypharmacy can expose patients to unfavorable drug effects and raise patient costs.

There could be a number of causes for the high prescription rate for antibiotics. The high level of routine empirical treatments observed in resource-poor nations is primarily a result of the increased occurrence of infectious diseases in developing countries, which increases the number of antibiotics prescribed. The other factor can be patient pressure on doctors. Antibiotic self-medication was reported to be 44–45.1% common in Ethiopia and Eritrea, according to several studies and a comprehensive review [12, 66, 67]. This finding may indicate that patients are more likely to directly or indirectly request antibiotic prescriptions from doctors, as they are heavily involved in self-medicating with antibiotics.

The percentage of encounters in this study when at least one antibiotic was prescribed was 47.8%, which is much higher than the WHO standard value of 20–26.2% [2] and indicates antibiotic misuse is there. This result is comparable with the result of Atif et al. (48.6%) [68]. Similar studies carried out in various nations indicated that a percentage of encounters with antibiotics were between 9.1% and 43%, which is less than the result reported by the current study [32, 42–44, 59, 62–64]. On the other hand, this result was lower than those of other comparable studies with 52.3–75.1% [1, 36, 45, 47, 49, 50, 53, 54, 57, 58, 60, 61, 68].

An urgent global issue that has an effect on, among other things, infection control efforts and the price of antimicrobial therapy is antimicrobial resistance, which is on the cusp of indiscriminate antibiotic prescribing practice. Overprescribing of this class of medication is discouraged. In the current study, 87.3% of the medications were prescribed by generic name, which is less than the WHO standard, which calls for all drug prescriptions to be written in generic names. This result is equivalent to that from Mengistu et al. [46] and is greater than several findings published from studies conducted in other nations [12, 32, 44, 45, 50, 57–59, 61–63, 68], while being lower than some other study findings from Ethiopia, Ghana, Iran, and Saudi Arabia [1, 36, 42, 43, 47, 53–55, 63].

When a certain brand of drug is not available, prescriptions written with the generic name enable dispensers to substitute therapeutic equivalents, and generic medications are less expensive, allowing broader market accessibility. Because a brand-name prescription could be expensive for the patient, health professionals are urged to recommend generic medicine names instead. Encounters with 13.5% of injectable were recorded in the current study, which is in line with the WHO standard (13.4–24.1%) [2]. In the current study, 99.2% of pharmaceuticals were prescribed from the nation's EML, which is slightly similar to WHO standard (100%).

4.2 Antibiotic Prescribing Predictors

This study found a strong correlation between the prescription of antibiotics and the patients' age, gender, and number of medications. Being under the age of 18 years has also been indicated to be highly related with antibiotic prescriptions. Therefore, as compared with other patient groups, patients under the age of 18 years got the majority of antibiotics. This result is comparable to studies done in Eritrea [12], Bangladesh [69], Yemen [70], and Cameroon [71]. This study found that men received antibiotics more frequently than women, which is comparable to studies from Bangladesh [69] and Ethiopia [72]. The result is in contrast to a study conducted in the UK [73], Cameroon [71], and Switzerland [74], which found a stronger correlation between female gender and the prescription of antibiotics. According to the current study, prescribing three or four drugs per prescription is significantly related to prescribing antibiotics.

The odds ratio of using an antibiotic increased by 2.57 for every increment in unit of medication This was consistent with research from Eritrea, which found that probabilities increased by 2.02 for every one-unit increase ($P < 0.001$; OR: 2.02; 95% CI: 1.62–2.52) [12], and Zambia, where it was shown that odds rise by 2.7 for every one-unit increase ($P < 0.001$; OR = 2.68, 95% CI: 2.20–3.25) [75]. Because the current study was cross-sectional, the results might not accurately reflect the seasonal variation in medication use. Furthermore, the study's findings could not be applicable to the entire country because they were based on the city of Dire Dawa. More study at the national level is necessary to get a complete picture of how medicines are used in the country.

5 Conclusion

The findings of the present investigation showed that the prescribing indicators in the public community pharmacy in Dire Dawa, Ethiopia, significantly deviated from the acceptable WHO standard for the prescription of antibiotics. In comparison to the WHO-recommended level (20–26.2%), 47.8% of prescriptions contained an antibiotic. Antibiotics prescribed from Watch group was 43.1%, which was proportionally high in percentage, while Access group accounts for 55.3%, which is slightly lower than the WHO recommended 60%. About 13.5% of the encounters contained an injection, which is within the range of 13.4–24.1% advised by the WHO. The average number of prescriptions per encounter and adherence to EML were just marginally below WHO-recommended levels. Antibiotic prescribing revealed a substantial correlation with patient age, gender, and the number of drugs per prescription. As a result, both prescribers and patients must consider antibiotic resistance and reasonable use, and additional research will be required to generalize the findings.

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Author Contributions BD, AW, and AM contributed to the original data and designed the study, BD and AM performed analysis and interpreted the data; BD and SY obtained the data; BD and AW wrote the first draft; BD, AW, AM, and SY critically reviewed and edited the manuscript for important intellectual content. BD oversaw the project. All authors read and approved the final version.

Declarations

Conflict of Interest BD, AW, AM, and SY declare that they have no potential conflicts of interest that might be relevant to the contents of this manuscript.

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