Original Research Article

SAGE Open Medicine

Antibiotics non-adherence and its associated factors among households in southern Ethiopia

SAGE Open Medicine
Volume 10: 1–11

DOI: 10.1177/20503121221090472
journals.sagepub.com/home/smo
SAGE

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Abstract

Objectives: This study aimed at assessing the prevalence of antibiotics non-adherence and its associated factor among households in southern Ethiopia.

Methods: A community-based cross-sectional study was conducted among 323 randomly selected households in Wenago town. To collect the data, structured questionnaire was used. Categorical variables were represented by frequency and percentage. For continuous variables, the mean value and standard deviation were used. Bivariate and multivariate logistic regression analyses were used to identify factors related to antibiotic non-adherence. Finally, for significant factors with *p*-values less than 0.05, the adjusted odds ratio with 95% confidence interval was calculated and evaluated.

Results: The prevalence of antibiotic non-adherence in the household was 194 (60.1%) (95% confidence interval = 55.1–65.6). Remission of symptoms (63%) is one of the top reasons for antibiotic non-adherence in the home. Male sex (adjusted odds ratio = 1.77, 95% confidence interval = 1.03–3.08), lower educational status (adjusted odds ratio = 3.42, 95% confidence interval = 1.51–7.75; adjusted odds ratio = 2.37, confidence interval = 1.12–5.02), poor attitude toward antibiotics use (adjusted odds ratio = 1.89; 95% confidence interval = 1.23–3.04), poor knowledge about antibiotics use (adjusted odds ratio = 1.34; 95% confidence interval = 1.11–2.39), and no-prescription information from pharmacy (adjusted odds ratio = 2.02, 95% confidence interval = 1.09–3.72) were all associated with non-adherence. While no medication discomfort (adjusted odds ratio = 0.31, 95% confidence interval = 0.178–0.56) had a negative effect on non-adherence.

Conclusion: In this study, antibiotic non-adherence was considerably high among the participants. Being male, lower educational status, poor attitude, poor knowledge, no-prescription information from pharmacy/druggist, and medication discomfort were related with antibiotic non-adherence. As a result, community service providers must provide relevant prescription information as well as appropriate counseling to antibiotic non-adherent patients.

Keywords

Antibiotics, households, prevalence, non-adherence, prescribed drug

Date received: 7 August 2021; accepted: 10 March 2022

Introduction

Antibiotics are one of the antimicrobial agents that are widely used globally[1] and are prescribed for the prevention and treatment of microbial infections.[2] However, some patients fail to take the prescribed doses, which is referred to as antibiotic non-adherence.[3]

Non-adherence to antibiotics has a considerable impact on treatment outcome, according to a comprehensive review and meta-analysis. Adherent patients got three times the good treatment outcome as non-adherent patients[4] and may result in microbial resistance, which reduces the efficacy of antimicrobials in the prevention and treatment of microbial infections and is associated with an increase in illness, death, health-care burdens, medical expenditures, reduces the future usefulness of antibiotics, and makes diagnosis more difficult.[5–8] A single study reported that from medication-related

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hospital admissions, 70% were due to drug non-adherence.[9] According to a systematic review and meta-analysis, the threat of antibiotic resistance is three times greater in low- and middle-income countries (LMICs) than in developed countries.[10]

As part of the World Health Organization (WHO)[11] approach, physicians and pharmacists must educate clients on the importance of completing the prescribed drugs and the proper use of medications for controlling drug-resistant microbes, Based on this, an experimental study conducted in Spain revealed that treatment adherence was 67.2% for groups that received educational interventions and 48.4% for groups that did not receive educational interventions.[12] However, according to different studies, the prevalence of antibiotic non-adherence ranges from 15% to 93%, with an international average of 50%.[13–16]

The most common reasons for antibiotic non-adherence were forgetting to take the drug, discomfort (medication side effect), taking more than one prescription, the cost of the drug, lack of awareness, insufficient knowledge about antibiotics, and remission of symptoms.[7,17–19] Antibiotic availability was a major concern in both upper and lower socioeconomic groups, which may be due to the very low economic status of a large number of nations, inappropriate use, the high cost of the most recent and efficacious antibiotics, extensive "over the counter" usage, and an increasing number of counterfeit drugs.[20–23] A comparison study discovered that 32% of antibiotics were dispensed without a medical prescription, with the frequency being higher in lower socioeconomic areas. Furthermore, a systematic review and meta-analysis study found that non-prescription antibiotic access accounted for 62% of all antibiotic access globally.[24]

