Consciousness of healthcare professionals on antimicrobial resistance in western Ethiopia

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Abstract

Background: Inappropriate and overuse of antimicrobial drugs by healthcare professionals are a global concern. Exploring healthcare professionals' consciousness on antimicrobial resistance is important to advance the approaches to improve antibiotic use. Hence, the aim of the current study was to assess the level of healthcare professionals' consciousness towards antimicrobial resistance and its control measures.

Methods: A cross-sectional study design was employed. Data was collected using a self-administered questionnaire to all healthcare professionals from May to June, 2017. Data were entered into Epi info version 7 and analyzed using SPSS version 21. The knowledge and belief scores were summarized using descriptive statistics. Univariate and multivariate logistic regression analysis were used to test the association, which was considered statistically significant if P-value < 0.05.

Results : From 269 healthcare professionals participated in the study, 58% were males with a mean age of 31.9 + 7.5 years and 76.6% were degree holders. Most of them were nurses (36.4%) and physicians (24.9%). The median knowledge and belief scores of healthcare professionals on antimicrobial resistance were 35 (range 23-83) and 29 (range 13-47), respectively. Forty seven percent of participants had poor belief score. A correlation test between knowledge and belief scores revealed a significant positive correlation (r = 0.551; P = 0.01). Hospital setting (adjusted odds ratio [AOR]: 4.65; 95% confidence interval [CI]: 2.39-9.06; P < 0.001; and AOR: 3.62; 95% CI: 1.76-7.44; P < 0.001) and training (AOR: 0.43; 95% CI: 0.23-0.83; P < 0.05; and AOR: 0.13; 95% CI: 0.06-0.25; P < 0.001) had significantly associated with good knowledge and belief scores, respectively.

Conclusions : More than half of healthcare professionals had good knowledge and belief scores on antimicrobial resistance. Prior training experience, type and setting of health institutions were significantly associated with both knowledge and belief scores. Hence, regular comprehensive educational training on antimicrobial resistance is recommended for healthcare professionals working on healthcare institutions.

Introduction

Antibiotics are among the most successful therapeutic agents used for combating bacterial infections [1]. Unfortunately, a serious disadvantage is the development of resistance against these agents [2, 3]. Emergence and spread of their resistance were linked to over antimicrobial exposure both at population and individual levels [4].

Several groups of researchers have shown increased drug resistance in developing countries [5]. The most important cause is that there has been a massive inappropriate and overuse of antibiotics worldwide across all ecosystems over the past decades including humans, animals, aquaculture, and agriculture [6–9].

These facts have prompted many to call for improvements in the way health professionals practice antimicrobials. The extent of the healthcare professionals' knowledge and belief on antibiotic use has been identified as a key factor that affects individual antimicrobial prescribing behavior [10–13].

The Ethiopian national baseline survey had reported that there is a knowledge gap on antimicrobial resistance (AMR) among healthcare professionals [11]. Based on this understanding, the national AMR contained strategy identified that healthcare professionals' awareness raising on AMR as one of the objectives to be addressed [14]. However, there were limited numbers of surveys have been conducted to assess healthcare professionals' knowledge and beliefs on antimicrobial use and resistance in Ethiopia. One of these studies which was conducted in Bahir Dar (northern Ethiopia) addressed only physicians and nurses [10], whereas another study in Dire Dawa (eastern Ethiopia) addressed paramedical staffs only [12]. The third study in Addis Ababa (central Ethiopia) tried to include physicians, nurses, and pharmacists [15].

The current study which was conducted in the western part of the country; therefore, aimed to assess the level of all healthcare professionals' knowledge and belief towards AMR, factors contributing to the development of AMR, the possible measures to limit the increasing rate of AMR, and factors associated with good knowledge and belief score. The study would have paramount importance to local health intervention plan and for governmental decisions in the area. In addition, the study could serve as a benchmark for further studies.

Methods And Materials

Study area and periods

The study was conducted in Nekemte Referral Hospital (NRH) and Wollega University Referral Hospital (WURH), in Nekemte town, East Wollega zone, Oromia National Regional State, Western Ethiopia. Nekemte town is located at 331 km from west of Addis Ababa. NRH was established in 1932 by Swedish missionary while WURF was founded by Wollega University as a teaching affiliated referral hospital and started providing service since September 2016. The study was conducted from May to June, 2017.

Study design

A cross-sectional study involving a self-administered questionnaire was employed to assess the knowledge and belief of healthcare professionals on antimicrobial drug use and resistance.

Study population

The source population was all healthcare professionals who were served in the aforementioned healthcare institutions while the study population was all healthcare professionals who were served during the study periods and permitted to involve in the study.

Sample size and sampling methods

All healthcare professionals who had a direct relation with antibiotic drugs in their healthcare practice and presented at the time of data collection and willing to participate in the study were included. The questioners were distributed for all healthcare providers available in different offices and wards and collected back after filling their responses. Three hundred sixty questionnaires (200 in NRH and 160 in WURH) were distributed to professionals who were accessible during the data collection. Ninety one of the distributed questionnaires were not received back because the health professionals were busy and reluctant to respond on time. Most of the non-responders were physicians and nurses. Therefore, total professionals involved in the study were 269. Of these, 53.2% professionals were from NRH. Nurses (n=98), physicians (n=67), public health officers (n=43), pharmacists (n=32), and midwives (n=29) were included.

Variables

The dependent variables were healthcare professionals' knowledge and belief scores on AMR while the independent variables were socio-demographic characteristics (sex, age), educational levels (diploma, degree, masters, PhD), and discipline (medicine, pharmacy, nursing, midwifery, and public health officer).

Data collection

A well-structured questionnaire was used to collect information from healthcare professionals. It was adapted and modified from previous studies [15,16], and had three parts. Demographic characteristics, awareness, and source of information on AMR of these professionals were recorded by part I while part II, consisted of 18 knowledge statements covering factors contributing to and helping to control AMR, was used to collect knowledge scores on AMR. The last part were used to rate their response on a five-point scale (1, very likely; 2, somewhat likely; 3, neutral; 4, somewhat unlikely; and 5, very unlikely) and 13 belief statements covering five aspects including the definition of AMR, who will be affected by AMR, the practice of antibiotic use to decrease resistance, and consequence of AMR. Respondents were required to answer according to a 5-point Likert scale (1, strongly agree; 2, agree; 3, neutral; 4, disagree; and 5, strongly disagree).

The questionnaire was developed in English. Content validation of the questionnaire was undertaken by a panel of academia pharmacists. Feedback was gathered to improve the questionnaire presentation, clarity, and congruency of meaning. The data collectors were four individuals who had a bachelor degree in health science. They were briefly trained on how to collect and react to the data collection process. Then they were assigned for data collection under the supervision of the principal investigator.

Data analysis

The collected data were checked for any deficit and cleaned prior to data entry into Epi info version 7. For the belief questions, some of the Likert scale responses were re-coded based on the positivity or negativity of the statements. Then it was analyzed in two ways. First, it was categorized and tabulated into two as 'agree' or 'disagree'. The response 'neutral' was taken as a disagreement. Second, the

individual responses were summed and the mean and the median scores were calculated. For the knowledge statements, the terms very likely and somewhat likely were counted as agreement while the other terms (neutral, somewhat unlikely, and very unlikely) were considered as disagreement. To calculate the sum and mean scores, no recoding was applied for the knowledge statements. The summed score was then dichotomized so as to carry the binary logistic regression and the values below the median were considered as good knowledge or belief scores.

Data was analyzed using SPSS version 21. Descriptive statistics were used to summarize frequencies. Binary logistic regression analysis was performed and the adjusted odds ratio was used to test the association. All independent variables with $P < 0.2$ in the univariate model were included in to the final multivariable model. For the final multivariable statistical analysis, the level of significance was set at $P < 0.05$.

