

Antibiotic Use: Knowledge, Attitude and Practices of a Southern Community in Lebanon

Ayat R A Hijazi ¹, Zeinab Jammoul ², Sukaina Fares ³, Kassem M Kassak ^{4*}

¹ Department of Family Medicine, American University of Beirut Medical Center, Beirut, LEBANON

² Department of Nursing Clinical and Professional Development, American University of Beirut Medical Center, Beirut, LEBANON

³ Department of Mathematics, Lebanese Consulate International School, Kano, NIGERIA

⁴ Department of Health Management and Policy American University of Beirut, Beirut, LEBANON

*Corresponding Author: kkassak@aub.edu.lb

Citation: Hijazi, A. R. A., Jammoul, Z., Fares, S. and Kassak, K. M. (2021). Antibiotic Use: Knowledge, Attitude and Practices of a Southern Community in Lebanon. *European Journal of Environment and Public Health*, 5(2), em0088. <https://doi.org/10.21601/ejeph/11111>

ARTICLE INFO

Received: 3 May 2021

Accepted: 29 Jun. 2021

ABSTRACT

Background: The irrational use of antibiotics is one of the leading causes to antibiotic resistance affecting the public's health. This study aimed at examining the public's knowledge, attitude, and practice in a Southern village of Lebanon.

Methods: A quantitative cross-sectional survey was conducted in Haddatha Village-Beit Jbeil in South Lebanon during the month of October 2017. The target population for the survey included Lebanese adults (21 years of age or older) that had been living in the Village for at least the past 3 years.

Results: All households were targeted, of whom 91 agreed to participate (86%), within the same household, we surveyed only one member. More than half of the respondents were misinformed about antibiotics usage to treat viral infections (60.4%), almost 30% reported that it cures all infections and 26.4% assumed that they can stop taking the antibiotic before completing the course if their symptoms improved. Half of the respondents (48.4%) conveyed expecting their physicians to prescribe antibiotics to treat common cold. On the other hand, 60% do not usually seek medical care when sick because they think that it is not needed. The results, also, showed that almost 30% take antibiotics without a physician's prescription. Approximately, half of the population reported consuming leftover antibiotics (50.5%), with only 5.6% waiting more than 4 days to start an antibiotic course.

Conclusion: This study reflects several misconceptions and poor knowledge regarding antibiotics use, with an exhibition of contentious attitude and practice. Therefore, it is recommended to advocate for policies to control the misuse of antibiotics through public health interventions targeting individuals and their families to limit antibiotic resistance.

Keywords: antibiotics resistance, misuse, misconceptions

INTRODUCTION

The economy and public health of nations are greatly impacted by antibiotic resistance (World Health Organization, 2016). Antimicrobial resistance is defined as the resistance of microorganisms to antimicrobial drugs for which they were originally effective (World Health Organization, 2014). The rise in antibiotic resistance in humans stems from the misuse and overuse of antibiotics (Barriere, 2015). It is widely reported that individuals infected with resistant strains are prone to treatment failure, prolonged hospitalization, increased mortality, and the need of treatment with a wide range of potentially toxic antibiotics (WHO, 2016). In fact, there is abounding evidence confirming that infections caused by antimicrobial-resistant microbes are associated with higher

mortality, morbidity and financial loss (Cosgrove et al., 2005; Sunenshine et al., 2007).

For that, antimicrobial resistance was declared by the World Health Organization as a major health challenge of the 21st century and an issue of prime concern to the global public health (Infectious Diseases Society of America, 2011b). In that respect, the public health threat of antibiotic resistance involves three main stakeholders: the individual/patient, the healthcare professional, and the policy maker. At the level of the healthcare professional, the misuse of antibiotics to treat viral infections, improper and/or insufficient patient education, poor prescribing practices, prescribing antimicrobial medicine when not in need, and the incorrect choice of medication or incorrect dosage contribute significantly to the problem (Infectious Diseases Society of

America, 2011a; Mouhieddine et al., 2015, Spellberg et al., 2004, World Health Organization, 2014).

Physicians may also prescribe antibiotics under the influence of the pharmaceutical industry, or to meet patients' expectations in fear of losing them to other physicians (Bisht et al., 2009; Brennan et al., 2006; Lopez-Vazquez, Vazquez-Lago and Figueiras, 2012). The self-medication practices, prior antimicrobial drug exposure, and poor adherence to medication regimes have been reported as factors enhancing antibiotic resistance (Ayukekbong, Ntemgwa and Atabe, 2017; Shehadeh et al., 2012; World Health Organization, 2014). Remarkably, an unjustified common practice is patients' self-medication with antibiotics to treat viral illnesses (Carlet et al., 2014b). At the level of the policymakers, the lack of national initiatives and political engagement coupled with poor enforcement of existing policies and guidelines, weak cooperation between ministries and unsustainable surveillance programs, further intensify the threat (Carlet, Pulcini and Piddock, 2014a; World Health Organization, 2020).

