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Antibiotic Self-Medication among Adults Suspected of Urinary Tract Infection in Addis Ababa

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Abstract

The aim of this study was to evaluate Antibiotic Self-medication Practice (ASMP) and its associated factors among adult patients suspected of urinary tract infection (UTI) in Addis Ababa, Ethiopia. A multi-center cross-sectional study was conducted between November 2020 and August 2021. Data were analyzed using SPSS 25. Simple and multiple binary logistic regression analyses were performed. The magnitude of the associations was quantified using an adjusted odd ratio (AOR) with a 95% confidence interval (CI). Urine samples with significant growth (>105cfu/mL) were subjected to biochemical identification of Gram-negative and Gram-positive bacteria. Resistance data were interpreted according to the Clinical Laboratory Standards Institute. A total of 531 adult patients participated. The mean age (± SD) was 43.74 (± 16.16) years. The majority (368, 69.3%) of the patients were female. The prevalence of ASMP was 10.4%. Nearly 80% of the patients had poor knowledge of antibiotics. The most self-reported antibiotic was amoxicillin (28, 50.9%). The primary reason for ASMP was past experience with drugs (29, 52.7%). Among the self-medicating, forty-eight (87.3%) patients reported that ASMP was unacceptable. Statistically, patients whose age (50 years and older), income (4000 birrs and below), and no history of UTIs were associated with ASMP. In addition, 106/129 (82.2%) bacteria isolates were MDR. The two commonly isolated bacteria were *Escherichia coli* (88, 68.2%) and *Klebsiella pneumoniae* (10, 7.8%). *E. coli* (91%) was ampicillin-resistant and 100% resistant to amoxicillin and doxycycline. The *K. pneumoniae* isolates were 100% ampicillin-resistant, amoxicillin-resistant, and doxycycline-resistant. Nine (8.5%) patients with MDR bacteria had ASMP. Almost one-third of the bacteria resisted six antibiotics (33.3%). ASM for UTIs is a common practice in Addis Ababa. Some self-medicated patients developed MDR UTIs. *Escherichia coli* and *Klebsiella pneumoniae* were resistant to most of the antibiotics. Low-income and elderly patients, in particular, constitute the target population for risks of ASMP.

INTRODUCTION

Urinary tract infection (UTI) is a spectrum of diseases caused by microbial invasion of the genitourinary tract [1]. Worldwide, it affects nearly 150 million individuals every year [2]. In addition, about 50% of women have reported having had a UTI at some point in their lives, causing 8.3 million office visits and more than 1 million hospitalizations, with an overall annual cost of more than $1 billion [3]. So far, several factors associated with a higher prevalence of UTIs have been reported, including age, gender, sexual activity, contraceptive use, previous history of UTI, indwelling catheter equipment, and hygiene problems [4,5]. Additionally, the urogenital microbiome is an important human microbiome niche with biologic plausibility in urinary tract health and disease, being tied to UTIs [6].

Several studies have found that Gram-negative bacteria are the primary cause of UTIs (80-85%). Within this division, the most common causal bacteria are *Escherichia coli* (75-87%), followed by *Klebsiella* spp., *Citrobacter* spp., *Enterobacter* spp., *Pseudomonas* spp., and *Proteus* spp., and Gram-positive pathogens such as *Enterococcus faecalis* and *Staphylococcus saprophyticus* [2,7].

Inappropriate antibiotic usage, overdose, and antibiotic self-medication are the most influential elements in the antibiotic resistance dilemma [8, 9]. Approximately 80% of antibiotics are utilized in the community, with the remaining 20% administered in hospitals [10]. Cizman [11] claims that 20-50% of all antibiotic use is inappropriate. Previous studies has found a link between antibiotic use and bacterial resistance [12,13].

Annually, an estimated 700,000 lives are lost due to antimicrobial resistance. This is projected to lead to the mortality of at least 10 million people by 2050 [14], and by 2030, antimicrobial resistance may lead to poverty among 24 million people worldwide [15], mainly in low-income countries. It is also important to note that there have not been many discoveries of antibiotics to combat antibiotic-resistant pathogens [16].

Self-medication (SM) with antibiotics is prevalent in

developing countries, including Ethiopia, and is considered a global health problem [17]. The causes of non-prescription sales of antibiotics for SM could vary from country to country because of different underlying contexts [18]. However, the appropriateness of SM is not well known. Therefore, a certain level of knowledge and health orientation is required to make it responsible [19]. Furthermore, factors such as healthcare utilization, proximity of pharmacies, and increased waiting time in healthcare facilities appear to be significantly associated with the SM of antimicrobials [20,21].

Actually, little was known about the association of previous SM with antibiotics and the development of drug resistance among UTI-suspected patients in the study settings in Addis Ababa, Ethiopia. As a result, this study was carried out to describe the study patients' experience with ASMP, the causative bacteria identified from the urine sample, the antimicrobial susceptibility test, and other associated factors from clinical data and sociodemographic profiles of the study patients regarding SM with antibiotics.

METHODOLOGY

Study Design, Period, and Setting

A multicentre institutional-based cross-sectional study was conducted from November 5, 2020, up to August 7, 2021. This study was carried out in Addis Ababa, Ethiopia, at Saint Paul's Hospital Millennium Medical College (SPHMMC), Arsho Diagnostic Laboratories (Piazza branch and Meskel flower branch), and the Ethiopian Public Health Institute. Each center has its own Department of Microbiology (culture unit) that offers drug susceptibility testing to adult patients suspected of having a UTI who come from other departments.

Participants

All adult patients (18 years of age and older) suspected of UTI who visited the culture unit of the study centers, presented during data collection, and volunteered to participate were included. Those who were very ill or had serious psychiatric problems were excluded from the study. The single-population proportion calculation was used to calculate the minimum required sample size for this study (531 patients), with a 50% proportion and a margin of error of 5%. The research proposal was assessed and approved by the institutional review board (IRB) of St. Paul's Hospital Millennium Medical College in Addis Ababa, Ethiopia.

The study was conducted once the ethical clearance (reference number: PM23/345) was obtained from the IRB and a support letter from the Academic and Research Vice Provost Office. Written and informed verbal consent was obtained from each adult patient after clear explanations about the purpose and aims of the study. Unique identifiers were removed to maintain patient privacy and keep the medical case issue confidential, and the collected data was placed in a locked cabinet to ensure confidentiality.

Sampling Technique

As a sampling technique, every patient who came to the urine culture unit of the study setting was included in this study. The data collectors and laboratory technologists communicated with the eligible patients for inclusion during the recruiting stage. The diagnosis technique was a routine, everyday activity of the study sites' culture units in Addis Ababa, Ethiopia. Clean midstream urine samples were obtained from enrolled individuals using a sterile wide-mouth container for the urine culture test. A urine sample's minimum permissible volume was 10ml. To ensure that the bacteria present in the urine were isolated and to avoid overcrowding, all samples were tested immediately upon arrival at the culture unit.

Variables, Definitions and Outcomes

The dependent variable was antibiotic self-medication (ASM) practice (yes or no). The questions used to assess the socio-demographic characteristics, knowledge, and practice regarding antibiotics and clinical questions were the independent variables. ASM is defined as an adult patient suspecting sickness and taking an antimicrobial medication within the last twelve (12) months without a prescription from a clinician. The term "drug resistance" refers to bacteria strains that are resistant to two or more antibiotics [22]. In this study, the total number of knowledge-related questions was twenty-one. Each correct response to a statement on knowledge of antibiotics was given a score of 1, whereas incorrect responses were given a score of 0. In the knowledge domain, the minimum and maximum possible scores were 0 and 21, respectively. Some of the questions had incorrect responses, and the scores were inverted. The total score of knowledge questions was determined using the formula stated in [23]. The total scores less than 80 and 80% and above were categorized as poor and good knowledge, respectively.

