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Public Knowledge and Attitude towards Antibiotic Use in Lebanon

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Abstract **Introduction:** Antibiotic resistance is a major threat in global public health. This study aims to assess the public knowledge, attitude and practice towards antibiotic use among general public in Lebanon. **Method:** It was a cross sectional study in a community-based pharmacy setting in Lebanon. It used a structured random interview to patients visiting community pharmacy seeking for antibiotics. Descriptive statistics were presented and multivariate logistic regressions were performed in data analysis. **Results:** A total of 495 participated in the study. The study sample had in general low knowledge (average = 6) and attitude score (average=3.16). High proportion of Lebanese participants believed that antibiotics were used for treatment of common cough cold and sore throat symptoms (59%) or viral infections (53%). 42% preferred to take antibiotics from the pharmacy without physician prescription. In the multivariable logistic regression analysis, females showed better knowledge toward antibiotic use compared to males (ORa=1.59, 95%CI=1.01-2.53). Compared to participants aged >50 years old, the level of adequate knowledge was higher in those aged 25-50 years old (ORa=3.66, 95%CI=1.79-7.49). **Conclusion:** This study identified important knowledge and attitude gaps among general public in Lebanon. Future antibiotic awareness campaigns and patient counselling should be implemented to reduce the risk of antibiotic resistance.

Keywords: *antibiotic, knowledge, attitude, Lebanon*

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1. Introduction

Antibiotic resistance is a major threat in global public health. The overuse and misuse of antibiotics may generate several problems, including the development of bacterial resistance, [1] adverse reactions, treatment failure and waste of resources. [1]

The World Health Organization (WHO) identified three key issues for public involvement: improving access to medical facilities, decreasing unnecessary use of antimicrobials, taking a full course of treatment, and not giving out medication to other people or keeping left-over medication for future needs. The WHO also urged member countries to initiate educational interventions for patients and the general population aimed at rationalizing the use of antibiotics to combat resistance. [2]

The lack of knowledge of medication such as antibiotics may greatly influence the probability of misuse or compliance. [3] Studies conducted elsewhere have demonstrated inappropriate practices such as sharing of antibiotics, [3] and the use of left over antibiotics. [4,5] There have been reports of a general lack of knowledge of correct antibiotic use and a lack of public awareness on the basic principles of antibiotic use, as well as indication for therapy. [4,5]

The World Health Organization (WHO) have also issued a Global Strategy for Containment of Antimicrobial Resistance in 2001 which urged member countries to initiate awareness and educational campaigns for patients and general community on appropriate use of antibiotics to combat antibiotic resistance. [2] This was echoed by International Pharmaceutical Federation (FIP) in 2008 in its Statement of Policy on Control of Antimicrobial Drug Resistance [6] and WHO Regional Office for South-East Asia [7] in 2010.

In Lebanon, antibiotics are mostly accessed without prescription despite the presence of a law that bans such practices. Therefore, it is important to assess the public knowledge, attitude and practice of antibiotic use among Lebanese population. The findings from this study would provide useful data which could form the basis for educational campaigns on appropriate use of antibiotics, thus addressing any misconceptions among the public.

2. Method

2.1. Design and Study Population

A cross sectional prospective study was conducted in a community-based pharmacy setting in Lebanon. Data was collected over a 1-year period (September 2015 to

September 2016) from 50 community pharmacies CPs distributed in six different districts in Lebanon: Beirut, South Lebanon, Nabatiyeh, Mount Lebanon, Bekaa, and North. Data on antibiotic use was collected using a structured random interview conducted by study researchers who had been briefed about the study's aims and methods. Consecutive customers aged 16 years and older arriving at community pharmacies seeking antibiotics were interviewed. The interview was based on a well-structured questionnaire, which had been pre-tested on a small pilot scale and subsequently modified to ensure that the data would provide reliable information.

The Lebanese University, Faculty of Pharmacy Internal Review Board waived the need for written informed consent. The patients were informed about the objective of the study and were asked to give an oral consent. Only those who were interested and who give their voluntary informed oral consent to participate in the study were enrolled.

2.2. Sample Size Calculation

A sample size was calculated assuming a type I error of 5% and a study power of 80% and 95%CI. Based on a previous study, 40% of patients were expected to self-medicate with antibiotics. [8] The minimal sample size necessary to show a twofold increase in the risk of exposure to non-prescribed antibiotics consists of 442 subjects.

