Prescribing pattern and associated factors in community pharmacies: A cross-sectional study using AWaRe classification and WHO antibiotic prescribing indicators at Dire Dawa, Ethiopia

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Abstract

**Background:** Antibiotics are more likely to trigger the development of antimicrobial resistance than other medications. Thus, they need to be prescribed, dispensed, and administered with greater caution. Timely evidence on medicine use, prescribing patterns, and the factors affecting the prescribing of an antibiotic would help decision-makers draft guidelines that would enable a more rational use of medicines.

**Methods:** Prospective and cross-sectional study was conducted in seven community pharmacies in Dire Dawa to assess current prescribing practices, including antibiotic use and associated factors. Using stratified random sampling techniques, 1200 encounters were reviewed between October 1 and October 31, 2022 and SPSS version 27 was used for descriptive statistics and logistic regression.

**Results:** The average medications per prescription was 1.96 and antibiotics were included in 47.83% of encounters while 43.03% were prescribed from Watch group. In 13.5% of the encounters, injections were administered. In multivariate models, patient age, gender, and the number of medications prescribed were all substantially related to the prescription of antibiotics. Antibiotics were about 2.5 times more likely to be prescribed to patients under the age of 18 than to subjects 65 and older (AOR: 2.51, 95% CI: 1.62-2.52; P <.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 those who received more than two drugs were 2.96 times more likely to receive an antibiotic (AOR: 2.96, 95%CI: 1.77–6.55; P = 0.003). The probabilities of prescribing antibiotics increased by 2.57 units for every unit increase in the number of medications (COR: 2.57; 95%CI: 2.16-3.47; P = 0.002).

**Conclusions:** According to this study, the amount of prescriptions with antibiotics at community pharmacies much higher than the WHO standard (20–26.2%). Additionally, 13.5% of encounters involved an injection, which is comparable to the World Health Organization standard of 13.4-24.1%. The prescribing of antibiotics was significantly correlated with the patient's age, gender, and number of medications.

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 at the least expensive possible to them and their 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 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\(^5\) and by 2023, the global cost of pharmaceuticals is anticipated to surpass $1.5 trillion\(^6\).
According to various research, up to 50% of prescribed medications are incorrectly supplied or administered. Furthermore, numerous studies have supported the link between growing antibiotic overuse and the creation and spread of bacteria that are resistant to treatment\textsuperscript{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\textsuperscript{13,16,17}.

One of the reasons contributing to the overuse of antibiotics has been identified as poor antibiotic prescribing, which includes prescribing an antibiotic when one is not necessary and delivering the incorrect antibiotic at the incorrect dose for the incorrect period. An important component in the global spread of antibiotic resistance is the improper use of antibiotics in primary care and hospital settings\textsuperscript{18}. The World Health Organization claims that antibiotic resistance is a serious public health issue that needs immediate response. The fact that antimicrobial resistance 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\textsuperscript{19,20}. Because community-based antibiotic usage is a significant component of overall antibiotic use, prudent antibiotic use in the ambulatory context aids in the rational use of antibiotics as a whole\textsuperscript{21}.

At different points in the drug use cycle, a variety of circumstances can promote irrational pharmaceutical usage. The most significant ones include lax prescription control and regulation, unrestricted access to medications, procurement and distribution of medications not based on an essential medicines list, financial incentives from pharmaceutical companies, inappropriate medication promotion, skewed information, and lack of appropriate knowledge and skills on the part of patients and providers\textsuperscript{15,22,23}.

Low-income nations 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. 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\textsuperscript{13,24–26}. In order to assess the use of antibiotics in healthcare institutions, WHO and the International Network of Rational Medicine Use have developed a set of indicators. Prescription indicators, facility indicators, and patient care indicators make up the three key indicators. In order to support the implementation of antibiotic stewardship programs (ASP) in various healthcare settings including community pharmacies as well, these indicators could be utilized as standards\textsuperscript{26–28}.

