ASSESSMENT OF KNOWLEDGE ATTITUDES AND PRACTICES OF HEALTHCARE PROFISSIONERS AND PATIENT ON ANTIBIOTIC USE AND RESISTANCE IN HODIEDAH TOWN

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ABSTRACT

Background: Antibiotics are type of antimicrobial agents, used for the management of bacterial infections. These drugs are not effective against viruses (e.g. those of common cold and flu) and no single antibiotic can cure all forms of infections, Improper utilization of antibiotic sperm its the emergence of resistant bacteria and overuse/misuse of them may lead also to the development of side effects and increasing cost of healthcare services. **Objective:** The aim of this study to understand the public and health worker knowledge of antibiotics use and antibiotic resistance. The aim of this study to understand the public and health worker knowledge of antibiotics use and antibiotic resistance causes. **Method:** This is a cross-sectional study was conducted based on a validated questionnaire. This study was conducted among four categories of population there are: physician, pharmacists ,nurses and those outside the medical range in Hodeida City over three months, from July to September, 2022. These groups are the ones who deal with antibiotics the most, so they were chosen in the study. **Results:** Among the most important findings in the knowledge part, a significant percentage of participants had low knowledge regarding the role of antibiotics. Approximately (72.7%) of the nurse,34.4% of pharmacist think that antibiotics can be used to treat viral infections, while 50.0% of pharmacist and 80% of nurse think they can be used for a cold and cough. **Conclusion:** There is a significant lack of understanding and practice of antibiotics ,and this was evident among those outside the health field compared to workers in the health field. However, when comparing understanding and practice among health workers with each other, we found that nurses were the category with the least understanding and practice regarding the dispensing and use of antibiotics.

KEYWORDS: Antibiotics**,** resistance**,** pharmacists**,** physician**,** knowledge**.**

INTRODUCTION

Antibiotics are type of antimicrobial agents, used for the management of bacterial infections. These drugs are not effective against viruses (e.g. those of common cold and flu) and no single antibiotic can cure all forms of infections, Improper utilization of antibiotics permits the emergence of resistant bacteria and overuse/misuse of them may lead also to the development of side effects and increasing cost of healthcare services.[1] The decline in the rate of development of novel antibiotics to face the threat of resistance has generated public health challenge to policy makers, healthcare providers, and the beneficiaries around the world.[2]

In Europe, for example, approximately 25,000 patients die each year from infections due to multidrug-resistant organisms. These infections lead also to more health expenses and loss of productivity of at least € 1.5 billion per year.[3] In the United States, at least 2 million people become infected each year with antibiotic-resistant bacteria and nearly 23,000 of them die as a direct result of associated infections. The estimated direct annual healthcare cost of antibiotic resistance for US health system is more than $20 billion, with additional indirect cost to society of $35 billion due to lost productivity, this trend is expected to continue until rational use of antibiotics is applied effectively, unnecessary usage is avoided, and solution is found to resistance dilemma.[4] The World Health Organization (WHO) has highlighted the role that can be played by general people to prevent and control the spread of resistance, and several key elements were identified: i) using antibiotics only when prescribed by a certified health professional; ii) never demanding antibiotics if health worker finds there is no need for them; iii)steady follow-up to advice of health

worker when using antibiotics; and iv) avoiding share or use of leftover antibiotics.[5]

Nevertheless, a large amount of evidence worldwide has showed widespread defects in population knowledge and attitude about antibiotics which affect their usage.[6]

Antibiotics are among the most commonly used medications globally and are of enormous importance to global health; despite their importance, the sustained effectiveness of antibiotics is endangered by the development of resistance. The excessive and unnecessary use of antibiotics has been reported as the main cause of antibiotic resistance.[7]

Forms of inappropriate use include physicians' antibiotic over-prescription, abuse of antibiotics by patients, use of antibiotics in animals for growth promotion, and use of antibiotics in nursing homes and long-term care facilities. It has been reported that the abuse of antibiotics by the public is an important risk factor for antibiotic resistance.[8] There have also been reports that people are ignorant of the role of antibiotics in the management of common infections. Thus, it is crucial to gain an understanding of the public knowledge and attitude towards antibiotics.[9]

Bacteria are classified into two categories based on their ability to cause diseases: pathogenic and non-pathogenic bacteria. Pathogenic bacteria are harmful to animals, plants, and humans while non-pathogenic bacteria are relatively harmless. Some bacteria may be harmful to humans but not to plants or animals or vice versa. An example of a pathogen only in humans is Salmonella typhi; Salmonella typhi is the causal bacteria of typhoid fever in humans. A bacterial infection needs tens of thousands to millions of bacteria to develop into a disease state, and bacterial infections develop when bacteria multiply before they are destroyed and removed by the body's defense system.[10] Bacteria can also synthesize toxic substances that are toxic to human tissues that enhance unfavorable interactions between the bacteria and the human body's defense system.[11]

Antibiotic Resistance
The ability of bacteria to resist the bacteriostatic or bactericidal effect of an antibiotic is referred to as antibiotic resistance, the development of resistant bacteria as well as ineffective therapy, resource wastage, increased cost of therapy, increased risk of adverse drug reaction, and more importantly, the rising economic burden on national and global health systems are all consequences of excessive use of antibiotics. Antibiotic resistance is a global problem as reported by the U.S. Centers for Disease Control and Prevention reports.[12,13]

Each year in the United States, at least 2,000,000 people acquire serious bacterial infections that are resistant to one or more of the antibiotics designed to treat them. At least 23,000 people die each year as a direct result of these antibiotic-resistant infections. Although in Canada the rates of antibiotic resistance are lower than most parts of the world, approximately 220,000 to 250,000 people are infected with nosocomial infections every year, and of these people, 8,000 – 12,000 people die from being infected with resistant strains.[14]

Relationship between antibiotic use and antibiotic resistance
Establishing a causal relationship between the amount of antibiotics used and the development of antibiotic resistance is not easy to analyze. However, there are underlying assumptions that explain the association between antibiotic use and antibiotic resistance. 'threshold' hypothesis suggests that antibiotic resistance could be reduced if the entire antibiotic usage in an environment remains below a level.[15]

Factors influencing antibiotic resistance
Various factors are highlighted as being responsible for antibiotic resistance. These factors can be classified into two categories: the bacterial factor and the human factor. The bacterial factor involves the ability of bacteria to change its genetic make-up. Following this change, the bacteria develop resistance to the antibiotics by producing biological activity that results in the antibiotics losing its antibacterial property, the bacterial factor is a natural process for the bacteria and cannot be prevented.[16]

