

# Knowledge and Attitude Towards Antimicrobial Resistance of Graduating Health Science Students of Wollega University

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**Background:** Antimicrobial resistance is a worldwide concern due to the inappropriate and irrational use of antibiotics. Thus, this study was aimed at determining the knowledge and attitude of graduating health science students of Wollega University towards antimicrobial resistance.

**Methods:** An institution-based cross-sectional study design was employed from June to July 2019. Epi-data version 3.1 was used to receive data and exported to SPSS version 25 for further analysis. Both bivariable and multivariable logistic regression analysis were done to find factors associated with attitudes of students towards antibiotic consumption and resistance at a 95% confidence level. The strength of association was measured with the odds ratio. Variables with a *p*-value of <0.05 at multivariable analysis were considered to be a significant variable. Finally, texts and simple frequency tables were used to present the findings.

**Results:** Out of 249, 232 students were included in this survey yielding a response rate of 93.6%. Hundred fifty-eight (68.1%) of them had adequate knowledge about antibiotic identification, role, side effects, and resistance. Students with a family member who works in health and related professions had a lower probability of stopping antibiotics when they feel better (AOR = 0.50, 95% CI: 0.28–0.90) and using leftover antibiotics (AOR = 0.51, 95% CI: 0.28–0.92) compared to their counterparts.

**Conclusion:** Students' knowledge on antibiotic identification, role, side effects, and resistance was suboptimal, and the attitude of students towards antibiotic consumption was unfavorable. Respondents having a family member in a health-related field showed a good attitude. Respondents with three years of study also had a good attitude, female gender showed good attitude, and urban residence were independent predictors of attitude toward antibiotic consumption. Training on antimicrobial resistance should be arranged for graduating class nursing and medical students, as they are the future prescribers.

**Keywords:** knowledge, attitude, antimicrobial resistance, university students

## Background

Antimicrobial consumption differs widely among countries.<sup>1</sup> Adequate knowledge about resistance to antibiotics is critical in the prevention of resistance as poor knowledge will lead to its inappropriate use.<sup>2–4</sup> Antimicrobial resistance is a significant problem<sup>5</sup> and non-reasonable use of antimicrobial consumption results in antibiotic resistance.<sup>6,7</sup> Bacteria resistance to antibiotic treatments (antimicrobial resistance, AMR) is a critical public health problem, and containment of AMR is an urgent priority, globally.<sup>8</sup> Understanding the use of antibiotics is parallel with a

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student's year of study. Put another way, those who acknowledged the emergence of occurrence of bacterial resistance were more likely to have appropriate knowledge on antibiotic effectiveness.<sup>9</sup> Results from a systematic review of developing countries on health practitioners found that antibiotic resistance was a general problem (75.2%), a global problem (84.7%), a national problem (88.0%), a problem in their health facilities (71.9%), and a problem in their daily practice (71.7%). Up to 78.2% of the participants reported that they were very confident or confident in antibiotic prescribing.<sup>10</sup> AMR might arise from different attitudes of consumers, such as antibiotics can prevent illnesses from becoming worse (74%). Fewer than half believe that antibiotics have no side effects (24%), that antibiotics can cure any disease (40%), and that antibiotic powders poured onto the skin can quickly cure injuries (37%).<sup>6</sup>

The occurrence of AMR will also lead doctors to shift from previous to current new antimicrobials as broad-spectrum therapy. In the occurrence of new antimicrobial health, professionals will consider another option to halt the transmission of infectious organisms for preventing the development of resistance to a previous treatment options. These all contribute to the existence of burden of AMR.<sup>11</sup>

One major challenge in developing countries is self-medication with antibiotics (53.5%).<sup>12</sup> AMR is a problem with multi-damage that can be tackled by the public if it is used responsibly.<sup>13</sup> The major cause of AMR is the non-reasonable use of antibiotics in the health facilities and by the whole society.<sup>8</sup> Therefore, the current study aimed at identifying the knowledge and attitude of graduating health science students of Wollega University towards AMR, which has not yet been studied. The result of this finding is aimed to be used for educational and policy change.

