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Nurses' knowledge, motivation, behaviors, and information sources on antibiotic use and resistance in Jordan

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ABSTRACT

Aim: This study aims to examine the nurse knowledge, motivation, and behavior about antibiotics and antibiotic resistance. A secondary objective was to study the preferred information sources used by Jordanian nurses, as well as their knowledge of the information available to promote rational prescription practices in the Jordanian health system.

Method: The study was cross-sectional in design and nurses (n=1,093) completed an online survey using Google Forms. Participation in the study was completely optional, and participants were free to drop out at any point. During the months of February-May 2022, nurses were asked to participate in a survey

Results: The study found 48.2% of nurses given prescribed antibiotics to the patients daily or multiple times a day in the preceding week; 13.3% of nurses provided support on daily or more frequent antibacterial drugs use or infection management. The reason for not giving advice regarding antibiotics were no leaflet regarding the use of the antibiotics (42.3%) and the patients do not get attention for the information (30.4%).

Conclusion: In conclusion, the findings of this study show that public health actions are needed (e.g., educational or communication campaigns). Nurses must be educated on the proper use of antibiotics and the emergence of antibiotic resistance. Antibiotic stewardship can benefit from the findings, which can be used to develop interventions aimed at improving antibiotic usage.

Keywords: nurses, antibiotics, resistance, health care

INTRODUCTION

To limit or perhaps halt the impending spike of nursing cases, the nursing profession must act now on a worldwide basis [1]. Antibiotic resistance has just 1% of the publications in the healthcare literature, which is unexpected, and alarming given that nurses are the biggest group of healthcare workers that contact with the population [2]. Investing in nurses has yielded enormous rewards in the clinical, social/economic, and policy sectors of health care systems across the world [3-5].

Professional requirements must be met by nurses who have the expertise and obligation to do so [6], and they perform a distinct and comprehensive job that covers all aspects that related to preparing antibiotics for administration and observing of their effects [7, 8]. Nurses have a considerably greater responsibility in preventing and controlling illness [4, 9-11]. Additionally, this job includes working with patients and their families in the clinic, as well as participating in clinical research and development, teaching nurses and the public, and advocating for changes in policy and practice [10, 12]. To address antibiotic resistance, nursing should be reexamined to see whether it can work in harmony with other sectors of the health care system [13]. With widespread public and worldwide awareness, it will make a difference.

The nurses are one of the most common professions that deal with many types of patients in daily basis in a variety of situations [11]. Nurses, who play a critical role in basic health care, have shown increase in the number of resources and facilities to prescribe antibiotics and other types of medications [4, 5]. An accelerating number of patients who being treated by advanced practice nurses, and a recent study indicated that these practitioners are more comprehensive and confident in prescribing antibiotics and providing information to patients than other professionals [3]. Nursing experience in education and skill provide them with the capability to guarantee that education system and supervision are adequate [8]. So, patients and their families followed the instruction given by nurses since they are the most trustable professionals [7, 14]. An increase in creative nurse practitioners and registered nurses' prescription has stimulated the growth of contribution via greater pharmacology preparation and abilities to begin engaging patients and family members in optimal drug usage [15, 16]. To avoid over-prescriptions, patients should be informed on the proper use of antibiotics [5]. This study aims to examine the nurse knowledge, motivation, and behavior about antibiotics and antibiotic resistance. A secondary objective was to study the preferred information sources used by Jordanian nurses, as well as their

knowledge of the information available to promote rational prescription practices in the Jordanian health system.

MATERIALS AND METHODS

Almost 1,093 nurses in Jordan were surveyed online for 10 minutes using a structured cross-sectional survey. Google Forms, a web-based survey platform, was used to collect data from the survey. Respondents were required to have a bachelor's degree in nursing or a higher educational status in order to be included in the study. The target demographic was approached via social media sites of nurses' professional associations, e.g., Facebook, with a link to participate in the study. An explanation of the study and a link to the surveys were included in the invitation. Survey participants were made aware that the survey was anonymously, meaning no personal identities of responders were gathered, and that their replies were confidential. Participation in the study was completely optional, and participants were free to drop out at any point. During the months of February-May 2022, nurses were asked to participate in a survey.