Ethical consideration

Ethical approval was obtained by Ethical Review Committee of College of Health Sciences, Wollega University. Letter of permission was written to the respective hospital directors to conduct the study. Verbal consent was reached with each healthcare staffs. To ensure confidentiality, the name and other identifiers of healthcare staffs were not recorded on the data collection instruments.

Results

Demographic characteristics of healthcare professionals

The total healthcare professionals participated in the study was 269. Their mean age was 31.9±7.5 (range 20-53) and majorities of them (58%) were males. Most of the study participants were nurses (36.4%) followed by physicians (24.9%). The majority of professionals (76.6%) were degree holders. Half of the respondents took different trainings related to antimicrobial resistance that were mainly from NRH (81%) (**Table 1**).

Table 1. Demographic characteristics of healthcare professionals participated in the study in East Wollega, western Ethiopia, from May to June, 2017

Characteristics		NRH	WURH	Total
Age (in years)	20 – 30	59 (41.3)	81 (64.3)	140 (52.0)
	31 – 40	65 (45.5)	37 (29.4)	102 (37.9)
	>40	19 (13.3)	8 (6.3)	27 (10.0)
	Mean (range)	31.9±7.5 (20-53)		
Sex	Male	70 (49.0)	86 (68.3)	156 (58.0)
	Female	73(51.0)	40 (31.7)	113 (42.0)
Level of education	Diploma	27 (18.9)	5 (4.0)	32 (11.9)
	Degree	89 (62.2)	117 (92.9)	206 (76.6)
	Masters	22 (15.4)	3 (2.4)	25 (9.3)
	PhD	5 (3.5)	1 (0.8)	6 (2.3)
Field of study	Nurse	45 (31.5)	53 (42.1)	98 (36.4)
	Physician	31 (21.7)	36 (28.6)	67 (24.9)
	Health Officer	33 (23.1)	10 (7.9)	43 (16.0)
	Pharmacy	17 (11.9)	15 (11.9)	32 (11.9)
	Midwifery	17 (11.9)	12 (9.5)	29 (10.8)
Attended training on antimicrobial resistance	Yes	116 (81.1)	32(25.4)	148 (55.0)
	No	27 (18.9)	94 (74.6)	129 (45.0)
*SD, standard deviation				

General awareness of healthcare professionals on AMR

Nearly three-fifth (59%) of healthcare professionals participated in the study believed that antibiotics were wrongly used in their clinical practices **(Fig 1)**.

Of the respondents who stated that antibiotics were wrongly used, 68.6% (84.5% in NRH vs 25.6% in WURH) did not mention the respective reasons for their wrong use. The most frequently mentioned reasons for their wrong use were inappropriate prescription (24, 14.5%) followed by knowledge or information gaps (11, 6.9%) **(Fig 2)**.

Nearly half of the respondents (47.2%) noted that resistance was the current challenging problem of antibiotic use while 26.4% noted resistance and other issues including toxicity. However, 26.4% respondents did not mention resistance in their list (**Fig 3**).

More than half of healthcare professionals (55%) believed that they do have sufficient information on antimicrobial resistance **(Fig 4)**.

Among the main sources of information on antimicrobial resistance, academic education followed by training **(Fig 5)**.

Knowledge of healthcare professionals on factors contributing to AMR

Healthcare workers in the two hospitals had higher awareness towards the factors contributing to bacterial resistance. Failure to finish the antibiotic course (89.2 %) and extensive use of newer antibiotics (74.0%) were the most and the least reported contributory factors for antimicrobial resistance, respectively. Poor infection control (88.8%), inappropriate antibiotic use (87.0%), antibiotic use without prescription (88.5%), medical instrumentation (83.3%), inappropriate antibiotic prescription (82.5%), prescribing antibiotics without culture (82.5%), and patient transfer between units (80.3%) were listed as factors for antimicrobial resistance. Two-way contingency table analysis showed that there was significant association between patient transfer between units, poor infection control, medical instrumentation, extensive use of newer antibiotics and prescribing antibiotics when no culture within the healthcare setting **(Table 2)**.

Table 2: Awareness of healthcare professionals on factors contributing to bacterial resistance in East Wollega, western Ethiopia, from May to June, 2017

Contributing Factors	Response	NRH	WURH	Total	Chi	P
Patient transfer between units	Agree	132 (92.3)	84 (66.7)	216 (80.3)	27.84	0.000
	Disagree	11 (7.7)	42 (33.3)	53 (19.7)		
Poor infection control	Agree	137 (95.8)	102 (81.0)	239 (88.8)	14.91	0.000
	Disagree	6 (4.2)	24 (19.0)	30 (11.2)		
Medical Instrumentation	Agree	137 (95.8)	87 (69.0)	224 (83.3)	34.42	0.000
	Disagree	6 (4.2)	39 (31.0)	45 (16.7)		
Inappropriate antibiotic prescription	Agree	121 (84.6)	101 (80.2)	222 (82.5)	0.92	0.337
	Disagree	22 (15.4)	25 (19.8)	47 (17.5)		
Inappropriate antibiotic Use	Agree	121 (84.6)	113 (89.7)	234 (87.0)	1.52	0.218
	Disagree	22 (15.4)	13 (10.3)	35 (13.0)		
Extensive use of newer antibiotics	Agree	120 (83.9)	79 (62.7)	199 (74.0)	15.66	0.000
	Disagree	23 (16.1)	47 (37.3)	70 (26.0)		
Failure to finish antibiotic course	Agree	128 (89.5)	112 (88.9)	240 (89.2)	0.027	0.87
	Disagree	15 (10.5)	14 (11.1)	29 (10.8)		
Use of antibiotic without prescription	Agree	131 (91.6)	107 (84.9)	238 (88.5)	2.94	0.087
	Disagree	12 (8.4)	19 (15.1)	31 (11.5)		
Prescribing antibiotics when no culture	Agree	128 (89.5)	94 (74.6)	222 (82.5)	10.32	0.001
	Disagree	15 (10.5)	32 (25.4)	47 (17.5)		

Knowledge of healthcare professionals on strategies used to control AMR

The current findings regarding medical staff awareness on methods used to control bacterial resistance were higher like the reports on the factors contributing to resistance. Infection control (96.7%), accurate diagnosis (94.4%), laboratory capacity surveillance (92.9%), public education (92.6%), better hygiene (91.8%), adherence to guidelines (91.4%), better antibiotic handling (90.3%), reducing hospital stay (88.1%), and hospital antibiotic restriction (81.0%) were noted (**Table 3**).

Table 3: Awareness of healthcare professionals on strategies used to control the emergence of bacterial resistance in East Wollega, western Ethiopia, from May to June, 2017

Contributing Factors	Response	NRH	WURH	Total
Better hygiene	Agree	142 (99.3)	105 (83.3)	247 (91.8)
	Disagree	1 (0.7)	21 (16.7)	22 (8.2)
Infection control	Agree	141 (98.6)	119 (94.4)	260 (96.7)
	Disagree	2 (1.4)	7 (5.6)	9 (3.3)
Reducing hospital stay	Agree	137 (95.8)	100 (79.4)	237 (88.1)
	Disagree	6 (4.2)	26 (20.6)	32 (11.9)
Adherence to guidelines	Agree	134 (93.7)	112 (88.9)	246 (91.4)
	Disagree	9 (6.3)	14 (11.1)	23 (8.6)
Hospital antibiotic restriction	Agree	124 (86.7)	94 (74.6)	218 (81.0)
	Disagree	19 (13.3)	32 (25.4)	51 (19.0)
Better antibiotic handling	Agree	129 (90.2)	114 (90.5)	243 (90.3)
	Disagree	14 (9.8)	12 (9.5)	26 (9.7)
Public education	Agree	133 (93.0)	116 (92.1)	249 (92.6)
	Disagree	10 (7.0)	10 (7.9)	20 (7.4)
Accurate Diagnosis	Agree	134 (93.7)	120 (95.2)	254 (94.4)
	Disagree	9 (6.3)	6 (4.8)	15 (5.6)
Lab capacity surveillance	Agree	133 (93.0)	117 (92.9)	250 (92.9)
	Disagree	10 (7.0)	9 (7.1)	19 (7.1)