Antibiotics have significantly reduced morbidity and mortality from infectious diseases. However, indiscriminate use, a key driver of antimicrobial resistance, is increasing at an alarming rate, and the situation is conceivably worse in many developing countries, including Ethiopia, where the development of resistance in the responsible pathogens has exacerbated the situation, often with very little resource to investigate and provide reliable susceptibility data on which rational treatments can be based, as well as means to optimize the use of antimicrobial agents.[25,26]

CDROs (community drug retail outlets) are common in Ethiopia due to their ease of access, wider availability of medicines, shorter wait times, and longer working hours. Dispensers in such settings are involved not only in filling prescriptions but also in self-care, which is related to the high rate of prescription-only medicines being dispensed without a prescription.[27–29] According to a systematic review and meta-analysis study, the pooled prevalence of inappropriate antibiotic use and the prevalence of self-antibiotic prescription in Ethiopia was 49.2% and 43.3%, respectively.[30]

A baseline survey conducted by the Food, Medicine, and Healthcare Administration and Control Authority of Ethiopia (FMHACA), approximately two-thirds of patients (70%) who visited outpatient clinics had one or more prescribed antibiotics, with a 40% of irrational prescription.[31] According to studies conducted in Gonder, Tigray, and Harar, the habit of inappropriate drug use and deficiency in completing the prescribed dose is more common, ranging from 21% to 92.6%.[32–35]

According to WHO,[36] some of the key public issues in the fight against antimicrobial resistance are improving public access to medical facilities, reducing unnecessary and irrational antimicrobial use, completing prescribed antimicrobial courses of therapy, and not sharing medication with others. However, clinicians and drug prescribers commonly assess medication adherence among patients undergoing follow-up treatment at the hospital level, but little is known about antibiotic non-adherence at the community level. As a result, the goal of this study was to find out how common antibiotic non-adherence is and what factors contribute to it in communities in Wenago town, Gedeo zone, Southern Nations, Nationalities, and People's Region (SNNPR), Ethiopia.

Conceptual framework

Conceptual framework on factors associated with antibiotics non-adherence which was adapted from the previous related studies[8,32–35,37–39] (Figure 1).

Methods and materials

Study settings

This research was carried out in southern Ethiopia, in the Gedeo zone, in the town of Wenago. The town was thought to have been founded in 1910 according to the Ethiopian calendar (372 km from Addis Ababa, the country's capital). The town has a total area of 49,581 m^2 and is located at 6022' to 6042' N and 38021' to 38041' E longitude, with an altitude of about 1400–2400 m above sea level (ASL), sharing borders with Oromia in the west, Yirgacheffe in the south, Dilla in the north, and Bule in the east.[40] Wenago town has approximately 3533 households divided into two kebeles: Tutufala and Buno. There are two health centers, two health posts, and four drug stores in town.

Study design and period

A community-based cross-sectional study design was carried out from 9 April 2021 to 14 May 2021 to assess the prevalence of antibiotics non-adherence and its associated factor among households in Wenago town, Gedeo zone, southern Ethiopia.

Study population

The study population consisted of a randomly selected household that visited a health facility and took the prescribed medication within the previous 6 months. Heads of

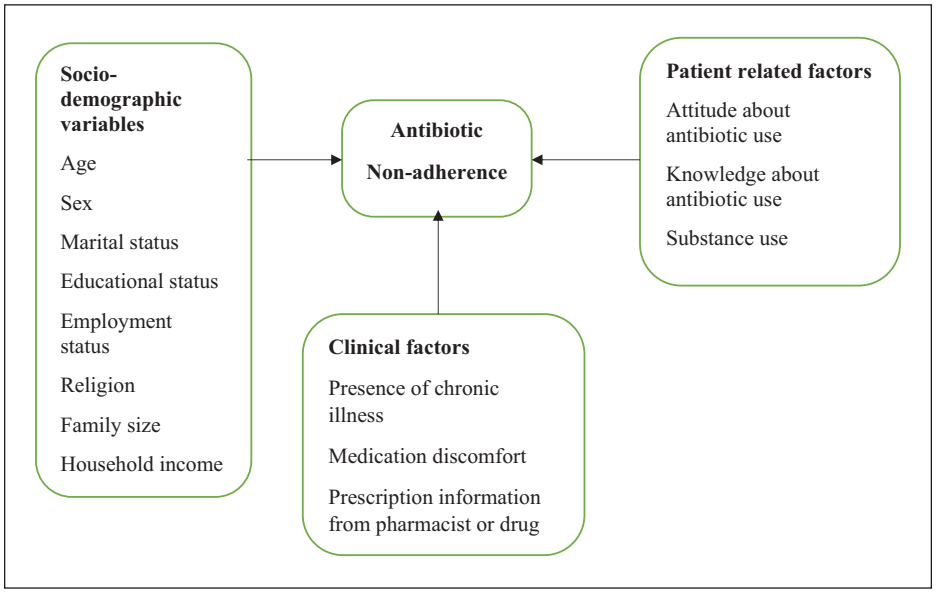

Figure 1. Factors related with antibiotics non-adherence adapted from different literatures, 2021.

households or any member of the household aged 18 years and up who had lived in the study area for at least 6 months and had been prescribed oral antibiotics in the previous 6 months were eligible. Closed households in more than two consecutive visits during the data collection period, participants who purchased antibiotics without a prescription from a pharmacy, and participants who shared antibiotics with a family member or neighbor were excluded from the study.