Regionally, very few studies have been published on the use of antibiotics in Arab countries, compared to western nations and developed countries (Otoom and Sequeira, 2006). In Lebanon, one cross-sectional survey study was conducted to assess knowledge, attitudes, and practices of antibiotics usage in Beirut district (Mouhieddine et al., 2015) mainly inhabited by middle- and upper-class population. For that, this study aimed to complement the earlier Beirut study by investigating the knowledge, attitude, and practice of inhabitants of a different district, with middle to low socio-economic status. It was conducted in Haddatha, a village in Southern Lebanon. The village is populated by a homogenous group in terms of religious beliefs & cultural values but varies in terms of occupations & educational levels. The choice of a rural district shall reflect the current public understanding, misconceptions, and malpractices regarding antibiotics outside the Capital Beirut. Expanding the assessment would give a broader prospective about this issue that would help plan appropriate interventions at a national level.

METHODOLOGY

Study Design

A quantitative cross-sectional survey was conducted in Haddatha Village-Beint Jbeil in South Lebanon during the month of October 2017. The study was navigated during different days of the week at different intervals of the day. The questionnaire used was adapted from the former mentioned study conducted by Mouhieddine et al. (2015).

Inclusion Criteria

The target population for the survey included (1) Lebanese (2) living in Haddatha Village (Bint Jbeil District) for at least the past 3 years (3) 21 years of age or older, and (4) cognitively able to understand the questions. One individual did not meet the criteria due to nationality and therefore was excluded from the study, we surveyed only one member within the same household.

Sample Characteristics

All the households in the village were visited of whom 91 agreed to participate. The response rate was 86%, noting that 15 residents rejected to partake in this study.

Questionnaire

The questionnaire included four parts. The first entailed nine questions related to the sociodemographic status of the respondents. The other three parts covered statements that assessed knowledge (15 questions), attitude (2 questions) and practice (5 questions). Patients were interviewed about their knowledge concerning the use and resistance of antibiotics and whether some generic drugs were antibiotics or not. Attitude was expressed in statements regarding their expectations from the physician concerning antibiotics prescriptions. Practice statements reflected the means they use to get antibiotics, how long do they usually wait before stating, and what are the main reasons for antibiotic consumption. The study objectives were well explained to each participant, and an oral consent script was provided emphasizing anonymity, voluntariness, and confidentiality. To ensure consistency, the questions were asked using the Arabic language.

Data Analyses

The response from the interviews were entered and analyzed using the Statistical Package for Social Science (SPSS), version 24. Frequency distribution was used to describe the number and percentages of all variables. The association between the polynomial demographics and knowledge level, attitudes and practice was assessed using the kruskal-wallis test. The association between the binomial demographics and each knowledge level and attitude category was measured using student's t-test. A p-value of <0.05 was considered statistically significant.

RESULTS

Half of the surveyed population were males (54%) and were between 41-50 years of age (29%), with a balanced percentage among the other age groups (**Table 1**). Moreover, close to 75% of the participants were married. Data also showed that most of the surveyed had some form of education and only 11% were illiterate and that half of the respondents (50%) earned between \$500-\$1000 (**Table 1**). Moreover, 48% of the respondents had 4-6 members in their family, while 14% had more than 6 household members. In addition, most of the respondents (92%) reported that they did not work in the health sector, but 25.3 % reported having a health care worker in their family (**Table 1**). Around 60% reported not having any kind of health insurance. On the other hand, among those who had a health insurance, 15% reported that medication expenses were not covered in their plans.

Table 1. Principle demographic characteristics of the study population

Demographic Characteristics	Frequency*	Valid Percentage (%)
Age (Years)		
21-30	18	20.0
31-40	14	15.6
41-50	26	28.9
51-60	14	15.6
More than 60	18	20.0
Gender		
Male	49	53.8
Female	42	46.2
Marital status		
Single	16	17.6
Married	68	74.7
Divorced	3	3.3
Widowed	4	4.4
Educational Level		
Illiterate	10	11.0
Elementary	33	36.3
Secondary	29	31.9
University	11	12.1
Post Graduate studies	3	3.3
No answer	5	5.5
Monthly Family Income (\$)		
< 500	12	13.2
500-1000	30	33.0
1001-1500	9	9.9
1501-2000	4	4.4
2001- 2500	2	2.2
> 2500	3	3.3
No answer	31	34.1
Number of household members		
1-3	34	37.4
4-6	44	48.4
>6	13	14.3
The respondent is a health-care worker		
Yes	7	7.7
No	84	92.3
A health-care worker in the family		
Yes	23	25.3
No	68	74.7
Having insurance		
Yes	36	39.6
No	55	60.4
Having insurance that covers medications		
Yes	31	86.1
No	5	13.9