Belief of healthcare professionals on definition and impact of AMR

One out of five respondents (20%) inappropriately believed that resistance as a 'body resistance to drugs'. Majority of respondents believed as 'most infections are becoming increasingly resistant to treatment by antibiotic drugs' (84.4%) and such resistant strains can spread from one person to another (82.5%). Nearly 80% of respondents told that infections caused by these resistant strains are difficulties to treat. In addition, 91.6% of healthcare professions believed that resistant infections could make some medical procedures like surgery more complicated. The overall correct understanding of healthcare professionals towards the definition and impact of AMR was ranged from 78.8% to 91.1% (**Table 4**).

Table 4: Belief of healthcare professionals on definition and impact of antimicrobial resistance in East Wollega, western Ethiopia, from May to June, 2017

Belief Questions	Response	NRH	WURH	Total
AMR occurs when your body becomes resistant to antibiotics and they no longer work as well	Agree	12 (8.4)	42 (33.3)	54 (20.1)
	Disagree	131 (91.6)	84 (66.7)	215 (79.9)
Many infections become increasingly resistant to treatment by antibiotics	Agree	123 (86.0)	104 (82.5)	227 (84.4)
	Disagree	20 (14.0)	22 (17.5)	42 (15.6)
If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause	Agree	125 (87.4)	87 (69.0)	212 (78.8)
	Disagree	18 (12.6)	39 (31.0)	57 (21.2)
Bacteria which are resistant to antibiotics can be spread from person to person	Agree	122 (85.3)	100 (79.4)	222 (82.5)
	Disagree	21 (14.7)	26 (20.6)	47 (17.5)
Antibiotic-resistant infections could make medical procedures like surgery and cancer treatment much more dangerous	Agree	135 (94.4)	111 (88.1)	246 (91.4)
	Disagree	8 (5.6)	15 (11.9)	23 (8.6)

Belief of healthcare professionals on antibiotic use

Despite the majorities of healthcare professionals (82.5%) believed that doctors should only prescribe antibiotics when they are needed, only 63.6% of healthcare professionals disagreed on the better use of antibiotics usage without prescription. In addition, 90% of respondents disagreed on antibiotic usage for ear infection; however, 36.4% of them agreed on their use for common cold. More than 60% (range 63.6% to 91.1%) of healthcare professionals on antibiotic use had correct beliefs but with some inconsistent response (**Table 5**).

Table 5: Belief of healthcare professionals on antibiotic use in East Wollega, western Ethiopia, from May to June, 2017

Belief Questions	Response	NRH	WURH	Total
Doctors should only prescribe antibiotics when they are needed	Agree	119 (83.2)	103 (81.7)	222 (82.5)
	Disagree	24 (16.8)	23 (18.3)	47 (17.5)
Since most antibiotics are widely used, safe and important drugs they had better be given without prescription	Agree	14 (9.8)	84 (66.7)	98 (36.4)
	Disagree	129 (90.2)	42 (33.3)	171 (63.6)
Common colds are cured more quickly with antibiotics	Agree	17 (11.9)	81 (64.3)	98 (36.4)
	Disagree	126 (88.1)	45 (35.7)	171 (63.6)
Ear infections in children 3–6 years old almost always require antibiotics	Agree	3 (2.1)	21 (16.7)	24 (8.9)
	Disagree	140 (97.9)	105 (83.3)	245 (91.1)

Belief of healthcare professionals on global, local, and individual impacts of AMR

Majorities of the healthcare professionals (97%) forwarded an appropriate belief towards the global pandemic nature of resistance. However, they had mixed belief towards who will be affected by AMR. Most healthcare professionals (83.3%) agreed with the statement ‘antibiotic resistance is an issue in other countries but not our local settings’. Similarly, 55.4% agreed with the question ‘antibiotic resistance is only a problem for people who take antibiotics regularly’. However, 66.9% of them responded as ‘antibiotic resistance is an issue that could affect them or their family’. A wider range of mixed responses (16.7% to 97%) was reported towards the global, local, and individual level impacts of AMR (**Table 6**).

Table 6: Belief of healthcare professionals on global, local, and individual level impacts of AMR in East Wollega, western Ethiopia, from May to June, 2017

Belief Questions	Response	NRH	WURH	Total
Antibiotic resistance is one of the biggest problems the world faces	Agree	139 (97.2)	122 (96.8)	261 (97.0)
	Disagree	4 (2.8)	4 (3.2)	8 (3.0)
Antibiotic resistance is an issue in other countries but not here	Agree	111 (77.6)	113 (89.7)	224 (83.3)
	Disagree	32 (22.4)	13 (10.3)	45 (16.7)
Antibiotic resistance is an issue that could affect me or my family	Agree	74 (51.7)	106 (84.1)	180 (66.9)
	Disagree	69 (48.3)	20 (15.9)	89 (33.1)
Antibiotic resistance is only a problem for people who take antibiotics regularly	Agree	59 (41.3)	90 (71.4)	149 (55.4)
	Disagree	84 (58.7)	36 (28.6)	120 (44.6)

Knowledge and belief scores of healthcare professionals

The mean knowledge score of healthcare professionals on AMR was 36.6±11.61 which was ranged from 23 to 83 and the median score was 35. Forty eight percent of healthcare professionals had knowledge above the median score which was a poor score. Similarly, the mean belief score of healthcare professionals on AMR was 28.7±6.88 which was ranged from 13 to 49 and the median score was 29. Nearly 45% of healthcare professionals had poor belief score. A correlation test between knowledge and belief scores showed that there was a significant negative correlation (r = 0.551, p=0.01) (Table 7).

Table 7: Percentage of healthcare professionals with good knowledge and belief score in East Wollega, western Ethiopia, from May to June, 2017

Variables		Number	Percent
Knowledge	Knowledge Score≤ 35	139	51.7
	Knowledge Score > 35	130	48.3
	Mean score	36.6±11.61	
	Median score (range)	35.0 (23.0-83.0)	
Belief	Belief Score ≤ 29	149	53.2
	Belief Score > 29	120	46.8
	Mean score	28.7±6.88	
	Median score (range)	29 (13-47)	
Correlation Test		Rho (r)= 0.551, P = 0.01	

Factors affecting good knowledge score

Hospital setting (adjusted odds ratio (AOR): 4.65; 95% confidence interval (CI): 2.39-9.06; P < 0.001) had significant independent association with good knowledge score while having no training had a poor knowledge score (AOR: 0.43; 95% CI: 0.23-0.83; P < 0.05) **(Table 8)**.