Data Collection Technique and Follow Up

An interviewer-administered questionnaire was used to collect data. The data collection questionnaire (both in English and Amharic languages) is supplemented in the appendices section. The questionnaire was adopted and modified from published articles [24,25]. The questionnaire had five components. These components were divided and included the sociodemographic profile (8 questions), knowledge assessing statements (21 questions), ASMP assessment (24 questions), clinical data (4 questions), and those related to antibiotic susceptibility test findings (2 questions). The data collectors were Pharmacists and laboratory professionals. Once the recruited adult patients gave a urine culture sample, the patient specimen identity number was registered on the date of data collection. Next, the follow-up continued to obtain the name of the isolated bacteria and its antibiotic drug susceptibility test results, if any.

LABORATORY PROTOCOLS

Culture Identification, And Susceptibility Tests

Urine specimens were directly inoculated onto blood agar

(Oxoid, England) and MacConkey agar (BD, USA) using a sterile standard calibrated wire loop (0.001), and streaked culture plates were incubated at 37ºC aerobically for 24 hours. The number and type of colony count were performed on a blood agar plate, and then bacteriuria was determined. Cultures with colony counts greater than 10^5 cfu/mL for single-isolated bacteria were considered significant. Identification of bacterial isolates was carried out using colony characteristics on blood agar, MacConkey agar, the gram reaction of the bacteria, and biochemical tests in accordance with standard procedures. Organisms isolated from the urine specimens of the patients were identified and tested for antimicrobial susceptibilities [26]. According to the standard operational procedures, antimicrobial susceptibility tests were done on Mueller-Hinton agar (Oxoid, England) using the Kirby-Bauer disk diffusion method [27]. Briefly, using a sterile wire loop, 3-5 pure colonies were picked from a blood agar plate or MacConkey agar and emulsified in nutrient broth (Oxoid, England) and mixed gently until they formed a homogenous suspension. The turbidity of the suspension was adjusted to the optical density of McFarland 0.5 to standardize the inoculum size. A sterile cotton swab was dipped into the suspension and distributed the bacteria suspension evenly over the entire surface of Mueller-Hinton agar (Oxoid, England). The antimicrobial agents tested were 39 antibiotics, according to [28].

Data Quality Management

To ensure that the statements were consistent, the questionnaire was translated from English to Amharic and vice versa. Then, two weeks before data collection, it was pretested at the International Clinical Laboratory in Addis Ababa, Ethiopia. The pretesting reactions led us to modify the questionnaire. The data collectors and the supervisor were trained on the questionnaire and the sampling technique by the principal investigator. Daily supervision and data checking were carried out to ensure that the data were complete and consistent.

Data Analyses

Data were entered and analyzed using SPSS version 25 software. All patient data were explored for its outliers and missing values. Descriptive statistics such as proportions, frequencies, means, and standard deviations were used to describe the characteristics of the study patients. A binary logistic regression was employed to identify factors associated with ASMP. All factors with a p-value ≤ 0.20 in the bivariable analyses were considered candidates for the multivariable regression model. In all statistical tests, $p < 0.05$ was considered statistically significant. In a clinical laboratory study, only urine samples with significant growth were further studied; significant growth was defined as the presence of > 10^5. colony-forming units per milliliter (cfu/mL) of urine [26]. After obtaining the pure strains, these were subjected to conventional biochemical identification methods to identify different gram-negative and gram-positive uropathogens. Resistance data were interpreted according to the Clinical Laboratory Standards Institute. Reference strains of *E. coli* (ATCC 25922) were used for quality control for antimicrobial susceptibility [28].

RESULTS

Sociodemographic Characteristics of Study Patients

In this study, a total of 531 patients were included. The mean score of age (± SD) was 43.74 (± 16.16) years. The minimum and maximum ages of the patients were 18 and 90 years, respectively. About one-third of the patients were 50 years and older (188, 35.4%). The majority of the patients were female (368, 69.3%), patients with a college and above educational background (254, 47.8%), and patients who were married (347, 65.3%). Most of the patients were government-employed (131, 24.7%) and came from urban areas (518, 97.6%). The main two religions of the patients in this study were Orthodox (316, 59.5%) and Muslim (119, 22.4%). The majority of the patient's monthly income was 2000 birr and below. Most of the study patients were from the Arsho Diagnostic Center (352, 66.3%) [Table 1].

Knowledge towards Antibiotics

In this study, 367 (70.8%) patients had heard the term antibiotic. Almost three-fourths (382, 71.9%) of the total patients self-reported that antibiotics were used to treat bacterial infections. However, some patients (39, 7.3%) self-reported that the clear indications of antibiotics were to treat viral infections.

As can be seen in Table 2, the self-reported response to the statements posed is as follows: 370 (71.9%) of the patients self-reported that broad-spectrum antibiotics are better than narrow-spectrum ones; 279 (52.5%) reported that higher doses result in faster recovery; 379 (71.4%) reported that lower doses result in fewer adverse reactions; 404 (76.1%), switching antibiotics enhances drug effects; 418 (78.7%), switching antibiotics reduces adverse reactions; 422 (79.5%), intravenous is better than oral medication; 322 (60.6%), ASM practice could cause drug resistance; 486 (91.5%), ASM practice could result in disease complications; 506 (95.3%) ASM practices could result in harmful effects, and 469 (88.3%) of the patients self-reported that ASM could not be practiced for all drugs.

According to most of the patients' self-reports, some drugs were not taken with other drugs (480, 90.4%); not taken with alcohol (510, 96%); and not taken with some kinds of food (514, 96.8%). Most patients self-reported that the same drug could be administered by oral, injection, topical, or other routes (482, 90.8%) and checked the expiration date of the drugs before purchasing or before using them (386, 72.7%). Additionally, 107 (20.2%) of the total patients had good knowledge of antibiotics [Table 2].

Common Self-Reported Reasons for avoiding ASM Practice

Generally, there were 476 (89.6%) patients who did not practice self-medication with antibiotics. Ninety-nine (20.8%) of the patients mentioned multiple reasons (such as fear of not using the wrong drug, fear of side effects, fear of wrong diagnosis, and wrong use of a drug) why they did not self-medicate with

Table 1: Sociodemographic characteristics of adult patients suspected of UTIs in Addis Ababa, Ethiopia, 2020/21 (n=531).

Variable	Category	Frequency, N (%)
Study settings	Arsho	352 (66.3)
	EPHI	108 (20.3)
	SPHMMC	71 (13.4)
Sex	Male	163 (30.7)
	Female	368 (69.3)
Age (years)	Mean ± SD	43.74 (± 16.16)
	18-24	36 (6.8)
	25-29	74 (13.9)
	30-34	89 (16.8)
	35-39	50 (9.4)
	40-44	57 (10.7)
	45-49	37 (7)
	≥ 50	188 (35.4)
Religion	Orthodox	316 (59.5)
	Muslim	119 (22.4)
	Protestant	93 (17.5)
	Jehovah's witness	2 (0.4)
	Catholic	1 (0.2)
Marital status	Married	347 (65.3)
	Single	134 (25.2)
	Widowed	31 (5.8)
	Divorced	14 (2.6)
	Separated	5 (5.8)
Education	Illiterate	16 (3)
	Write and read only	42 (7.9)
	Primary school	94 (17.7)
	Secondary school	125 (23.5)
	College and above	254 (47.8)
Occupation	Government	131 (24.7)
	Private (owner)	108 (20.3)
	House wife	104 (19.6)
	Private (employed)	99 (18.6)
	Retired	40 (7.5)
	Jobless	21 (4)
	Student	14 (2.6)
	Others*	14 (2.6)
Residence	Urban	518 (97.6)
	Rural	13 (2.4)
Monthly income (birr)	≤ 2000	204 (38.4)
	2001-3000	79 (14.9)
	3001-4000	44 (8.3)
	4001-5000	69 (13)
	5001-6000	19 (3.6)
	≥ 6001	116 (21.8)

EPHI: Ethiopian Public Health Institute; SPHMMC: Saint Paul's Hospital Millennium Medical College; N: Number; SD: Standard deviation; Others *: farmers, house servants, and church servants.