The human factor involves the misuse of antibiotics. This misuse of antibiotics results in selective antibiotic pressure which is the process whereby antibiotics kill susceptible bacteria, allowing antibiotic-resistant bacteria to survive and multiply. This is regarded as the most important factor stimulating the development of antibiotic resistance.[17]

A form of antibiotic misuse is inappropriate antibiotic prescriptions by physicians in which antibiotics are prescribed based on experience without conducting a pathogen test to identify if the pathogen involved is bacterial, viral, or fungi. Also, these antibiotics are prescribed without carrying out an antibiotic sensitivity test to determine which antibiotic is appropriate in the particular situation.[18] Another form of antibiotic misuse involves the general public. Substantial global evidence has shown that the general community plays a role in the increase and spread of antibiotic resistance.[19]

Controlling antibiotic resistance
A major strategy recommended for controlling antibiotic resistance is the education of the public about the role of antibiotics and its appropriate use. The government of Canada has developed educational tools to educate the public on appropriate antibiotic uses as well as ways to minimize the exposure to bacterial infections. This information can be found on the Health Canada website, information regarding antibiotic use can also be assessed on the Canadian Institute for Health Information (CIHI)

website. Other programs such as programs as Do bugs need drugs? (DBND) and Choosing Wisely are involved with educational campaigns for the public and healthcare professionals.[20]

DBND is a community education program about handwashing and responsible use of antibiotics. They provide educational materials to healthcare professionals and the public that explain why antibiotic resistance is an issue and steps to prevent antibiotic resistance from developing. Handwashing education is a key component of DBND's educational campaign which is very important because this prevents infections and the need for treatment.[21]

Choosing Wisely Canada is a national campaign that helps clinicians and patients engage in conversations about unnecessary tests and treatments, and make smart and effective care choices. Choosing Wisely Canada inspires and engages healthcare professionals to take leadership in reducing unnecessary tests, treatments and procedures, and enables them with simple tools and resources that make it easier to choose wisely. A component of this campaign is the Antibiotic Wisely that focuses on providing education and recommendations on using antibiotics more wisely.[22]

One of the rationales for educating the public about antibiotic resistance is to help influence the public demand for antibiotic prescriptions as well as minimize antibiotic misuse, However, there is a wide variation in people's understanding of antibiotic use, hence the need to tailor educational interventions to address these variations as well as their learning needs. Unfortunately, there is a limitation in knowledge or studies assessing the educational needs of the public in Yemen about antibiotic use. To my knowledge, there are no population-based studies that have investigated the public's knowledge and attitude about antibiotic use. Studies conducted internationally.[23]

In Yemen, a research has shown that there are various knowledge gaps regarding to antibiotic use that needs to be addressed among the public. Many of the respondents across the various studies had incorrect views about antibiotics and its uses. There is a great need to protect currently available antibiotics from being rendered ineffective by irrational antibiotic use and antibiotic resistance hence the need for conducting more research on the role of the public focusing on their knowledge and attitude towards antibiotic use, especially in Yemen. This research study aimed to contribute in filling this gap through understanding the public knowledge and attitude regarding antibiotic use from a cross sectional survey. The aim of this study to understand the public and health worker knowledge of antibiotics use and antibiotic resistance causes.

MATERIALS AND METHODS
Methodology
Study Design and Setting
This is a cross-sectional study was conducted based on a validated questionnaire. This study was conducted among four categories of population there are: physician, pharmacists, nurses and those outside the medical range in Hodeida City over three months, from July to September, 2022. These groups are the ones who deal with antibiotics the most, so they were chosen in the study.

Study variables
Antibiotic prescribing (dependent variable) in the treatment of different diseases was assessed based on the type, frequency. Also, antibiotic prescribing was assessed based on independent variables, such as patients-physicians related variables and the likely of bacterial infections.

Sample size calculation and participants
We estimated the representative sample size using based on the Daniel sample size formula[36], assuming a 95% confidence interval, a 5% margin of error, and a 50% response distribution, the representative sample size will be 104 participants.

Study tool and data collection
A validated questionnaire was used to collect the data from participants. This tool was designed based on similar previous studies[37,38] with slight modification on their items. The questionnaire was passed to doctor at Al-hodeidah University and doctor at sana'a University. We considered their comments in the designing of the final version. The final version of the questionnaire consists of three parts. The first part contains demographic data for physicians and patients, the second part contains information about the knowledge of antibiotic prescription, the third part contains the practice about antibiotics.

Five Pharmacy students in the fifth year at the University of Science and Technology Hodeida branch were trained before data collection.

Statistical analysis
Categorical variables, such as the sociodemographic data for the pharmacy, physicians, Nurses and other participants, were represented as frequency and percentage. Associations between antibiotic prescribing (dependent variable) and both knowledge and practice (independent variables) were studies using chi-square test. The extent of this association was determined using univariate logistic regression.

Data were analyzed using SPSS version 26 for Windows® (IBM Corp., Armonk, NY, USA). A p- value of less than 0.05 was considered statistically siginificant.

RESULTS AND DISCUSSION
Table 1: Sociodemographic data for participants.

Sociodemographic data		Count	%
Age	Under 18 years old	20	19.2%
	18 to 40 Years old	71	68.3%
	Over 40 years old	13	12.5%
Gender	Men	74	71.2%
	Women	30	28.8%
Occupation	I do not Work	13	12.5%
	employee	59	56.7%
	literal	1	1.0%
	housewife	0	0.0%
	student	29	27.9%
	other	2	1.9%
Specialization	doctor	20	19.2%
	nurse	11	10.6%
	pharmacist	32	30.8%
	Non-medical field	41	39.4%
Nationality	yemeni	104	100.0%
	Non-yemeni	0	0.0%
Place of residence	city	76	73.1%
	countryside	28	26.9%
education level	uneducated	0	0.0%
	Basic education	4	3.8%
	intermediate education	35	33.7%
	Above average education	2	1.9%
	collegiate	56	53.8%
	postgraduate	7	6.7%

A total of 104 participants were enrolled in this study. The participants' sociodemographic data were as the following: the majority (68.3%, n=71) of the participants were related to the age range between 18-40 years, and (19.2% n=20) of the participants were less than 18 years and 12.5% n=13) were >40 years.

Regarding the gender of the participants, the majority (71.2%, n= 74) of them were male patients and more than fifty percent (56.7%, n= 59) of them were Occupation. Most of the participants (73,1%, n= 76) live in Urban, while (26.9%, n= 28) live in Rural.