Table 8: Factors associated with good knowledge score on antimicrobial resistance among healthcare professionals in East Wollega, western Ethiopia, from May to June, 2017

Variables		Crude OR [95% CI]	Adjusted OR [95% CI]
Age groups (in years)	20-30	0.30 [0.12-0.73]**	0.54 [0.19-1.51]
	31-40	0.65 [0.26-1.63]	0.88 [0.31-2.53]
	>41	1	1
Hospital setting	NRH	6.93 [4.06-11.85]***	4.65 [2.31-9.06]***
	WURH	1	1
Field of study	Midwife	0.79 [0.30-2.15]	1.61 [0.48-5.41]
	Physician	0.42 [0.19-0.92]*	0.82 [0.31-2.19]
	Nurse	0.48 [0.23-1.02]	1.08 [0.43-2.74]
	Pharmacy	0.29 [0.11-0.76]*	0.45 [0.15-1.34]
	Health Officer	1	1
Level of education	Diploma	0.38 [0.04-3.69]	0.32 [0.03-3.86]
	Degree	0.18 [0.02-1.58]	0.40 [0.04-4.18]
	Masters	0.30 [0.03-2.97]	0.28 [0.02-3.12]
	PhD	1	1
Training	Yes	1	1
	No	0.21 [0.13-0.36]***	0.43 [0.23-0.82]*

Where, P < 0.05; **, P < 0.01; and ***, P < 0.001.*

Factors affecting good belief score

Training (AOR: 0.13; 95% CI: 0.06-0.25; P < 0.001) and hospital setting (AOR: 3.62; 95% CI: 1.76-7.44; P < 0.001) had significant independent association with good belief score (Table 9).

Table 9: Factors associated with good belief score on antimicrobial resistance among healthcare professionals in East Wollega, western Ethiopia, from May to June, 2017

Variables		Crude OR [95% CI]	Adjusted OR [95% CI]
Sex	Male	0.52 [0.32-0.86]*	0.77 [0.38-1.55]
	Female	1	1
Field of study	Midwife	3.33 [1.21-9.16]*	0.99 [0.25-3.85]
	Physician	1.25 [0.45-3.45]	0.37 [0.12-1.17]
	Nurse	0.60 [0.26-1.39]	0.89 [0.30-2.62]
	Pharmacy	1.08 [0.49-2.41]	0.54 [0.15-1.87]
	Health Officer	1	1
Training	Yes	1	1
	No	0.08 [0.04-0.14]***	0.13 [0.06-0.25]***
Hospital setting	NRH	8.03 [4.65-13.88]***	3.62 [1.76-7.44]***
	WURH	1	1
Age groups (in years)	20-30	0.26 [0.10-0.67]**	0.62 [0.19-2.06]
	31-40	0.44 [0.16-1.19]	0.71 [0.21-2.44]
	>41	1	1
Level of education	Diploma	0.51 [0.05-5.00]	0.25 [0.02-3.77]
	Degree	0.21 [0.2-1.85]	0.35 [0.03-4.09]
	Masters	0.30 [0.03-2.97]	0.18 [0.01-2.32]
	PhD	1	1

*Where *, P < 0.05; **, P < 0.01; and ***, P < 0.001.*

Discussion

The current study showed that above half of healthcare professionals (51.7%) had good knowledge scores. A comparable response is reported in some other studies conducted in Dire Dawa [12], Addis Ababa [15], and Jordan [16]. If applicable, these findings are hopefully as better knowledge and may be correlated well with better health practices. Similar to other findings, level of knowledge of the study participants was insignificantly associated (P > 0.05) with sex [11], age groups, education, and experience of having training about AMR [12].

Unlike to the present study, however, different studies had found a statistically significant association between sex [12], age groups [11, 12], and experience of having medical training with good knowledge score [11]. This discrepancy may be due to sample size and statistical method difference.

Regarding training, unlike to this study, one survey on junior doctors reported that training did not appear to be associated with a better awareness of antibiotic resistance [17]. However, another survey of internal medicine junior and senior doctors found that previous personal experience with resistance was the best predictor of a better recognition of the problem of antibiotic resistance in practice [18].

In this study, differences in the knowledge among healthcare professionals field of studies were found in contrast to the reports in Addis Ababa and Jordan [15, 16]. In the current study, the crude odds ratio report showed that the health care pharmacist and physicians were found to have poor knowledge score. Given the high patient load in the low income country perspective, most of the physicians were busy in most circumstances in our settings. Therefore, they might have poor focus to respond to the questions. The issue with the pharmacist will further have another face. Most of them in the practice were graduates of the profit based private institutions with less focus on the quality of education. Due to this the federal government officially closed all extension programs in health sciences since 2017. Equivocally this is also true for the nurses. To our context, the difference among them might be because of the fact that the pharmacists were excluded from the clinical care where multiple peer learning's might have some role. All this and other issues might have contributed for the discrepancy. Fortunately the difference had disappeared in the multivariable association test. In contrast to our study, one survey in Dire Dawa, eastern Ethiopia, found significantly different ($P = 0.004$) knowledge score among pharmacists, health officers, nurses, laboratory technologists and midwives. Other studies in India reported that nurses and pharmacists had better knowledge about antibiotic effectiveness than other paramedical staffs [11]. Statistically significant difference was also observed between physicians and nurses in some aspects of knowledge and beliefs on one report from Bahir Dar, northern Ethiopia [10].

In addition, the study participants had better knowledge about the contributing factors of resistance and resistance management techniques with an overall good knowledge score (median score < 35) for 51.7% of the participants. Similarly, 53.2% of the study participants had a good belief score (median score < 29). However, a mixed response is also noted. Unlike the Jordan and the central Ethiopian studies [15, 16], health professionals in our study forwarded a mixed belief towards the global, local, and individual level impacts of AMR. Furthermore, a multivariable binary logistic regression analysis for the dichotomized belief score revealed a significant association with good belief score among NRH staffs (AOR: 3.62; 95% CI: 1.76–7.44; $P < 0.001$) (Table 9). This might be supported by the fact that about 81% of them had training experiences (Table 1).

The current findings might justify the necessity of more regular in-service training schedules that can address all healthcare settings. Therefore, all healthcare professionals should have up-to-date information on the epidemiology and impact of AMR as well as when to use or not to use antibiotics so as to decrease the selection of new AMR. Particularly practical skills on the use of antibiotics for upper respiratory infections are very important as per our country context in general [19, 20].

In the present study, the belief of the study participants had no statistically significant association with sex, age groups, level of education and field of study or profession type. Like in the knowledge score,

respondents without trainings on antimicrobial resistance had a statistically significant good belief score in multivariable binary logistic regression analysis (AOR: 0.13; 95% CI: 0.06–0.25; P < 0.001) than those who took trainings. In contrast to this, one survey on junior doctors reported that training did not appear to be associated with a better awareness of antibiotic resistance [17]. Similar to our study, another survey of internal medicine junior and senior doctors found that previous personal experience with resistance was the best predictor of a better recognition of the problem of antibiotic resistance in practice [18]. All this indicates that more regular and improved training methods should be actively promoted. Similarly, NRH staffs had a significantly higher knowledge score (AOR: 4.65; 95% CI: 2.39–9.06; P < 0.001) compared with those who are working in WURH. This may be attributed to the fact that health professionals in NRH had more training opportunities than WURH (Table 1). This was further supported with the good belief score of NRH staffs as compared to WURH (AOR: 3.62; 95% CI: 1.76–7.44; P < 0.001). In addition, the two hospitals were different in terms of their service years. The NRH has been established since 1932. However, the WURH was only in its first year of service during the data collection period. Therefore, this might also contribute to the difference in the response variability of the healthcare professionals among the two hospitals.

To our knowledge, our multi-centered study of health professionals from all disciplines and specialties in East Wollega Zone of two hospitals provides a unique and comprehensive assessment that had not been yet performed in our country. However, our study had some limitations. The data collection tool lacks proper adaptation to the setting context. As a result some variables were missed and thus challenges in the interpretation of results were apparent. There is a possibility that respondents gave socially desirable answers. Administering the questionnaire between two hospitals in different time periods might affect in the communication of the results, and all these might limit the comparability of the results.