Table 2: Knowledge towards antibiotics of the adult patients suspected of urinary tract infection in Addis Ababa, Ethiopia.

SN.	Knowledge Statements	Count, N (%)	
		Yes	No
K1	I heard about the word antibiotics	376 (70.8)	155 (29.2)
K2	Antibiotics treat		
K2.1	Bacterial infection	382 (71.9)	-
K2.2	Viral infection	39 (7.3)	-
K2.3	I do not know	110 (20.7)	-
K3	Broad-spectrum antibiotics are better than narrow-spectrum ones	370 (69.7)	161 (30.3)
K4	Higher doses result in faster recovery	252 (47.5)	279 (52.5)
K5	Lower doses result in less adverse reactions	152 (28.6)	379 (71.4)
K6	Switching antibiotics enhances drug effects	127 (23.9)	404 (76.1)
K7	Switching antibiotics reduces adverse reactions	113 (21.3)	418 (78.7)
K8	Intravenous is better than oral medication	422 (79.5)	109 (20.5)
K9	Antibiotic self-medication could cause drug resistance	322 (60.6)	209 (39.4)
K10	Antibiotic self-medication can be practiced for all drugs	62 (11.7)	469 (88.3)
K11	Antibiotic self-medication can result into disease complication	486 (91.5)	45 (8.5)
K12	Antibiotic self-medication can result into harmful effects	506 (95.3)	25 (4.7)
K13	Some drugs cannot be taken with other drugs	480 (90.4)	51 (9.6)
K14	Some drugs cannot be taken with alcoholic drinks	510 (96)	21 (4)
K15	Some drugs cannot be taken with some kinds of foods	514 (96.8)	17 (3.2)
K16	Some drugs are contraindicated or cannot be given to children	514 (96.8)	17 (3.2)
K17	Some drugs are contraindicated or cannot be given to pregnant	515 (97)	16 (3)
K18	Some drugs cannot be given to breast feeding mothers	504 (94.9)	27 (5.1)
K19	Some drugs Cannot be taken by people with chronic diseases	431 (81.2)	100 (18.8)
K20	Same drug can be given by oral, injection, topical or other routes	482 (90.8)	49 (9.2)
K21	Checking expiry date of the drugs you purchase or before use	386 (72.7)	145 (27.3)
	Level of knowledge		
	Poor Knowledge	424 (79.8)	
	Good Knowledge	107 (20.2)	

Knowledge question number; Some drugs: some antibiotics.

antibiotics. However, among the self-reported single reasons mentioned by the patients for avoiding the practice of self-medication with antibiotics, the two most common reasons were fear of the side effects of drugs (93, 19.5%) and the chance of a wrong diagnosis (79, 16.6%). Twenty-three (4.8%) patients self-reported that they refused the practice of antibiotic self-medication because of their interest in visiting their doctors for consultation and prescription [Table 3].

Antibiotic Self-Medication Practice

In this study, the overall prevalence of antibiotic self-medication practice was 10.4% (55/531). The two common ways of requesting antibiotics from different drug sources were by mentioning the name of the drug (30, 54.5%) and by mentioning the signs and symptoms of illness (13, 23.6%). The prominent sources of drugs for self-medication with antibiotics in this study were community pharmacies (50, 90.9%). Most of the patients' antibiotic selection basis for self-medication was an indication of the drug (27, 49.1%) and type of antibiotic (20, 36.4%). The sources of drug-related information for self-medication with antibiotics in the majority of the self-reported patients were their own experience (14, 25.5%), followed by community pharmacists, previous doctors' prescriptions, and opinions of friends (11, 20%) each of the sources.

As to patients' self-reports, the two most common diseases or conditions treated by self-medication with antibiotics were

Table 3: Common self-reported reasons of the adult patients for avoiding the self-medication with antibiotics during the past 12 months in Addis Ababa, Ethiopia.

Reasons for Avoiding ASM Practice (N=476 patients)	Frequency, N (%)
Not to use a wrong drug (≠ 1)	51 (10.7)
Fear of side effects (≠ 2)	93 (19.5)
Fear of wrong diagnosis (≠ 3)	79 (16.6)
Fear of wrong use of a drug (≠ 4)	57 (12)
All above mentioned (≠ 1, ≠ 2, ≠ 3, ≠ 4)	99 (20.8)
Lack of Drug knowledge to have ASMP	28 (5.9)
Want doctor visit (for consultation and prescription)	23 (4.8)
Due to My chronic illness	12 (2.5)
No illness in the past 12 months	8 (1.7)
Easy access for health facility	7 (1.5)
Others*	19 (4.1)
Total	476 (100)

*Others: those mentioned both (≠ 1, and ≠ 3), (≠ 2 and ≠ 3), and (≠ 3 and ≠ 4); ASMP; Antibiotic self-medication Practice.

urinary tract infections (14, 25.5%) and peptic ulcer disease (9, 16.4%). In addition, fever (6, 10.9%), tonsillitis (5, 9.1%), and unexplained infections (6, 10.9%) were also reported and treated by self-medication with antibiotics [Table 4].

Self-Medicated Antibiotics and Reasons for ASMP

Amoxicillin (28, 50.9%), ciprofloxacin (13, 23.6%), and the sulfamethoxazole-trimethoprim combination (5, 9.1%) were the three most commonly self-medicated antibiotics, according to patient self-report. Although several patients admitted to self-medicating with antibiotics, they failed to name the medications (8, 14.5%).

Knowing the drug before self-medication (29, 52.7%), minor illness (14, 25.5%), and urgency (7, 12.7%) were the three most prevalent self-reported reasons for self-medication with antibiotics [Table 5].

Antibiotic Self-Medication Information

The majority of self-medicated patients self-reported: 20 (36.4%) never checked drug leaflet instructions; 20 (57.1%) claimed that they partially understood the drug leaflet instructions; 48 (87.3%) reported that antibiotics self-medication is unacceptable practice; 34 (61.8%), found alleviation/relief from their ailment as a result of self-medication with antibiotics; in 31 (56.4%) cases, they were unable to successfully treat common infections; 36 (65.5%) were unconcerned about using counterfeit antibiotics, and 25 (45.5%) discontinued using antibiotics after finishing or running out of their medications.

Furthermore, only 2 (3.6%) patients with antibiotic self-medication practices used the same drugs with different names. The maximum number of drugs used for self-medication with antibiotics was only one drug (46, 83.6%). Most patients determined the dose of antibiotics used by consulting pharmacists (36, 65.5%). Forty-four (80%) patients self-reported that they had never changed the antibiotic dose during therapy. However, the main reason for patients who changed the dose during therapy was health improvement at some point before finishing the expected length of therapy.

Table 4: Self-Reported Information on Antibiotics Self-medication among Adult Patients Attending the Study Settings, Addis Ababa, Ethiopia.

Variables	Frequency, (%)
Antibiotic self-medication Practice (ASMP)	
Yes	55 (10.4)
No	476 (89.6)
Source of information	
Community pharmacists	11 (20)
Family members	3 (5.5)
Opinion of friends	11 (20)
My own experience	14 (25.5)
Previous doctor's prescription	11 (20)
Internet searching	2 (3.6)
Pharmacist and friends	1 (1.8)
Others*	2 (3.6)
Selection basis	
Type of antibiotics	20 (36.4)
Brand of antibiotics	6 (10.9)
Price of antibiotics	1 (1.8)
Indications (use)	27 (49.1)
type and side effects of antibiotics	1 (1.8)
Source of Drug	
Community Pharmacies	50 (90.9)
Leftover from previous prescription	2 (3.6)
From neighbor	1 (1.8)
Open Market/shop	2 (3.6)
Ways of requesting the drug	
By mentioning the name of the drug	30 (54.5)
By mentioning the sign and symptom of illness	13 (23.6)
By showing drug container	9 (16.4)
By showing a piece of paper (With Drug name)	3 (5.5)
Diseases/symptoms ≠	
Urinary tract infection	14 (25.5)
Peptic Ulcer Disease	9 (16.4)
Abdominal pain	7 (12.7)
Fever	6 (10.9)
Unexplained Infections	6 (10.9)
Tonsilitis	5 (9.1)
Cough	4 (7.3)
Wound infection	1 (1.8)
Typhoid disease	2 (3.6)
Toothache	2 (3.6)
Others**	5 (9.1)

Others*: Neighbor and Open Market; Others**, such as diarrhea, tape worm infection; ≠; the total percentage for the diseases/symptoms treated is not equivalent to 100% as patients might have more than one response.