*Missing values ranged between 1% and 34%

Knowledge and Attitude

Among the respondents, at least 72% indicated that antibiotics kill bacteria. Most of the respondents (86.6%) have knowledge concerning the importance of completing a full course of antibiotic to achieve effectiveness, and that overuse can lead to resistance (86.8%) (Table 2). Moreover, 83.5% answered correctly that antibiotics may induce an allergic reaction (Table 2). Furthermore, out of the respondents who incorrectly labeled antibiotics, 60.4% thought that it can treat viral infections and 29% thought it can cure all infections. In addition, 73.6% reported that antibiotics can reduce pain and inflammation and 53.8% thought it can reduce fever. Nearly 42% believed that antibiotics do not have side effects and almost 30% thought that antibiotics are medicines that can

cure stomachaches and disinfect digestive tract. In addition, 22% of respondents did not know or were not sure that penicillin is an antibiotic and about 32% considered Profen/Ibuprofen/Profinal an antibiotic.

In addition to knowledge, the study examined the attitude and expectations of households from their doctors regarding antibiotics. The results showed that almost half of the respondents (48.4%) expect their doctors to prescribe antibiotics to treat common cold and 15.4% of these respondents ask their physicians to prescribe antibiotics when they suffer from common cold symptoms (Table 3).

Table 2. Respondents knowledge of antibiotics use

Knowledge	Agree n (%)	Disagree n (%)	Unsure n (%)
Antibiotics kill bacteria	66(72.5)	16(17.6)	9(9.9)
Antibiotics treat viral infections	55(60.4)	22(24.2)	14(15.4)
Antibiotics cure all infection	26(28.9)	59(65.6)	5(5.6)
Antibiotics reduce pain and inflammation	67(73.6)	22(24.2)	2(2.2)
Antibiotics reduce fever	49(53.8)	40(44.0)	2(2.2)
Antibiotics are medicines that cure stomachaches and disinfect digestive tract	19(20.9)	65(71.4)	7(7.7)
Penicillin is an antibiotic	70(77.8)	6(6.7)	14(15.6)
Aspirin is an antibiotic	6(6.6)	81(89.0)	4(4.4)
Panadol/Paracetamol is an antibiotic	8(8.9)	81(90)	1(1.1)
Profen/Ibuprofen/Profinal is an antibiotic	29(31.9)	58(63.7)	4(4.4)
Antibiotic overuse leads to antibiotic resistance	79(86.8)	6(6.6)	6(6.6)
Antibiotics may induce an allergic reaction	76(83.5)	8(8.8)	7(7.7)
Antibiotics do not cause side effects	38(41.8)	46(50.5)	7(7.7)
You can stop taking the full course of antibiotics if your symptoms improve	24(26.4)	64(70.3)	3(3.3)
Antibiotic effectiveness is reduced if a full course of antibiotics is not completed	79(86.8)	7(7.7)	5(5.5)

Table 3. Respondents attitude towards their physician's antibiotics prescription

Attitude	Agree n (%)	Disagree n (%)	Unsure n (%)
I expect my doctor to prescribe antibiotics if I suffer from common cold symptoms	44(48.4)	46(50.5)	1(1.1)
I ask my doctor to prescribe me antibiotics if I suffer from common cold symptoms	14(15.4)	77(84.6)	-

Table 4. Frequency distribution of respondents by their antibiotic practices and habits

Practice Habits (a)	Frequency	Valid Percentage (%)
The way of getting antibiotics		
With a doctor prescription	64	71.1
Pharmacist's advice	22	24.4
Personal Choice	4	4.4
The reason for using antibiotics		
Fever	28	30.8
Cold	45	49.5
Pain and inflammation	28	30.8
Urinary tract infection	58	63.7
Skin wound	33	36.3
Teeth and gum inflammation	63	69.2
Ear inflammation	63	69.2
Diarrhea	6	6.6
Consulting a doctor when the respondent is sick		
Always	46	50.5
Sometimes	25	27.5
Rarely	18	19.8
Never	2	2.2
Reason for not always consulting a doctor		
Money	3	6.8
Unavailability of doctors	-	-
Out of fear	2	4.5
No need for a doctor	26	59.1
No time	3	6.8
Others	10	22.7
Waiting time before starting an antibiotic		
Directly	11	12.4
1-2 days	49	55.1
3-4 days	24	27
>4 days	5	5.6

Practice

While the most common channel "of getting antibiotics" was through a doctor's prescription (71.1%), 24.4% was through a pharmacist's advice; and only 4.4% took antibiotics without consultation (Table 4). When asked about the reasons

of taking antibiotics, the most frequent answer was for teeth, gum, and ear inflammation (69.2%) followed by urinary tract infection (63.7%). Almost half of the respondents thought that cold was a rational cause to take antibiotics and 30.8% answered that pain and inflammation requires using