Conclusions

Overall, this study revealed that there was good awareness of the risk factors and control measures of antimicrobial resistance among the different disciplines. However, a wide range of mixed belief was reported on the definition, the indication of antibiotic use, and the global, local, and individual impacts of antimicrobial resistance. Hospital setting and prior training experience on antimicrobial resistance were independently associated with good belief and knowledge scores. In line with the higher percentage of professionals with training, healthcare professionals in Nekemte Referral Hospital had significantly higher knowledge score than in Wollega University Referral Hospital. Therefore, this implies that regular comprehensive educational training programs on antimicrobial resistance are desirable for both hospital staffs to decrease the future risk of antimicrobial resistance.

Abbreviations

AMR: antimicrobial resistance; NRH: Nekemte Referral Hospital; OR: odds ratio; SPSS: statistical package for social sciences; and WURH: Wollega University Referral Hospital.

Declarations

Ethics approval and consent to participate

Ethical clearance was requested and approved by the Ethical Committee of College of Health Sciences, Wollega University, Ethiopia.

Consent for publication

All authors have reviewed and consent for publication of this manuscript.

Availability of data and materials

The datasets supporting the conclusion of this article are included within the article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

The study was conceptualized by GA, and he was a major contributor in analyzing and writing the manuscript. The data was collected, analyzed, and interpreted by GA and AB. GA was GA and AB substantially revised and modified the manuscript. All authors read and approved the final manuscript.

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References

1. Hancock REW. The Complexities of Antibiotic Action. Mol Syst Biol. 2007;3:1–2.

2. Arias CA, Murray BE. Antibiotic-Resistant Bugs in the 21st Century — A Clinical Super-Challenge. N Engl J Med. 2009;360:439–43.
3. Fair RJ, Tor Y. Antibiotics and Bacterial Resistance in the 21st Perspect Medicin Chem. 2014;6:25–64.
4. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of Antibiotic Prescribing in Primary Care on Antimicrobial Resistance in Individual Patients: Systematic Review and Meta-Analysis. BMJ. 2010;340:1–11.
5. Okeke IN, Laxminarayan R, Bhutta ZA, Duse AG, Jenkins P, O'Brien TF, et al. Antimicrobial Resistance in Developing Countries. Part I: Recent Trends and Current Status. Lancet Infect Dis. 2005;5:481–93.
6. Blaser M. Antibiotic Overuse: Stop the Killing of Beneficial Bacteria. Nature. 2011; 476:393-4.
7. Grigoryan L, Burgerhof JGM, Degener JE, Deschepper R, Lundborg CS, Monnet DL, et al. Determinants of Self-Medication with Antibiotics in Europe: The Impact of Beliefs, Country Wealth and the Healthcare System. J Antimicrob Chemother. 2008;61:1172–9.
8. Alemkere G. Antibiotic Usage in Surgical Prophylaxis: A Prospective Observational Study in the Surgical Ward of Nekemte Referral Hospital. PLoS One. 2018; doi: 10.1371/ journal.pone.0203523.
9. Alemkere G, Tenna A, Engidawork E. Antibiotic Use Practice and Predictors of Hospital Outcome among Patients with Systemic Bacterial Infection: Identifying Targets for Antibiotic and Healthcare Resource Stewardship. PLoS One. 2019; doi: 10.1371/journal. pone.0212661.
10. Abera B, Kibret M, Mulu W. Knowledge and Beliefs on Antimicrobial Resistance among Physicians and Nurses in Hospitals in Amhara Region, Ethiopia. BMC Pharmacol Toxicol. 2014;15:1–7.
11. Sadasivam K, Chinnasami B, Ramraj B, Karthick N, Saravanan A. Knowledge, Attitude and Practice of Paramedical Staffs Towards Antibiotic Usage and Its Resistance. Biomed Pharmacol J. 2016;9:337–43.
12. Tafa B, Endale A, Bekele D. Paramedical Staffs Knowledge and Attitudes Towards Antimicrobial Resistance in Dire Dawa, Ethiopia: A Cross-sectional Study. Ann Clin Microbiol Antimicrob. 2017;16:1–14.
13. Tennant I, Nicholson A, Gordon-Strachan GM, Thoms C, Chin V DM. A Survey of Physicians' Knowledge and Attitudes Regarding Antimicrobial Resistance and Antibiotic Prescribing Practices at the University Hospital of the West Indies. West Indian Med J. 2010;59:165–70.
14. Strategy for the Prevention and Containment of Antimicrobial Resistance for Ethiopia, Addis Ababa, 2015. p. 1–30. Available from: http://extwprlegs1.fao.org/docs/ pdf/eth171512.pdf.
15. Berha AB, Amin D, Alebachew M. Awareness and Beliefs of Antimicrobial Resistance among Health Professionals Working at Tikur Anbessa Specialized Hospital, Addis Ababa: Ethiopia. J Bioanal Biomed. 2017;09:123–9.
16. Alzoubi K, Ayoub N, Al-Sakaji S, Al-Azzam S, Mhaidat N, Masadeh M. Awareness of Bacterial Resistance among Physicians, Pharmacists and Nurses. Int J Occup Med Environ Health. 2009;22:363–72.

17. Pulcini C, Williams F, Molinari N, Davey P, Nathwani D. Junior Doctors' Knowledge and Perceptions of Antibiotic Resistance and Prescribing: A Survey in France and Scotland. Clin Microbiol Infect. 2011;17:80–7.
18. Wester C wiliam, Durairaj L, Evans AT, Schwartz DN, Husain S, Martinez E. Antibiotic Resistance: A Survey of Physicians Perception. Arch Intern Med. 2002;162:2210–6.
19. Erku DA, Aberra SY. Non-Prescribed Sale of Antibiotics for Acute Childhood Diarrhea and Upper Respiratory Tract Infection in Community Pharmacies: A Two Phase Mixed-Methods Study. Antimicrob Res Infect Control. 2018;7:1–7.
20. Mamo G, Teshome A. Evaluation of Antibiotics Use in the Treatment of Upper Respiratory Tract Infection in Bedele District Hospital, Southwest Ethiopia. J Sci Inovetive Res. 2017;6:38–43.

1. Hancock REW. The Complexities of Antibiotic Action. Mol Syst Biol. 2007;3:1–2.
2. Arias CA, Murray BE. Antibiotic-Resistant Bugs in the 21st Century — A Clinical Super-Challenge. N Engl J Med. 2009;360:439–43.
3. Fair RJ, Tor Y. Antibiotics and Bacterial Resistance in the 21st Perspect Medicin Chem. 2014;6:25–64.
4. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. Effect of Antibiotic Prescribing in Primary Care on Antimicrobial Resistance in Individual Patients: Systematic Review and Meta-Analysis. BMJ. 2010;340:1–11.
5. Okeke IN, Laxminarayan R, Bhutta ZA, Duse AG, Jenkins P, O'Brien TF, et al. Antimicrobial Resistance in Developing Countries. Part I: Recent Trends and Current Status. Lancet Infect Dis. 2005;5:481–93.
6. Blaser M. Antibiotic Overuse: Stop the Killing of Beneficial Bacteria. Nature. 2011; 476:393-4.
7. Grigoryan L, Burgerhof JGM, Degener JE, Deschepper R, Lundborg CS, Monnet DL, et al. Determinants of Self-Medication with Antibiotics in Europe: The Impact of Beliefs, Country Wealth and the Healthcare System. J Antimicrob Chemother. 2008;61:1172–9.
8. Alemkere G. Antibiotic Usage in Surgical Prophylaxis: A Prospective Observational Study in the Surgical Ward of Nekemte Referral Hospital. PLoS One. 2018; doi: 10.1371/ journal.pone.0203523.
9. Alemkere G, Tenna A, Engidawork E. Antibiotic Use Practice and Predictors of Hospital Outcome among Patients with Systemic Bacterial Infection: Identifying Targets for Antibiotic and Healthcare Resource Stewardship. PLoS One. 2019; doi: 10.1371/journal. pone.0212661.
10. Abera B, Kibret M, Mulu W. Knowledge and Beliefs on Antimicrobial Resistance among Physicians and Nurses in Hospitals in Amhara Region, Ethiopia. BMC Pharmacol Toxicol. 2014;15:1–7.
11. Sadasivam K, Chinnasami B, Ramraj B, Karthick N, Saravanan A. Knowledge, Attitude and Practice of Paramedical Staffs Towards Antibiotic Usage and Its Resistance. Biomed Pharmacol J. 2016;9:337–43.
12. Tafa B, Endale A, Bekele D. Paramedical Staffs Knowledge and Attitudes Towards Antimicrobial Resistance in Dire Dawa, Ethiopia: A Cross-sectional Study. Ann Clin Microbiol Antimicrob. 2017;16:1–14.