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\textsuperscript{11,22}. 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 studies on Ethiopian public facilities shows a problem in the prescribing pattern, extrapolating the evidence to community pharmacies may not be possible due to coverage and service level difference\textsuperscript{3,5,29–34}. So, this study was aimed at evaluating the community
pharmacies' prescribing patterns using WHO AWaRe classification and 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 within 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 Dire Dawa community pharmacies using a quantitative approach to assess prescribing pattern and factors associated with antibiotic prescribing using WHO 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 October 1 to October 31, 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 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. 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 World Health Organization 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." Random sampling was applied systematically within strata. Due to high service level 1200 prescriptions were then distributed proportionately. The anticipated 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 didn't fulfill the inclusion criteria the process continue to make the necessary number of samples.
2.4 Selection Criteria

Prescriptions containing at least one drug were included in the study, while those containing only medical supplies or with illegible handwriting were excluded from the assessment. This was done to ensure that only accurate and reliable data was included in the assessment; omitting illegible prescriptions prevented any misinterpretation of the data.

2.5 Data Collection

Three health professionals used prescription assessments to prospectively collect data. A 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 customized observational checklist that was prepared using prescribing manuals of the Ethiopian FDA and WHO\(^35,36\).

2.6 Data Quality Control

The principal investigators trained data collectors and supervisors, and the data collection checklist was pre-tested at other community pharmacy before the actual data collection began; those data were not used in the analysis. Following pilot results, necessary changes were made. Data was 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 double-entered on the Census and Survey Processing System (CSPro) version 7.7.3 and exported to SPSS version 27. Descriptive summaries of the socio-demographic variables were computed using the mean and standard deviation (SD) as appropriate. The logistic regression method was used to investigate the relationship between antibiotic prescribing and its predicting factors. In all logistic regression analyses, the odds ratio with a 95% confidence interval was reported. With p < 0.05, all analyses were considered significant.

3. Results

3.1 Socio-Demographic Information

A total of 1,200 prescription papers were included in the study, of which 54.70% were female and 45.30% were male with a median age of 29.4 (IQR: 40). The age classification was based the children, adult and elder age level by using \(\leq 18\), 19-64 and \(\geq 65\) years of age. The majority of prescription indicates adult
information’s with 566 (47.17%). There was no age description written on 7.5% the prescriptions (Table 1).

**Table 1:** Socio-demographic characteristics of the study population

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤18</td>
<td>373</td>
<td>31.08%</td>
</tr>
<tr>
<td>19–64</td>
<td>566</td>
<td>47.17%</td>
</tr>
<tr>
<td>≥65</td>
<td>171</td>
<td>14.25%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>511</td>
<td>45.30%</td>
</tr>
<tr>
<td>Female</td>
<td>617</td>
<td>54.70%</td>
</tr>
</tbody>
</table>

### 3.2 Drug-Related Information

There were a total of 2354 prescriptions, 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 contains one (31.5%), two drugs (38.4%), and three drugs (15.08%).

The use of standard prescriptions with an identification card number among community pharmacies was 82.8%. The name (98.25%), sex (94%), and age (92.5%) of the patient were the most commonly recorded patient-related information, while the patient's weight (14.25%) and address (11.83%) were the least recorded patient-related information (Table 2).

The frequency of administration (96.09%), dose (85.47%), and method of medication administration (84.62%) were the most often listed drug-related details on prescriptions. The class of medications that were most frequently administered was antimicrobials (35.34%), followed by cardiovascular medications (24.12%) and analgesics (16.52%).

### 3.3 WHO Prescribing Indicators

The assessment of prescribing pattern using the prescribing indicators revealed that the percentage of encounters with antibiotics was 47.83% and the percentage of injectables was 13.50%. In terms of
injectables, 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 87.34%, and those from the Ethiopian Essential Medicine List were 99.19%. The total number of antibiotics prescribed was 832 (35.3%) of all prescribed medications (Figure 1).