Sample size determination and sampling technique

The sample size was calculated with a confidence level of 95% and a degree of precision of 5% using the formula for single population proportion for cross-sectional study: $n=(z\alpha/2)^2pq/d^2$, where n is the sample size, $z\alpha/2$ is the critical value = 1.96, p = 67.9% (prevalence of antibiotic non-adherence in a previous study in Gonder, Ethiopia),[32] and d is the margin of error = 0.05. Using this information, the sample size will be calculated as follows: $n=(1.96)^2\times0.679\ (0.321)/(0.05)^2=276$. Adding a 10% non-respondent rate yields a sample size of 304, but we included 323 households.

Sampling techniques and procedures

The required participants were chosen using a systematic random sampling technique in this study. Prior to the actual data collection, a preliminary survey was conducted to determine whether or not households had visited a health facility and brought the prescribed antibiotics in the previous 6 months. According to the preliminary survey results in the last 6 months, 1766 households out of 3533 visited a health facility and received antibiotics. The sample size was calculated by dividing the number of selected households by the sample size ($K=N/n=1766/323=5$), and after selecting the first household via lottery, every fifth household was included until the sample size was met. Finally, for households with more than one eligible participants, interview was done to select a participants using lottery method, although in the event of a household with no eligible participants the immediate next household was questioned. Revisits of two times were done in case where eligible respondents will not available at the time of data collection.

Data collection techniques and procedure

The structured questionnaires were adapted from various studies on a similar topic. It contains socio-demographic characteristics (sex, educational status, age, marital status, occupation, monthly income, religion, family size), data about antibiotic non-adherence, reasons for antibiotic non-adherence, substance misuse (chat chewing, smoking, and alcohol), any chronic illness, any discomfort related to the drug, relationship with health practitioner, social support, and getting prescription information from pharmacist.[8,33,37,41,42] The knowledge and attitude toward antibiotic use were assessed using a questioner with eight and seven item questions, respectively.[35,43] To achieve consistency, the data collection tools were translated into the local language and then back into English. To collect the data, four data collectors (pharmacy students) and two health extension workers were participated. The interviews were conducted in the homes of study participants, and data collectors went from house to house in each of the selected kebeles until the sample size was reached. Participants were informed about the study's purpose, the potential risks and benefits of participating, the study's confidentiality, and their right to refuse to

participate or withdraw from the study at any time before data collection began. Following that, each participant provided informed consent, and data were collected via an interviewer-administered questionnaire. Every day, the supervisor and investigators double-checked the questionnaire for completeness. The data were gathered between 9 April 2021 and 14 May 2021.

Study variables

The dependent variable in this study was antibiotic non-adherence, and the independent variables were divided into three categories: age, gender, educational status, monthly income, marital status, and family size are socio-demographic variables. Factors affecting the patient: attitude toward antibiotic use, knowledge about antibiotic use, and current substance use: any of chat chewing, drinking alcohol, smoking, and so on. Clinical factors include any chronic illness (having at least one chronic illness, such as HIV/AIDS, tuberculosis, chronic renal disease, diabetes mellitus, etc.), medication discomfort, and prescription information from a pharmacist or drug dispenser.

Operational definitions

Antibiotics non-adherence. If a respondent in the household reports missing more than one dose after receiving prescribed antibiotics from a health facility by a licensed health professional for their illness (acute episodes) in the previous 6 months, which was administered for scheduled time.[39]

Remission of symptoms. Participants were questioned about why they had stopped taking antibiotics. If their response was that they would stop taking antibiotics, once they believed their symptom had resolved.