Additionally, most of the patients self-reported that they never switched (47, 85.5%) of the antibiotics used by other antibiotics during the self-medication period. However, among those who switched their antibiotics during the self-medication period, their main reason was the failure of the former antibiotics to treat their diseases or symptoms (88.1%) [Table 6].

Clinical Data of the Patients

In this study, 211 patients (39.7%) had co-morbidities. Patients' self-reports revealed that 365 (68.7%), 279 (52.5%), and 105 (19.8%) had clinical presentations of UTIs, histories of UTIs, and catheterizations, respectively. According to the urine

Table 5: Self-Medicated Antibiotics and Reasons for Self-Medication by Adult Patients Suspected of UTIs attending at the Study Settings, Addis Ababa, Ethiopia.

Variables	Frequency, (%)
Self-medicated Antibiotics ≠	
Amoxicillin	28 (50.9)
Ciprofloxacin	13 (23.6)
Sulfamethoxazole-trimethoprim	5 (9.1)
Ampicillin	4 (7.3)
Tetracycline	3 (5.5)
Ceftriaxone	4 (7.3)
Norfloxacillin	2 (3.6)
Amoxicillin-Clavulanic acid	1 (1.8)
Cefixime	1 (1.8)
Cloxacillin	1 (1.8)
Unable To Mention the Drug Name	8 (14.5)
Reasons for Antibiotic self-medication	
I know the drug before	29 (52.7)
Minor illness	14 (25.5)
Urgency case	7 (12.7)
Time constraint	3 (5.5)
Self-medication is cheap	1 (1.8)
Health institutions are far, and I know the drug	1 (1.8)

≠; the total percentage for the antibiotics used is not equivalent to 100% as patients might have used more than one antibiotic type.

culture test results, 129 (24.3%) patients obtained urine test identification with bacterial isolates [Table 7].

Urine Culture Identification Test and Isolation

In this study, there were 531 (100%) patients who submitted a urine sample for a culture test. Of these patients, 402 (75.7%) of the patients had no bacteria isolate. However, 129 (24.3%) of the patients were diagnosed with UTI and had bacterial isolates. The prevalence of urinary tract infection among the UTI-suspect adult patients was 24.3%. The two common bacteria identified and isolated were *E. coli* (88, 68.2%) and *K. pneumoniae* (10, 7.8%) [Table 8].

Antibiotic Susceptibility Test

In total, 39 antibiotics were tested for antibiotic susceptibility by disease specialists from the three different health institutions in the study settings of the culture unit. Accordingly, the following antibiotic susceptibility test findings were reported: among 55 *E. coli* isolates, 50 (90.9%) were ampicillin resistant, 32 (100%) were amoxicillin resistant, and 22 (100%) were doxycycline resistant. However, low levels of resistance were reported to meropenem (1/29, 3.4%) and cefepime (12/49, 24.5%).

In the fluoroquinolone class of antibiotics, 22 (100%) of the *E. coli* isolates and 24 (96%) of the 25 *E. coli* isolates were sensitive to moxifloxacin and levofloxacin, respectively. Unlike moxifloxacin, 23 (42.6%) of 54 *E. coli* isolates were ciprofloxacin resistant, 9 (31%) of 29 *E. coli* isolates were norfloxacin resistant, and 2 (50%) of the 4 *E. coli* isolates were nalidixic acid resistant. Twenty-eight (65.1%) of the 43 *E. coli* isolates were cephalothin-resistant. Among 38 *E. coli* isolates tested with amikacin, 35 (92.1%) were sensitive to amikacin. Additionally, of 56

Table 6: Antibiotic Self-medication information.

Variables	Frequency, (%)
Checking Drug leaflet instructions	
Yes, always	19 (34.5)
Yes, sometimes	16 (29.1)
Never	20 (36.4)
Understanding Drug leaflet instruction	
Fully understood	15 (42.9)
Partly understood	20 (57.1)
Attitude towards Antibiotic Self-medication Practice	
Better Practice	2 (3.6)
Acceptable Practice	5 (9.1)
Unacceptable practice	48 (87.3)
Outcomes of ASMP	
Cured from the illness	17 (30.9)
Get relief from the illness	34 (61.8)
No improvement	4 (7.3)
Successful treatment status during infection Using ASMP	
Yes, I can	15 (27.3)
I am not sure	9 (16.4)
No, I can not	31 (56.4)
Concern for Using Counterfeit Antibiotics	
Yes, very strongly	6 (10.9)
Yes, partially	13 (23.6)
No concern at all	36 (65.5)
Stop Taking Antibiotics	
After symptoms disappeared	20 (36.4)
After Antibiotics ran out	25 (45.5)
After completion of the treatment course	8 (14.5)
After consulting a pharmacist	2 (3.6)
Using the same drug with different names	
Yes	2 (3.6)
No	53 (96.4)
Maximum Number of drugs used in a single illness	
One	46 (83.6)
Two	6 (10.9)
Three	2 (3.6)
Four	1 (1.8)
I know the dosage of the antibiotics	
By checking the package insert	5 (9.1)
By consulting a pharmacist	36 (65.5)
By consulting my families/friends	3 (5.5)
From the internet	1 (1.8)
From my previous experience	6 (10.9)
By checking the drug leaflet and consulting a pharmacist	2 (3.6)
Others	2 (3.6)
Changing the dose during Self-medication	
Yes, always	3 (5.5)
Yes, sometimes	8 (14.5)
Never	44 (80)
Reasons for changing the dose during ASMP	
Due to improvement	5 (41.7)
Worse thing happened	4 (33.3)
To decrease the side effects	2 (16.7)
Other	1 (8.3)
Switching Antibiotics During SMP	
Yes, always	3 (5.5)
Yes, sometimes	5 (9.1)
Never	47 (85.5)
Reason of Switching Antibiotics During SMP	
The former antibiotics did not work	8 (88.9)
Due to improvement	1 (11.1)

SMP: Self-medication Practice; ASMP: Antibiotic Self-medication Practice.

Table 7: Clinical data of the patients.

Variable	Frequency (%)
Co-morbidity	
Yes	211 (39.7)
No	320 (60.3)
UTI symptoms	
Yes	365 (68.7)
No	166 (31.3)
History of Catheterization	
Yes	105 (19.8)
No	426 (80.2)
History of UTI	
Yes	279 (52.5)
No	252 (47.5)
Urine culture result	
Yes (organism isolate)	129 (24.3)
No organism isolates	402 (75.7)

UTI: Urinary Tract Infection.

Table 8: Urine Culture Result of Adult Patients Suspected of Urinary Tract Infections in study settings, Addis Ababa, Ethiopia.

Isolation status		Frequency, N (%)
Culture result	*E. coli*	88 (68.2)
	K. pneumoniae	10 (7.8)
	Providencia Species	6 (4.7)
	Enterococcus faecalis	5 (3.9)
	Klebsiella Oxytoca	4 (3.1)
	Pseudomonas Species	3 (2.3)
	Staphylococcus aureus	3 (2.3)
	Enterococcus faecium	3 (2.3)
	Morganella Morganni	2 (1.6)
	Others*	5 (3.9)
	Total isolates	129 (100)

Others*; Citrobacter freundi (1), Citrobacter diversus (1), Enterobacter spp. (1), Enterococcus spp. (1), and Staphylococcus aureus (1).