As well as the majority of participants (53.8% n=56) were graduate and (33.7% n=35 intermediate education) as education level as showmen in table 1 and figures 1-5.

With regard to the specialties of the participants, the category of participants from outside the health field was the largest among the participants with a percentage of 39.4%, while pharmacists constituted 30.8% and doctors 19.2%, and the category of nurses was the least participating with a percentage of only 10.6% as showmen in figure 6.
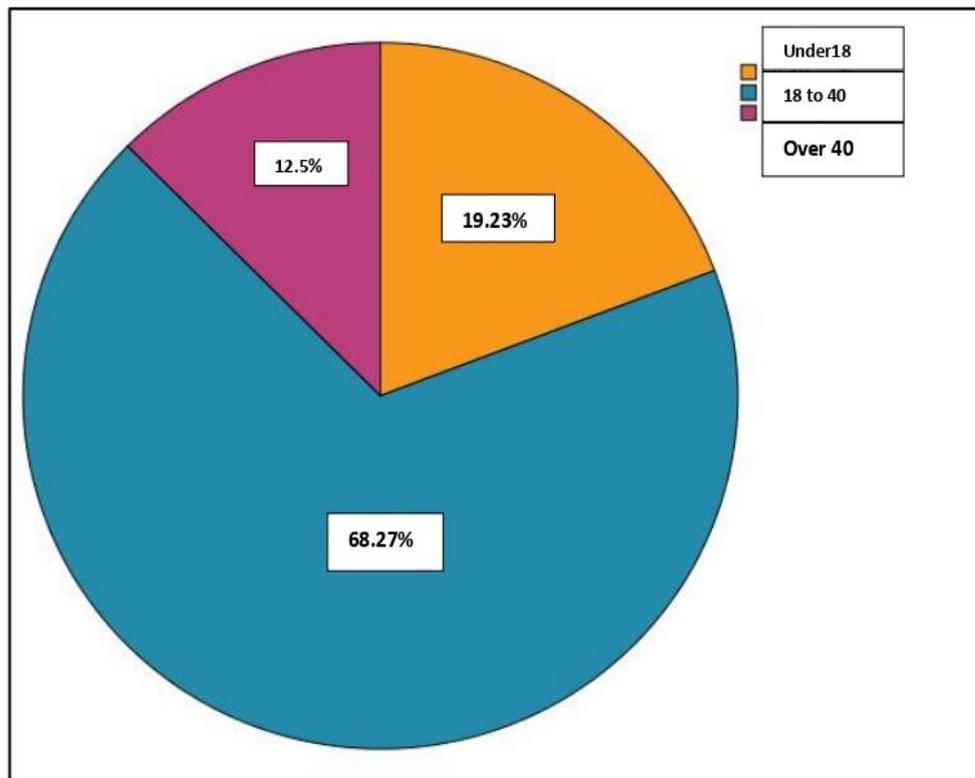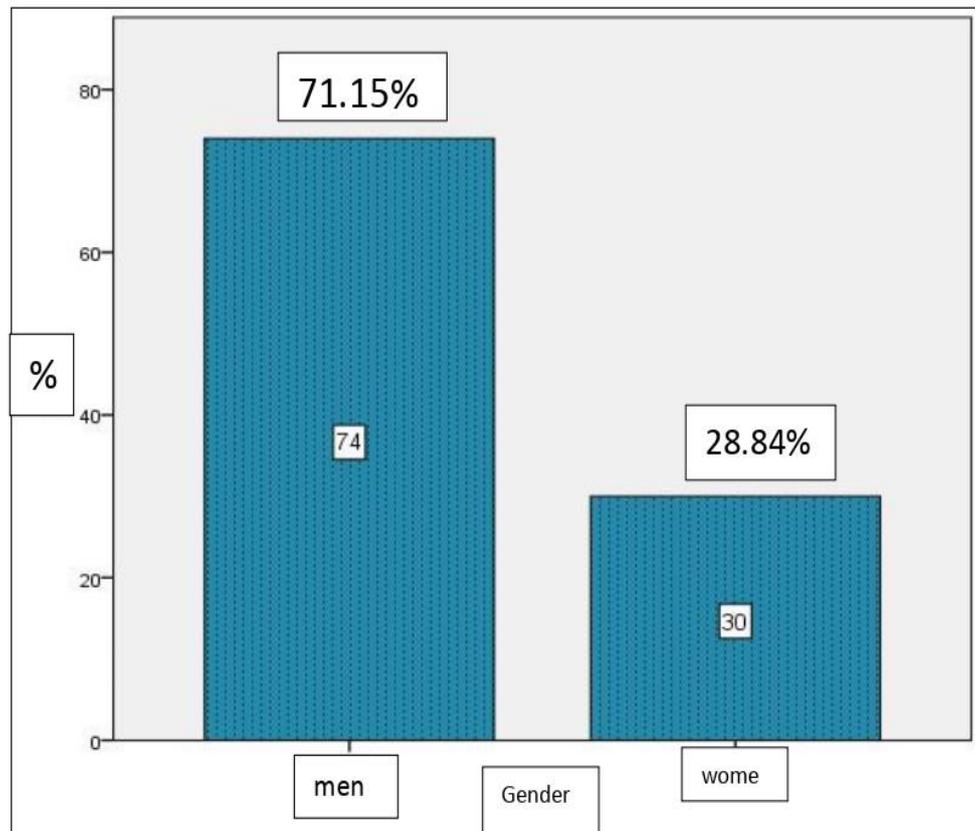
Fig 1: Age of participants.
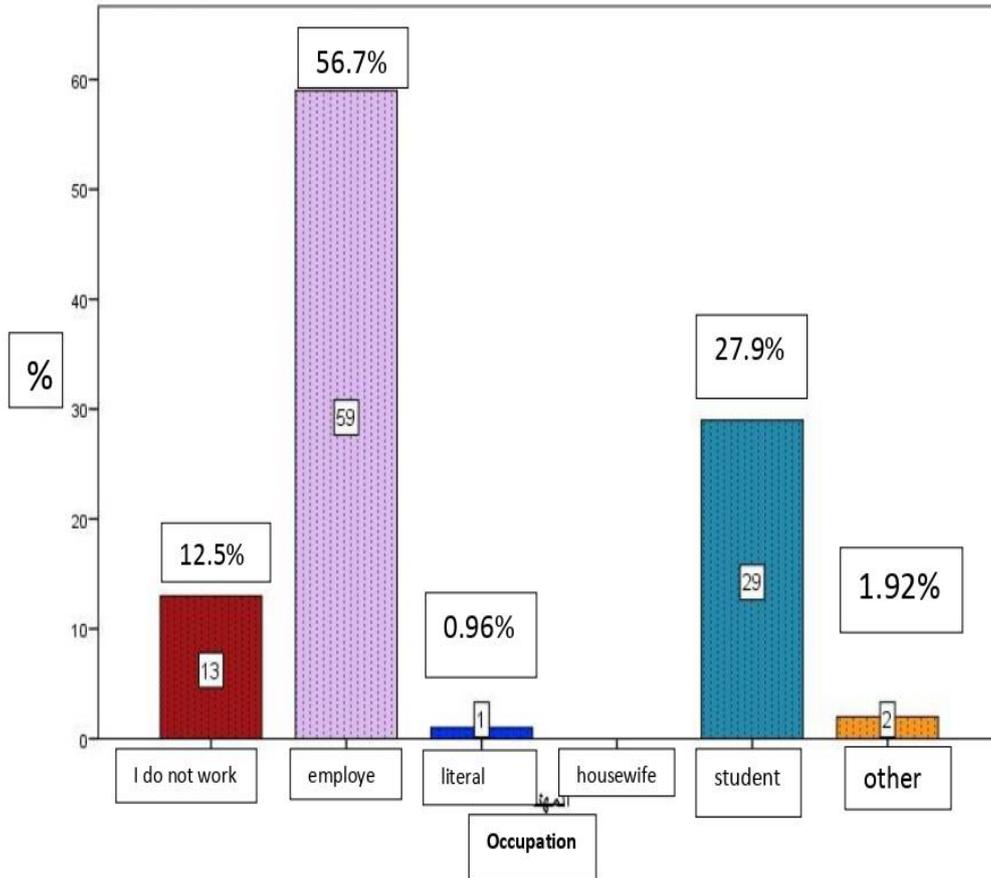