Table 5. Respondents practice habits of antibiotic consumption

Practice Habits- Antibiotic consumption	Agree n (%)	Disagree n (%)	Unsure n (%)
When I get a cold, I take antibiotics to help me get better more quickly	30(33)	60(65.9)	1(1.1)
I normally stop taking antibiotics when I start feeling better	36(39.6)	54(59.3)	1(1.1)
I usually give my antibiotics to a sick family member	21(23.1)	70(76.9)	-
I use the antibiotics of a family member when sick	24(26.4)	67(73.6)	-
I usually keep antibiotic stocks at home	48(52.7)	43(47.3)	-
I use leftover antibiotics if I get the same illness again	46(50.5)	45(49.5)	-
I take antibiotics according to the instructions	71(78.9)	19(21.1)	-
I usually look at the expiry date of the antibiotic before taking it	75(84.3)	13(14.6)	1(1.1)

Table 6. Sociodemographic determinants of antibiotics knowledge

	Kills Bacteria		Kills Viruses		Reduces fever		Cures stomach aches		Penicillin is an antibiotic		Aspirin is an antibiotic		Paracetamol is an antibiotic		Have no side effects	
	χ^2	P-value	χ^2	P-value	χ^2	P-value	χ^2	P-value	χ^2	P-value	χ^2	P-value	χ^2	p-value	χ^2	P-value
Age	2.97	.226	5.27	.071	4.97	.083	4.84	0.89	8.54	.014	8.207	.017	5.67	.058	6.28	.043
Marital status	.686	.71	4.23	.12	7.64	.022	4.39	.11	.368	.832	4.01	.134	6.08	.048	4.88	.087
Monthly Family Income	8.73	.013	.707	.702	3.36	.186	6.53	.038	.359	.836	.748	.688	1.33	.512	9.57	.008
No. household members	6.28	.043	.013	.993	1.36	.507	.727	.695	1.24	.537	8.337	.015	2.98	.225	2.22	.329

Table 7. Sociodemographic determinants of antibiotics practice

	When having cold, take antibiotics for a faster recovery		Give personal antibiotics to a sick family member		Use leftover antibiotics if has the same illness again		Looks at expiry dates of antibiotics before using		Consult a doctor when sick		Wait before starting an antibiotic	
	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Age	3.208	.201	.344	.558	.109	.741	2.42	.297	5.06	.167	13.5	.004
Marital status	4.272	.118	.332	.564	.40	.527	6.22	.045	11.16	.011	3.59	.309
Monthly Family Income	1.865	.394	.721	.396	2.77	.096	4.57	.101	1.69	.638	3.715	.294
No. household members	1.495	.474	.403	.525	2.53	.111	2.06	.357	1.09	.779	2.93	.401
Educational level	10.27	.006	6.64	.01	4.79	.029	2.98	.225	.739	.864	6.54	.088
Works in the health sector	.161	.923	.327	.568	.178	.673	1.402	.496	3.39	.334	2.84	.417
relatives who work in the health sector	6.04	.049	1.72	.189	1.29	.255	3.502	.174	7.31	.063	.618	.892
Insurance	.861	.65	.024	.876	1.42	.232	1.483	.476	2.41	.491	1.93	.587

antibiotics (Table 4). In addition, more than half responded that they usually wait 1-2 days before starting antibiotics and 12.4% start directly (Table 4). Almost fifty percent of the respondents always consult a doctor when sick, 27.5% reported that they consult a doctor sometimes, and 19.8% rarely consult a doctor (Table 4). Of the latter, around 59% reported not needing the doctor while 13.6% justified it by a financial barrier and lack of time.

Furthermore, thirty-three percent of respondents took antibiotics when they get cold to "get better more quickly" and 39.6% stop taking antibiotics when they start feeling better (Table 5). More than half of the respondents (52.7%) keep antibiotics stocks at home and 23.1% give their antibiotics to a family member when sick. Moreover, almost 26% reported that they use the antibiotics of a family member when sick and 50.5% use leftover antibiotics. This was paralleled by 21% of respondents not taking antibiotics according to instructions

and 14.6% not checking the expiry date before taking it (Table 5).

KAP and Sociodemographic Determinants

The association of different sociodemographic determinants and knowledge is presented in Table 6. Marital status was found statistically associated with respondents knowing if antibiotics should be taken for fever ($p=0.022$). The age of the interviewed residents was correlated to their correct identification of penicillin and aspirin with p values 0.014 and 0.017 respectively. On the other hand, there was no statistical significance between knowledge and educational level, working in the health sector, having a relative working in the health sector, and having an insurance. The waiting time before taking an antibiotic was highly associated with age ($p=0.004$) (Table 7). Moreover, a high association was found between the educational level of respondents and taking antibiotics for cold to accelerate treatment ($p=0.006$). Education level was also associated to giving antibiotics to a

Table 8. Sociodemographic determinants of respondents' justification for antibiotics use