E. coli isolates, 29 (51.8%) of them were ceftriaxone sensitive, 18 (78.3%) of the 23 *E. coli* isolates tested were piperacillin-tazobactam sensitive and 15 (78.9%) of the 19 *E. coli* isolates were tobramycin sensitive.

Among the tested antibiotics on *K. pneumoniae* isolates, 6 (100%) for ampicillin, 5 (100%) for amoxicillin, and 4 (100%) for doxycycline were resistant. Providencia species were resistant to six (100%) isolates carried on ampicillin and amoxicillin, respectively. For *K. oxytoca*, cotrimoxazole was resistant to 3 (100%) of the isolates [Table 9].

Multi-Drug Resistance (MDR)

Among the total bacterial isolates (n = 129), the overall prevalence of multi-drug-resistant bacteria was reported for 106 (82.2%) bacterial isolates, which were resistant to two or more antibiotics. Within the overall MDR findings, the three most common multi-drug resistances were reported for *E. coli* (69, 65.1%), *K. pneumoniae* (9, 8.5%), and Providencia species (6, 5.7%), respectively. Regarding the number of drugs resisted, the three groups of antibiotics commonly resisted were R2 (14, 13.2%), R3, R6, and R8 (13, 12.3%) each group, and R4 (11, 10.4%), respectively. One (1.4%) of the *E. coli* isolates and one (50%) of the *S. aureus* isolates were resistant to eighteen and sixteen antibiotics, respectively. In this study, more than 80% of the findings showed that the common uropathogenic organisms that developed multi-drug resistance were gram-negative bacteria [Table 10].

MDR Report versus Antibiotic self-medication

As can be seen in [Table 11], among those patients who had MDR bacteria, 9/106 (8.5%) of them had antibiotic self-medication practices. Three (33.3%) of the patients who had MDR and ASMP were reported to have resistance to six antibiotics. Among the patients with no self-medication practice history but with MDR, most of them developed resistance to thirteen antibiotics (13.4%).

Factors Associated with Antibiotics Self-medication Practice

As stated in [Table 12] below, the current study revealed that patients who were 50 years old and older were about 4 times (AOR: 4.338 (CI: 1.407-13.380); P-value: 0.011) more likely to have antibiotic self-medication practice compared to patients who were 18-24 years old. Additionally, most of the patients whose monthly income was less than 4000 birrs (Adjusted Odds Ratio (AOR): 2.610 (confidence interval (CI): 1.331-5.171); p = 0.005) and those with no history of UTIs (AOR: 1.952 (CI: 1.062-3.588); p = 0.031) were significantly associated with ASMP compared to patients with high-incomes and UTI histories, respectively.

DISCUSSION

This study involved a total of 531 patients from three institutions in Addis Ababa, Ethiopia. The overall prevalence of self-medication with antibiotics among adult patients suspected of UTIs was 10.4%. This proportion is similar to a previous study [29] though it is lower than the findings of studies conducted in Saudi Arabia [20], Haiti [25], Sudan [30], Eritrea [31], and Egypt [32]. The differences in prevalence results between studies may be attributed to uncontrolled drug distribution, the presence of pharmacies that dispense antibiotics without a prescription, sociodemographic characteristics, sample size, the presence or absence of co-morbidities, and the level of antibiotic knowledge.

Amoxicillin was the most often self-medicated antibiotic in this study, according to patient self-reports. Similar findings to the current study have been published and supported in previous studies undertaken in India [33], Kabul (Afghanistan) [34], and Myanmar [35]. This could be explained by the fact that amoxicillin is more "familiar" and more widely available than other antibiotics. Amoxicillin is typically used as a first-line antibiotic for a variety of conditions, including urinary tract infections, acute otitis media, and pneumonia [36]. This could be attributed to amoxicillin's high safety profile, which allows its use in a wide range of populations and age groups [37]. Penicillins, which include amoxicillin, have been claimed to be the most commonly used antibiotics for self-medication [36,38, 39].

Table 9: Antibiotic Susceptibility Test Results of Bacteria Isolated from Symptomatic UTI Adult Patients at the study settings in Addis Ababa, Ethiopia.

Drug		*E. coli*	*K. pneumoniae*	*E. faecalis*	*Prov.* Species	*K. Oxytoca*	*Pseud. Species*	*M. Morganni*	*S. aureus*	Others	*E. faecium*
AMP	S	5 (9.1)	-	4 (80)	-	-	-	-	1 (33.3)	-	-
	R	50 (90.9)	6 (100)	1 (20)	6 (100)	4 (100)	-	1 (100)	2 (66.7)	2 (100)	3 (100)
AMPS	S	1 (16.7)	-	4 (100)	-	-	-	-	1 (50)	1 (100)	-
	R	5 (83.3)	1 (100)	-	-	2 (100)	-	-	1 (50)	-	-
AUG	S	14 (43.75)	2 (66.7)	3 (100)	-	-	-	-	1 (50)	1 (50)	-
	R	14 (43.75)	-	-	-	2 (100)	-	-	1 (50)	1 (50)	-
	I	4 (12.5)	1 (33.3)	-	-	-	-	-	-	-	-
AMK	S	35 (92.1)	5 (100)	1 (100)	3 (100)	4 (100)	1 (50)	-	-	-	-
	R	2 (5.3)	-	-	-	-	1 (50)	-	-	-	-
	I	1 (2.6)	-	-	-	-	-	-	-	-	-
AMX	S	-	-	4 (100)	-	-	-	-	-	-	-
	R	32 (100)	5 (100)	-	6 (100)	4 (100)	-	1 (100)	2 (100)	1 (100)	3 (100)
AZS	S	-	-	-	-	-	-	-	-	-	-
	R	-	1 (100)	-	-	-	-	-	-	-	-
BEP	S	-	-	2 (100)	-	-	-	-	-	-	-
	R	-	-	-	-	-	-	-	2 (100)	1 (100)	2 (100)
CFP	S	21 (67.8)	4 (100)	-	3 (100)	1 (100)	-	-	1 (50)	1 (100)	-
	R	10 (32.2)	-	-	-	-	2 (100)	-	1 (50)	-	-
CFT	S	29 (56.9)	5 (71.4)	-	3 (50)	1 (50)	-	-	1 (50)	1 (50)	-
	R	22 (43.1)	2 (28.6)	-	3 (50)	1 (50)	2 (100)	1 (100)	1 (50)	-	-
CFRO	S	22 (40)	3 (42.9)	-	2 (40)	1 (25)	-	1 (100)	1 (50)	1 (33.3)	-
	R	32 (58.2)	4 (57.1)	-	3 (60)	3 (75)	2 (100)	-	1 (50)	1 (33.3)	-
	I	1 (1.8)	-	-	-	-	-	-	-	1 (33.4)	-
NTF	S	48 (70.6)	3 (30)	2 (66.7)	4 (80)	-	-	-	1 (100)	2 (66.7)	-
	R	19 (27.9)	6 (60)	1 (33.3)	1 (20)	2 (100)	-	1 (100)	-	1 (33.3)	1 (100)
	I	1 (1.5)	1 (10)	-	-	-	-	-	-	-	-
GEN	S	57 (77)	7 (77.8)	-	4 (66.7)	4 (100)	-	1 (100)	2 (66.7)	1 (50)	-
	R	15 (20.3)	2 (22.2)	-	2 (33.3)	-	2 (100)	-	1 (33.3)	1 (50)	-
	I	2 (2.7)	-	-	-	-	-	-	-	-	-
IMPN	S	3 (75)	-	-	-	-	-	-	-	-	-
	R	1 (25)	-	-	-	-	-	-	-	-	-
LVF	S	24 (96)	1 (50)	-	2 (100)	-	-	-	-	2 (100)	2 (100)
	R	1 (4)	1 (50)	-	-	-	-	-	-	-	-
LNZD	S	-	-	1 (100)	-	-	-	-	-	-	-
MTC	S	-	-	-	-	-	-	-	1 (50)	1 (100)	-
	R	-	-	-	-	-	-	-	1 (50)	-	-
MXF	S	22 (100)	-	-	2 (100)	-	-	-	-	1 (100)	1 (100)
CZD	S	19 (59.4)	4 (80)	-	3 (100)	1 (100)	1 (33.3)	-	-	1 (100)	-
	R	11 (34.4)	1 (20)	-	-	-	2 (66.7)	-	-	-	-
	I	2 (6.2)	-	-	-	-	-	-	-	-	-
CIP	S	30 (55.6)	2 (50)	-	2 (66.7)	-	-	-	1 (100)	2 (66.7)	1 (50)
	R	23 (42.6)	2 (50)	-	1 (33.3)	1 (100)	1 (100)	-	-	1 (33.3)	1 (50)
	I	1 (1.8)	-	1 (100)	-	-	-	-	-	-	-
CPTN	S	14 (32.6)	3 (60)	-	2 (33.3)	1 (25)	-	-	1 (50)	1 (50)	-
	R	28 (65.1)	2 (40)	-	4 (66.7)	3 (75)	2 (100)	-	1 (50)	-	-
	I	1 (2.3)	-	-	-	-	-	-	-	-	-
CFPM	S	34 (69.4)	5 (83.4)	-	4 (100)	1 (100)	1 (50)	-	1 (50)	2 (66.7)	-
	R	12 (24.5)	1 (16.6)	-	-	-	1 (50)	1 (100)	1 (50)	1 (33.3)	-
	I	3 (6.1)	-	-	-	-	-	-	-	-	-
CEF	S	29 (51.8)	5 (55.6)	-	3 (60)	1 (100)	-	-	1 (50)	2 (100)	-
	R	26 (46.4)	4 (44.4)	-	2 (40)	-	1 (100)	-	1 (50)	-	-
	I	1 (1.8)	-	-	-	-	-	-	-	-	-
NOR	S	20 (69)	-	-	1 (50)	-	-	-	-	-	1 (33.3)
	R	9 (31)	2 (100)	2 (100)	1 (50)	2 (100)	-	-	-	-	2 (66.7)
DOX	S	-	-	-	1 (16.7)	-	-	-	1 (50)	-	-
	R	22 (100)	4 (100)	4 (100)	5 (83.3)	2 (100)	-	1 (100)	1 (50)	-	1 (100)
PCN	S	-	-	2 (100)	-	-	-	-	-	1 (100)	-