The European Center for Diseases Control and Prevention (ECDC) survey [17], which was painstakingly constructed and rigorously verified, served as the foundation for this investigation. Only nurses were targeted instead of all health professionals and students in Jordan, and the area in Jordan was included rather than Jordan as a whole, making this question specifically about Jordan. Antibiotics to enhance development in farm animals is permitted in Jordan and only includes options available to nurses in Jordan. As part of the study team's validation process, the revised survey was examined for both its content and face validity.

10 nurses participated in an online pilot study of the questionnaire, and the results of that study were not included in the final study. The survey's final version was approved after it was subjected to expert evaluation and pilot distribution. The survey was offered in both Arabic and English for respondents to select from. Parts of the poll were divided into the following categories: gender, age, experience, governorate, and major role were all covered in the five demographic and background questions. Ability-related questions included questions on how much knowledge and insight a person has about antibiotic resistance. They incorporated evaluations of both real and virtual expertise in their work. Respondents pick whether the core knowledge is true or wrong when assessing their real understanding of resistant bacteria (eight items). On a five-item Likert scale, the authors evaluated participants' perceptions of their level of expertise. utilized a Likert scale to rate accessibility to guidelines and teaching materials for three questions on opportunity.

Likert-scale questions were used to gauge how much the participants agree that administering antibiotics had a negative impact on the establishment of resistant and the nurse's critical role in preventing this. Antibiotic dispensing frequency and personalized patient counselling were two of three behavior-related questions that the nurse was asked to answer. A nurse's guide on antibiotic usage and resistance, as well as country-level measures to combat antibiotic use and resistance, are included. Studying the data according to sample size calculator a margin of error of 5%, a confidence level of 95%, a population size of 25,700 Jordanian nurses, and a response distribution of 50%, the sample size was calculated. The total number of participants was 1,093.

Table 1. Demographic characteristics of the nurses (n=1,093)

		Frequency	Percentage (%)
Insurance	No	56	5.1
	Yes	1037	94.9
Income	Less than 400	358	32.8
	400 to 800	675	61.8
	800 to 1,000	51	4.7
	More than 1,000	9	.8
Gender	Male	213	19.5
	Female	875	80.1
Working place	Not working	12	1.1
	Government	835	76.4
	Private	225	20.6
	University	21	1.9
Experience	1 to 5 years	340	31.1
	6 to 10	314	28.7
	More than 10	439	40.2
Marriage	Single	289	26.4
	Married	748	68.4
	Divorced	56	5.1
Education	Diploma	274	25.1
	Bachelor	623	57.0
	Master	175	16.0
	Doctorate	12	1.1
	Others	9	.8
Type of job	Clinical practice	935	85.5
	Administration	128	11.7
	Education	30	2.7
Description	No	223	20.4
	Yes	870	79.6
Smoking	No	696	63.7
	Yes	397	36.3

Ethical Consideration

This study was approved by Jordan University of Science and Technology IRB. The authors were ensured that the participation in the study is voluntary, and the participants know that they could withdraw at any time. Moreover, the research assistant provided the participants with their contacting details for answering any question.

Data Analysis

The authors used SPSS version 27 to analyze the data. The authors used descriptive statistics to describe the demographical variables of the participants. The authors used mean and percentage to describe the response of the participants to the questions related to knowledge, motivation, sources of information and behavior related to antibiotic use and antibiotic resistance. The authors used multiple regression to determine the predictors of knowledge toward antibiotic use and antibiotic resistance among nurses.