Attitude toward antibiotic use. Seven attitude questionnaires were used to assess respondents' attitudes toward antibiotics; if a respondent scored above the mean score for attitude assessment items, it was considered to have a positive attitude toward antibiotic use. The attitude questionnaires were designed using a 2-point Likert-type scale with the options "agree" and "disagree."[35,43]

Knowledge about antibiotic use. Eight knowledge questionnaires were used to assess the participants' knowledge; if a respondent scored higher than the mean score, they were considered to have good knowledge about antibiotic use. The knowledge questionnaires had "Yes" and "No" responses.[35,43]

Statistical analysis

Data was entered into Epi-info version 17 data entry software before being exported to Statistical Package for the Social Sciences (SPSS) version 25 statistical software for analysis. For categorical variables, frequency and percentage were used to describe the variables. For continuous variables, the mean value and standard deviation (SD) were used. In addition, cross tabulation was used to show the proportion (percentage) of each variable in relation to the outcome variable. A binary logistic regression analysis was performed to demonstrate the relationship between independent variables and the dependent variable. For variable selection, each variable was tested against the dependent variable at a p-value of 0.25. Then, those variables whose p-value less than 0.25 at bivariate logistic regression will be considered in multivariate logistic regression. The variables with p-values less than 0.25 in bivariate logistic regression were then taken into account in multivariate logistic regression. Variables with p-values less than 0.05 in multivariate logistic regression were considered to be factors associated with antibiotic non-adherence. Finally, for significant variables, an adjusted odds ratio (AOR) with a 95% confidence interval (CI) was calculated and interpreted.

Data quality management

Throughout the data collection period, the principal investigator checked the completeness and consistency of the questionnaires on a daily basis. Data collectors were trained, and the principal investigator oversaw them on a daily basis. A pre-test was also conducted on 5% of the sample size in Dilla Town, after which the data collection tools were modified accordingly.

Result

Socio-demographic characteristics

In this study, out of the total 323 participants, 177 (54.8%) were females with a mean age of 37 years (95% CI = 36–38 years), half (50.5%) of them found under the age of 37 years, more than half (54%) of participants have monthly incomes of less than 2923 Ethiopian birr with mean monthly income of 2923 Ethiopian birr (95% CI = 2753–3092 birr). Moreover, nearly half (48%) of the participants have a family size of greater than 5 with mean family size of 5 (95%: 5.2–5.6) (Table 1).

Knowledge and attitude about antibiotic use

The majority of 269 participants (83.3%) agreed that different antibiotics are needed to cure different diseases, more than two-thirds (69.3%) agreed that antibiotics are effective against bacteria, and about 24% claimed that antibiotics are effective against viruses. Antibiotics, according to a large number of participants, can treat symptoms such as fever, cough, pain, and inflammation (82.4%). The majority of participants (81.6%) also stated that using antibiotics unnecessarily can lead to increased bacterial resistance. More than

Table 1. Socio-demographic characteristics of the participants of Wenago town, Gedeo zone, SNNPR, Ethiopia, 2021 ($n = 323$).

Variables	Frequency (percentage)
Sex	
Male	152 (47.0%)
Female	171 (53%)
Age (mean) in years	37
Less than or equal to 37 years	163 (50.5)
Greater than 37 years	160 (49.5%)
Monthly income (mean)	2923 ETB
Less than or equal to 2923	175 (54.2%)
Greater than 2923	148 (45.8%)
Religion	
Protestant	188 (58.2%)
Orthodox	80 (24.7%)
Muslim	48 (14.8%)
Others*	7 (2.1%)
Educational status	
Unable to read and write	92 (28.5%)
Primary	87 (26.9%)
Secondary	65 (20.1%)
Collage and above	79 (24.5%)
Marital status	
Single	57 (17.6%)
Married	205 (63.5%)
Divorced	31 (9.6%)
Widowed	30 (9.3%)
Occupation	
Student	29 (9%)
Government employee	73 (22.6%)
Merchant	91 (28.17%)
Farmer	52 (16.1%)
House wife	55 (17%)
Other**	23 (7.1%)
Family size (mean)	5
Less than or equal to 5	169 (52.3%)
More than 5	154 (47.7%)

ETB: Ethiopian birr.
*Catholic, wakefeta.
**Daily labor, pension.

one-third (42.1%) of the participants scored above the mean for antibiotic use knowledge, with a mean value ± SD score of (5.6 ± 1.22).

Furthermore, the majority of participants (80.2%) agreed that finishing the antibiotic course and not storing antibiotics at home for future use were critical (78.3%). 63.8% of the participants agreed that antibiotics should not be obtained from family or friends without first consulting a physician, and a sizable proportion (69.7%) disagreed that antibiotics should be purchased from a pharmacy without a prescription. However, a sizable proportion of respondents (66.6% and 57.9%, respectively) opposed the use of antibiotics to treat coughs that lasted more than a week and sore throats.

Table 2. Knowledge and attitude item response of the participants of Wenago town, Gedeo zone, SNNPR, Ethiopia, 2021 ($n = 323$).