Fig 2: Gender of participants.
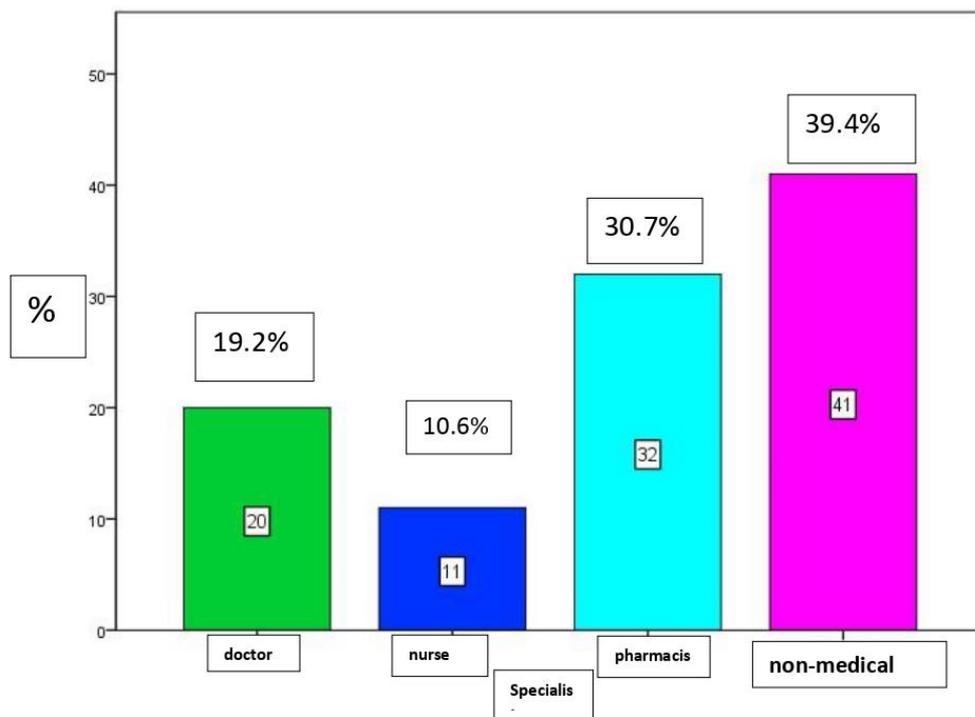
Fig 3: Occupation of participants.