RESULTS

Demographical Variables

Table 1 showed the characteristics and working characteristics for the participants. The number of participants in the study 1,093. The mean for age is 30+3. The number of females is 875 (80.1) and the number of males is 218(19.5). Most

Table 2. Response of nurses to questions knowledge regarding using of antibiotics and antibiotic resistance

		Wrong		Do not know		Right	
	Answer	Count	Row N %	Count	Row N %	Count	Row N %
Antibiotics are effective against viruses.	False	741	67.5%	72	6.6%	285	26.0%
Antibiotics are effective against cold infections.	False	767	69.9%	95	8.7%	236	21.5%
Unnecessary use of antibiotics makes them become ineffective.	False	88	8.0%	60	5.5%	950	86.5%
Taking antibiotics has associated side effects or risks such as diarrhea, colitis, & allergies.	True	73	6.6%	107	9.7%	918	83.6%
Every person treated with antibiotics is at an increased risk of antibiotic resistant infection.	True	149	13.6%	144	13.1%	805	73.3%
Antibiotic resistant bacteria can spread from person to person.	True	450	41.0%	242	22.0%	406	37.0%
Healthy people can carry antibiotic resistant bacteria.	True	121	11.0%	220	20.0%	757	68.9%
The use of antibiotics to stimulate growth in farm animals is legal in Jordan.	False	127	11.6%	497	45.3%	474	43.2%

Table 3. The predictors of knowledge regarding antibiotic among nurses

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Standard error	Beta		
(Constant)	2.370	.638		3.717	.000
Insurance	.440	.195	.069	2.263	.024
Income	-.157	.084	-.065	-1.877	.061
Gender	.079	.113	.022	.697	.486
Nationality	.541	.311	.053	1.740	.082
Working place	.066	.093	.023	.716	.474
Experience of working	-.168	.062	-.100	-2.721	.007
Marriage	-.047	.089	-.017	-.529	.597
Education	.236	.060	.122	3.922	.000
Type	-.050	.098	-.016	-.515	.607
Prescription	.247	.105	.071	2.360	.018
Smoking	.189	.092	.065	2.052	.040

of them were married 748 (68.4%). Almost 835 (76.4%) are working in the governmental hospitals and 935 (85.5) were working in duties related to clinical practices.

Knowledge Regarding Antibiotics Among Nurses

Respondents received better scores for their real knowledge of questions relating antibiotics resistance (**Table 2**). These items were “taking antibiotics has associated side effects or risks such as diarrhea, colitis, allergies (83%)”, and “every person treated with antibiotics is at an increased risk of antibiotic resistant infection (73.3%)”, all yielded noticeably lower scores. When asked if it is OK to use antibiotics to promote the growth of farm animals, a low score (19.0%; **Table 2**) was noted. Each respondent received a summated score, which represented the total number of right responses to the questions about actual knowledge. According to estimates. The mean score of knowledge among nurses regarding antibiotics was .70.

Predictors of Knowledge Toward Antibiotics Among Nurses

Multiple regressions test was used to determine the predictors of knowledge toward antibiotics. Model was significant (F=5.58, p=.05). The predictors for knowledge toward antibiotics were insurance (B=.069, p=.024), experience of working (B=.1, p=.0070, education (B=.122, p=.001), expose to prescription (B=.071, p=.018), and smoking (B=.065, p=.04) (**Table 3**).

Perceived Knowledge, Opportunity, and Motivation of Nurse Regarding Appropriate Antibiotic Use and Resistance

The study sample exhibited low levels of perceived knowledge, for example, 9.5% of participants agreed with the statement about awareness of antibiotic resistance (**Table 4**). Only 42.7% of respondents agreed on concerning the role of environmental variables as a contributor four of 11 to antibiotic resistance in the assessment of perceived knowledge of environmental issues connected to antibiotics. On the items describing opportunities, 17.2% of respondents agreed with statement that they had high accessibility to the infection management guidelines they needed, and 39.9% of respondents agreed that they had easy access to the resources they needed to advise clients on wise antibiotic use. Regarding motivation, 13.4% of participants agreed the assertion that they knew there was a link between prescribing antibiotics and the emergence of antibiotic resistance. Almost 8.6% of the responders agreed with the assertion that they play a crucial role in reducing antibiotic resistance (**Table 4**). Concerning the practices of nurses in promoting prudent antibiotic use, 23.8% of the survey participants dispensed an antibiotic once daily or more than once daily in the previous week, 39.9% of the survey participants provided resources on prudent antibiotic use or infection management once daily or more than once daily in the previous week.