## Methods

### Study Design and Study Population

A university-based cross-sectional study design was undertaken at Wollega University Institute of Health Sciences, starting June to July 2019. The study area is 327 km west from Addis Ababa, the capital city. This survey was undertaken on students studying a Bachelor of Science at the Institute of Health Sciences in the academic year 2018/2019. As we obtain information from the Institute's assistant office of the registrar, there were 249 Bachelor of Science completing students in the 2018/2019 academic year in eight

academic units comprising pediatrics and neonatology, emergency and critical care nursing, surgical and operation room theatre nursing, psychiatry and ophthalmic nursing, generic nursing, midwifery, pharmacy, and health officer.

### Sample Size and Sampling Procedure

Because the total population under the study was less than the calculated sample size, which was only 242, we therefore considered all of the respondents who can satisfy the inclusion criteria who were invited for their response.

### Tool for Data Collection and Data Collection Technique

Data were collected using a semistructured tool, which was taken from a previous study.<sup>14</sup> The tool includes 25 questions (three sociodemographic, one source of information, nine knowledge, and 12 attitude questions). The tools focus on different directions of the respondent's knowledge, attitude and practice regarding ordering antibiotics.

Then respondents were requested to respond to the questionnaire. The data collectors supervised the respondents during completion of the tool by restricting the use of reference material and discussion with their friends to find the correct answer.

### Data Collection Instrument

The tool contains five parts. Part I has eight sociodemographic items, part II concerns frequency of antibiotics use, part III has nine items on knowledge about antibiotics, part IV has six items about awareness of antibiotics resistance, and part V has eight items regarding attitude towards consumption of antibiotics. In total, a 31-point self-administered questionnaire was adapted from a previous study conducted in Italy.<sup>14</sup>

### Data Processing and Analysis

Epi-data version 3.1 software was used for data entry after checking its completeness and consistency. Then, data were exported to SPSS version 25 for analysis and interpretation. The descriptive statistics were presented with frequency and percentage. Finally, the analyzed data were organized and presented in tabular, graphical, and narrative forms as necessary.

### Ethical Issue

Wollega University Research Ethics Review Committee (WUREC) approved this research before actual data collection. A consent sheet was prepared in English and

attached to the tool on a separate page. There was a consent form with the purpose of the study and a description as the study has no impact over the respondents. Signed informed consent was taken from all respondents prior to data collection.

## Results

Among 249 respondents who were invited to this study, 232 responded fully, with a response rate of 93.6%. Eighty-two (35.3%) respondents have been followed during their study within the university for three years, while 55 (23.7%) were followed for five years. According to this study of total study respondents, 65.9% (153) have stated that they have practiced antibiotics use with around 43.8% of the practice 1–2 times and 3%–5% each while 13.4% have practiced more than five times in last year (Table 1).

## Knowledge About Antibiotics Role, Side Effects and AMR

Twelve questions with three categories (Antibiotics role, Side effects, and AMR) were utilized. Accordingly, 84.9% of respondents agree that penicillin or amoxicillin is an antibiotic, while 73.3% of respondents disagree that aspirin is an antibiotic. Twenty-eight percent of respondents wrongly categorized paracetamol as antibiotics and 72.6% of respondents knew that antibiotics are used for the treatment of bacterial disease. Regarding AMR, 86.6% of respondents knew that irrational consumption of antimicrobials results in antibiotic resistance; however, 32.1% agree that it is okay to discontinue taking antimicrobials when symptoms are disappearing, which is the main reason for the occurrence of AMR (Table 2).

## Attitude Towards Antimicrobials

More than half (56.5%) of respondents have the attitude that antimicrobials have to be taken only if prescribed by a doctor, while 52.2% have the attitude that antimicrobials can be bought without a doctor/health professional order. Also, 53.9% of respondents had started an antibiotic therapy after a simple a doctor's/health professional's call, without a proper medical examination (Table 3).