Table 2: Patient and drug related information on the prescriptions

<table>
<thead>
<tr>
<th>Patient related information (N = 1200)</th>
<th>Number of drugs per prescription (N = 1200)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>Encounter</td>
</tr>
<tr>
<td>Standard Prescription</td>
<td>994</td>
</tr>
<tr>
<td>Date</td>
<td>630</td>
</tr>
<tr>
<td>Name</td>
<td>1179</td>
</tr>
<tr>
<td>Age</td>
<td>1110</td>
</tr>
<tr>
<td>Sex</td>
<td>1128</td>
</tr>
<tr>
<td>Weight</td>
<td>171</td>
</tr>
<tr>
<td>Address</td>
<td>142</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>582</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drug related information on prescription (N = 2354)</th>
<th>Class of drugs prescribed (N = 2354)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose</td>
<td>2012</td>
</tr>
<tr>
<td>Strength</td>
<td>348</td>
</tr>
<tr>
<td>Dosage form</td>
<td>447</td>
</tr>
<tr>
<td>Route</td>
<td>1992</td>
</tr>
<tr>
<td>Frequency</td>
<td>2262</td>
</tr>
<tr>
<td>Duration</td>
<td>1769</td>
</tr>
<tr>
<td>Quantity</td>
<td>602</td>
</tr>
</tbody>
</table>

N – Number of Encounters and Drugs prescribed

3.4 AWaRe Classification

The World Health Organization has developed a classification system called AWaRe, which stands for Access, Watch, and Reserve\textsuperscript{36,37}. According to this classification, antibiotics have been classified into
three groups based on whether they need to be generally accessed (Access Group), carefully watched (Watch Group), or only reserved for special situations (Reserve Group). Access group covers 55.29%, Watch group with 43.03% and Reserve with 1.68% of prescribed drugs. The most commonly prescribed antibiotics from Access were amoxicillin (47.2%), amoxicillin-clavulanic acid (13.3%), and metronidazole (10.7%), while from Watch, the drugs were ciprofloxacin (54.2%) and ceftriaxone (34.4%). Two drugs observed on the prescription were under reserve classification (meropenem and vancomycin) (Table 3).

### 3.5. Healthcare Professional Related Information

From the 1200 prescription papers assessed, 934 (77.83%) contained the prescriber's name, while 997 (83.08%) contained the prescriber's signature. The dispensers' names were available in 416 (34.67%) and their signatures were available in 752 (62.67%) prescription papers (Figure 1).

**Table 3**: Classification of the antibiotic types using the AWaRe methodology

<table>
<thead>
<tr>
<th>AWaRe Classification</th>
<th>Access % (N = 460)</th>
<th>Watch % (N = 358)</th>
<th>Reserve % (N = 14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin</td>
<td>47.2%</td>
<td>54.2%</td>
<td>78.6%</td>
</tr>
<tr>
<td>Amoxicillin/ Clavulanic acid</td>
<td>13.3%</td>
<td>34.4%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>10.7%</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>Cloxacillin</td>
<td>8.3%</td>
<td>3.1%</td>
<td></td>
</tr>
<tr>
<td>Doxycycline</td>
<td>6.7%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>Tinidazole</td>
<td>5.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others*</td>
<td>4.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gentamicin</td>
<td>2.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norfloxacin</td>
<td>1.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>0.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Sulfadiazine, Nitrofurantoin, Cefazolin, Ampicillin

### 3.6 Antibiotic Prescribing Predictors

At the bivariate level, the predictors of antibiotic prescribing, age (p = 0.001), gender (p = 0.003), and number of medicines prescribed (p = 0.011), were significantly associated with antibiotic prescribing. Antibiotic prescriptions were 2.5 times more likely to be given to patients under the age of 18 than to
patients 65 and older (AOR: 2.51, CI: 1.88–5.42). Similarly, men were more likely than women to receive an antibiotic prescription (AOR: 1.74; CI: 1.18–2.33). When compared to those who received one or two antibiotics per prescription, those who received three or more drugs per prescription were around three times more likely to receive an antibiotic (AOR: 2.96, CI: 1.77–6.55). (Table 4).