Avoiding Unnecessary Prescribing of Antibiotics and Its Impact on Changing Nurses’ Views and Practice

The most often mentioned explanation (45.3%) given by respondents when asked why they were unable to provide guidance or resources while dispensing antibiotics was because the patient was not looking for information. Insufficient time (27.1%) and a lack of resources (37.0%) were other frequent explanations.

An examination of individuals if they had received any information in the previous 12 months about preventing the needless prescription of antibiotics only (22.9) said yes and if the information were changed their minds, all of the

Table 4. Perceived knowledge, opportunity, and motivation of nurse regarding appropriate antibiotic use and resistance

		SA	A	D	SD	N/A	U	IDU
Perceived knowledge								
I know what antibiotic resistance is.	Count	24	82	146	631	156	7	52
	Row N %	2.2%	7.5%	13.3%	57.5%	14.2%	0.6%	4.7%
I know there is a connection between my dispensing of antibiotics and emergence and spread of antibiotic resistant bacteria.	Count	17	72	177	473	255	5	99
	Row N %	1.5%	6.6%	16.1%	43.1%	23.2%	0.5%	9.0%
I know what information to give to individuals about prudent use of antibiotics and antibiotic resistance.	Count	30	232	291	404	77	6	58
	Row N %	2.7%	21.1%	26.5%	36.8%	7.0%	0.5%	5.3%
I have sufficient knowledge about how to use antibiotics appropriately for my current practice.	Count	23	86	167	643	143	1	35
	Row N %	2.1%	7.8%	15.2%	58.6%	13.0%	0.1%	3.2%
I have a key role in helping control antibiotic resistance.	Count	20	75	189	524	223	2	65
	Row N %	1.8%	6.8%	17.2%	47.7%	20.3%	0.2%	5.9%
Opportunity								
I have easy access to guidelines I need on managing infections.	Count	30	159	318	432	81	9	69
	Row N %	2.7%	14.5%	29.0%	39.3%	7.4%	0.8%	6.3%
I have easy access to the materials I need to give advice on prudent antibiotic use and antibiotic resistance.	Count	106	332	241	292	65	2	60
	Row N %	9.7%	30.2%	21.9%	26.6%	5.9%	0.2%	5.5%
I have easy access to the materials I need to give advice on prudent antibiotic use and antibiotic resistance.	Count	44	212	317	378	81	4	62
	Row N %	4.0%	19.3%	28.9%	34.4%	7.4%	0.4%	5.6%
Motivation								
I have good opportunities to provide advice on prudent antibiotic use to individuals.	Count	29	119	304	483	94	15	54
	Row N %	2.6%	10.8%	27.7%	44.0%	8.6%	1.4%	4.9%
Environmental factors such as wastewater in the environment are important in contributing to antibiotic resistance in bacteria from humans?	Count	21	61	214	436	312	18	36
	Row N %	1.9%	5.6%	19.5%	39.7%	28.4%	1.6%	3.3%

Note. SA: Strongly agree; A: Agree; SD: Strongly disagree; D: Disagree; N/A: Not available; U: Undecided; & IDU: I do not understand

Table 5. Respondents who received information on avoiding unnecessary prescribing of antibiotics and its impact on changing their views and practice

Question	Yes	No	Unsure
In the last 12 months, did you receive any information about avoiding unnecessary prescribing of antibiotics? (n=1,093)	250 (22.9%)	272 (24.9%)	570 (52.2%)
Did the information contribute to changing your views about avoiding unnecessary prescribing of antibiotics? (n=250)	250 (100.0%)	0 (0.0%)	0 (0.0%)
On the basis of the information you received, have you changed your practice on prescribing antibiotics? (n=250)	225 (90.0%)	0 (0.0%)	25 (10%)

participants were said yes and more than 90% of them were changed their practices (**Table 5**).