## Multivariable Logistic Regression

Multivariable analysis showed that students who had family members working in health and related professions had a lower likelihood of stopping antimicrobial use when they started to feel better (AOR= 0.50, 0.28–0.90).

Respondents that come from a family member with health and health-related professions were less likely to use left-over antibiotics (AOR= 0.51, 95% CI: 0.28–0.92) when compared to their counterparts (Table 4).

Similarly, a lower probability of using leftover antibiotics (AOR=0.27, 95% CI:0.12–0.63) and using follow-up phone calls for a doctor without any medical evaluation (AOR=0.31, 95% CI:0.14–0.67) was found among students with three years of university study as compared to 5 years of university study. However, the probability of taking antibiotics only when prescribed by the doctor was 2.16 times higher among students with three years of university study as compared to five years study (AOR=2.16, 95% CI:1.05–4.42). The study also indicated that males were 3.42 times more likely to stop taking antibiotics when they start to feel better compared to their female counterparts (AOR=3.42, 95% CI:1.505–7.767). Concerning residence, urban dwellers were less likely to use leftover drugs (AOR= 0.46, 95% CI:0.26–0.83) compared to their counterparts (Table 5).

## Discussion

Antimicrobial resistance is global public health agenda due to inappropriate and irrational use of antibiotics.<sup>15,16</sup> There is a dearth of information on the knowledge of health science students about antibiotic use and antimicrobial resistance as well as their attitudes towards antibiotics consumption in Ethiopia, particularly in the study area.

In the present study, about three-fourths of the respondents agreed that antibiotics are useful for bacterial infections. However, 29.7% and 39.7% of them wrongly agreed that antibiotics are useful for viral infections and any kinds of pain and inflammation, respectively. This finding is comparable with a study done in India (22%) and Kuwait (42.6%) where the study subjects agreed that antibiotics are effective in viral infections.<sup>17,18</sup> However, it was lower than the study conducted in Italy, in which more than 95% of subjects agreed on antibiotics used for bacterial infections but they are not indicated for any kind of pain and inflammations.<sup>19</sup> This is probably due to the difference in the socio-economic and cultural backgrounds of the study respondents. It may also have resulted from a difference in the depth of academic training and professional practice. Moreover, in the present study, about 28% of respondents wrongly agreed that paracetamol is an antibiotic that can reduce pain. This is comparable to the study done in Central and Southeast Europe,<sup>20</sup> in which the students believed that paracetamol is an antibiotic that treats pain, although the proportion was reducing with advancing years of study.

**Table 1** Socio-demographic Characteristics of Graduating Health Sciences of Wollega University Western, Ethiopia 2019

		Frequency	Percent
Sex of respondent	Male	142	61.2
	Female	90	38.8
	Total	232	100.0
Age	20–24	99	42.7
	25–30	117	50.4
	31–34	13	5.6
	35–40	3	1.3
Place of birth	Total	232	100.0
	Rural	136	58.6
	Total	232	100.0
Place of birth of father	Urban	63	27.2
	Rural	169	72.8
	Total	232	100.0
Place of birth of mother	Urban	68	29.3
	Rural	164	70.7
	Total	232	100.0
At least one member of your family works in a healthrelated field	Yes	113	48.7
	No	119	51.3
	Total	232	100.0
Department	ECCN	13	5.6
	Gene N	33	14.2
	Midwifery	35	15.1
	MLS	14	6.0
	Ophthalmic	13	5.6
	Nursing		
	ORT	10	4.3
	Pediatrics	10	4.3
	Pharmacy	55	23.7
	Psychiatry	19	8.2
	Public h	13	5.6
	Surgical	17	7.3
Total	232	100.0	
Duration of stay in university	3rd year	82	35.3
	4th year	95	40.9
	5th year	55	23.7
	Total	232	100.0
Antibiotics use in the last year	Yes	153	65.9
	No	79	34.1
	Total	232	100.0

**Abbreviations:** ECCN, Emergency and Critical Care; MLS, Medical Laboratory science; Gene N, Generic Nursing; ORT, operation room theatre nurse; public h, public health.