	Take antibiotics for cold		Take antibiotics for skin wounds		Take antibiotics for ear inflammation		Take antibiotics for diarrhea	
	Z	p-value	Z	p-value	Z	p-value	Z	p-value
Age	-1.224	.221	-.652	.514	-.107	.915	-2.121	.034
Marital status	-.308	.758	-.875	.382	-.402	.688	-1.252	.210
Monthly Family Income	-1.439	.150	-.959	.338	-1.321	.186	-.225	.822
No. household members	-1.619	.106	-1.996	.046	-1.075	.283	-2.314	.021
Educational level	-.099	.921	-1.073	.283	-.072	.943	-.551	.582
Works in the health sector	-.421	.673	-.376	.707	-.717	.473	-.849	.396
relatives who work in the health sector	-.659	.510	-.329	.742	-.560	.576	-.467	.640
Insurance	-1.195	.232	-.911	.362	-.036	.972	-.321	.748

family member when sick and using leftover antibiotics with p-values of 0.01 and 0.029 respectively (Table 7). Taking antibiotics for skin wounds and for diarrhea was related to the number of household members (Table 8).

DISCUSSION

This study reflects the real situation of a southern community. Where people have several misconceptions and misuses for antibiotics. More than half of the respondents think that antibiotics treat viral infections, which justifies why almost 50% would take it to treat common cold. A study performed by Jamhour et al. (2017) in Beirut and Northern Lebanon, showed a similar percentage (51%) of those who believe that antibiotics are effective against viruses (Jamhour et al., 2017). Such practices are coherent with reported results from studies in the Euro-Mediterranean region and developing countries (Alhomoud et al., 2017; Ocan et al., 2015). Three quarters of the respondents in this study reported that antibiotics are effective towards reducing pain and inflammation and more than half believe it eradicates fever. These results highlight the mere fact that people still think that antibiotics are equivalent to painkillers and antipyretics, which can be discontinued when symptoms improve (Lim and Teh, 2012). This was also reflected by 26.4% of the respondents who think that they can stop taking antibiotics before completing the full course.

Alhomoud et al. (2017) reported that relatives, friends, and previous successful experience with the same antibiotic are the major sources of information regarding antibiotics. Almost half of the households in this study kept antibiotics and used leftovers which is three folds the reported rates in a UK study (Mcnulty et al., 2007). In that they reported that 16% of the respondents kept leftover antibiotics to be used for repeated infection (8%) or other infections (31%). This malpractice of using leftovers, can be attributed to patient's unawareness of the indications for use, side effects, and contraindications, which puts them at risk of using drugs inappropriately (Alhomoud et al., 2017; Khalifeh, Moore and Salameh, 2017). The study also reported that a significant proportion of respondents (48.4%) expect their doctors to prescribe antibiotics to treat common cold and 15.4% requested that from them. This speaks to the nature of the doctor-patient

relationship in which the provider might tend to prescribe antibiotics, even though it is not warranted unnecessary, just to meet patients' demand and satisfaction (Oh et al., 2010). In that realm, a study from Jordan showed that patient demand was among the key elements that affect the physician's decision to prescribe a specific medication (Alhomoud et al., 2017).

On another front, pharmacists realize the harmfulness of selling antibiotics without a prescription and are aware of the fines (Bin Nafisah et al., 2017). However, they continue to comply to patient's requests and sell antibiotics with no medical prescription to keep regular customers satisfied and compete with other pharmacies (Bin Nafisah et al., 2017). In this study, quarter of the respondents reported seeking a pharmacist's consultation to prescribe antibiotics. Similar behaviors were reported in Kuwait (Awad and Aboud, 2015) where 42.3% relied on pharmacists as their resort. Likewise, in Saudi Arabia the sale of antibiotics without a medical prescription ranged from 63 to 82% (Alhomoud et al., 2018). Other countries in the Middle East such as Iran, turkey, the United Arab Emirates, Oman, Yemen, Jordan, Syria and Egypt also reported such behaviors (Alhomoud et al., 2018). This clearly indicates that there is an urgent need for policy and regulation enforcement directed towards Health care professionals as well as awareness and education efforts for the population at large.

At the institutional level, the order of physicians should have a monitoring system to invigilate prescriptions against medical codes to prevent misuse. The order of pharmacists has a role to play as well. Pharmacists should be enthused to advise the public about the proper use of antibiotics. Several studies have shown that antibiotic awareness interventions by pharmacists enhanced the public knowledge about the appropriate use of antibiotics and also improved their understanding of antimicrobial resistance (Finch et al., 2004; Gonzales et al., 2005; Ranji et al., 2008). Pharmacists should also act within their scope of practice by referring those seeking medical advices to physicians and nearby primary care centers and prevent the dispensing of antibiotics without medical prescriptions. They are in a great position to promote the rational use of antibiotics among their customers since patients frequently visit pharmacies to obtain antibiotics (Alhomoud et al., 2018).