PTDB	S	18 (78.3)	2 (40)	-	1 (100)	-	-	1 (100)	-	2 (100)	-
	R	3 (13)	-	-	-	-	-	-	-	-	-
	I	2 (8.7)	3 (60)	-	-	-	-	-	-	-	-
SMX	R	2 (100)	-	-	-	-	-	-	-	-	-
TTC	S	9 (25.7)	1 (20)	-	1 (16.7)	-	-	1	1 (50)	1 (50)	-
	R	26 (74.3)	4 (40)	4 (100)	5 (83.3)	2 (100)	1 (100)	1	1 (50)	1 (50)	2 (100)
TOBR	S	15 (78.9)	2 (100)	1 (100)	1 (100)	1 (100)	-	1 (100)	-	-	-
	R	4 (21.1)	-	-	-	-	-	-	-	1 (50)	-
	I	-	-	-	-	-	-	-	-	1 (50)	-
VAN	S	-	-	3 (100)	-	-	-	-	-	1 (100)	2 (100)
NA	S	2 (50)	-	-	-	-	-	-	-	-	-
	R	2 (50)	1 (100)	-	-	-	-	-	-	1 (100)	1 (100)
MER	S	28 (96.6)	4 (100)	-	-	-	1 (50)	2 (100)	-	2 (100)	-
	R	1 (3.4)	-	-	-	-	1 (50)	-	-	-	-
CFLXN	S	-	-	-	-	-	-	-	-	1 (100)	-
	R	1 (100)	-	-	-	-	-	-	-	-	-
CFOX	S	3 (75)	2 (100)	-	-	-	-	-	-	-	-
	R	1 (25)	-	-	-	-	-	-	-	-	-
COT	S	9 (24.3)	2 (40)	-	-	-	-	1 (100)	-	-	-
	R	28 (75.7)	3 (60)	-	-	3 (100)	-	-	-	2 (100)	-
CFXM	S	17 (43.6)	3 (75)	-	-	1 (50)	-	1 (100)	-	1 (100)	-
	R	22 (56.4)	1 (25)	-	1 (100)	1 (50)	1 (100)	-	-	-	-
CFZO	S	25 (33.3)	3 (37.5)	-	2 (40)	2 (50)	-	1 (100)	1 (50)	2 (100)	-
	R	49 (65.3)	5 (62.5)	-	3 (60)	2 (50)	2 (100)	-	1 (50)	-	-
	I	1 (1.4)	-	-	-	-	-	-	-	-	-
CLDA	S	-	-	-	-	-	-	-	1 (100)	-	-
ERY	S	-	-	-	-	-	-	-	1 (50)	-	-
	R	-	-	-	-	-	-	-	1 (50)	-	-

AMP, ampicillin; AMPS, ampicillin-sulbactam; AUG, augmentin; AMK, amikacin; AMX, amoxacillin; AZS; azithromycin; BEP, benzathine penicillin; CFP, cefpodoxime; CFT, cefotaxime; CFRO, cefuroxime; NTF, nitrofurantoin; GEN, gentamycin; IMPN, imipenem; LVF, levofloxacin; LNZD, linezolid; MTC, methicillin; MXF, moxifloxacin; CZD, ceftazidime; CIP, ciprofloxacin; CPTN, cephalothin; CFPM, cefepime; CEF, ceftriaxone; NOR, Norfloxacin; DOX, doxycycline; PCN, penicillin; PTDB, piperacillin-tazobactam; SMX, sulphamethoxazole; TTC, tetracycline; TOBR, tobramycin; VAN, vancomycin; NA; nalidixic acid; MER, meropenem; CFLXN, cefalexin; CFOX, cefoxitin; COT, cotrimoxazole; CFXM, cefixime; CFZO, cefazolin; CLDA, clindamycin; ERY, erythromycin.

Table 10: Multi-Drug Resistance Pattern of Bacterial Isolates from Symptomatic UTI Patients Attending at the study settings, Addis Ababa, Ethiopia.