With regard to antimicrobial side effects, 75.9%, 54.7% and 63.4% of the study participants claimed that antimicrobials kill important normal flora, lead to secondary infections, and result in allergic reactions, respectively.

This is again lower than a study done in Italy where more than 90% of study subjects claimed the aforementioned side effects. However, it is comparable with a study done in India, which pointed out that 73.7% of respondents agreed that antibiotics could kill good bacteria. This might be due to the difference in education quality.<sup>19,21</sup>

With regards to AMR knowledge, the current study pointed out that 64.2% of subjects knew about antibiotic resistance. Consistent with this finding, a study from Hungary indicated that participants have realized the public health impact of antimicrobial resistance.<sup>22</sup> As it is a condition for which a bacterium loses its response towards an antimicrobial, 86.6% agreed that antibiotic misuse leads to resistance and 67.7% agreed on taking a full course of antibiotic treatment irrespective of symptomatic improvement to prevent the development of antimicrobial resistance. This is comparable with the study findings from Nigeria (63.3%), Pakistan (62.5%), and India (54.5%).<sup>21,23,24</sup> However, it is low compared to the study done in Italy where more than 90% of respondents were agreed that misuse leads to resistance (98%), a full course of treatment is mandatory despite symptoms improving (94.8%), and who knew that antibiotic resistance can occur when the bacteria lose sensitivity to the agent (93.9%). The discrepancies could have resulted from the fact that in developed nations, students can get access to health information even before formal academic education from different sources, which is less likely in developing countries like Ethiopia. On the other hand, it is high compared to the study done in Egypt (52%) and a systematic review done worldwide where 53% of subjects agreed about taking antibiotics despite feeling better and 45.6% of subjects agreed that antibiotic misuse leads to antibiotic resistance according to the review done worldwide.<sup>19,25,26</sup>

Although respondents have average knowledge of antibiotic use, side effects, and resistance, their attitude/behavior towards antibiotic consumption is not good. This study revealed that 65.9% of respondents took a full course of antibiotic treatment. This is higher than the study done in Jordan, which was 38.8%.<sup>27</sup> However, it is lower than the research conducted in Italy, which was 84.78%.<sup>14</sup> More than half (60.3%) of the study subjects usually take antibiotics for a cold or sore throat, which is consistent with the study conducted in Egypt (62%).<sup>25</sup> Concerning knowledge, 68% of the study subjects were knowledgeable about antibiotics and antibiotic resistance,

**Table 2** Knowledge About Antibiotics Use Among Graduating Health Sciences of Wollega University Western, Ethiopia 2019