**Table 4: Predictors of antibiotic prescribing**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Antibiotic Prescribed</th>
<th>Bivariate Analysis</th>
<th>COR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Percent Yes Percent COR (95% CI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤18</td>
<td>146 25.66% 206 36.85%</td>
<td>2.22 (1.54-5.20)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>19–64</td>
<td>321 56.41% 282 50.45%</td>
<td>1.01 (0.54 -1.46)</td>
<td>0.645</td>
<td></td>
</tr>
<tr>
<td>≥65</td>
<td>102 17.93% 71 12.70%</td>
<td>Ref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>227 42.67% 284 47.65%</td>
<td>1.96 (1.27-2.78)</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>305 57.33% 312 52.35%</td>
<td>Ref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Medication</td>
<td></td>
<td></td>
<td></td>
<td>0.011</td>
</tr>
<tr>
<td>Prescribed</td>
<td>One 265 42.33% 113 19.69%</td>
<td>Ref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two 273 43.61% 188 32.75%</td>
<td>0.69 (0.24-1.23)</td>
<td>0.132</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Three 52 8.31% 129 22.47%</td>
<td>2.48 (0.39-24.21)</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four 32 5.11% 102 17.77%</td>
<td>3.25 (0.51-33.46)</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Five/Above 4 0.64% 42 7.32%</td>
<td>8.02 (0.79-46.84)</td>
<td>0.017</td>
<td></td>
</tr>
</tbody>
</table>

COR Crude Odds Ratio, CI Confidence Interval, *p < 0.05 was considered significant

The full analysis model fitness test was performed to confirm the suitability and found analysis model containing all predictors was statistically significant, \( C^2 (5, N=1200) = 63.291, P<.001 \), indicated that the model was able to distinguishes between the respondents who had been prescribed antibiotics and those who had not. Hosmer and Lemeshow test also supported the model fitness (\( C^2 = 12.523, df = 7, P = 0.572 \)). The model as a whole also explained between 55.3% (Cox and Snell R square) and 76.6% (Nagelkerke R square) of the variance in in antibiotic prescription and correctly classified 73.26% of those who had one.

According to the model's sensitivity, it correctly identified 64.2% of the group with an antibiotic prescription. Furthermore, the specificity was 69.8%. Age (\( p <0.001 \)), gender (\( p = 0.011 \)), and number of medicines prescribed (\( p = 0.017 \)) remained significantly associated with antibiotic prescribing after
adjusting for potential confounders using multivariate logistic regression (Table 5). There is a significant increase in antibiotic prescribing with an increase in the number of medicines prescribed \((p = 0.002)\). The odds of prescribing antibiotics increased by 2.57 units for every unit increase in the number of medicines prescribed \((\text{COR: } 2.57; 95\% \text{CI: } 2.16–3.47)\).

**Table 5: Multivariate analysis of predictors of antibiotics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Multivariate Analysis</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COR (95% CI)</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>≤18</td>
<td>2.51 (1.88-5.42)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>19–64</td>
<td>1.23 (0.79-1.98)</td>
<td>0.442</td>
</tr>
<tr>
<td>≥65</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.74 (1.18-2.33)</td>
<td>0.011</td>
</tr>
<tr>
<td>Female</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>No of Medication Prescribed</td>
<td></td>
<td>0.017</td>
</tr>
<tr>
<td>One/Two</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>Three/Four</td>
<td>2.96 (1.77-6.55)</td>
<td>0.003</td>
</tr>
<tr>
<td>Five/Above</td>
<td>7.02 (0.98-37.56)</td>
<td>0.112</td>
</tr>
</tbody>
</table>

AOR Adjusted Odds Ratio, CI Confidence Interval, * \(p < 0.05\) was considered significant