2.3. Data Collection

Data was acquired through a structured questionnaire filled by an interviewer. If a customer had more than one request, CPs filled out one documentation form per request. The questionnaire was obtained after wide review of literature. (Lim & Teh, 2012; Kim et al., 2011; Alzoubi et al., 2013; Awad & Aboud, 2015; Napolitano, Izzo, Di Giuseppe, & Angelillo, 2013) The questionnaire included many sections that were chosen following an extensive review of literature. The questionnaire was translated into Arabic and subjected to a process of forward and backward translation into English. It was pretested and validated first on 20 patients visiting 4 different pharmacies before starting the survey.

The questionnaire consisted of dichotomous, and close-ended questions. It consisted of 5 sections. The first section was related to sociodemographic characteristics including age, sex, occupation, educational and marital status, monthly income, medical insurance, and the presence of a care provider at home. Education was divided into five classes of illiterate, primary, complementary, secondary, and academic education levels. Work status was categorized into currently working, retired and never working, while marital status was categorized into married, single, and widow/divorced.

The second section consisted of 13 questions to evaluate respondent's knowledge bout antibiotics in four aspects: action and use (5 statements), side effects (4 sentences) and resistance (4 questions). A three-likert scale (1=agree, 2=uncertain, 3=disagree) was used to evaluate the participants' response. Nine attitude statements were included in section three, and the participants were required to answer in three likert scale also. Finally, the fifth section included 6 statements to explore the patient and doctor relationship regarding prescribed antibiotic and the responses were measured using three-likert scale also.

2.4. Statistical Analysis

Statistical analysis was done using SPSS version 19. Descriptive statistics of the respondents' knowledge and attitudes regarding antibiotic use and bacterial resistance were reported. After data cleaning, data was assessed. Percentages was used for multinomial variables, means and standard deviations for continuous variables. The internal consistency for the sections to determine knowledge of and attitude towards use of antibiotics was assessed using Cronbach's α test. The Cronbach's alpha for the knowledge score was 0.795 and 0.651 for the attitude score. To describe the knowledge and attitudes of the participants, a score was calculated according to the number of correctly answered questions targeting the knowledge and attitudes regarding antibiotic usage. The knowledge score was categorized as inadequate or adequate. The attitude score was categorized as poor and good. Each correct answer was assigned 1 point while wrong or uncertain responses were assigned 0 points. Then, the sum of the responses for each patient was calculated. The maximum knowledge score was 13 points and 9 points for the attitude score. Thus, the knowledge scores were categorized into inadequate (0-6/13) or adequate (7-13/13) while the attitude score was divided into poor (0-4/9) or good (5-9/9) as dichotomous variables. [9,10]

Associations of demographic variables (gender, age, family income level, education level, employment and marital status) with knowledge and attitudes were first evaluated using a bivariate analysis by chi-squared test. The correlation test was used to examine the association between knowledge and attitude score. Multivariate analysis using Logistic regressions was used to assess the correlation between the Knowledge and attitude dichotomous score as dependent variables and sociodemographic characteristics as independent variables taking into account potential confounding variables that had a $p < 0.2$ in bivariate analysis. A p-value <0.05 was considered significant.

3. Results

3.1. Baseline Characteristics

A total of 495 patients were recorded in the study. Table 1 shows the demographic characteristics of the participants. In this sample, females were more than males (69.9% vs 30.1%). The majority being between 16 and 50 years of age (88.3%), while 11.7% were >51 years of age. About half of patients had a university degree (56.2%), while 13.8% had secondary education, 30.3% had intermediate and elementary education. 34.3% were currently working. The monthly income with greatest prevalence among the respondents was 2000000 LL (62.2%). Almost 21.8% had concomitant comorbidities.