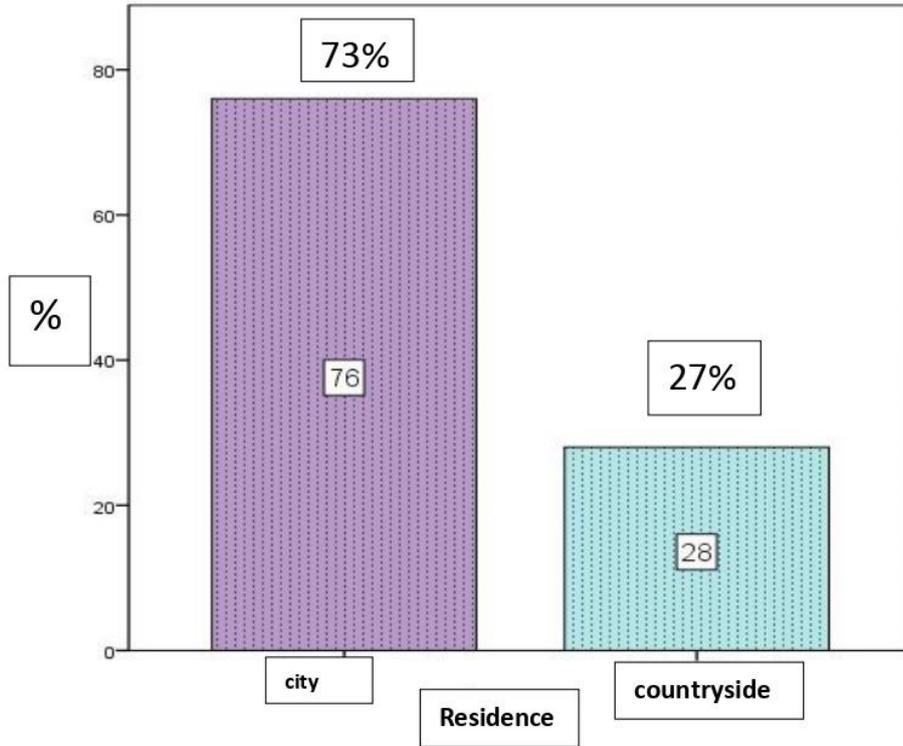

Fig 4: Specialist of participants.
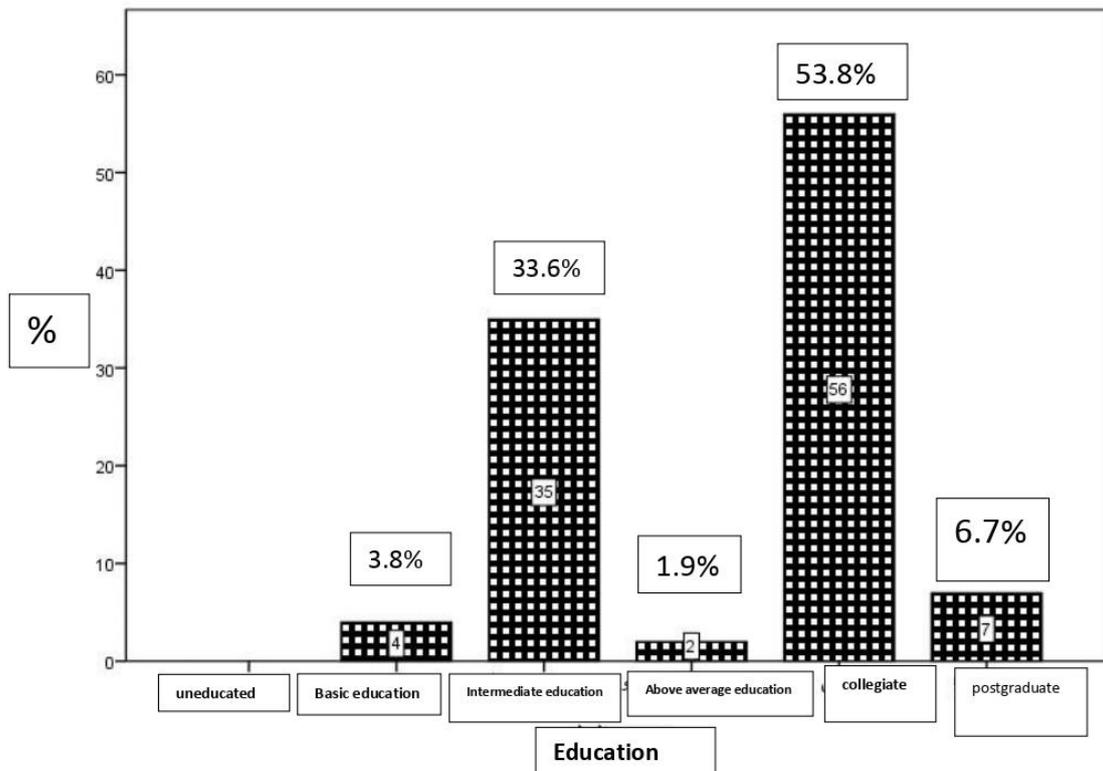
Fig 5: Residence of participants.

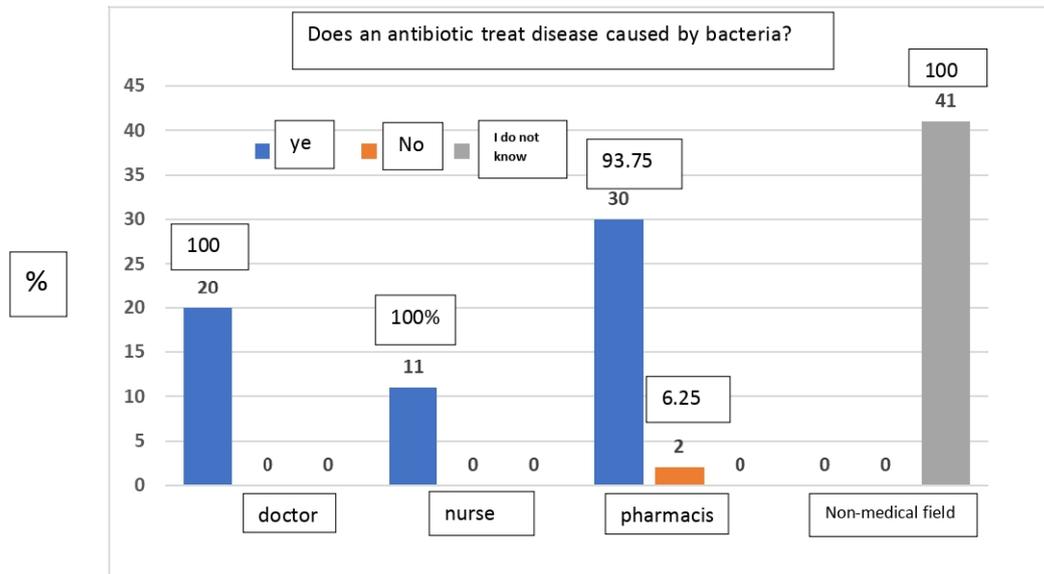**Fig 6: Education levels of participants.**

Fig 7: Does an antibiotic treat disease caused by bacteria?

In Figure 7 above, we asked the participants a question: Does an antibiotic treat disease caused by bacteria? The participants' answers were as follows: All doctors and nurses answered yes by 100%, while 93% of the pharmacists answered yes, and about 7% of them answered that antibiotics do not treat bacterial diseases. On the other hand, those outside the health sector aa.

In Figure 8 below, we asked the participants a question: Do you think antibiotics help speed recovery from cold and cough? The participants' answers were as follows: Two-thirds of the doctors, 75.0%, answered that it does

not help speed up recovery, while 25% of them answered that it helps speed up recovery from cold and cough. While the majority of nurses 81.8% answered that antibiotics help speed recovery from cold and cough, while 18.2% of them answered no.