Sources of Information About Avoiding Unnecessary Antibiotic Use and Their Influence in Changing Nurses' Views

Figure 1 showed only 25.8% of participants could offer assistance or resources when they were required. Workplace (52%), clinical practice guidelines (22%), and professional bodies (22%) were other frequently mentioned resources for information. The workplace of a nurse (49%), clinical practice guidelines19.2%), and group training (18%) were the most often used sources that influenced (**Figure 1**).

The Using of Social Media and Initiatives in the Community to Prevent Overuse of Antibiotics

Regarding the sources of information for antibiotics of nurses, 74.8% use Facebook, followed by Insta (11.7%), Google (33.1%), LinkedIn (1.8%), and YouTube (16.2%). For antibiotic usage and resistance information.

According to the nurses, the most effective levels on preventing overuse of antibiotics were working on all levels (46.8%) and individual level (35.1%). For the initiatives in the community to prevent overuse of antibiotics based on nurse's information were using of Handbook collections and information resources for health care professionals (29.4) and advertisement in TV and radio (29%) (**Table 6**).

DISCUSSION

The fight against antibiotic resistance can be accomplished and assisted by nurses who helped in guidance and administration of antibiotics [18]. Antibiotic usage is common among medical professionals, including nurses [2]. Antibiotic use is hindered by a variety of factors, including a lack of awareness, a lack of resources, and a lack of motivation. It is possible to reduce antibiotic resistance by encouraging nurses to use antibiotics more wisely [8, 16]. Antibiotic use and resistance were well known concepts by the nurses who participated in this study. In this study, there were several issues when it came to accessing recommendations and patient educational material. Those who work with clinical facilities have a clear sense of mission. This first-of-its-kind study of nurses' awareness, attitudes, and behaviors related to antibiotic use and resistant in the Middle East was conducted using a modified form of a validated ECDC questionnaire among nurses in Jordan. New programming like antibiotic stewardship can benefit from the large number of nurses responded to the survey's questions. Researchers have shown a lack of confidence among many nurses in promoting antibiotic stewardship.

In our study, the predictors of knowledge for antibiotics among nurses were having insurance, having nursing experience, having higher education, expose to antibiotic prescription. According to another study, nurse under 35 years