Table 1. Characteristics of the study population

	Total participants N=495 (100%)
Gender:	
Male	149 (30.1%)
Female	346 (69.9%)
Age group:	
16-25	244 (49.3%)
25-50	193 (39%)
>50	58 (11.7%)
Educational level:	
Primary and less	150 (30.3%)
Secondary	67 (13.5%)
University	278 (56..2%)
Marital status:	
Single	259 (52.3%)
Married	236 (47.7%)
Currently working:	
Employed	170 (34.3%)
Unemployed or retired	325 (65.7%)
Family income (LL):	
<2000000	131 (26.5%)
>2000000	44 (8.9%)
No answer	320 (64.6%)
Presence of comorbidities:	
Yes	109 (21.8%)
No	392 (78.2%)
Antibiotic request per year	
1st time	166 (33.5%)
More than once	326 (65.9%)
Presence f insurance on medication coverage	
Yes	313 (63.2%)
No	173 (34.9%)

3.2. Knowledge Description

The study sample had in general low knowledge score (average = 6 points). Only 13.1% believed that antibiotics can kill bacteria. 54% and 59% responded that antibiotics can kill viruses and are effective against cough and cold. 54.3% of participants believed that antibiotics are effective in reducing fever and pain and can kill normal flora that live in the skin and gut. Almost 53% of participants realized that bacteria are becoming resistant to antibiotics and that the unnecessarily use of antibiotics has increased the risk of bacterial resistance. 25% believed that if antibiotics are taken for long period of time, the bacteria become more resistant to antibiotics and 36% believed that taken less doses do not decrease the bacterial resistance. Approximately, 45% of participants believed that antibiotics can cause side effects including hepatic and renal problems. Almost 65% stopped taking antibiotic if they get side effects including skin allergic reaction. (Table 2)

Five variables (age, education, employment and family income level and presence of insurance) showed a significant association (p-value<.005) with the respondents' knowledge regarding antibiotic use, according to the chi-squared test. Young age participants and those with higher educational level showed more adequate knowledge. Employed participants with higher income and with medical insurance showed better knowledge. Gender was not significantly associated with better knowledge of antibiotic use. (Table 3).

Table 2. Knowledge Attitude and Patient Physician Relationship among participants

Knowledge for antibiotic:	**Correct Answer**	**Incorrect Answer**	**Uncertain**
Antibiotic Action			
Antibiotics work on most coughs and colds	110 (22.2%)	293 (59.2%)	92 (18.6%)
Antibiotics can kill bacteria	65 (13.1%)	351 (70.9%)	79 (16%)
Antibiotics can kill viruses	108 (21.8%)	267 (53.9%)	120 (24.2%)
Antibiotics are effective in reducing pain	269 (54.3%)	106 (21.4%)	120 (24.2%)
Antibiotics can kill the bacteria that normally live on the skin and in the gut	269 (54.3%)	75 (15.2%)	151 (30.5%)
Antibiotic Resistance:			
Bacteria are becoming resistant to antibiotics	264 (53.3%)	107 (21.6%)	124 (25.1%)
The unnecessarily use of antibiotics can increase the resistance of bacteria to them	269 (54.3%)	115 (23.2%)	111 (22.4%)
If antibiotics are taken less than the prescribed dose, bacteria become less resistant to antibiotics	178 (36%)	167 (33.7%)	150 (30.3%)
If antibiotics are taken for a long time, bacteria become more resistant to antibiotics	126 (25.5%)	211 (42.8%)	157 (31.7%)
Antibiotic Side effects:			
Antibiotic does not cause side effects	221 (44.6%)	159 (32.1%)	115 (23.2%)
Antibiotic may cause hepatic and renal problems.	234 (47.3%)	123 (24.8%)	138 (27.9%)
If you get side effects during a course of antibiotics treatment you should stop taking them as soon as possible	302 (61%)	92 (18.6%)	101 (20.4%)
If you get some kind of skin reaction when using an antibiotic, you should not use the same antibiotic again	344 (69.5%)	72 (14.5%)	79 (16%)
Patient Attitude	**Agree**	**Disagree**	**Uncertain**
Positive attitude			
I normally look at the expiry date of antibiotic before taking it	368 (73.5%)	83 (16.6%)	43 (8.6%)
Need for patient education.	370 (74.9%)	63 (12.8%)	61 (12.3%)
Negative Attitude			
I stop taking the antibiotic if the symptoms do not improve after taking it.	240 (48.6%)	222 (44.9%)	32 (6.5%)
I stop taking the antibiotic if the symptoms do not improve after taking it.	240 (48.6%)	222 (44.9%)	32 (6.5%)
I prefer to be able to buy antibiotics from the pharmacy without a prescription.	208 (42.1%)	215 (43.5%)	71 (14.4%)
I prefer to keep antibiotics at home in case there may be a need for them later	129 (26.1%)	301 (60.9%)	64 (13%)
I prefer to use an antibiotic if I have a cough for more than a week	166 (33.6%)	234 (47.4%)	94 (19%)
When I have a sore throat I prefer to use an antibiotic	151 (30.6%)	255 (51.6%)	88 (17.8%)
I share antibiotic with someone else in my family/friends with similar symptoms to mine	156 (31.6%)	263 (53.2%)	75 (15.2%)
Patient Physician Relationship	**Agree**	**Disagree**	**Uncertain**
Pharmacists often tell you how antibiotics should be used	376 (76.3%)	52 (10.5%)	65 (13.2%)
Doctors often take time to inform the patient during the consultation how antibiotics should be used	186 (37.7%)	222 (45%)	85 (17.2%)
Physicians routinely prescribed antibiotics to treat common cold symptoms	253 (51.3%)	150 (30.4%)	90 (18.3%)
I request antibiotic prescriptions from my physician	182 (36.9%)	248 (50.3%)	62 (12.8%)
I trust the doctor decision if she or he decides not to prescribe antibiotic	326 (66.1%)	101 (20.5%)	66 (13.4%)
I consult another physician to prescribe antibiotics if their physician disagreed to do so	168 (34.1%)	238 (48.3%)	87 (17.6%)