On the other hand, half of the pharmacists 50% answered yes and the other half answered no. In addition, 51.2% of those outside the health sector answered that antibiotics help speed recovery from cold and cough, while the rest 48.8% answered that they do not know.
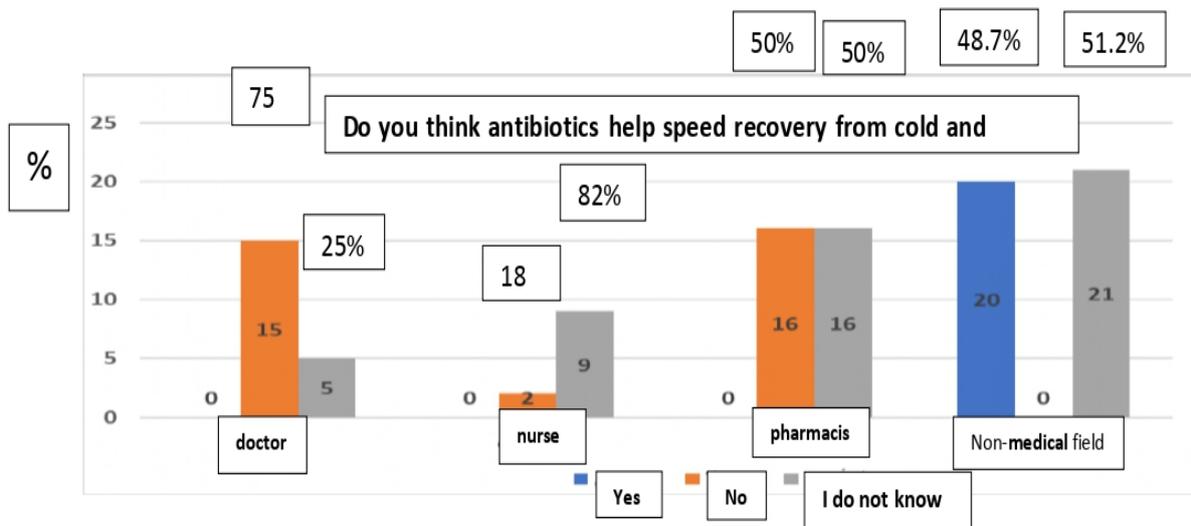

Fig 8: Do you think antibiotics help speed recovery from cold and cough.
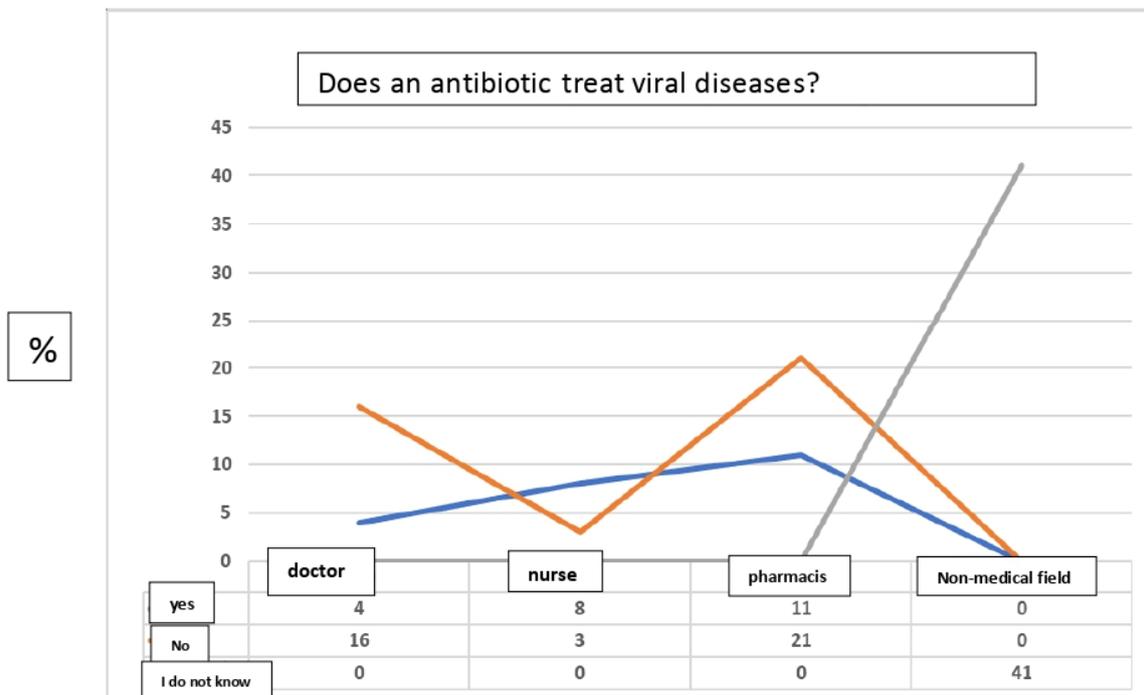
Fig 9: Does an antibiotic treat viral diseases.

In Figure 9 above, the participants were asked: Does an antibiotic treat diseases caused by viruses? The answers of the participants were as follows: the majority of doctors, 80.0%, answered that antibiotics do not treat viral diseases, while 20% of them answered that they treat viral diseases. While the majority of nurses 72.7% answered yes, while only 27.3% answered no.

On the other hand, half of the pharmacists, 65.6%, said that antibiotics do not treat viral diseases, and the rest of the pharmacists, 34.4%, believe that antibiotics treat diseases caused by viruses. As for those outside the health sector, they all answered that they do not know.
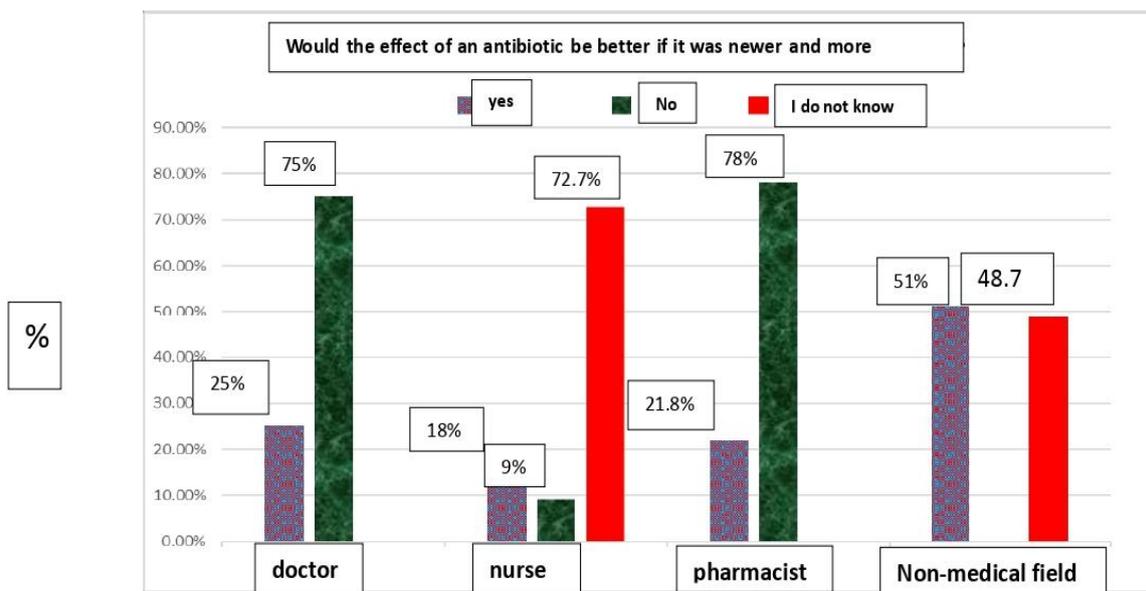
Fig.10: Would the effect of an antibiotic be better if it was newer and more expensive?