13. Tennant I, Nicholson A, Gordon-Strachan GM, Thoms C, Chin V DM. A Survey of Physicians' Knowledge and Attitudes Regarding Antimicrobial Resistance and Antibiotic Prescribing Practices at the University Hospital of the West Indies. West Indian Med J. 2010;59:165–70.
14. Strategy for the Prevention and Containment of Antimicrobial Resistance for Ethiopia, Addis Ababa, 2015. p. 1–30. Available from: http://extwprlegs1.fao.org/docs/ pdf/eth171512.pdf.
15. Berha AB, Amin D, Alebachew M. Awareness and Beliefs of Antimicrobial Resistance among Health Professionals Working at Tikur Anbessa Specialized Hospital, Addis Ababa: Ethiopia. J Bioanal Biomed. 2017;09:123–9.
16. Alzoubi K, Ayoub N, Al-Sakaji S, Al-Azzam S, Mhaidat N, Masadeh M. Awareness of Bacterial Resistance among Physicians, Pharmacists and Nurses. Int J Occup Med Environ Health. 2009;22:363–72.
17. Pulcini C, Williams F, Molinari N, Davey P, Nathwani D. Junior Doctors' Knowledge and Perceptions of Antibiotic Resistance and Prescribing: A Survey in France and Scotland. Clin Microbiol Infect. 2011;17:80–7.
18. Wester C wiliam, Durairaj L, Evans AT, Schwartz DN, Husain S, Martinez E. Antibiotic Resistance: A Survey of Physicians Perception. Arch Intern Med. 2002;162:2210–6.
19. Erku DA, Aberra SY. Non-Prescribed Sale of Antibiotics for Acute Childhood Diarrhea and Upper Respiratory Tract Infection in Community Pharmacies: A Two Phase Mixed-Methods Study. Antimicrob Res Infect Control. 2018;7:1–7.
20. Mamo G, Teshome A. Evaluation of Antibiotics Use in the Treatment of Upper Respiratory Tract Infection in Bedele District Hospital, Southwest Ethiopia. J Sci Inovetive Res. 2017;6:38–43.

Figures

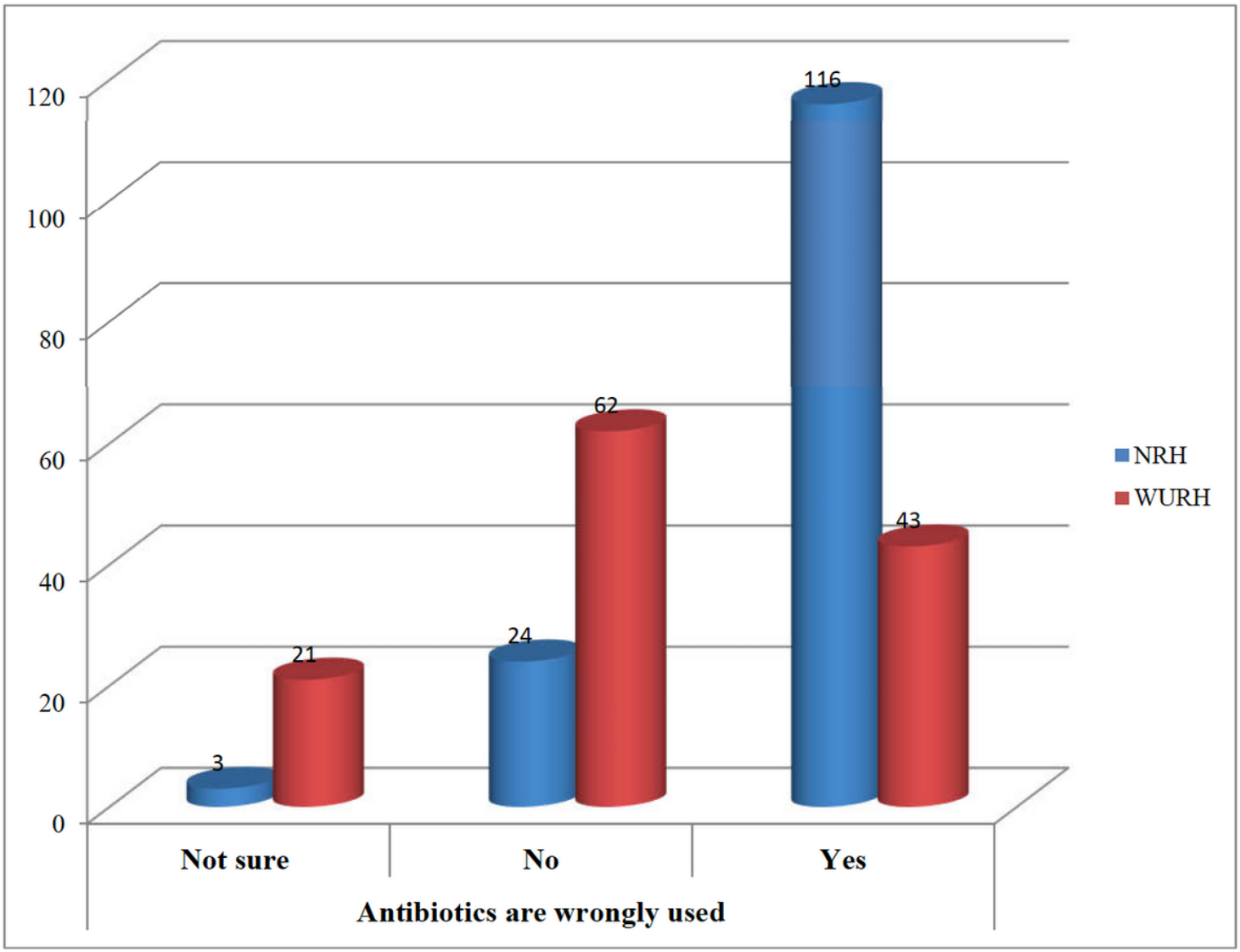

Figure 1

Perception of healthcare professionals on wrong use of antibiotics in East Wollega, western Ethiopia, from May to June, 2017. NRH, Nekemte Referral Hospital; and WURH, Wollega University Referral Hospital.