**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 81.25\%; when compared to studies done in Ethiopia and other parts of the world, this was relatively higher than some findings to 77.25\%, lower than findings from some previous similar studies, which were 83.1% to 93.5%, and comparable to the study done by Gashaw et al., which was 81.3\%.
All prescription papers need to have a date on it for both retrieval and legal reasons. Contrarily, in this study, 98.25% 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.\footnote{43,45,46} It falls short of a research done in Gondar and Dilla, Ethiopia, where the results were 99.83% and 99.79%, respectively.\footnote{39,42} In order 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 written in the current study was 92.55%, which is consistent with a study conducted in Bahir Dar and Dessie, Ethiopia, where 92.6% and 93.5% were reported.\footnote{40,43}

Although the result is lower than previous comparable studies conducted in Mekelle and Dilla, Ethiopia\footnote{32,42}, it is greater than study findings from Gondar, Ethiopia, Khartoum, Sudan, and Western India\footnote{39,47,48}. Particularly for the pediatric population, age is a significant factor in dosage estimates and the choice of suitable dosage forms. In terms of the sex of the patients, 89.92% of prescription papers in the current study included sex; this result was greater than that of similar studies\footnote{39,40,45,48}, but lower than that of similar studies\footnote{42–44,48}. If prescribers fail to include diagnoses on prescription documents, pharmacy staff will be unable to analyze prescription orders. Therefore, in order to promote the best possible treatment patient results, they should include diagnoses on every single prescription paper.

Drug doses were recorded on 85.47% 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%\footnote{39–41,43–45,47}. The type of dosage forms was disclosed on 437 (18.99%) prescription papers, which is comparable with research from Dessie (17.6%) and Mizan, Ethiopia (17.9%)\footnote{43,44}. 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\footnote{41,45,46}. The method of drug administration was noted on 84.62% of prescription papers in the current study, which is roughly equivalent to earlier findings from Harar, 81.8% \footnote{45} and Dessie, 82.2\%\footnote{43} in Ethiopia, but less than previous studies of a comparable studies that reported between 88.1 and 93.1\%\footnote{42,44,46}.

The frequency of drug administration was disclosed on prescription papers in about 96.09% 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\%\footnote{39–43,45,46,49}. The proportion of prescription papers that specified the length of the therapy was 75.15%, which is comparable to a Bahir Dar study's (74.61\%) finding\footnote{40}, but lower than those studies done in Dessie (80.1\%) and Gondar (82\%), Ethiopia\footnote{39,43}. However, compared to other research' findings, which range from 20\% to 74.6\%, this figure is higher\footnote{41,42,44,45,48}. 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 every single piece of information. In order 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 that visited the community pharmacy in Dire Dawa as part of the current study, a total of 2354 medications were prescribed, resulting in an average of 1.96 prescriptions prescribed each encounter, which is somewhat higher than the WHO standard (1.6-1.8)\(^2\) as well as results from comparable investigations carried out across Ethiopia, which revealed an average of 1.64 to 1.90 medications per encounter\(^1,31,39–42,50,51\). However, compared to 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\(^26,27,56–62,43,45,47,48,52–55\). Prescribers should restrict medicine prescriptions to only those that are absolutely essential 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\(^10,63,64\). 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 47.83 percent, which is much higher than the WHO standard value of 20-26.2 percent\(^2\) and indicates antibiotic misuse is there. This result is comparable with Atif et al. result (48.6\%)\(^65\). 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\(^27,39–41,52–54,60\). On the other hand, this result was lower than those of other comparable studies with 52.3\% to 75.1\%\(^1,31,61,62,65,42,45,47,48,50,51,58,59\).

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, 87.34\% 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.\(^43\) and is greater than several findings published from studies conducted in other nations\(^10,27,62,65,41,42,48,52,53,58–60\), while being lower than some other study findings from Ethiopia, Ghana, Iran, and Saudi Arabia\(^1,31,39,40,45,50,51,53,56\).
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 injectables were recorded in the current study, which is in line with the WHO standard (13.4-24.1%)\(^2\). In the current study, 99.19% of pharmaceuticals were prescribed from the nation's EML, which is slightly similar with what is advised by WHO (100%).