Despite the fact that Lebanon has passed a law (law No. 367), to regulate and standardize the process of dispensing medications, the population in Lebanon was still able to obtain antibiotics without a medical prescription. Saudi Arabia suffers from the same problem as well (Bin Abdulhak et al., 2011; Farah et al., 2015). In addition, effective implementation of existing decrees and policies is critical to improve the judicious use of antibiotics. This is believed to improve knowledge, attitude, and practices. As a result of Brazil's enforcement of the restrictive law that considers antibiotics as controlled drugs, as such pharmacies were obliged to disclose each prescription to dispense the drug. After that significant drop in sales of antibiotics was witnessed (Moura et al., 2015). This entails that pharmacist must be liable for their practices and the ministry must monitor, inspect, and issue fines for those who do not adhere.

The Lebanese Law restricting antibiotics use and controls dispensing, is improperly implemented, and evaluated. Guidelines complement with the Law should be standardized and well implemented by all hospitals and primary care centers with the ministry's direct supervision. According to Decree Law No. 118 article-49 of the Municipal Act, the municipal council should oversee public programs for health affairs and contribute to the fees of projects of public interest. Therefore, municipalities should take a stand in cooperating with ministries to allocate a budget and organize health-related activities among villages according to their specific needs. Regulatory measures must go in parallel with public education campaigns. Such measures have had a great impact on controlling the non-prescription sale of antibiotics and improved the resistance profiles of diseases (Lee et al., 2013; Ventola, 2015).

At the level of the community, educational campaigns had proven to be one of the most successful tools for improving the awareness of the public about antibiotics (Alhomoud et al., 2017). It was found that more than half of the sample do not always consult a physician when sick (59.1%). Awareness campaigns must target health literacy, as low health literacy is linked with poorer outcomes (Berkman et al., 2011). For that, educational programs become highly crucial to promote the appropriate use of antibiotics (Alhomoud et al., 2018). Health information can be disseminated through several forms, including brochures and posters, public lectures and seminars, public media such as television, radio, and advertisements on social media platforms, and lectures encouraging the proper use of antibiotics. The World Health Organization (WHO), empathized on the dangers of improper antibiotics use and common practices that prevent antibiotic resistance (Iossa and White, 2018). To further promote this notion, more community awareness campaigns, and stronger enforcement of regulations are still needed to handle the issue of antibiotics in the Middle East.

CONCLUSION

The future of antibiotics remains unpredictable with the increase of reported resistance and the minimal progression in antibiotic development. It is important to intervene before the population is condemned by resistant microorganisms. The

results of this study revealed multiple gaps and in order to change these misconceptions and malpractices, multiple interventions are needed across different ecological levels. While the above recommendations are tied up to the knowledge and practice in a southern village in Lebanon, nevertheless, its implications can be easily generalized to the general population in Lebanon and perhaps to the region given the reported similar practices. Reinforcement and compliance to the law concerning antibiotics dispensing is therefore crucial. For that, decision makers shall improve practice concerning this topic. Municipalities and ministries should organize health awareness and promotion campaigns leading to better behavior, especially among rural villages. The order of physicians and pharmacists should collaborate to monitor the practice of their attendants. A system of validation to invigilate prescriptions against medical codes should be initiated to prevent misuse. Consequently, pharmacists should be highly compliant to the law and advise the public about the proper use of antibiotics. Considering these findings, future studies should be done to evaluate the effectiveness of such interventions and its effects on the appropriate use of antibiotics.

Author contributions: All co-authors have involved in all stages of this study while preparing the final version. They all agree with the results and conclusions.

Funding: No external funding is received for this article.

Declaration of interest: The authors declare that they have no competing interests.

Ethical considerations: This study ensured the freedom of choice, privacy, and confidentiality of the research subjects. The study was approved by the American University of Beirut Institutional Review Board, Lebanon.

Availability of data and materials: All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

REFERENCES

- Alhomoud, F., Aljamea, Z., Almahasnah, R., Alkhalifah, K., Basalelah, L. and Alhomoud, F. K. (2017). Self-medication and self-prescription with antibiotics in the Middle East—do they really happen? A systematic review of the prevalence, possible reasons, and outcomes. *International Journal of Infectious Diseases*, 57, 3-12. <https://doi.org/10.1016/j.ijid.2017.01.014>
- Alhomoud, F., Almahasnah, R. and Alhomoud, F. K. (2018). "You could lose when you misuse" – factors affecting over-the-counter sale of antibiotics in community pharmacies in Saudi Arabia: A qualitative study. *BMC Health Services Research*, 18(1), 915. <https://doi.org/10.1186/s12913-018-3753-y>
- Awad, A. I. and Aboud, E. A. (2015). Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. *PloS One*, 10(2), e0117910. <https://doi.org/10.1371/journal.pone.0117910>