Knowledge about antibiotic use	Response	
	Yes	No
Different antibiotics are needed to cure different diseases	269 (83.3%)	54 (16.4%)
Antibiotics can kill bacteria	224 (69.3%)	99 (30.7%)
Antibiotics can treat symptoms such as fever, cough, pain, and inflammation	266 (82.4%)	57 (17.6%)
Antibiotics can kill viral diseases	78 (24%)	245 (76%)
Antibiotics have side effects such as diarrhea, nausea, and vomiting	229 (70.9%)	94 (29.1%)
People can be allergic to antibiotics	243 (75.2%)	80 (24.8%)
The unnecessarily use of antibiotics can increase the resistance of bacteria	263 (81.6%)	60 (18.6%)
Antibiotic resistance is worldwide problem	176 (54.5%)	147 (45.5%)
Attitude toward antibiotic use	Agree	Disagree
I always complete the course of treatment with antibiotics even if I feel better	266 (80.2%)	64 (19.8%)
If I feel better after a few days, I sometimes stop taking my antibiotics before completing the course of treatment	99 (30.7%)	224 (69.3%)
I prefer to keep antibiotics at home in case there may be a need for them later	70 (21.7%)	253 (78.3%)
It is good to be able to get antibiotics from relatives or friends without having to see a medical doctor	117 (36.2%)	206 (63.8%)
I prefer to be able to buy antibiotics from the pharmacy without a prescription	98 (30.3%)	225 (69.7%)
I prefer to use an antibiotic if I have a cough for more than a week	108 (33.4%)	215 (66.6%)
When I have a sore throat I prefer to use an antibiotic	136 (42.1%)	187 (57.9%)

Almost 147 (45.5%) of the participants scored above the mean value for attitudes toward antibiotic use, with a mean value ± SD score (3.2 ± 1.56) (Table 2).

The magnitude of antibiotics non-adherence

Out of the total 323 study participants, 194 (60.1%) (95% CI = 55.1–65.6) had antibiotics non-adherence and 129 (39.9%) have adhered the drug in the last 6 months (Figure 2).

Reasons for antibiotics non-adherence

Reasons for drug non-adherence were 39 (62.9%), 12 (19.4%), 6 (9.7%), and 5 (8.1%) due to remission of symptoms (they do not need to continue treatment if their condition improves), cost of the medication, forgetting, and other reasons, respectively (Figure 3).

Antibiotic non-adherence status by selected variables

Out of the 194 participants with antibiotic non-adherence, 100 (51.5%), 126 (64.9%), 66 (34.0%), 97 (half), 106 (54.6%), and 106 (54.6%) were males, unable to read and write, married, less than or equal to 37 years old, monthly income less than or equal to 2923 Ethiopian birr, and more than five family members, respectively.

Besides that, 62 (33.2%), 121 (62.4%), 147 (75.7%), 85 (40.2%), and 104 (53.60%) of the participants with antibiotic non-adherence had poor knowledge about antibiotic use, poor attitude toward antibiotic use, were unable to obtain prescription information from a pharmacy or (drug dispenser), and felt discomfort, respectively (Table 3).

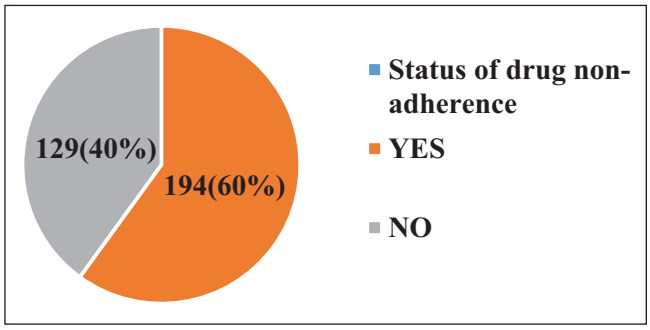

Figure 2. The status of antibiotics non-adherence among households in Wenago town, SNNPR, Ethiopia, 2021 ($n = 323$).

Factors associated with drug non-adherence

After testing each variable at a p-value of 0.25 in bivariate logistic regression analysis, the variables with p-values less than 0.25 were as follows: participant sex, educational status, family size, knowledge about antibiotics use, attitude about antibiotics use, prescription information from pharmacist, and medication discomfort. In multivariate logistic regression, the statistically significant variables with p-values less than 0.05 were as follows: respondent sex, educational status, a poor knowledge about antibiotic use, a poor attitude toward antibiotic use, a lack of prescription information from a pharmacist, and medication discomfort are all factors were considered.