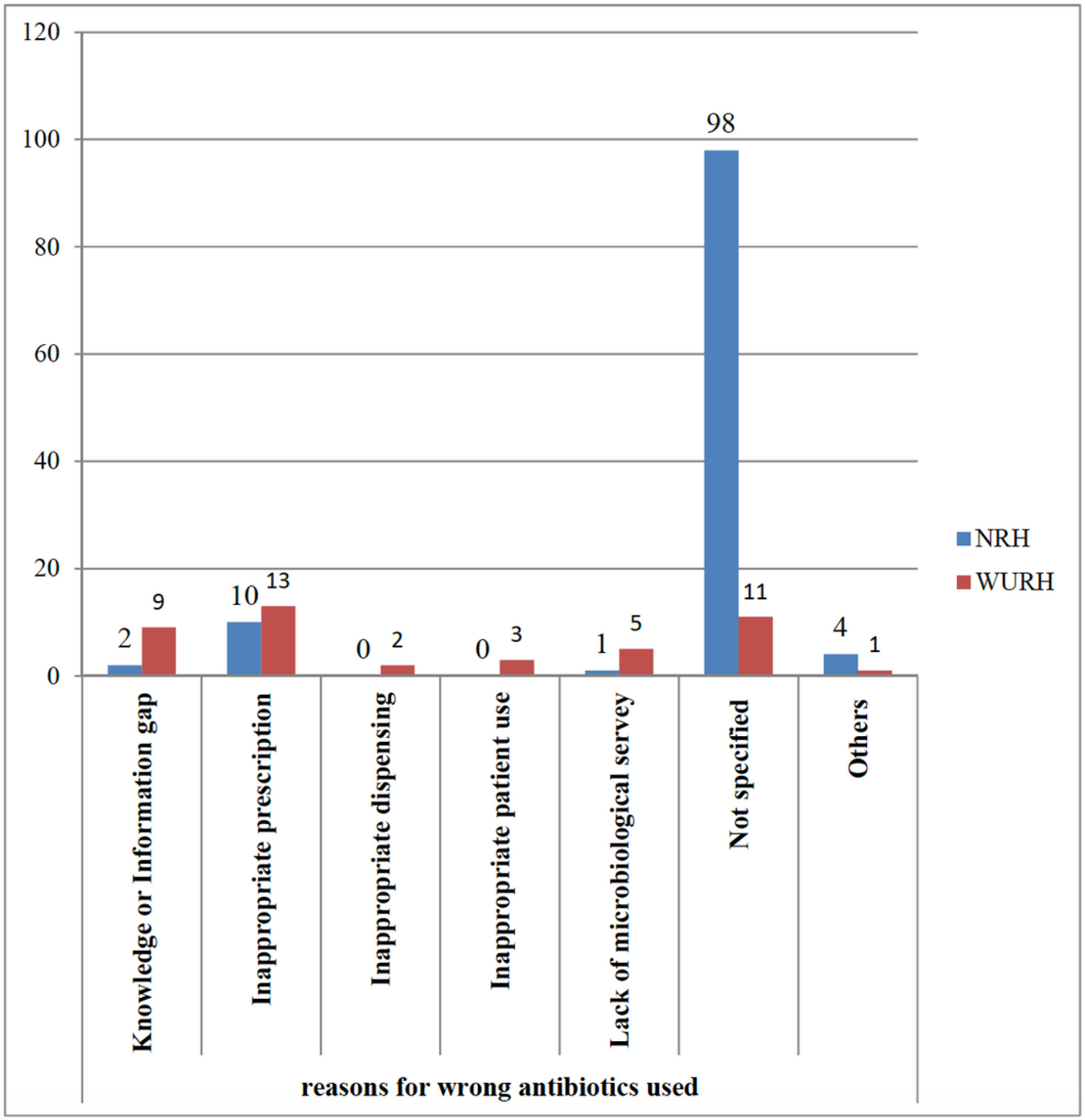

Figure 2

Reasons on wrong use of antibiotics among healthcare professionals in East Wollega, western Ethiopia, from May to June, 2017. NRH, Nekemte Referral Hospital; and WURH, Wollega University Referral Hospital.

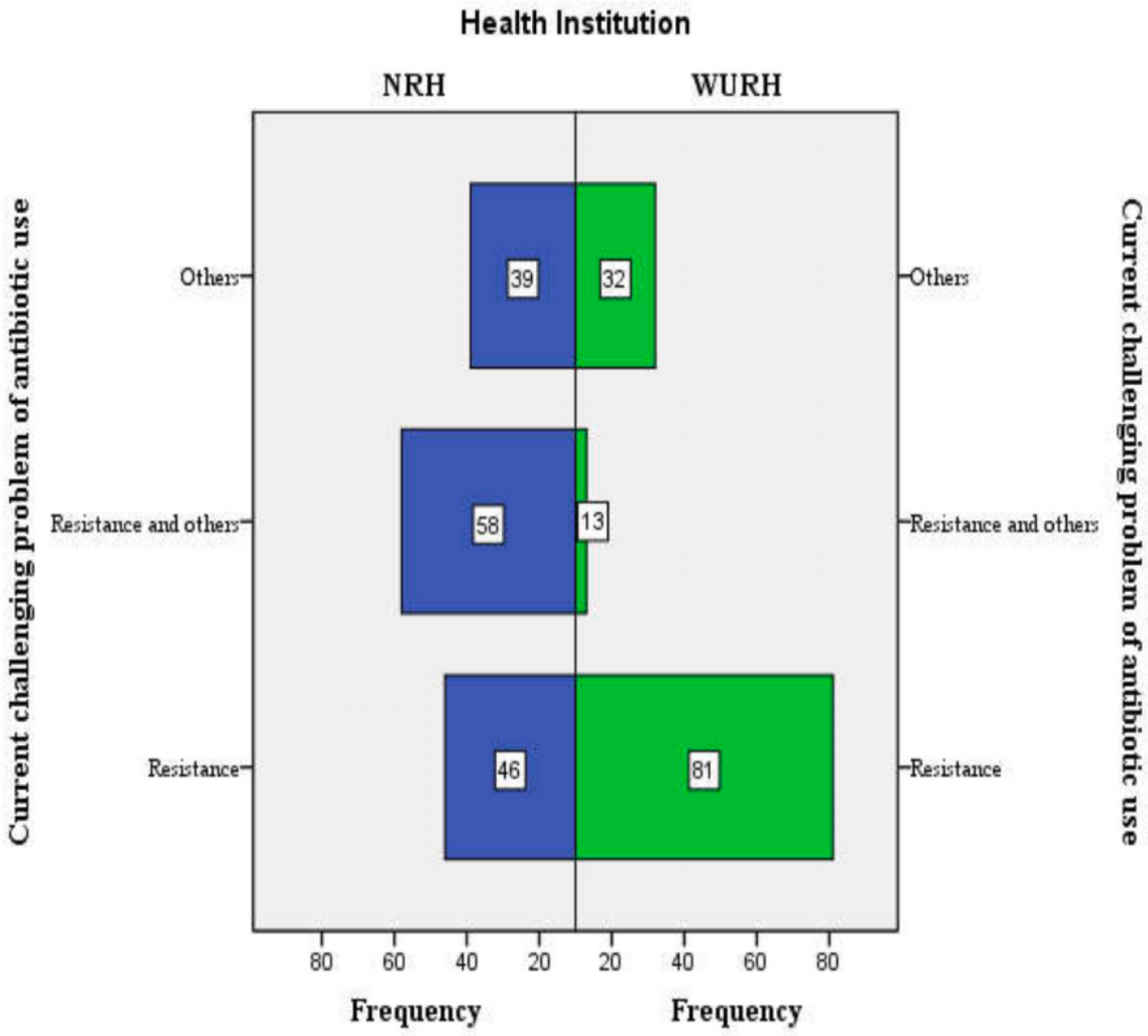

Figure 3

Awareness of resistance as the current challenging problem of antibiotic use among healthcare professionals in East Wollega, western Ethiopia, from May to June, 2017. NRH, Nekemte Referral Hospital; and WURH, Wollega University Referral Hospital.