In Figure 10, the participants were asked: Would the effect of an antibiotic be better if it was newer and more expensive? The answers of the participants were as follows: the majority of doctors 75.0%, and pharmacists 78.1% answered no, while the rest answered yes. While the majority of nurses 72.7% answered that they do not know. As for those outside the health sector, 51.2% answered yes and 48.8% said that they do not know.
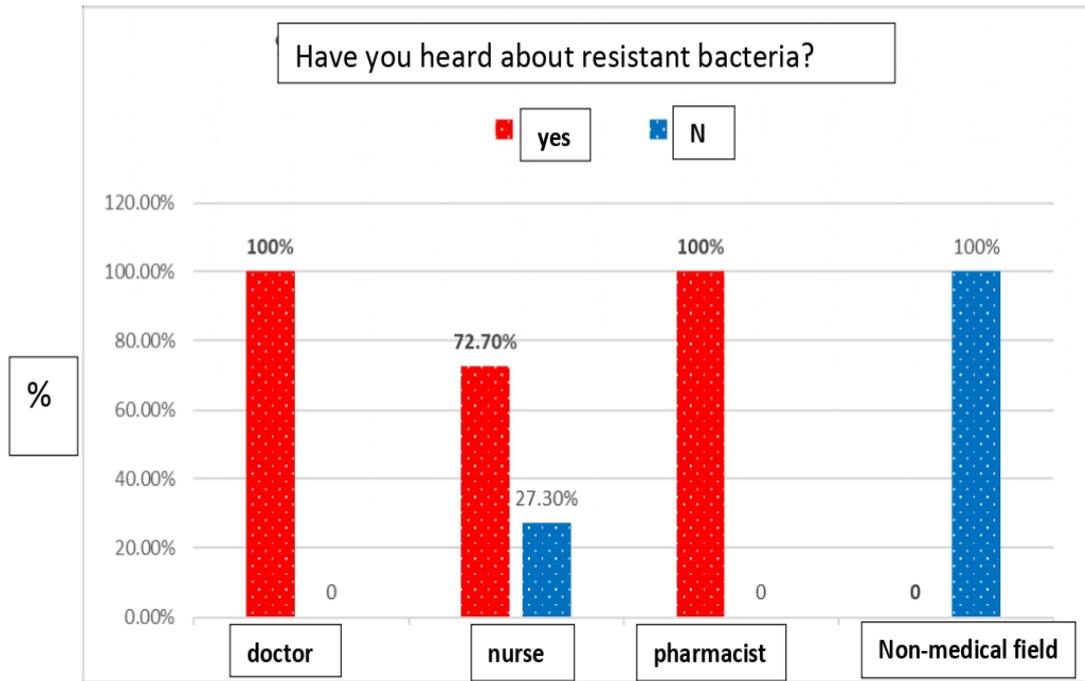
Fig 11: bacterial resistance knowledge.
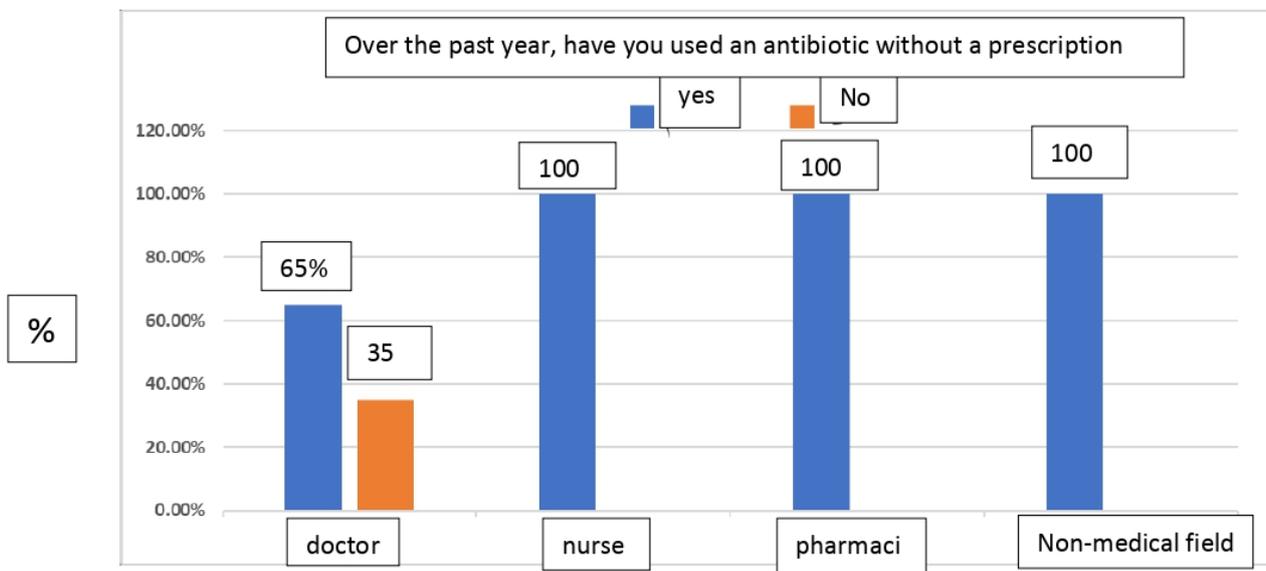
Fig 12: use antibiotic without prescript.