The risk of antibiotic non-adherence among males was nearly two times higher than that of females (AOR = 1.77, 95% CI = 1.03–3.08), the risk of non-adherence among participants who were unable to read and write was three times higher than those with educational status of college and above (AOR = 3.42, 95% CI = 1.51–7.75), participants with primary educational status reported more than two times the likelihood of antibiotic non-adherence than the corresponding comparison group. The odds of antibiotic non-adherence was 1.89 times more likely among participants with a poor attitude toward antibiotic use than among those with a good

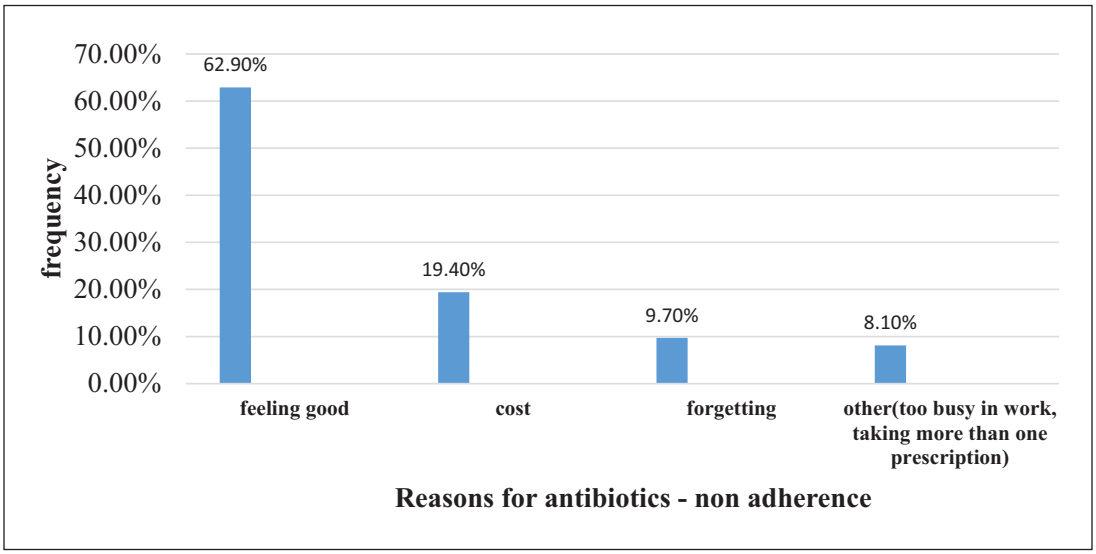

Figure 3. Reasons for antibiotic non-adherence among households in Wenago town, SNNPR, Ethiopia, 2021 ($n = 323$).

Table 3. The number of antibiotics non-adherence status of Wenago town divided by selected variables ($n = 323$).

Variables	Antibiotics non-adherence	
	Yes	No
Sex		
Male	100 (51.5%)	52 (40.3%)
Female	94 (48.5%)	77 (59.7%)
Educational status		
Unable to read	66 (34.0%)	26 (20.2%)
Primary	58 (29.9%)	29 (22.5%)
Secondary	40 (20.6%)	25 (19.4%)
Collage and above	30 (15.5%)	49 (37.9%)
Age		
Below or equal to 37 years	97 (50%)	66 (51.2%)
Above 37 years	97 (50%)	63 (48.8%)
Marital status		
Single	34 (17.5%)	23 (17.8%)
Married	126 (64.9%)	79 (61.2%)
Divorced	17 (8.8%)	14 (10.9%)
Widowed	17 (8.8%)	13 (10.1%)
Family size		
Less or equal to 5	88 (45.4%)	81 (62.8%)
Greater than 5	106 (54.6%)	48 (37.2%)
Monthly income		
Below or equal to 2923 ETB	106 (54.6%)	69 (53.5%)
Above 2923 ETB	88 (45.4%)	60 (46.5%)
Attitude toward antibiotic use		
Good	73 (37.6%)	74 (57.3%)
Poor	121 (62.4%)	55 (42.7%)
Knowledge about antibiotic use		
Good	125 (66.8%)	69 (50.7%)
Poor	62 (33.2%)	67 (49.3%)
Prescription information from pharmacy or druggist		
Yes	47 (24.3%)	39 (30.2%)
No	147 (75.7%)	90 (69.8%)
Current substance use		
Yes	85 (40.2%)	53 (37.2%)
No	109 (59.8%)	76 (62.8%)
Chronic illness		
Yes	33 (17.0%)	21 (16.3%)
No	161 (83.0%)	108 (83.7%)

ETB: Ethiopian birr.

attitude (AOR = 1.89; 95% CI = 1.23–3.04). Antibiotic non-adherence was 1.34 times more likely among participants with poor knowledge of antibiotic use than among those with good knowledge (AOR = 1.34; 95% CI = 1.11–2.39). The risk of antibiotic non-adherence was twice as high among participants who did not have enough prescription information from pharmacists (drug dispensers) as among those who did (AOR = 2.02, 95% CI = 1.09–3.72). Participants who did not experience any discomfort were 69% less likely than the comparison group to practice antibiotic non-adherence (AOR = 0.31, 95% CI = 0.178–0.56) (Table 4).