- Ayukekbong, J. A., Ntemgwa, M. and Atabe, A. N. (2017). The threat of antimicrobial resistance in developing countries: causes and control strategies. *Antimicrobial Resistance & Infection Control*, 6(1), 47. <https://doi.org/10.1186/s13756-017-0208-x>
- Barriere, S. (2015). Clinical, economic and societal impact of antibiotic resistance. *Expert Opinion On Pharmacotherapy*, 16(2), 151-153. <https://doi.org/10.1517/14656566.2015.983077>
- Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J. and Crotty, K. (2011). Low health literacy and health outcomes: an updated systematic review. *Annals of internal medicine*, 155(2), 97-107. <https://doi.org/10.7326/0003-4819-155-2-201107190-00005>
- Bin Abdulhak, A. A., Altannir, M. A., Almansor, M. A., Almohaya, M. S., et al. (2011). Non prescribed sale of antibiotics in Riyadh, Saudi Arabia: a cross sectional study. *BMC Public Health*, 11, 538. <https://doi.org/10.1186/1471-2458-11-538>
- Bin Nafisah, S., Bin Nafesa, S., Alamery, A. H., Alhumaid, M. A., et al. (2017). Over-the-counter antibiotics in Saudi Arabia, an urgent call for policy makers. *The Journal of Infection in Developing Countries*, 10, 522-526. <https://doi.org/10.3855/jidc.1502>
- Bisht, R. E. K. H. A., Katiyar, A. L. O. K., Singh, R. A. J. A. T. and Mittal, P. (2009). Antibiotic resistance-A global issue of concern. *Asian Journal of Pharmaceutical and Clinical Research*, 2(2), 34-39.
- Brennan, T. A., Rothman, D. J., Blank, L., Blumenthal, D., Chimonas, S. C., et al. (2006). Health industry practices that create conflicts of interest: a policy proposal for academic medical centers. *Jama*, 295(4), 429-433. <https://doi.org/10.1001/jama.295.4.429>
- Carlet, J., Pulcini, C. and Piddock, L. J. (2014). Antibiotic resistance: a geopolitical issue. *Clinical Microbiology and Infection*, 20(10), 949-953. <https://doi.org/10.1111/1469-0691.12767>
- Carlet, J., Rambaud, C. and Pulcini, C. (2014). Save antibiotics: A call for action of the World Alliance Against Antibiotic Resistance (WAAAR). *BMC Infectious Diseases*, 14(1), 436. <https://doi.org/10.1186/1471-2334-14-436>
- Cosgrove, S. E., Qi, Y., Kaye, K. S., Harbarth, S., Karchmer, A. W. and Carmeli, Y. (2005). The impact of methicillin resistance in staphylococcus aureus bacteremia on patient outcomes mortality, length of stay, and hospital charges. *Infection Control*, 26(02), 166-174. <https://doi.org/10.1086/502522>
- Farah, R., Lahoud, N., Salameh, P. and Saleh, N. (2015). Antibiotic dispensation by Lebanese pharmacists: A comparison of higher and lower socio-economic levels. *Journal of Infection and Public Health*, 8(1), 37-46. <https://doi.org/10.1016/j.jiph.2014.07.003>
- Finch, R. G., Metlay, J. P., Davey, P. G. and Baker, L. J. (2004). Educational interventions to improve antibiotic use in the community: report from the International Forum on Antibiotic Resistance (IFAR) colloquium, 2002. *The Lancet Infectious Diseases*, 4(1), 44-53. [https://doi.org/10.1016/S1473-3099\(03\)00860-0](https://doi.org/10.1016/S1473-3099(03)00860-0)
- Gonzales, R., Corbett, K. K., Leeman-Castillo, B. A., Glazner, J., Erbacher, K., et al.. (2005). The "minimizing antibiotic resistance in Colorado" project: impact of patient education in improving antibiotic use in private office practices. *Health Services Research*, 40(1), 101-116. <https://doi.org/10.1111/j.1475-6773.2005.00344.x>
- Infectious Diseases Society of America. (2011a). Bad bugs, no drugs as antibiotic discovery stagnates... A public health crisis brews, July 2004. *Infectious Diseases Society of America (IDSA)* [online] <http://www.idsociety.org/BBND/>
- Infectious Diseases Society of America. (2011b). Combating antimicrobial resistance: policy recommendations to save lives. *Clinical Infectious Diseases*, 52(suppl 5), S397-S428. <https://doi.org/10.1093/cid/cir153>
- Iossa, G. and White, P. C. 2018. The natural environment: a critical missing link in national action plans on antimicrobial resistance. *Bull World Health Organ*, 96(12), 858-860. <https://doi.org/10.2471/BLT.18.210898>
- Jamhour, A., El-Kheir, A., Salameh, P., Hanna, P. A. and Mansour, H. (2017). Antibiotic knowledge and self-medication practices in a developing country: A cross-sectional study. *American Journal of Infection Control*, 45(4), 384-388. <https://doi.org/10.1016/j.ajic.2016.11.026>
- Khalifeh, M., Moore, N. and Salameh, P. 2017. Evaluation of self-medication use of antibiotics within Lebanese population: A prospective pilot study. *American Journal of Pharmaceutical Sciences*, 5, 31-39. <https://doi.org/10.12691/ajps-5-2-3>
- Lee, C. R., Cho, I. H., Jeong, B. C. and Lee, S. H. (2013). Strategies to minimize antibiotic resistance. *International Journal of Environmental Research and Public Health*, 10(9), 4274-4305. <https://doi.org/10.3390/ijerph10094274>
- Lim, K. K. and Teh, C. C. (2012). A cross sectional study of public knowledge and attitude towards antibiotics in Putrajaya, Malaysia. *Southern Med Review*, 5(2), 26-33. PMID:PMC3606936
- Lopez-Vazquez, P., Vazquez-Lago, J. M. and Figueiras, A. (2012). Misprescription of antibiotics in primary care: a critical systematic review of its determinants. *Journal of Evaluation in Clinical Practice*, 18, 473-484. <https://doi.org/10.1111/j.1365-2753.2010.01610.x>
- McNulty, C. A., Boyle, P., Nichols, T., Clappison, P. and Davey, P. (2007). The public's attitudes to and compliance with antibiotics. *Journal of Antimicrobial Chemotherapy*, 60(suppl_1), i63-i68. <https://doi.org/10.1093/jac/dkm161>
- Mouhieddine, T. H., Olleik, Z., Itani, M. M., Kawtharani, S., Nassar, H., et al. (2015). Assessing the Lebanese population for their knowledge, attitudes and practices of antibiotic usage. *Journal of Infection and Public Health*, 8(1), 20-31. <https://doi.org/10.1016/j.jiph.2014.07.010>
- Moura, M. L., Boszczowski, I., Mortari, N., Barrozo, L. V., Neto, F. C., et al. (2015). The impact of restricting over-the-counter sales of antimicrobial drugs: preliminary analysis of national data. *Medicine*, 94(38), e1605. <https://doi.org/10.1097/md.0000000000001605>