Table 3. Factors significantly associated with Public Knowledge toward antibiotic use:

	Level of Knowledge			Level of Attitude		
	Inadequate Knowledge	**Adequate Knowledge**	**P-value**	**Poor Attitude**	**Good Attitude**	**p-value**
Gender						
Male	88 (59.1%)	61 (40.9%)	.167	101 (68.2%)	47 (31.8%)	.052
Female	181 (52.3%)	165 (47.7%)		204 (59%)	142 (41%)	
Age group						
16-25	135 (55.3%)	109 (44.7%)	<.001	146 (59.8%)	98 (40.2%)	.559
25-50	90 (46.6%)	103 (53.4%)		120 (62.5%)	72 (37.5%)	
>50	44 (75.9%)	14 (24.1%)		39 (67.2%)	19 (32.8%)	
Educational level						
Primary and less	92 (61.3%)	58 (38.7%)	.004	102 (68.5%)	47 (31.5%)	.118
Secondary	44 (65.7%)	23 (34.3%)		41 (61.2%)	26 (38.8%)	
University	133 (47.8%)	145 (52.2%)		162 (58.3%)	116 (41.7%)	
Marital status						
Single	137 (52.9%)	122 (47.1%)	.498	161 (62.2%)	98 (37.8%)	.84
Married	132 (55.9%)	104 (44.1%)		144 (61.3%)	91 (38.7%)	
Currently working						
No	191 (58.8%)	134 (41.2%)	.006	191 (58.8%)	134 (41.2%)	.059
yes	78 (45.9%)	92 (54.1%)		114 (67.5%)	55 (32.5%)	
Family income (LL)						
<2000000	61 (46.6%)	70 (53.4%)	.004	97 (74.6%)	33 (25.4%)	.002
>2000000	17 (38.6%)	27 (61.4%)		27 (61.4%)	17 (38.6%)	
No answer	191 (59.7%)	129 (40.3%)		181 (56.6%)	139 (43.4%)	
Presence of comorbidities						
No	232 (59.6%)	157 (40.4%)	.064	232 (59.6%)	157 (40.4%)	.064
Yes	73 (69.5%)	32 (30.5%)		73 (69.5%)	32 (30.5%)	
Daman						
No	115 (66.5%)	58 (33.5%)	<001	114 (66.3%)	58 (33.7%)	.091
Yes	147 (47%)	166 (53%)		183 (58.5%)	130 (41.5%)	
Ab request						
1st time	91 (54.8%)	75 (45.2%)	.912	109 (66.1%)	56 (33.9%)	.158
More than once/ year	177 (54.3%)	149 (45.7%)		194 (69.5%)	132 (40.5%)	

Data presented as number (%) were performed using Chi2 respectively and a p-value < 0.05 is considered significant.