Discussion

In this study, the overall prevalence of drug non-adherence was found to be 60.1% (95% CI = 55.1–65.6). Respondent's sex, educational status, poor knowledge about antibiotic use, a poor attitude toward antibiotic use, a lack of prescription information from a pharmacist, and medication discomfort were all statistically significant predictors of antibiotic non-adherence.

The overall prevalence of drug non-adherence was found to be 60.1% (95% CI = 55.1–65.6). The study findings consistent with a studies done in LMICs (Bangladesh (50%),[44] India,[15] Nigeria (63.4%)[19]). The findings also lower than previous studies conducted in Ethiopia (67.9% and 92.6%).[33,45] Moreover, it is higher than previous Ethiopian studies conducted in Tigray (21%),[34] Harar (34%),[35] Yirgalem (37.9%),[46] and other LMICs (Nigeria (51.0%),[38] Malawi (20%),[47] and Malaysia (34.8%)[48]).

The inconsistency may be due to households stop their medication when they feel good without filling the prescribed dose accounting for about 62.9% in the study area and 65.3% in Nigerian study[38] and households expect clinical improvement after few days of treatment which may leads to antibiotic non-adherence. Moreover, the reasons for household's antibiotic non-adherence were also non-satisfaction with health-care services, cost of the drugs, and forgetting and low level of community awareness about antibiotic resistance.[8,37,45,49] The discrepancy from previous studies might be due to the difference in measuring the non-adherence this study considered the self-reported non-adherence condition and difference in the implementation of antibiotic prescribing practices in these settings.

The likelihood of antibiotic non-adherence among males was almost two times higher than that of females. Inconsistent with studies done in China's reported no significant association between gender and drug non-adherence[19,41] and also inconsistent with Italian studies[42] reported females sex were more prone to antibiotics non-adherence, the difference might be due to males mostly misuse substances which encourages to antibiotic non-adherence in the study setting.

In this study, participants who were unable to read and write had a threefold higher risk of antibiotic non-adherence than those with a college education or higher, and participants with primary education had a more than twofold higher risk of antibiotic non-adherence than the corresponding comparison. This finding was consistent with previous research conducted in Ethiopia, Spain, Bangladesh, and Italy, which found that lower educational status was associated with inadequate awareness of proper antibiotic use and poor comprehension of the instruction.[12,16,42,50] The discovery could be attributed to the participants' educational

Table 4. Factors associated with drug non-adherence on Wenago town, SNNPR, Ethiopia, 2021 ($n = 323$).

Serial number	Variables	Bivariate, COR [95% CI]	*p*-value	Multivariate, AOR [95% CI]	*p*-value
1	Sex		**0.048**		**0.036***
	Male	1.57 [1.00–2.47]		1.77 [1.03–3.08]	
	Female	1.00		1.00	
2	Age		0.838		
	Less than or equal to 37 years	0.95 [0.61–1.49]			
	Greater than 37 years	1.00			
3	Educational status		**0.000**		**0.013***
	Unable to read and write	4.15 [2.18–7.87]		3.42 [1.51–7.75]	
	Primary	3.27 [1.73–6.17]		2.37 [1.12–5.02]	
	Secondary	2.61 [1.33–5.13]		1.31 [0.58–2.93]	
	Collage and above	1.00		1.00	
4	Marital status		0.881		
	Single	1.13 [0.46–2.77]			
	Married	1.22 [0.56–2.64]			
	Divorced	0.93 [0.33–2.55]			
	Widowed	1.00			
5	Family size		**0.002**		0.143
	Less than or equal to 5	0.49 [0.31–0.77]		0.66 [0.38–1.15]	
	Greater than 5	1.00		1.00	
7	Income		0.839		
	Less than 2923 ETB	1.04 [0.67–1.63]			
	Greater than 2923 ETB	1.00			
8	Attitude toward antibiotic use		**0.001**		**0.000*****
	Good	1.00		1.00	
	Poor	2.23 [1.41–3.51]		1.89 [1.23–3.04]	
9	Prescription information from pharmacist		**0.232**		**0.024***
	Yes	1.00		1.00	
	No	1.35 [0.82–2.23]		2.02 [1.09–3.72]	
10	Knowledge about antibiotic use		**0.004**		**0.031***
	Yes	1.00		1.00	
	No	1.59 [1.24–3.12]		1.34 [1.11–2.39]	
11	Current substance use		0.589		
	Yes	1.00			
	No	0.88 [0.71–1.79]			
12	Chronic illness		0.863		
	Yes	1			
	No	0.95 [0.521–1.73]			
13	Feel discomfort		**0.028**		**0.038***
	Yes	1			
	No	0.60 [0.385–0.95]		0.31 [0.178–0.56]	

COR: crude odds ratio; CI: confidence interval; AOR: adjusted odds ratio; ETB: Ethiopian birr.
[1]indicates reference.
*Statistically significant at $p < 0.05$.
***Statistically significant at $p < 0.001$.

capability, which could be used to involve them in their treatment plan. However, this is in contrast to studies from China and Nigeria, which found no link between educational level and antibiotic non-adherence.[19,41] The difference could be attributed to the small sample size and the study participants' inclusion.