Bacteria Isolates		R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R18	MDR, N (%)
E. coli	Count, (%)	8 (11.6)	8 (11.6)	7 (10.1)	7 (10.1)	10 (14.5)	5 (7.2)	7 (10.1)	2 (2.9)	2 (2.9)	4 (5.8)	3 (4.3)	1 (1.4)	1 (1.4)	3 (4.3)	-	1 (1.4)	69 (100)
	% Within NDR	57.1	61.5	63.6	70	76.9	83.3	53.8	33.3	50	66.7	100	100	100	100	-	100	65.1
K. pneumoniae	Count, (%)	1 (11.1)	-	2 (22.2)	1 (11.1)	1 (11.1)	1 (11.1)	1 (11.1)	-	1 (11.1)	1 (11.1)	-	-	-	-	-	-	9 (100)
	% Within NDR	7.1	-	18.2	10	7.7	16.7	7.7	-	25	16.7	-	-	-	-	-	-	8.5
E. faecalis	Count, (%)	2 (50)	1 (25)	1 (25)	-	-	-	-	-	-	-	-	-	-	-	-	-	4 (100)
	% Within NDR	14.3	7.7	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8
Prov. Species	Count, (%)	1 (16.7)	-	1 (16.7)	-	-	-	1 (16.7)	2 (33.3)	-	1 (16.7)	-	-	-	-	-	-	6 (100)
	% Within NDR	7.1	-	9.1	-	-	-	7.7	33.3	-	16.7	-	-	-	-	-	-	5.7
K. Oxytoca	Count, (%)	-	-	-	-	-	-	2 (50)	2 (50)	-	-	-	-	-	-	-	-	4 (100)
	% Within NDR	-	-	-	-	-	-	15.4	33.3	-	-	-	-	-	-	-	-	3.8

Pseudo. Species	Count, (%)	-	-	-	-	1 (33.3)	-	1 (33.3)	-	1 (33.3)	-	-	-	-	-	-	-	3 (100)
	% Within NDR	-	-	-	-	7.7	-	7.7	-	25	-	-	-	-	-	-	-	2.8
M. Morganni	Count, (%)	1 (50)	-	-	1 (50)	-	-	-	-	-	-	-	-	-	-	-	-	2 (100)
	% Within NDR	7.1	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	1.9
S. aureus	Count, (%)	-	1 (50)	-	-	-	-	-	-	-	-	-	-	-	-	1 (50)	-	2 (100)
	% Within NDR	-	7.7	-	-	-	-	-	-	-	-	-	-	-	-	100	-	1.9
Others	Count, (%)	-	3 (75)	-	-	1 (25)	-	-	-	-	-	-	-	-	-	-	-	4 (100)
	% Within NDR	-	23.1	-	-	7.7	-	-	-	-	-	-	-	-	-	-	-	3.8
E. faecium	Count, (%)	1 (33.3)	-	-	1 (33.3)	-	-	1 (33.3)	-	-	-	-	-	-	-	-	-	3 (100)
	% Within NDR	7.1	-	-	10	-	-	7.7	-	-	-	-	-	-	-	-	-	2.8
Total	Count, (%)	14 (13.2)	13 (12.3)	11 (10.4)	10 (9.4)	13 (12.3)	6 (5.7)	13 (12.3)	6 (5.7)	4 (3.8)	6 (5.7)	3 (2.8)	1 (0.9)	1 (0.9)	3 (2.8)	1 (0.9)	1 (0.9)	106 (100)
	% Within NDR	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Notes: NDR, Number of Drug Resistance; N, number; MDR, Multi-Drug Resistance (for two or more antibiotics); R2, resistance to two antibiotics; R3, resistance to three antibiotics; R4, resistance to four antibiotics; R5, resistance to five antibiotics; R6, resistance to six antibiotics; R7, resistance to seven antibiotics; R8, resistance to eight antibiotics; R9, resistance to nine antibiotics; R10, resistance to ten antibiotics; R11, resistance to eleven antibiotics; R12, resistance to twelve antibiotics; R13, resistance to thirteen antibiotics; R14, resistance to fourteen antibiotics; R15, resistance to fifteen antibiotics; R16, resistance to sixteen antibiotics; R18, resistance to eighteen antibiotics. Prov. Species, Proventcia Species.

In this study, the most common self-medicated conditions treated with antibiotics were urinary tract infections, as found in previous studies [39,40]. However, this result differs from those of [36] and [41], which mentioned that ASM was mainly used for upper respiratory tract problems. Similarly, it varies from [35], which discovered that a sore throat was followed by flu symptoms, and from [34], which reported that a sore throat was the cause of the majority of ASMP episodes. The diversity in the type of condition treated by ASM across studies could be related to changes in the research period based on the season, regional variation, and health infrastructure.

The primary reason for ASM among the participants in this study group was previous experience or simple familiarity with the drug name. This is similar to what has been found in previous studies [31,42,43]. Unlike this study, other studies reported other reasons, such as previous experience and lack of time [34], availability of the drug at the local drug store [44], cost-saving [32], and socio-cultural, economic, and regulatory factors [36], for seeking self-medication with antibiotics.

In this study, symptom resolution was most often cited as a positive result of self-medication. This result agrees with an earlier study [45]. The primary sources of antibiotic procurement were local pharmacies. Earlier studies found similar results [20,33,46]. Lax prescribing protocols or loose pharmacy practices are not uncommon in many low- and middle-income countries, contributing to misuse [47]. Additionally, this study showed that the main source of information for the antibiotic self-medication practice of most of the patients was their own past experience. This result is in line with a previous study [48].

Patients with a monthly income of 4,000 birr or less were statistically more likely to practice self-medication with antibiotics compared to those with higher incomes. This result is similar to those found in studies conducted in Addis Ababa, Ethiopia, and China [24,49,50], respectively. The current finding, however, contradicts the finding published by [51].

In low-income countries, self-medication predominates over clinic visits due to its lower costs. The WHO claims that self-medication provides a cheap alternative for people who are unable to afford healthcare costs, and thus, self-medication is often the first response to illness among people with low income [52]. Usually, most people prefer self-medication rather than suffer the high cost of laboratory tests and other services often ordered at clinics.

Patients in this study who had no history of UTIs were more likely to self-medicate than patients with infection histories. This practice is similar to that of patients with pulmonary tuberculosis, who were also less likely to self-medicate with antibiotics [47]. According to [53], in a similar statement to this current conclusion, patients with more chronic diseases become

Table 11: The cross tabulation of Multi-Drug Resistant Report versus the Antibiotic Self-medication Practice in the study settings, Addis Ababa, Ethiopia.

Variable			Antibiotic SM Practice N (%)		Total
			Yes	No	
MDR	R2	Count (%)	1 (7.1)	13 (92.9)	14 (100)
		% Within ASMP	11.1%	13.4%	13.2%
	R3	Count (%)	0	13 (100)	13 (100)
		% Within ASMP	0.0%	13.4%	12.3%
	R4	Count (%)	1 (9.1)	10 (90.9)	11 (100)
		% Within ASMP	11.1%	10.3%	10.4%
	R5	Count (%)	1 (10)	9 (90)	10 (100)
		% Within ASMP	11.1%	9.3%	9.4%
	R6	Count (%)	3 (23.1)	10 (76.9)	13 (100)
		% Within ASMP	33.3%	10.3%	12.3%
	R7	Count (%)	0	6 (100)	6 (100)
		% Within ASMP	0.0%	6.2%	5.7%
	R8	Count (%)	1 (7.7)	12 (92.3)	13 (100)
		% Within ASMP	11.1%	12.4%	12.3%
	R9	Count (%)	0	6 (100)	6 (100)
		% Within ASMP	0.0%	6.2%	5.7%
	R10	Count (%)	0	4 (100)	4 (100)
		% Within ASMP	0.0%	4.1%	3.8%
	R11	Count (%)	1 (16.7)	5 (83.3)	6 (100)
		% Within ASMP	11.1%	5.2%	5.7%
	R12	Count (%)	1 (33.3)	2 (66.7)	3 (100)
		% Within ASMP	11.1%	2.1%	2.8%
	R13	Count (%)	0	1 (100)	1 (100)
		% Within ASMP	0.0%	1.0%	0.9%
	R14	Count (%)	0	1 (100)	1 (100)
		% Within ASMP	0.0%	1.0%	0.9%
	R15	Count (%)	0	3 (100)	3 (100)
		% Within ASMP	0.0%	3.1%	2.8%
	R16	Count (%)	0	1 (100)	1 (100)
		% Within ASMP	0.0%	1.0%	0.9%
	R18	Count (%)	0	1 (100)	1 (100)
		% Within ASMP	0.0%	1.0%	0.9%
Total		Count (%)	9 (8.5%)	97 (91.5)	106 (100)
		% Within ASMP	100.0%	100.0%	100.0%

MDR: Multidrug resistance; ASMP: Antibiotic Self-medication Practice; SM: Self-medication; R2: Resistance to 2 antibiotics; R3: Resistance to 3 antibiotics; R4: Resistance to 4 antibiotics; R5: Resistance to 5 antibiotics; R6: Resistance to 6 antibiotics; R7: Resistance to 7 antibiotics; R8: Resistance to 8 antibiotics; R9: Resistance to 9 antibiotics; R10: Resistance to 10 antibiotics; R11: Resistance to 11 antibiotics; R12: Resistance to 12 antibiotics; R13: Resistance to 13 antibiotics; R14: Resistance to 14 antibiotics; R15: Resistance to 15 antibiotics; R16: Resistance to 16 antibiotics; R18: Resistance to 18; N: Number.

more acclimated to a set of signs and symptoms associated to their health issues and may seek a prescription.