Area of Assessment	Items	Choice	n (%)
Identification of antibiotics	Penicillin or amoxicillin is an antibiotic	Strongly disagree	11 (4.7)
		Disagree	24 (10.3)
		Agree	117 (50.4)
Strongly agree		80 (34.5%)	
Aspirin is an antibiotic	Strongly disagree	78 (33.6)	
	Disagree	92 (39.7)	
	Agree	53 (22.8)	
Paracetamol is an antibiotic	Strongly disagree	9 (3.9)	
	Disagree	78 (33.6)	
	Agree	89 (38.4)	
Strongly agree	Disagree	49 (21.1)	
	Agree	16 (6.9)	
	Strongly agree	78 (33.6)	
Knowledge about antibiotic use	Antibiotics are useful for bacterial infections	Strongly disagree	19 (8.2)
		Disagree	33 (14.2)
		Agree	117 (50.4)
Strongly agree	Disagree	63 (27.2)	
	Agree	72 (31.0)	
	Strongly agree	91 (39.2)	
Antibiotics are useful for viral infections (e.g., lu)	Strongly disagree	65 (28.0)	
	Disagree	4 (1.7)	
	Agree	47 (20.3)	
Antibiotics are indicated to reduce any kind of pain and inflammation	Strongly disagree	93 (40.1)	
	Disagree	85 (36.6)	
	Agree	7 (3.0)	
Strongly agree	Disagree	43 (18.5)	
	Agree	141 (60.8)	
	Strongly agree	35 (15.1)	
Knowledge about side effects	Antimicrobials can kill "good bacteria" existing in our body	Strongly disagree	23 (9.9)
		Disagree	82 (35.3)
		Agree	110 (47.4)
Strongly agree	Disagree	17 (7.3)	
	Agree	29 (12.5)	
	Strongly agree	56 (24.1)	
Antibiotics can lead to secondary infections following the removal of good microorganisms residing in our body	Disagree	124 (53.4)	
	Agree	23 (9.9)	
	Strongly agree	29 (12.5)	
Antibiotics can cause allergic reactions	Strongly disagree	56 (24.1)	
	Disagree	124 (53.4)	
	Agree	23 (9.9)	
Strongly agree	Disagree	29 (12.5)	
	Agree	56 (24.1)	
	Strongly agree	124 (53.4)	

(Continued)

**Table 2** (Continued).

Area of Assessment	Items	Choice	n (%)
Knowledge regarding antimicrobial non-response	Antimicrobial resistance is a condition in which a bacterium loses its response for antimicrobials	Strongly disagree	37 (15.9)
		Disagree	46 (19.8)
		Agree	82 (35.3)
		Strongly agree	67 (28.9)
Irrational consumption of antimicrobials results to antimicrobial resistance	Irrational consumption of antimicrobials results to antimicrobial resistance	Strongly disagree	13 (5.6)
		Disagree	18 (7.8)
		Agree	160 (69.0)
		Strongly agree	41 (17.7)
It is okay to stop taking antibiotics when symptoms are improving	It is okay to stop taking antibiotics when symptoms are improving	Strongly disagree	74 (31.9)
		Disagree	83 (35.8)
		Agree	54 (23.3)
		Strongly agree	21 (9.1)

which is higher than the study findings from Amman, Jordan (23%), and Kuwait (47%),<sup>17,27</sup> while it is lower than the study finding from the University of Zambia (87.3%).<sup>28</sup> The discrepancy might be due to the reason

**Table 3** Attitude Towards Antimicrobial Resistance Among Graduating Health Sciences Students of Wollega University Western, Ethiopia 2019

Variables		n	%
Take antibiotics for cold	Yes	140	60.3
	No	92	39.7
Take for fever	Yes	125	53.9
	No	107	46.1
Stop taking antibiotics when feeling better	Yes	79	34.1
	No	153	65.9
Take only if prescribed by doctor	Yes	131	56.5
	No	101	43.5
Keep leftover antibiotics for future use	Yes	74	31.9
	No	158	68.1
Take leftovers without doctor consultation for cold, flu	Yes	88	37.9
	No	144	62.1
Do you by antibiotics without medical receipt?	Yes	121	52.2
	No	111	47.8
Have you ever started an antibiotic therapy following a phone call from a doctor without any medical evaluation?	Yes	107	46.1
	No	125	53.9



**Table 4** Variables Associated with Attitudes and Behaviors About Antimicrobial Consumption Among Graduating Health Sciences Students of Wollega University Western, Ethiopia Multivariable Results on 2019