This study found that the odds of antibiotic non-adherence were at least twice as high among participants who had poor attitudes toward antibiotic use as those who had good attitudes toward antibiotic use. This finding is consistent with research conducted in Saudi Arabia and Australia.[8,51] This could be because the patient stopped taking medication

because they believed their illness did not require any more medication, or because they had a misunderstanding about their illness's situation and progression. Furthermore, most patients require immediate symptom control rather than microbe investigation and treatment.

Antibiotic non-adherence was 1.34 times more likely among participants with poor antibiotic knowledge compared to those with good knowledge. This is consistent with findings from Chinese[41] and Spanish[12] studies in which participants with a good understanding of antibiotic use had a higher risk of adherence. As a result, increasing the patient's knowledge would have a positive effect on adherence, and patient education in the proposed dispensing protocol is regarded as an implicit strategy for improving compliance.

In a recent study, participants who did not have enough prescription information were twice as likely as those who did have enough prescription information from a pharmacist (drug dispensers). This study is consistent with one conducted in Lisbon, Portugal.[37] According to a study conducted in Bangladesh, the finding could be attributed to the fact that health providers frequently fail to effectively communicate with their patients about basic treatment plan information.[44] As a result, in order to reduce the rate of drug non-adherence, health-care providers should provide patients with prescription information about proper drug intake. Moreover, a positive provider–patient relationship reinforces and motivates patients to stick to treatment regimens.[16]

Furthermore, this study found that participants who did not experience any discomfort were 44% less likely than the corresponding comparison group to practice antibiotic non-adherence. This finding is consistent with a study conducted in Saudi Arabia,[8] and the result may be related to patients' concerns about adverse effects; according to a study conducted in China, 61.2% of the participants fear the side effect of the drug, which contributes to drug non-compliance.[41] The reason could be due to drug dispensers' inability to educate patients on how to minimize medication side effects and the rationale for using antibiotics in the study setting.

Limitation of the study

As to the limitation; this study was intended to assess a 6-month drug non-adherence practice, which does not include the life time practice and measuring of the non-adherence using a single questions (self-reported) might underestimated or overestimate the prevalence. The recall bias might affect the prevalence as well as the small number of the selected households. Moreover, households of the rural setting of Wenago districts were not addressed, which may affect generalizability of the study and the knowledge and attitude scores were calculated by adding the number of correct answers and not weighting them based on their estimated importance. To minimize the recall bias, we trained the data collection team carefully, to select non-distracting area for the interview, utilize non-ambiguous and local terms, and elaborate the questions easily for the participants.

Conclusion

In this study, antibiotic non-adherence was considerably high among the participants. Male gender, lower educational status, poor attitude, poor knowledge, no-prescription information from pharmacy/druggist, and medication discomfort were all associated with antibiotic non-adherence. As a result, community service providers should be encouraged to provide community interventions and proper counseling of patients on treatment adherence and the consequences of drug non-adherence. Furthermore, the government should impose strict regulations on pharmacies in order for them to provide accurate prescription information to their customers.

Acknowledgements

The authors acknowledge Dilla University Referral Hospital for technical support and study participants for their willingness to participate. Moreover, the authors' deepest gratitude forwarded to the Wenago town administration office for their sustainable assistance.

Author contributions

All the authors involved in the conceptualization of the study, data collection supervision, and write up of the first draft of the manuscript as well as submission of the manuscript. All authors read and approved the final manuscript.

Availability of data and material

Data will be made available by request.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval for this study was obtained from the Institutional Review Board (IRB) of the Dilla University with ethical number of duirb/035/21-4, a supportive letter from the office of community-based education (CBE), and a permission letter from the Wenago administrative office.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Informed consent

Before the interview, each respondent was asked if they were willing to participate after being informed of the research's purpose. To maximize true responses, all participants gave verbal informed consent before to the study, which was approved by Dilla University's IRB. During the study, the issue of ensuring privacy

and confidentiality was given more attention by keeping the patient's name anonymous and using identification numbers to refer to each study participant.

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Supplemental material

Supplemental material for this article is available online.

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