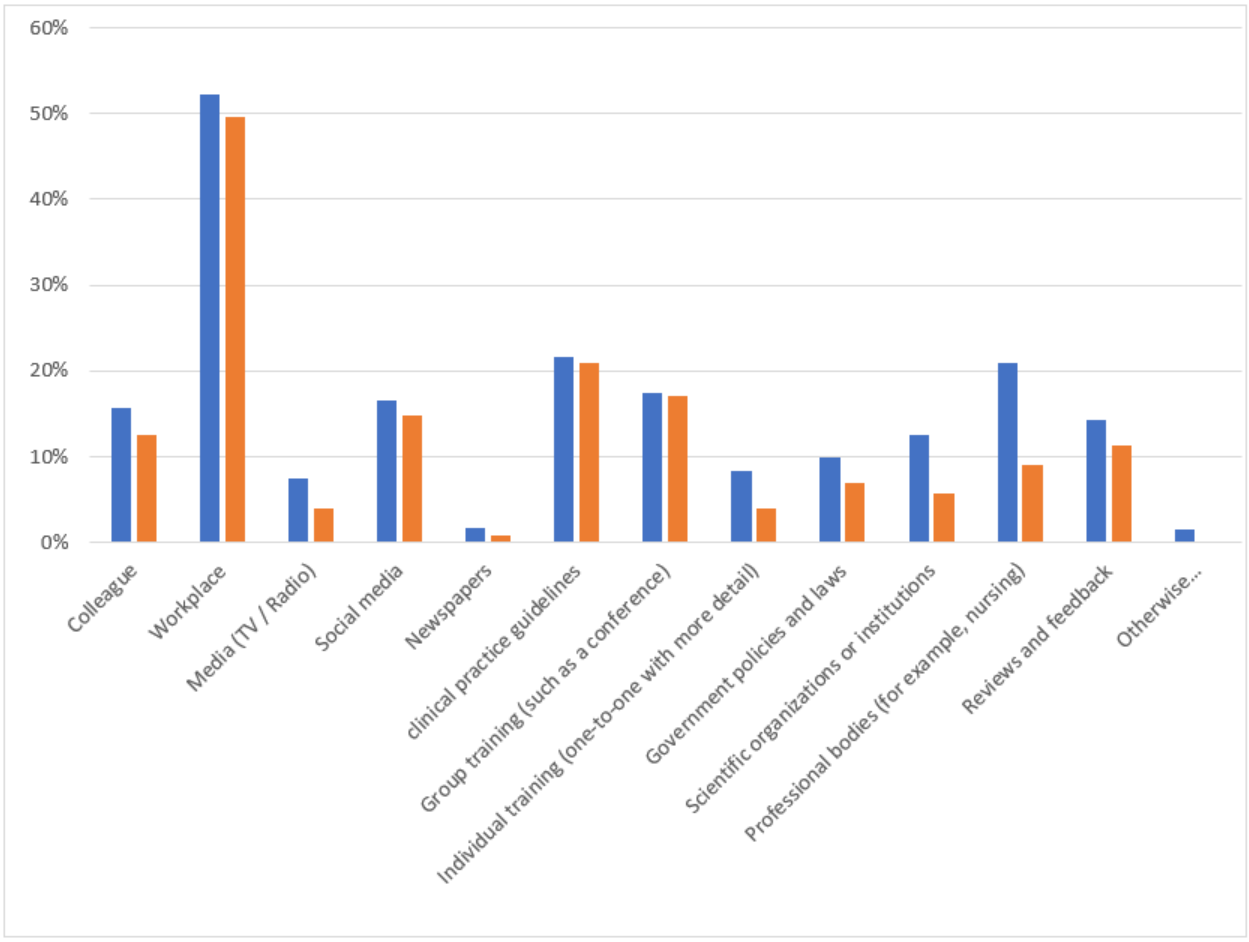

Figure 1. Sources of information that nurses first get about avoiding indiscriminate antibiotic use and their influence in changing nurses' views (Source: Authors' own elaboration)

Table 6. The initiatives in the community to prevent overuse of antibiotics

Initiative	N	N%
Television and advertising	317	29%
Handbook collections and information resources for health care professionals	317	29%
Local or regional guidelines on infection management	153	14%
Raising awareness by professional organizations	308	28%
Conferences/activities focused on addressing antibiotic resistance	225	21%
Antibiotic awareness posters or flyers	291	27%
Newspaper articles (local) on antibiotic resistance	87	8%
local campaigns	131	12%
World antibiotic awareness week	150	14%
I am not aware of any initiatives	317	29%

old were significantly more likely to correctly solve the questions. People who had been employed in their current job for less than five years were the most likely to participate in the study (70%). As a group, the reactions were positive [19].