3.3. Attitude and Patient Physician Relationship

The study sample had in general poor attitude score (mean= 4.19). Almost 57.4% stopped taking the medication if the symptoms disappear. 42% preferred to take antibiotic from the pharmacy without physician prescription. About 33% preferred to take antibiotic in cases of cough, flu and sore throat. 26% preferred keeping antibiotic at home in case of emergency and 31% shared the antibiotics with someone else if he had similar signs and symptoms. Approximately 73% checked the expiry date of medication before taking it and that there was need for patient education about the appropriate use of antibiotics. (Table 2)

According to the chi-squared test, females showed better attitude compared to males toward the appropriate use of antibiotic (p=.052). Age and education were not significantly associated with better attitude of appropriate antibiotic use. (Table 3)

Approximately 76% of participants responded that pharmacists tell them how to administer antibiotic. 51% expected that physicians routinely prescribe antibiotics in case of cold symptoms and that 37% of physicians spent time to inform patient about the usage of antibiotics. 66% trusted physicians if they decided not to prescribe antibiotic and 34% consulted another physician if the first physician disagreed to prescribe antibiotic. (Table 2)

3.4. Practice

Almost half read the instructions on the label to see the correct usage and safe of medication. 26.4% told the pharmacist about the concurrent medication at the time of OTC. Greater than half of participants reported requesting antibiotic more than once per year. Almost 65% of participants reported returning to pharmacy if the symptoms do not improve and returning to physician.

3.5. Multivariable Analysis

In the multivariable logistic regression analysis (Table 4), females showed better knowledge score compared to males (ORa=1.59, 95%CI=1.01-2.53). Compared to participants aged >50 years old, the level of adequate knowledge of antibiotic was higher in those aged 25-50 years old (ORa=3.66, 95%CI=1.79-7.49). Compared to unemployed participants, those with higher income had better knowledge score (ORa=3.17, 95%CI=1.78-6.79). Participants with insurance on medication coverage had also better knowledge score (ORa=2.06, 95%CI = 1.38-3.07).

Table 4. Multivariable logistic regression of Knowledge and Attitude score:

Multivariate Analysis	aOR	95% CI	p-value
Knowledge			
Gender	1.59	1.01-2.53	.045
Age group			<.001
16-25	3.05	1.49-6.28	.002
25-50	3.66	1.79-7.49	.002
>50	1	Reference	
Income group (LL)			<.001
<2000000	1.73	1.07-2.77	.005
>2000000	3.17	1.78-6.79	.024
No answer	1	Reference	.003
Insurance of medication coverage	2.06	1.38-3.07	<.001
Attitude			
Income group (LL)			.001
<2000000	.415	.26-.66	<.001
>2000000	.785	.41-1.51	.468
No answer	1	Reference	
Presence of comorbidities	.62	.38-1	.05
Insurance of medication coverage	1.62	1.08-2.42	.019

aOR: adjusted odds ratio above 1 indicates increased n appropriateness and below 1 less appropriateness. CI: Confidence Interval
Only factors significantly associated with better or worse appropriateness are shown.

Moreover, a step-wise multiple logistic regression was conducted on attitude of antibiotic usage (Table 4); three were shown to be significant predictors. Patients with comorbidities showed lower attitude score (ORa=.62, 95%CI= .38-1). Compared to unemployed participants with income <2000000 showed lower attitudes (ORa=.41, 95%CI=.26-.66) but those with income >2000000 didn't show significant difference in attitude toward appropriate antibiotic usage. Presence of medical insurance showed better attitude score (ORa=1.62, 95%CI=1.08-2.42).

4. Discussion

The results of this study demonstrated the knowledge, attitudes and practice toward antibiotic use among general public in Lebanon. This will help in testing the adequacy of knowledge and provide further insight in designing future educational campaigns targeting general public to promote appropriate antibiotic use and help in reducing antibiotic resistance. The average knowledge and attitude score was low. This finding is similar to that of neighboring countries in Jordan. [11] These results were supported by high proportion of Lebanese participants using antibiotic for common cough cold and sore throat symptoms. This means that that they are using antibiotic for diseases that do not require them. Other studies conducted in United Kingdom, [12] Sweden, [13] Korea, [14] Italy [15] and United State [16] showed that many people thought that antibiotics are effective for common cold and cough symptoms and may be used for viral infections.

Participants were not well informed to the meaning of antibiotic resistance and were unaware of the spread of bacterial resistance. They didn't know that stopping the antibiotic early or as the symptoms disappear without completing the full course of antibiotic can increase the risk of antibiotic resistance. In our study, almost half of participants knew that antibiotics can kill normal flora that lives normally in the skin and gut which is similar percentage to that reported in Korea (57%) [14] but higher than that in UK (43%). [12] Many participants were aware of antibiotic side effects where approximately 60% stopped taking antibiotic as soon as side effects occur and stopped taking it again later. But only 40% knew that antibiotic can cause hepatic or renal problems.