Variables		Stop Taking Antibiotics When Start Feeling Better		Take Antibiotics Only When Prescribed by the Doctor		Used Leftover Antibiotics	
		AOR (95% CI)	P value	AOR (95% CI)	Pvalue	AOR (95% CI)	P value
Family member works in health field	Yes	0.50 (0.28–0.90)	<b>0.021*</b>	-	-	0.51 (0.28–0.92)	<b>0.025*</b>
	No						
Duration of stay in university	3 years	0.54 (0.23–1.27)	0.156	2.16 (1.05–4.42)	<b>0.035*</b>	0.27 (0.12–0.63)	<b>0.003*</b>
	4 years			1.01 (0.52–1.98)	0.975	0.26 (0.12–0.57)	<b>0.001*</b>
	5 years						
Place of residence	Urban	-		1.69 (0.98–2.94)	<b>0.058</b>	0.46 (0.26–0.83)	<b>0.010*</b>
	Rural	-					
Gender	Male	3.42 (1.505–7.767)	<b>0.003*</b>	-	-	-	-
	Female			-	-	-	-

**Note:** \*Significant variable; bolded figures are the *p*-value of significant variables.

**Table 5** Multi-Variable Analysis Result on Intention to Use Antimicrobial Consumption Among Graduating Health Sciences Students of Wollega University Western, Ethiopia 2019

Variables		Buy Antibiotics Without a Medical Receipt		Used Antibiotics Following Phone Call from a Doctor Without Any Medical Evaluation	
		AOR (95% CI)	Pvalue	AOR (95% CI)	Pvalue
Family member works in health field	Yes	0.71(0.42–1.19)	0.191	0.57(0.33–1.00)	<b>0.051</b>
	No				
Duration of study in university	3 years	-	-	0.31(0.14–0.67)	<b>0.003*</b>
	4 years	-	-	0.23(0.11–0.49)	<b>0.000*</b>
	5 years				
Gender	Male	1.44 (0.85–2.46)	0.180	-	-
	Female				

**Note:** \*Indicates significant variable; bolded figures are the *p*-value of significant variables.

that the study subjects of Zambia University were only medical students.

In this study, it was found that the students who have a family member employed in health and related areas had a higher probability of taking a full course of antibiotic treatment, which is supported by existing evidence in Italy.<sup>19</sup> This is due to the fact that students who have a family member working in the health field might have relatively better awareness about antimicrobial resistance. Furthermore, the present study revealed a lower likelihood of taking leftover antibiotics among students who studied for three years in the university compared to those who studied for five years, which is consistent with a finding from Saudi Arabia.<sup>29</sup> This maybe due to the reason that students might have developed overconfidence as they advanced in the year of study and used leftover drugs. Moreover, males were

more likely to discard antibiotics as soon as they were feeling better compared to females, which is supported by evidence from India.<sup>18</sup>

## Limitations of the Study

The study was conducted in a single university so its findings cannot be generalized to all medical and health science students in Ethiopia. The study also had recall bias as it took place over an extended period. Social desirability bias might have been introduced because the students might have answered what they expected to be right rather than what they were actually practicing.

## Conclusion

Students' knowledge on antibiotic identification, role, side effects and resistance was suboptimal and their

attitude towards antibiotic consumption was unfavorable. Respondents having a family member in a health-related field showed good attitude, respondents with three years of study also had good attitude, female gender also had good attitude and urban residence were independent predictors of attitude toward antibiotic consumption. Thus, health professionals should give due attention to discouraging the use of leftover drugs and discontinuing antibiotics when feeling better. Furthermore, training on antimicrobial resistance should be arranged for graduating classes of nursing and medical students, as they are the future prescribers.

## Abbreviations

AMR, antimicrobial resistance; AOR, adjusted odds ratio; ECCN, Emergency and Critical Care; MLS, Medical Laboratory Science.

## Data Sharing Statement

The datasets used for this publication can be obtained from the primary author on reasonable request.

## Ethical Approval and Consent to Participate

Wollega University Research Ethics Review Committee (WUREC) approved this research before actual data collection. A consent sheet was prepared in English and attached to the tool as a page. There is a consent form with the purpose of the study and description as the study had no any impact over the respondents. A signed informed consent was taken from all respondents prior to data collection.

## Consent for Publication

Not applicable.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no competing interests.

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