In our study, when tested on nurse's understanding of antibiotic usage and resistance, nurses respond correctly to many questions. The most questions answered correctly were unnecessary use of antibiotics makes them become ineffective 86.6% and taking antibiotics has associated side effects or risks such as diarrhea, colitis, allergies 83.5%. In another study, according to criteria on the actual knowledge scales, the higher risk of resistance in every individual treated with an antibiotic were much lower than expected [19]. An earlier research conducted in 30 European nations found that 97% of nurses asked agreed or highly agreed with the statement, "I know what resistance to antibiotics is" [20]. Antibiotic usage (prescription, administration, and dispensing) has been shown to be a significant factor in the development of resistance to antibiotics [21-23]. Respondent nurses had a high level of self-reported knowledge.

In our study, nurses claimed to have a thorough understanding of antibiotic resistance, as well as what information to provide patients and the proper methods for administering antibacterial agents. Surveys of Hungarian health care provider in community recently found that they were well-versed in antibiotic usage [24]. In a study, health care professionals replies to questions about antibiotic-related environmental variables revealed a lack of familiarity, stressing the need for education [19]. Health care professionals and nurses' conduct toward more sensible antibiotic usage is not just influenced by knowledge. Nurses must have the chance

and desire to address antibiotic use, as well as the necessary knowledge, to provide optimal antibiotic use practices [8].

In our study, the main reasons for not giving information about antibiotics use were absence of leaflet or booklet and lack of interest from the patients. Patients' lack of interest in receiving information on antibiotic use and a lack of resources were the two most prevalent reasons given for not providing such guidance [19]. Many community nurses believe in the significance of educating patients in order to reduce the spread of infectious illnesses [25].

In our study, continuing educations courses and clinical guidelines were the most frequently utilized resources among nurse who responded to the survey, and this was congruent with information from study among nurses in Jordan(19). Antibiotic prescriptions benefit greatly from the use of published recommendations [26, 27].

Interestingly, social media was a primary source of information for a significant proportion of nurses who responded to the survey (22.8%). But this source of knowledge had little impact on their perspective. Notably, there are issues with the quality of information on social media, as well as hazards that come along with it [28, 29].

According to Jordan's national antibiotic resistance action plan, most responders were unaware of their presence [19]. Professional organizations and conferences/events focusing on combating antibiotic resistance were highlighted as one of the primary strategies which focus on antibiotics awareness and resistance. Nurses should play a greater role in educating the public about the proper use of antibiotics [19]. A study conducted by nurses in Italy found this requirement [30]. The most popular source of knowledge on drugs in Russia was training sessions [17, 20]. The methodologies used in this investigation are well established and verified. Despite this, there are certain drawbacks. participants reported positive conduct as a result of social desirability bias. The anonymized dispersion of the survey reduced some of this bias. Those who do not have access to the internet and/or smart phones may be left out of the online distribution process.

As the literate review, the authors found that health care professionals routinely utilizes the internet and smart phones, such bias is not likely to be considerable [31]. The authors found that the survey had a higher percentage of female nurses responding.

Other recent studies have similarly found that women are more likely to respond than men [30]. This study had no way to verify that the participants were nurses because the survey was filled out by the participants. It is probable to know who are engaged in antibiotic resistance are much more likely to respond to this online survey. As a result, we were able to determine how well nurses in Jordan understand antibiotic usage and resistance, as well as what opportunities exist for them to learn more about these topics.

Limitations

There are many limitations for this study. Firstly, using a cross-sectional study which limit the external validity of the study. Secondly, using a social media which limit the filling of the survey to the participants who using social media. Another limitation is using a convenience sample which limits the generalizability of the results to Jordanian nurses.

CONCLUSION

In conclusion, the findings of this study show that public health actions are needed (e.g., educational or communication campaigns). Nurses must be educated on the proper use of antibiotics and the emergence of antibiotic resistance. Antibiotic stewardship can benefit from the findings, which can be used to develop interventions aimed at improving antibiotic usage. Policies, nurses, and professional associations may learn about the current state of nurses' development toward better behavior to promote judicious antibiotic use from the models, opportunities, and motivators in this study.

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Ethical statement: Authors stated that the study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Jordan University of Science and Technology (IRB, Reference: 10/140/2021).

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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