In term of attitudes our study showed that 42% preferred to take antibiotic from the pharmacy without physician prescription. Recent studies from Lebanon reported similar self-medication rate (40%). [8] It is similar to that reported in Mediterranean countries which ranged from 40.7% to 78% namely Jordan, [17] United Arab Emirates, [18] Iraq [19] and Kuwait. [20] In contrast it is higher than that reported in Hong Kong, Malaysia, UK and European countries which ranged between 4.8 to 9%. [12,21,22,23,24] This is due to unregulated rules in Lebanon to restrict the self-medication use of prescribed antibiotic in community pharmacies. Hence, the current study highlights the need for further enforcement of regulations. Moreover, almost 48% stopped taking the medication if the symptoms disappear. This explains the rapid increase in bacterial resistance in Lebanon due to use of antibiotic beyond the scope.

About 33% preferred to take antibiotic in cases of cough, flu and sore throat. This explains the misconception present among the study participants regarding the role of antibiotic. A possible reason for inadequacy of knowledge in this area is the use of term "germ" rather than "bacteria" or "viruses" by the physicians during medical counseling. [13] Moreover, 26% preferred keeping antibiotic at home in case of emergency and 31% shared the antibiotics with someone else if he has similar signs and symptoms. This suggests that many Lebanese individuals share antibiotics with others and use them as necessary thus subjecting the Lebanese population to the problem of antibiotic misuse.

Approximately 76% of participants responded that pharmacists tell them how to administer antibiotic. This showed that many individuals obtained information about antibiotic use from pharmacists which highlight that pharmacists can have a vital role to play in public education about the prudent use of antibiotics. Therefore, implementation of pharmaceutical care in community pharmacies can help to improve public knowledge and attitude towards antibiotics in Lebanon. Community pharmacists are the most accessible health care providers to the public, and can contribute to public knowledge about appropriate antibiotic use.

51% expected that physicians routinely prescribe antibiotics in case of cold symptoms It is well documented that overprescribing by physicians even in the absence of appropriate indications due to diagnostic doubt and patient demand are factors contributing to antibiotic resistance. [2,25] Numerous reports show that patient's expectation is an important factor for antibiotic prescribing and that antibiotics are more likely to be prescribed under patient pressure. [26,27]

Our results identified demographic groups with poor knowledge toward antibiotic use, including persons with low educational status and those aged >50 years old. As we found, a higher educational level was associated with better knowledge and attitude [23,28], and the elderly are

less knowledgeable about antibiotics in general. [12] Moreover, females and those with higher income or medical insurance show better knowledge and attitude score compared to males. Previous studies reported significant association between self-medication and age, male gender, education level and lower socioeconomic status. [29,30]

Participants' knowledge found to correlate positive attitude. Appropriate knowledge of antibiotics was identified to be a predictor for positive attitude towards antibiotic use. [14] These findings support the idea that the better knowledge on antibiotics usage and the potential for antibiotic resistance can change attitudes and behaviors regarding the appropriate use of antibiotic. An understanding of antibiotic use is important because personal decisions are based on these understandings. [22] They can impact physicians' prescription behavior, [31] as well as lead to decreasing suboptimal use of antibiotics, such as using short courses and sub-therapeutic doses. [22]

This study has several limitations. While efforts were done to obtain representative samples, the over presentation of female gender and higher educational level indicate selection bias. This surveys were also filled using face to face questionnaire, therefore, there is a possibility of information and recall bias. Moreover, it is a cross sectional study, therefore, it does not allow causality to be attributed to the observed associations. Despite these limitations, this study provides important information for evaluating and improving knowledge, attitude and practice towards antibiotics use among general public in Lebanon.

5. Conclusion

This study identified important knowledge and attitude gaps among general public in Lebanon. Future antibiotic awareness campaigns and patient counselling should be implemented to fill up the knowledge and attitude gaps as an effort against antibiotic resistance. This aim to reduce the risk of antibiotic resistance.

Conflicts of Interest

The authors declare no conflicts of interest.

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Contribution of Authors

Malak Khalifeh shared the original idea, did the study, and wrote the original manuscript.

Nicholas Moore shared the original idea, and edited/amended the manuscript.

Pascale Salameh shared the original idea, and edited/amended the manuscript.

All authors read and approved the final manuscript as submitted.

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