Table (2) Specialist of participants and knowledge:

Knowledge The axis of knowledge		Specializations of the study participants							
		doctor		nurse		pharmacist		Non-medical field	
		Count	N %	Count	N %	Count	N %	Count	N %
Does an antibiotic treat disease caused by bacteria?	I do not know	0	0.0%	0	0.0%	0	0.0%	41	100.0%
	No	0	0.0%	0	0.0%	2	6.3%	0	0.0%
	Yes	20	100.0%	11	100.0%	30	93.8%	0	0.0%
the antibiotic treat Does diseases caused by viruses?	I do not know	0	0.0%	0	0.0%	0	0.0%	41	100.0%
	No	16	80.0%	3	27.3%	21	65.6%	0	0.0%
	Yes	4	20.0%	8	72.7%	11	34.4%	0	0.0%
Do you think the antibiotic helps speed recovery from a cold, cough?	I do not know	0	0.0%	0	0.0%	0	0.0%	20	48.8%
	No	15	75.0%	2	18.2%	16	50.0%	0	0.0%
	Yes	5	25.0%	9	81.8%	16	50.0%	21	51.2%

Does the antibiotic work better if it is newer and more expensive in price?	I do not know	0	0.0%	8	72.7%	0	0.0%	20	48.8%
	No	15	75.0%	1	9.1%	25	78.1%	0	0.0%
	Yes	5	25.0%	2	18.2%	7	21.9%	21	51.2%
Have you heard of bacterial resistance?	No	0	0.0%	3	27.3%	0	0.0%	41	100.0%
	Yes	20	100.0%	8	72.7%	32	100.0%	0	0.0%
In your opinion, what is the main reason for the misuse of antibiotics?	The bad economic situation	1	5.0%	8	72.7%	6	18.8%	17	41.5%
	Difficulty getting the necessary medical care	1	5.0%	1	9.1%	7	21.9%	0	0.0%
	Previous experiences	4	20.0%	1	9.1%	5	15.6%	0	0.0%
	All of the above	14	70.0%	1	9.1%	14	43.8%	24	58.5%
	Other	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Over the past year, have you used an antibiotic without a prescription ticket?	No	7	35.0%	0	0.0%	0	0.0%	0	0.0%
	Yes	13	65.0%	11	100.0%	32	100.0%	41	100.0%
How many times have you taken the antibiotic in the past year?	1-3 times	15	75.0%	10	90.9%	26	81.3%	21	51.2%
	3-5 times	5	25.0%	1	9.1%	6	18.8%	0	0.0%
	More than 5 times	0	0.0%	0	0.0%	0	0.0%	20	48.8%
Have you ever read the leaflet attached to the antibiotic box?	No	2	10.0%	0	0.0%	11	34.4%	41	100.0%
	Yes	18	90.0%	11	100.0%	21	65.6%	0	0.0%
If your answer is yes, how much percent did you understand the instructions for use?	0-25%	2	10.0%	0	0.0%	4	12.5%	41	100.0%
	25-50%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	50-75%	4	20.0%	3	27.3%	6	18.8%	0	0.0%
	75-100%	14	70.0%	8	72.7%	22	68.8%	0	0.0%
Have you experienced any side effects with the use of an antibiotic?	No	4	20.0%	3	27.3%	7	21.9%	41	100.0%
	Yes	16	80.0%	8	72.7%	25	78.1%	0	0.0%
Do you keep antibiotic residues longer than its treatment period?	No	16	80.0%	10	90.9%	26	81.3%	21	51.2%
	Yes	4	20.0%	1	9.1%	6	18.8%	20	48.8%

Table (3) Specialist of participants and Practice.

Practice محور الممارسة	Specializations of study participants							
	doctor		nurse		pharmacist		Non-medical	
	Count	N %	Count	N %	Count	N %	Count	N %
Do you always consult a doctor before giving your child an antibiotic?	20	100.0%	11	100.0%	32	100.0%	41	100.0%
How often do you usually give your child antibiotics without a prescription?	20	100.0%	11	100.0%	32	100.0%	41	100.0%
How often does your pediatrician prescribe antibiotics for your child over the phone?	20	100.0%	11	100.0%	32	100.0%	41	100.0%
Do you give your child the same antibiotic you take for yourself if they have the same symptoms as you?	20	100.0%	11	100.0%	32	100.0%	41	100.0%
When did you stop giving your child antibiotics?	20	100.0%	11	100.0%	32	100.0%	41	100.0%

Table 4: Correlation between knowledge and specialist of participants.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.321	1.820		1.276	0.205	-1.292-	5.935
	Does the antibiotic treat diseases caused by bacteria?	3.451	.378	.535	9.128	**0.005***	2.700	4.202
	Does the antibiotic treat diseases caused by viruses?	2.314	.373	.283	6.200	**0.004***	1.573	3.055
	Do you think the antibiotic helps speed d, coughrecovery from a col?	.958	.388	.118	2.468	**0.015***	.187	1.729
	Does the antibiotic work better if it is newer and more expensive in price?	1.255	.260	.155	4.833	**-0.001***	.739	1.770
	Have you heard about bacterial resistance (Bacterial resistance)?	-.748-	.571	-.059-	-1.310-	**0.002***	-1.882-	.386
	In your opinion, what is the main reason for the misuse of antibiotics?	.762	.120	.163	6.342	.5820	.523	1.000
	Over the past year, have you used an antibiotic without a prescription ticket?	-.242-	.439	-.010-	-.552-	**-0.00***	-1.113-	.629
	How many times have you taken the antibiotic in the past year?	1.349	.405	.172	3.329	.0510	.544	2.154
	Have you ever read the leaflet attached to the antibiotic box?	2.762	.341	.220	8.103	.3480	2.085	3.438
	ts Have you experienced any side effec with the use of an antibiotic?	1.445	.345	.115	4.194	.0670	.761	2.129

a. Dependent Variable:Understanding and knowledge

Table 5: Association between specialist and practice

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
*specialist	Between Groups	(Combined)	.555	2	.278	.339	.714
	Within Groups		49.159	60	.819		
*practice	Total		49.714	62			

Table 6: Association between specialist and knowledge

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
specialist	Between Groups	(Combined)	84.336	12	7.028	13.694	.000
knowledge	Within Groups		46.703	91	.513		
	Total		131.038	103			

Table 7: Association between specialist and (practice& knowledge)

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
practice	Between Groups	.153	2	.077	.138	.872
	Within Groups	33.402	60	.557		
	Total	33.556	62			
knowledge	Between Groups	3709.276	3	1236.425	336.036	**.000***
	Within Groups	367.945	100	3.679		
	Total	4077.221	103			

Statistical analysis
The results presented in Table 3 indicate that there are no significant differences in the release patterns of the different brands, with a p-value of < 0.05.

CONCLUSION
There is a significant lack of understanding and practice of antibiotics, and this was evident among those outside the health field compared to workers in the health field. However, when comparing understanding and practice among health workers with each other, we found that

nurses were the category with the least understanding and practice regarding the dispensing and use of antibiotics.

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