In the present study, 55.29% of the antibiotics were in the Access group, which is lower than the study carried out in Eritrea, which was 71.9%\(^10\). In addition, 43.03% of the antibiotics were in the Watch group and 1.68% were in the Reserve group, specifically vancomycin and meropenem, which is higher than the Watch group and Reserve group percentages in the aforementioned study\(^10\), which were 22.1% and 0%, respectively. 54.2% of all medications used in the Watch category are ciprofloxacin, while 34.4% are ceftriaxone. This drugs use must therefore be closely monitored both in the community and in public facilities.

### 4.2 Antibiotic Prescribing Predictors

This study discovered a substantial correlation between patients' age, gender, and number of medications and their prescription for antibiotics. Antibiotic prescriptions were found to be substantially associated with being under the age of 18. Patients under the age of 18 got the highest proportion of antibiotics when compared to the other patient categories which is similar to research from Asmara, Eritrea\(^10\), Dhaka, Bangladesh\(^66\), Aden, Yemen\(^67\), and Kumbo, Cameroon\(^68\). According to this study's findings, men were more likely than women to receive an antibiotic, which is in line with research from Dhaka, Bangladesh\(^66\), and Fiche, Ethiopia\(^69\). This stands in stark contrast to a study conducted in the UK\(^70\), Cameroon\(^68\), and Bern, Switzerland\(^71\), which found a stronger correlation between female gender and the prescription of antibiotics. According to the results of the current study, prescribing three or four medications per prescription was substantially associated with prescribing antibiotics.

The odds ratio of using an antibiotic increased by 2.57 for every increment in unit of medication (P = 0.002; OR: 2.57; 95% CI: 2.16-3.47). 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)\(^10\) 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)\(^72\). The results of the study may not accurately reflect the seasonal change in medication use because it was cross-sectional. Additionally, because the study's results were based on the city of Dire Dawa, they might not apply to the entire nation. To acquire a thorough picture of medicine use in the nation, more research at the national level is required.

### 5. Conclusion
The results of the current study demonstrated that there was a significant deviation from the acceptable WHO standard for the prescription of antibiotics in the prescribing indicators in the public community pharmacy in Dire Dawa, Ethiopia. The proportion of prescriptions containing an antibiotic was 47.83 percent, about double the WHO-recommended standard (20–26.2 percent). Antibiotics prescribed from Watch group was 43.03% which was proportionally high in percentage. In the meantime, 13.5% of encounters contained an injection, which is within the range of 13.4%–24.1% advised by the World Health Organization. The average number of prescriptions per encounter and adherence to Essential Medicine List (EML) were just marginally below WHO-recommended levels. The prescribing of antibiotics revealed a strong association with patient age, gender, and the quantity of medications per prescription.

**Abbreviations**

AMR: Antimicrobial Resistance; ASP: Antimicrobial Stewardship Program; AWaRe: Access, Watch, Reserve; DTC: Drug and Therapeutics Committee; EML: Essential Medicine List; INRDU: International Network of Rational Medicine Use; LMIC: Low and Middle Income Countries; OPD: Outpatient Department; STG: Standard Treatment Guideline; WHO: World Health Organization

**Declarations**

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**Author Contributions**

All authors contributed to the original idea, drafting the proposal, data acquisition, data analysis, and drafting and revising the manuscript; they agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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The authors declare that they have no conflicts of interest.

**References**


44. Biru TT, Ayele T. Prescribers’ Adherence To the Basic Principles of Prescription.
47. Rabie D, Kheder SI. Assessment of Prescribing and Dispensing Practices Based on WHO Core Prescribing Indicators in Hospital and Community Pharmacies in Khartoum State - Sudan. 2020.


**Figures**
Figure 1

Prescribing practice, prescribers and dispensers information in community pharmacies