The result of this study showed that the majority of the patients, 50 years of age and older, were statistically more likely to self-medicate. This is similar to previous studies [16,43], which stated that there is a significant positive association between old age and SMP across countries, and [43], which stated that older individuals are prone to self-medication, especially if they have chronic diseases. Unlike the current findings, other studies reported a negative association between increasing age and self-medication practice with antibiotics [42,54].

In this work, 82.2% of patients diagnosed with UTIs had MDR

Table 12: Multiple Logistic regression analysis of the study variables towards Antibiotic Self-medication Practice in the study settings, Addis Ababa, Ethiopia.

Variable	ASMP		Crude Odds Ratio (95%, CI; P< 0.05)	Adjusted Odds Ratio (95%, CI; P< 0.05)
	Yes	No		
Age				
18-24	7 (12.7)	29 (6.1)	1	1
25-29	13 (23.6)	61 (12.8)	1.133 (0.409-3.140)	1.237 (0.428-3.576)
30-34	11 (20)	78 (16.4)	1.712 (0.606-4.838)	2.170 (0.725-6.496)
35-39	7 (12.7)	43 (9)	1.483 (0.470-4.676)	1.888 (0.566-6.305)
40-44	4 (7.3)	53 (11.1)	3.198 (0.864-11.844)	3.914 (0.979-15.639)
45-49	4 (7.3)	33 (6.9)	1.991 (0.529-7.499)	1.997 (0.493-8.092)
≥ 50	9 (16.4)	179 (37.6)	4.801 (1.659-13.896); 0.004*	4.338 (1.407-13.38); 0.011*
Married status				
Single	22 (40)	112 (23.5)	1	1
Married in lifetime	33 (60)	364 (76.5)	2.167 (1.214-3.868); 0.009*	1.659 (0.881-3.125)
Educational level				
College and above	34 (61.8)	220 (46.2)	1	1
Secondary and below	21 (38.2)	256 (53.8)	1.884 (1.062-3.342); 0.03*	0.945 (0.475-1.878)
History of UTI				
Yes	36 (65.5)	243 (51.1)	1	1
No	19 (34.5)	233 (48.9)	1.817 (1.013-3.258); 0.045*	1.952 (1.062-3.588); 0.031*
Monthly income (birr)				
≥ 4001	32 (58.2)	172 (36.1)	1	1
≤ 4000	23 (41.8)	304 (63.9)	2.459 (1.394-4.337); 0.002*	2.610 (1.331-5.117); 0.005*

ASMP: Antibiotic Self-medication Practice; CI: Confidence Interval; UTI: Urinary Tract Infection; p: p-value; *: p-value < 0.05 (significant); married in lifetime: include currently married, divorced, and separated patients.

bacterial infections. Within this MDR data, 8.5% of them had ASMP. An earlier study conducted at Hawassa (Ethiopia) [55] supports this finding. In addition, a couple of reports indicated that the inappropriate use of antibiotics contributed to the development of antibiotic resistance [12], overdose, and ASMP [8,9]. The findings of the present study impose the urgency of careful monitoring and regulation of drug consumption, drug delivery, and drug dispensing in developing countries to prevent self-medication [56]. Usually, most experts have advised the establishment of an antibiotic stewardship index to gauge the proportion of a country's gross domestic product that is spent on publicly funded health programs [57].

In this study, MDR UTIs were common among the suspected patients, including those with a history of ASMP. In a harmonized report on this finding by [58], it was reported that the prevalence of MDR pathogens in the community is higher. This finding implies that bacteria strains are circulating in the community with the potential to cause severe MDR infections. Consequently, in the health care system, there is a decrease in antibiotic treatment options. This assertion is backed by [59,60] which states that MDR bacteria are also generating healthcare-associated and community-acquired infections such as UTIs, which result in treatment failure. Therefore, for proper management of UTIs in a particular region, it is necessary to conduct an extensive

investigation and implement an antibiotic policy based on antimicrobial susceptibility tests.

The most common causes of MDR UTIs among the suspected patients in this study were *E. coli, K. pneumoniae*, and *Providencia* species, respectively. This most common prevalent bacteria finding is supported by previous reports [61, 62]. There are different types of bacteria in the gastrointestinal tract. During drug exposure, the development of bacterial resistance is easier in the digestive microbiota due to the large number of bacteria (greater than 10^9 bacteria per gram of stool), promoting contact and the emergence of resistant mutants. In addition, UTIs are most often of ascending origin due to contamination from the perineal flora, reflecting the digestive flora. Therefore, this selective pressure due to ASMP of the same antibiotic has a definite clinical impact [47].

This study indicated that among adult patients suspected of UTIs, the most common uropathogenic bacteria identified and isolated was *Escherichia coli*. This result agrees with those of previous studies [55,63]. The possible reason why *Escherichia coli* presents the highest prevalence in most of the studies is its commonness as a urinary pathogen [64].

In this study, *E. coli* was found to be highly resistant to amoxicillin (32, 100%), doxycycline (22, 100%), but least resistant to meropenem (1, 3.4%). Other studies have reported similar results in terms of high resistance to amoxicillin [65, 66]. Meropenem was reported to be the most effective drug. However, it should not be administered empirically unless infections are life-threatening. Carbapenems are considered drugs of last resort [67]. Despite this, the use of "last-resort" antibiotics such as carbapenems has increased. Between 2000 and 2010, the global consumption of carbapenems increased by 45% [68].

Among the antibiotics tested on *E. coli* isolates in this study, moxifloxacin showed maximum efficacy and was 100% sensitive against *E. coli*, similar to that found in an earlier study [69]. In the present study, over 80% of self-medicating patients self-reported that the practice was unacceptable, in contrast to what has been observed in a study performed in Kabul [38]. Among the limitations of the current study are the nature of the study design, which was a cross-sectional study, and possible recall bias for some questions. In contrast, the hospital and diagnostic centres with national and international organizations accredited laboratories and their urban settings were the strengths of this study. Finally, it is worth highlighting that this study focused on the presence of ASMP among adult patients with MDR bacteria-induced UTIs.

CONCLUSION

In conclusion, this study revealed that self-medication with antibiotics for urinary tract infections is a common practice in Addis Ababa. Low-income patients, in particular, constitute the target population for risks of ASMP. Since it has been found a significant positive association between old age and SMP, stating that older individuals are prone to self-medication. Worryingly, some of these patients have developed multi-drug resistant UTIs. The two most common uropathogenic organisms detected were *E. coli* and *K. pneumoniae*. In most of the cases, these uropathogenic bacteria were resistant to the commonly prescribed antibiotics.

AUTHORSHIP CONTRIBUTION STATEMENT

Conceptualization: Mebrahtu Eyasu (ME) and Sagrario Martín-Aragón (SM), Juana Benedi González (JBG); Data curation: ME, and SM; Formal analysis: ME, and SM; Funding acquisition: ME; Investigation: ME, SM, JBG, José Antonio Romero (JAR); Methodology: ME, and SM; Project administration: ME, SM, and JBG; Resources: ME, and SM; Software: ME, and SM; Supervision: SM, JBG, JAR; Writing – original draft: ME, and SM; and Writing – review & editing: ME, SM, JBG, JAR.

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