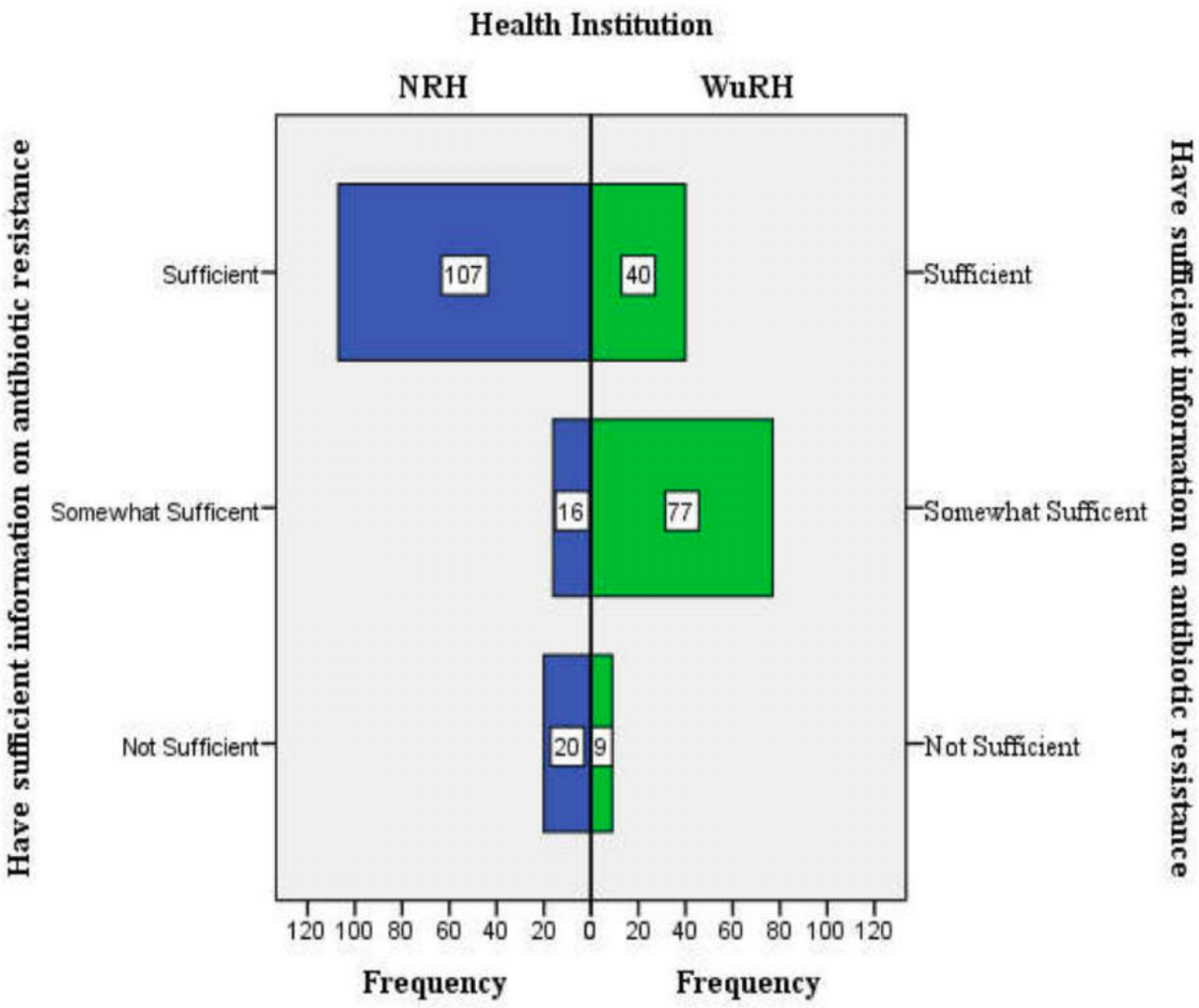

Figure 4

Exposure status to the concept of antimicrobial resistance among healthcare professionals in East Wollega, western Ethiopia, from May to June, 2017. NRH, Nekemte Referral Hospital; and WURH, Wollega University Referral Hospital.

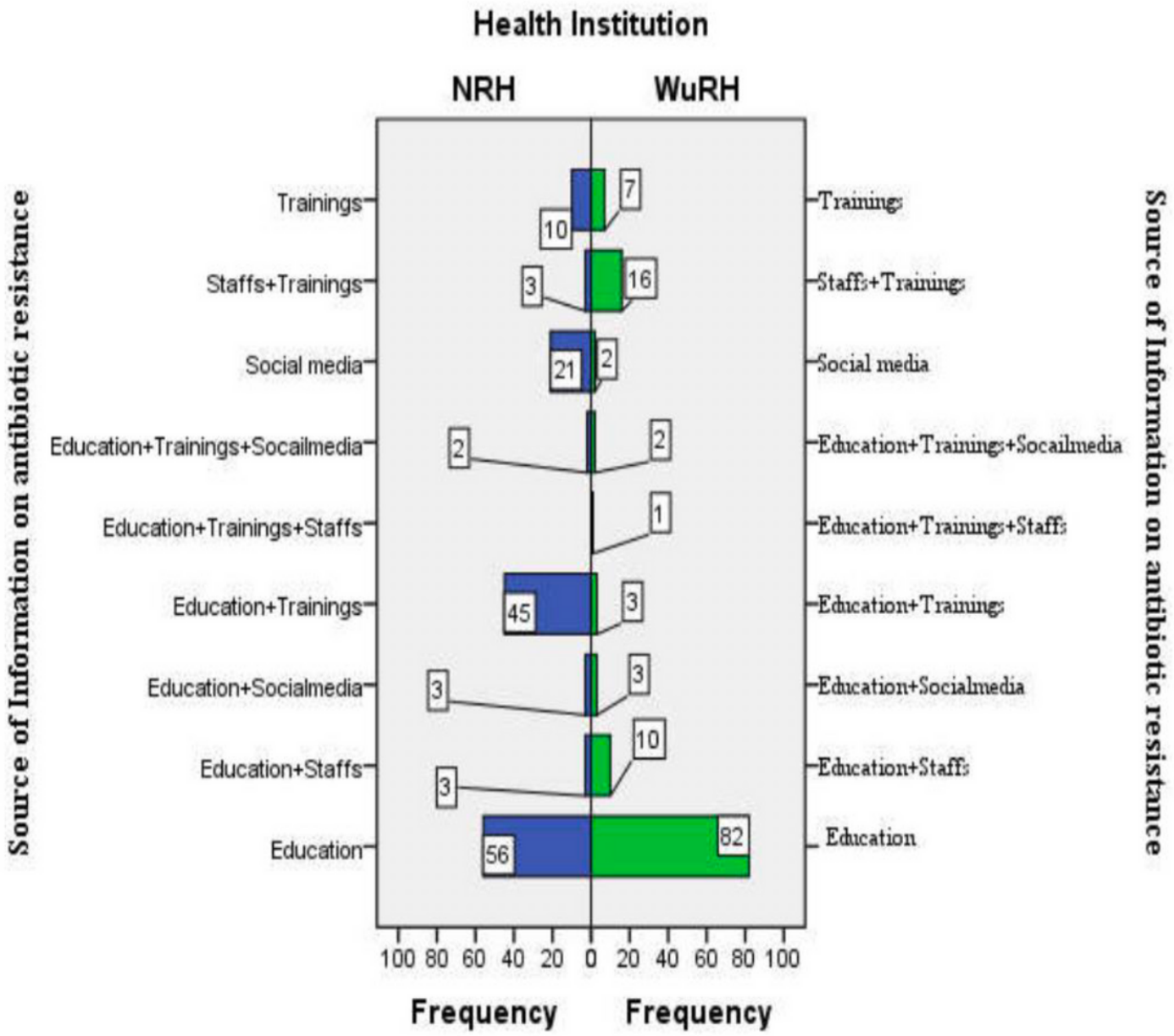

Figure 5

Source of information on antimicrobial resistance among healthcare professionals in East Wollega, western Ethiopia, from May to June, 2017. NRH, Nekemte Referral Hospital; and WURH, Wollega University Referral Hospital.