- Ocan, M., Obuku, E. A., Bwanga, F., Akena, D., Richard, S., Ogwal-Okeng, J. and Obua, C. (2015). Household antimicrobial self-medication: a systematic review and meta-analysis of the burden, risk factors and outcomes in developing countries. *BMC Public Health*, 15, 742. <https://doi.org/10.1186/s12889-015-2109-3>
- Oh, A. L., Hassali, M. A., Al-Haddad, M. S., Sulaiman, S. A. S., Shafie, A. A. and Awaisu, A. (2010). Public knowledge and attitudes towards antibiotic usage: a cross-sectional study among the general public in the state of Penang, Malaysia. *The Journal of Infection in Developing Countries*, 5(05), 338-347. <https://doi.org/10.3855/jidc.1502>
- Otoom, S. A. and Sequeira, R. P. (2006). Health care providers perceptions of the problems and causes of irrational use of drugs in two Middle East countries. *International Journal of Clinical Practice*, 60(5), 565-570. <https://doi.org/10.1111/j.1742-1241.2005.00808.x>
- Ranji, S. R., Steinman, M. A., Shojania, K. G. and Gonzales, R. (2008). Interventions to reduce unnecessary antibiotic prescribing: a systematic review and quantitative analysis. *Medical Care*, 46(8), 847-862. <https://doi.org/10.1097/MLR.0b013e318178eabd>
- Shehadeh, M., Suaifan, G., Darwish, R. M., Wazaify, M., Zaru, L. and Alja'fari, S. (2012). Knowledge, attitudes and behavior regarding antibiotics use and misuse among adults in the community of Jordan. A pilot study. *Saudi Pharmaceutical Journal*, 20(2), 125-133. <https://doi.org/10.1016/j.jsps.2011.11.005>
- Spellberg, B., Powers, J. H., Brass, E. P., Miller, L. G. and Edwards, J. E. (2004). Trends in antimicrobial drug development: implications for the future. *Clinical Infectious Diseases*, 38(9), 1279-1286. <https://doi.org/10.1086/420937>
- Sunenshine, R. H., Wright, M. O., Maragakis, L. L., Harris, A. D., Song, X., et al. (2007). Multidrug-resistant *Acinetobacter* infection mortality rate and length of hospitalization. *Emerging Infectious Diseases*, 13(1), 97. <https://doi.org/10.3201/eid1301.060716>
- Ventola, C. L. (2015). The antibiotic resistance crisis: part 2: management strategies and new agents. *Pharmacy and Therapeutics*, 40(5), 344. PMID:PMC4422635
- World Health Organization. (2014). *Antimicrobial resistance: global report on surveillance*. Available at: <http://www.who.int/drugresistance/documents/surveillancereport/en/>
- World Health Organization. (2016). *Antimicrobial resistance*. Available at: <http://www.who.int/mediacentre/factsheets/fs194/en/>
- World Health Organization. (2020). *Antimicrobial resistance*. Available at: <https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance>