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Assessing the Lebanese population for their knowledge, attitudes and practices of antibiotic usage

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Summary Antibiotic-resistant bacteria has become a global phenomenon, mainly due to the inappropriate use of antibiotics. There are no studies in Lebanon to assess the public's knowledge, attitudes and practices (KAP) of antibiotic usage. A cross-sectional study was carried out using a self-administered questionnaire completed by a random convenience sample of 500 people. Nearly half of the respondents (46.1%) demonstrated moderate knowledge levels, while 40.6% demonstrated moderate attitudes. Although 80.2% knew that antibiotics are anti-bacterial, 73.5% did not know that antibiotics are not anti-viral. Moreover, 68.3% of respondents reported consuming antibiotics 1—3 times per year, while 22.4% consumed antibiotics on their own accord. Approximately 66.7% realized that abusing antibiotics could lead to

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resistance. Participant knowledge and attitudes were significantly associated with monthly family income, educational level, place of residency, having medical insurance, working in the health sector or having a relative working in the health sector. Nation-wide awareness campaigns targeting susceptible demographics should be initiated.

Introduction

An infection was considered serious until the discovery of antibiotics. The term antibiotics, which means ''against life'', is derived from the fact that an antibacterial drug is extracted from living creatures and used to kill or attenuate bacteria. However, there is a tight correlation between longer duration and multiple courses of antibiotic uptake and higher rates of bacterial resistance [1]. Multi-resistant bacteria have become a major public health concern worldwide, and the discovery of new antibiotics is not helping much in fighting the newly emerging resistant bacteria. For example, southern and eastern Mediterranean regions have provided evidence of high rates of resistance, especially to penicillin [2], and unfortunately, the majority of the public remains ignorant of this distressing problem [3]. A combination of causes can increase the chance of developing drug resistance, such as patients' expectations, patient and health care professionals' lack of education, pharmaceutical marketing, antibiotic selling without a prescription [4,5], inadequate dosage, broad-spectrum antibiotics [6], and accessibility of over-the-counter antibiotics in many countries [7], and it can even arise from not completing the course of antibiotics [8]. Moreover, the misuse of antibiotics in treating viral infections, which has no beneficial clinical outcome [9—13], and the prevalence of self-medication is alarmingly high [14,15].

Nosocomial infections caused by multi-resistant, bacillus Gram-negative bacteria are associated with high morbidity and mortality, especially in intensive care units and wards, and the costs of hospital stays are increased with patients requiring 2nd or 3rd line drugs that are less effective and more toxic and expensive [16]. The most common hospital-encountered bacillus Gram-negative bacteria are *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Acinetobacter baumanii* [17]. While only 14% of strains of *K. pneumoniae* isolated in French hospitals were beta-lactamase-producing in 1990, this rate currently approaches 40% in some centers [18]. While they were once limited to the hospital environment, these multi-resistant bacteria have become a major community-acquired infection, affecting people with little or no contact with the hospital environment [19]. Following the rise of the rate of these multi-resistant bacteria and their diffusion outside hospitals, efforts were put in place, based on epidemiological surveillance, for the application of strict hygiene measures and regulations on antibiotic usage [20]. According to the World Health Organization (WHO), surveillance and mechanistic studies of bacterial resistance are the most important measures in terms of controlling the spread of resistant bacteria [21].

Several countries have undertaken national campaigns to modify the public's misconceptions regarding the effectiveness of antibiotics, promote appropriate antibiotic use, and prevent the development of antibiotic resistance. Unfortunately, in Lebanon, very few studies have been conducted to target the emergence of resistant bacteria. One study, conducted at a tertiary healthcare center in Lebanon, showed an increased or fluctuating resistance to several bacteria, including *Acinetobacter* spp., *P. aeruginosa*, *E. coli*, *K. pneumonia*, *Enterococcus* spp., *Staphylococcus aureus*, *Streptococcus viridans* and *Streptococcus pneumoniae* [22]. Furthermore, another healthcare center in Lebanon reported antibiotic susceptibility to several bacterial strains; by using a beta lactamase spectrum to define bacterial resistance, it was discovered that resistance was 31% for *E. coli* and 35% for *Klebsiella* in 2006 [23]. In 2010, the same hospital found that bacterial resistance increased to 43% for *E. coli* and 48% for *Klebsiella* [24].

Population knowledge, attitudes and practices (KAP) have been evaluated in many studies to identify a certain condition and a set of variables affecting that condition. The knowledge component assesses what people know, while the attitude component assesses what they feel and practice assesses their behavior. There are no studies that target the Lebanese population to assess their KAP concerning the usage of antibiotics. Although it is generally known that there is a misuse of

antibiotics in Lebanon, it has never been documented.

Thus, our objective was to assess the current KAP regarding antibiotic usage in a Lebanese sample, as well as to identify demographic characteristics associated with the highest risk of attaining resistance.

Methodology

Study design

A cross sectional survey using a validated questionnaire was conducted among the general public in the capital of Lebanon, Beirut, during the months of May and June 2013. The questionnaire was adapted from former studies [25—27], and modified by removing questions that were not of high importance and making the questions suitable for use among the Lebanese population.

Inclusion/exclusion criteria

Eligible participants were (1) aware of the term ''antibiotics'' or any of its marketed equivalents; (2) living in Lebanon for at least the past 5 years to ensure that they have adapted to Lebanese habits that affect the KAP of antibiotic consumption; and (3) at least 18 years old. Those who did not meet all of these criteria were excluded from the study.

Sample size and selection of sample

A random convenience sample of 500 people was included in this study. The convenience sample was chosen from Beirut because it is the capital and largest city in Lebanon, and contains a rich demographic variety where people from different Lebanese cities or villages are present for residence, work, or recreation.

Data collection took place across the 12 districts of Beirut. People were surveyed in the street and in their homes by going street by street with a consistent pattern of choosing one building then disregarding the immediate building next to it. In addition, only odd floors of the buildings were chosen to be as unbiased and consistent as possible. This study was performed on working days as well as weekends, and at different times of the day.

Questionnaire

The questionnaire was comprised of four parts. Part 1 consisted of 14 demographic questions, while part 2 consisted of 6 questions aiming at assessing the practice of antibiotics use among respondents, with the specification of the source, as well as the reason for antibiotic intake. Part 3, consisting of 15 statements, aimed at assessing the antibiotic knowledge of respondents. The areas evaluated included antibiotics role (6 statements), identification (4 statements), side effects (3 statements), and completion of the course of treatment (2 statements). Part 4 (8 statements) evaluated public attitudes toward antibiotic use, including the use of antibiotics to alleviate colds, respondent's expectations of doctor's antibiotic prescription, course of treatment completion, sharing and keeping stocks of antibiotics, and compliance with label information and the expiration date. For parts 3 and 4, respondents had to choose, according to a five-point Likert scale, among five possible answers: ''Strongly agree'', ''Agree'', ''Neutral'', ''Disagree'', and ''Strongly Disagree''. However, to make the analyses easier, ''Strongly Agree'' and ''Agree'' were merged into ''Agree'', and ''Strongly Disagree'' and ''Disagree'' were merged into ''Disagree'' while ''Neutral'' remained the same. The questionnaire was initially developed in English and was then translated into Arabic. The Arabic version was followed by a pilot test to make sure that it was fully understandable by the general public. The pilot study demonstrated that the questionnaire was fully understandable and thus did not require any further modifications.

Data analyses

The Statistical Package for Social Sciences program (SPSS) version 20 was used for data entry and analyses. Descriptive statistics were carried out by providing the number and percentage of each of the demographic variables as well as the questions about knowledge, attitudes and practices. To describe the knowledge and attitudes of the participants, a score was calculated according to the number of correctly answered questions targeting the knowledge about antibiotics and attitudes regarding antibiotic usage, and the attitudes and knowledge scores were both categorized as poor, moderate and good. The score was calculated by giving one point for every correct question answered and no points if the answer was wrong or uncertain, to reach a maximum of 15 points and 9 points for the knowledge and attitudes scores, respectively. Thus, the knowledge scores were categorized into poor (0—5/15), moderate (6—10/15) or good (11—15/15) while the attitudes scores were divided into poor (0—3/9), moderate (4—6/9) and good (7—9/9). ANOVA one-way analysis was used

to check for a significant association between the multinomial demographics and knowledge level and attitudes. The Student's *t*-test was used to check for a significant association between the binomial demographics and each knowledge level and attitude category. A *p*-value <0.05 was considered statistically significant.

Results

Upon reviewing the surveys, 5 incomplete surveys were found and excluded from the study, leaving us with a sample of 495 respondents. According to the acquired data (Table 1), there was a descending order of distribution of the respondents from younger to older age, with the highest percentage among the 18—30 years group (41.4%) and the lowest among those greater than 60 years old who accounted for only 4% of the sample. The breakdown of age groups in our sample is comparable to the breakdown of the age groups in the Lebanese population [28]. The majority of the respondents were Lebanese (92.5%) and the sample was distributed almost equally between genders (48.9% were male while 51.1% were female). The monthly income with the greatest prevalence among the respondents was $1000—$1500 (26.7%). As expected, the majority of respondents live in the city or in the suburbs (95.1%), and Beirut was the place of origin for most of the participants (60.4%). Approximately 88.8% had completed at least secondary school, which is consistent with previous studies concerning the level of education in Lebanon [29]. Approximately 88.7% reported that they do not work in the health sector but approximately 30% said they have a relative who works in this field. Almost 70% have health insurance with only 42.0% sure that the insurance covers medication.

Practice

Sixty-eight percent of respondents reported that in an ''average'' year they used antibiotics 1—3 times. Moreover, 16.8% reported no antibiotic consumption while 4.4% reported excessive antibiotic consumption of more than 6 times per year (Table 2).

The most frequent answer for the question ''How do you get your antibiotics'' was ''by doctor's prescription'' (65.1%) followed by ''pharmacist's advice'' (39.2%). The percentage of people who answered that they choose to take an antibiotic without consultation was 22.4%. Upon asking about the reasons for using antibiotics, 73.5% thought that the common cold was a valid reason. As for the time that they wait before starting an antibiotic course once they get sick, the most frequently reported answers were ''1—2 days'' (36.2%) and ''3—4 days'' (30.1%). Furthermore, 23.0% said that they directly start an antibiotic course once they get sick while 10.7% would wait more than 4 days before starting.

Only 27.5% of the subjects always consult a doctor when sick while the majority (48.7%) answered that they sometimes consult a doctor when sick. The reason behind this observation was investigated in a separate question, i.e., ''reason for not always consulting a physician?'' where the most frequently reported reason was ''such situations do not need a physician'' (55.4%). The second most frequent answer was ''money'' (19.4%). Only 0.8% attributed this to ''doctor unavailability''.

Knowledge

Most of the respondents (46.1%) showed a moderate level of knowledge while 37.6% had a good level of knowledge and 16.4% were poorly knowledgeable about antibiotics (Table 3). No statistically significant differences in knowledge levels were found between age groups, gender, place of origin, number of household members and nationality (Lebanese vs. non-Lebanese). On the other hand, the level of knowledge was significantly associated (p-value < 0.05) with monthly family income, place of residency, education level, spending a year abroad, working in the medical sector or having a relative who works in the medical sector, in addition to having insurance and insurance that covers medication costs.

The highest correct answer among the knowledge questions was 80.2% representing respondents who considered antibiotics as anti-bacterial agents. On the other hand, the percentage of respondents who incorrectly regarded antibiotics as anti-viral agents was 54.1%, while 19.4% were unsure of the answer. Over two-thirds (78.4%) could correctly identify that Panadol (paracetamol) is not an antibiotic. Moreover, 66.7% realized that antibiotic misuse could cause antibiotic resistance. However, 19.6% incorrectly believed that antibiotics have no side effects and 16.4% were unsure. When it came to complying with the full course of antibiotic treatment, about half of the respondents had a positive response (53.1%).

Attitude

The majority of the sample (40.6%) showed a moderate attitude score, followed by equal

Table 1 The frequencies and percentages of demographic characteristics and antibiotic consumption.

Variable		Frequency	Percentage
Age	18–30	205	41.4%
	31–40	118	23.8%
	41–50	99	20.0%
	51–60	53	10.7%
	>60	20	4.0%
Gender	Male	242	48.9%
	Female	253	51.1%
Nationality	Lebanese	458	92.5%
	Non-Lebanese	37	7.5%
Have you lived outside Lebanon for more than a year?	No	347	70.1%
	Yes	148	29.9%
Monthly family income	<$500	42	8.5%
	$500–$1000	104	21.0%
	$1000–$1500	132	26.7%
	$1500–$2000	84	17.0%
	$2000–$2500	44	8.9%
	>$2500	89	18.0%
Place of residency	City	306	61.8%
	Suburbs	165	33.3%
	Village	24	4.8%
Number of household members	3–4	163	32.9%
	4–6	308	62.2%
	>6	24	4.8%
What is your highest education level?	None	8	1.6%
	Elementary	49	9.9%
	Secondary	121	24.4%
	University	317	64.0%
Do you work in the health sector?	No	439	88.7%
	Yes	56	11.3%
Do you have relatives who work in the health sector?	No	347	70.1%
	Yes	148	29.9%
Do you have insurance?	No	150	30.3%
	Yes	345	69.7%
Does your insurance cover medication?	No	136	27.5%
	Yes	209	42.2%
	Not applicable	150	30.3%
Average antibiotic consumption per year	Don't use	83	16.8%
	1–3	338	68.3%
	4–6	52	10.5%
	>6	22	4.4%
	Total	495	100.0%

percentages (29.7%) for both poor and good attitude scores (Table 4). The percentage of respondents who incorrectly expect the doctor to prescribe an antibiotic for the common cold was 56.0%. Approximately 48.5% of the respondents do not stop taking antibiotics when their symptoms improve. A considerable percentage (52.3%) believes that antibiotics can accelerate their common cold recovery, and 39.0% of these respondents ask their doctors to prescribe antibiotics in such cases. Moreover, more than half of the respondents appear to store antibiotics (52.1%)

Table 2 Questions targeting practice habits.

Question	Answer		Frequency	Percentage
How do you get your antibiotics?	Doctor's prescription		322	65.1%
	Without a doctor's prescription		76	15.5%
	Pharmacist's advice		194	39.2%
	Non-medical person's advice		35	7.1%
	Personal Choice		111	22.4%
What is the reason for using antibiotics? Mutually exclusive answers	Fever		184	37.2%
	Cold		364	73.5%
	Pain and inflammation		136	27.5%
	Urinary tract infection		133	26.9%
	Skin wound		55	11.1%
	Teeth and gum inflammation		215	43.4%
	Ear inflammation		158	31.9%
	Diarrhea		54	10.9%
Do you consult a doctor when you're sick?	Never		13	2.6%
	Rarely		105	21.2%
	Sometimes		241	48.7%
	Always		136	27.5%
	Total		495	100.0%
Reason for not always consulting a doctor (total applicable: 359 respondents)	Money	No	263	73.3%
		Yes	96	26.7%
	Unavailability of doctors	No	355	98.9%
		Yes	4	1.1%
	Scared	No	329	91.6%
		Yes	30	8.4%
	No need for a doctor	No	85	23.7%
		Yes	274	76.3%
	No time	No	307	85.5%
		Yes	52	24.5%
Waiting time before starting an antibiotic? Mutually exclusive answers	Directly		114	23.0%
	1—2 days		179	36.2%
	3—4 days		149	30.1%
	>4 days		53	10.7%
	Total		495	100.0%

and use the left-overs for future illness (48.3%). Alternatively, 69.7% do not give antibiotics to a sick family member and 69.7% usually read the instructions on the label and 83.2% read the expiration date (Tables 5 and 6).

There was no significance between attitude score and age, gender, place of origin in Lebanon, insurance covering medications, the number of household members and nationality. However, monthly family income, education level, place of residence, having health insurance, the respondent or a family member working in the health sector, and spending a year outside Lebanon were significantly associated with the attitude score.

A positive correlation of 0.496 was found between the knowledge and attitude scores. As the knowledge scores increase, the attitude scores increase, and vice versa. This relation is very strong and significant (p-value < 0.0001).

Discussion

This study reveals important errors regarding the usage of antibiotics: people are using excessive amounts or using them for diseases that do not require them. Yet to be certain about this excessive antibiotic use, a review of the medical records or prospective surveillance should be performed. Upon asking about the reasons for using antibiotics, an obvious misconception was revealed: 73.5% thought that the common cold is a valid reason for taking antibiotics. A possible reason for inadequacy of knowledge in this area could be due to the term ''germ'', which was normally used during medical counseling rather than the microbiological terms ''bacteria'' or ''virus'' [27].

The public was more familiar with trade names than generic names, which is expected. However, 36.0% did not know or were unsure if

Table 3 The percentages of answers on questions related to knowledge and the frequencies of the different levels of knowledge.

Statement	Agree	Unsure	Disagree
Antibiotics kill bacteria	402 (80.2%)	56 (11.3%)	37 (7.5%)
Antibiotics treat viral infections	268 (54.1%)	96 (19.4%)	131 (26.5%)
Antibiotics cure all infections	90 (18.2%)	109 (22.0%)	296 (59.8%)
Antibiotics reduce pain and inflammation	356 (71.9%)	50 (10.1%)	89 (18.0%)
Antibiotics reduce fever	338 (68.3%)	80 (16.2%)	77 (15.6%)
Antibiotics are medicines that cure stomachaches and disinfect digestive tract	191 (38.6%)	113 (22.8%)	191 (38.6%)
Penicillin is an antibiotic	263 (53.1%)	184 (37.2%)	48 (9.7%)
Aspirin is an antibiotic	63 (12.7%)	102 (20.6%)	330 (66.7%)
Panadol is an antibiotic	45 (9.1%)	62 (12.5%)	388 (78.4%)
Profen is an antibiotic	82 (16.6%)	173 (34.9%)	240 (48.5%)
Antibiotic overuse leads to antibiotic resistance	330 (66.7%)	109 (22.0%)	56 (11.3%)
Antibiotics may induce an allergic reaction	330 (66.7%)	90 (18.2%)	75 (15.2%)
Antibiotics do not cause side effects	97 (19.6%)	81 (16.4%)	317 (64.0%)
You can stop taking the full course of antibiotics if your symptoms improve	191 (38.6%)	41 (8.3%)	263 (53.1%)
Antibiotic effectiveness is reduced if a full course of antibiotics is not completed	292 (59.0%)	113 (22.8%)	90 (18.2%)

Knowledge score	Frequency	Percentage
Poor	81	16.4%
Moderate	228	46.1%
Good	186	37.6%

antibiotics have side effects. This may imply that the patients are not getting enough information from health care professionals concerning the drugs they use.

The majority (68.3%) of the sample consumed antibiotics 1—3 times per year, which we consider a moderate level of consumption, where a healthy individual should not, on average, use antibiotics

Table 4 The percentages of answers on questions related to attitude and the frequencies of the different attitude scores.

Statement	Agree	Unsure	Disagree
When I get a cold, I take antibiotics to help me get better more quickly	259 (52.3%)	19 (3.8%)	217 (43.9%)
I expect my doctor to prescribe antibiotics if I suffer from common cold symptoms	277 (56.0%)	95 (19.2%)	123 (24.8%)
I ask my doctor to prescribe me antibiotics if I suffer from common cold symptoms	121 (24.4%)	72 (14.6%)	302 (61.0%)
I normally stop taking antibiotics when I start feeling better	236 (47.7%)	19 (3.8%)	240 (48.5%)
I usually give my antibiotics to a sick family member	131 (26.5%)	19 (3.8%)	345 (69.7%)
I usually keep antibiotic stocks at home	258 (52.1%)	31 (6.3%)	206 (41.6)
I use leftover antibiotics if I get the same illness again	239 (48.3%)	33(6.6%)	223 (45.1%)
I take antibiotics according to the instructions	345 (69.7%)	40 (8.1%)	110 (22.2%)
I usually look at the expiry date of the antibiotic before taking it	412 (83.2%)	21 (4.3%)	62 (12.5%)

Attitude score	Frequency	Percentage
Poor	147	29.7%
Moderate	201	40.6%
Good	147	29.7%

Table 5 The percentages of demographic variables distributed among poor, moderate, and good scores of knowledge and the corresponding *p*-value.

Variable		Poor	Moderate	Good	*p*-Value
Age	18—30	34 (16.6%)	107 (52.2%)	64 (31.2%)	0.431
	31—40	18 (15.3%)	48 (40.7%)	52 (44.0%)	
	41—50	14 (14.1%)	37 (37.4%)	48 (48.5%)	
	51—60	12 (22.7%)	27 (50.9%)	14 (26.4%)	
	>60	3 (15.0%)	9 (45.0%)	8 (40.0%)	
Gender	Male	39 (16.1%)	119 (49.3%)	84 (34.7%)	0.528
	Female	42 (16.6%)	109 (43.1%)	102 (40.3%)	
Nationality	Lebanese	71 (15.5%)	213 (46.5%)	174 (38.0%)	0.466
	Non-Lebanese	10 (27.0%)	15 (40.6%)	12 (32.4%)	
Have you lived outside for more than a year?	No	67 (19.3%)	164 (47.3%)	116 (33.4%)	0.001[a]
	Yes	14 (9.5%)	64 (43.2%)	70 (47.3%)	
Monthly family income	<$500	14 (33.3%)	23 (54.8%)	5 (11.9%)	0.0001[a]
	$500—$1000	21 (20.2%)	49 (47.1%)	34 (32.7%)	
	$1000—$1500	27 (20.5%)	61 (46.2%)	44 (33.3%)	
	$1500—$2000	7 (8.3%)	39 (46.4%)	38 (45.3%)	
	$2000—$2500	7 (15.9%)	22 (50.0%)	15 (34.1%)	
	>$2500	5 (56.2%)	34 (38.2%)	50 (5.6%)	
Place of residency	City	39 (12.8%)	136 (44.4%)	131 (42.8%)	0.0001[a]
	Suburbs	36 (21.8%)	78 (47.3%)	51 (30.9%)	
	Village	6 (25.0%)	14 (58.3%)	4 (16.7%)	
Place of origin	North	2 (14.3%)	4 (28.6%)	8 (57.1%)	0.607
	Mount Lebanon	6 (9.0%)	35 (52.2%)	26 (38.8%)	
	Beqaa (Interior)	2 (14.4%)	6 (42.8%)	6 (42.8%)	
	Beirut	53 (17.7%)	139 (46.5%)	107 (35.8%)	
	South	8 (12.5%)	29 (45.3%)	27 (42.2%)	
	Not applicable	10 (27.0%)	15 (40.6%)	12 (32.4%)	
Number of household members	1—3	23 (14.1%)	78 (47.9%)	62 (38.0%)	0.635
	4—6	55 (17.9)	136 (44.1%)	117 (38.0%)	
	>6	3 (12.5%)	14 (58.3%)	7 (29.2%)	
What is your highest education level?	None	3 (37.5%)	5 (62.5%)	0 (0.0%)	0.0001[a]
	Elementary	17 (34.7%)	24 (49.0%)	8 (16.3%)	
	Secondary	23 (19.0%)	67 (55.4%)	31 (25.6%)	
	University	38 (12.0%)	132 (41.6%)	147 (46.4%)	
Do you work in the health sector?	No	80 (18.2%)	214 (48.8%)	145 (33.0%)	0.0001[a]
	Yes	1 (1.8%)	14 (25.0%)	41 (73.2%)	
Any relatives who work in the health sector?	No	69 (19.9%)	174 (50.1%)	104 (30.0%)	0.0001[a]
	Yes	12 (8.1%)	54 (36.5%)	82 (55.4%)	
Do you have insurance?	No	41 (27.3%)	71 (47.4%)	38 (25.3%)	0.0001[a]
	Yes	40 (11.6%)	157 (45.5%)	148 (42.9%)	
Does your insurance cover medication?	No	14 (10.3%)	52 (38.2%)	70 (51.5%)	0.016[a]
	Yes	26 (12.4%)	104 (49.8%)	79 (37.8%)	
	Not applicable	41 (27.3%)	72 (48.0%)	37 (24.7%)	

[a] Significant at 95% confidence interval.

more than once per year. The most frequent answer for the question ''How do you get your antibiotics'' was ''by doctor's prescription'' (65.1%) followed by ''pharmacist's advice'' (39.2%), which suggests a major role for pharmacists in our community in prescribing and delivering antibiotics. The percentage of people referring to a doctor for prescription (65.1%) was not satisfying because it means that approximately 35.0% of the population consumes antibiotics without a doctor's

Table 6 The percentages of demographic variables distributed among poor, moderate, and good attitude scores and the corresponding *p*-value.

Variable		Poor	Moderate	Good	*p*-Value
Age	18—30	61 (29.8%)	88 (42.9%)	56 (27.3%)	0.294
	31—40	38 (32.2%)	44 (37.3%)	36 (30.5%)	
	41—50	30 (30.3%)	31 (31.3%)	38 (38.4%)	
	51—60	15 (28.3%)	27 (50.9%)	11 (20.8%)	
	>60	3 (15.0%)	11 (55.0%)	6 (30.0%)	
Gender	Male	72 (29.8%)	102 (42.1%)	68 (28.1%)	0.477
	Female	75 (29.6%)	99 (39.1%)	79 (31.2%)	
Nationality	Lebanese	139 (30.3%)	182 (39.7%)	137 (29.9%)	0.639
	Non-Lebanese	8 (21.6%)	19 (51.4%)	10 (27.0%)	
Have you lived outside for more than a year?	No	118 (34.0%)	133 (38.3%)	96 (27.7%)	0.003[a]
	Yes	29 (19.6%)	68 (45.9%)	51 (34.5%)	
Monthly family income	<$500	15 (35.7%)	17 (40.5%)	10 (23.8%)	0.0001[a]
	$500—$1000	29 (27.9%)	45 (43.3%)	30 (28.8%)	
	$1000—$1500	52 (39.4%)	55 (41.7%)	25 (18.9%)	
	$1500—$2000	22 (26.2%)	36 (42.9%)	26 (31.0%)	
	$2000—$2500	8 (18.2%)	19 (43.2%)	17 (38.6%)	
	>$2500	21 (23.6%)	29 (32.6%)	39 (43.8%)	
Place of residency	City	76 (24.8%)	129 (42.2%)	101 (33.0%)	0.001[a]
	Suburbs	64 (38.8%)	60 (36.4%)	41 (24.8%)	
	Village	7 (29.2%)	12 (50.0%)	5 (20.8%)	
Place of origin	North	2 (14.3%)	6 (42.9%)	6 (42.9%)	0.076
	Mount Lebanon	16 (23.9%)	25 (37.3%)	26 (38.8%)	
	Beqaa (Interior)	3 (21.4%)	5 (35.7%)	6 (42.8%)	
	Beirut	100 (33.4%)	123 (41.1%)	76 (25.4%)	
	South	18 (28.1%)	23 (35.9%)	23 (35.9%)	
	Not applicable	8 (21.6%)	19 (51.4%)	10 (27.0%)	
Number of household members	1—3	44 (27.0%)	73 (44.8%)	46 (28.2%)	0.27
	4—6	97 (31.5%)	121 (39.3%)	90 (29.2%)	
	>6	6 (25.0%)	7 (29.2%)	11 (45.8%)	
What is your highest education level?	None	5 (62.5%)	3 (37.5%)	0 (0.0%)	0.0001[a]
	Elementary	21 (42.9%)	22 (44.9%)	6 (12.2%)	
	Secondary	43 (35.5%)	52 (43.0%)	26 (21.5%)	
	University	78 (24.6%)	124 (39.1%)	115 (36.3%)	
Do you work in the health sector?	No	143 (32.6%)	177 (40.3%)	119 (27.1%)	0.0001[a]
	Yes	4 (7.1%)	24 (42.9%)	28 (50.0%)	
Any relatives who work in the health sector?	No	115 (33.1%)	138 (39.8%)	94 (27.1%)	0.009[a]
	Yes	32 (21.6%)	63 (42.6%)	53 (35.8%)	
Do you have insurance?	No	55 (36.7%)	65 (43.3%)	30 (20.0%)	0.0001[a]
	Yes	92 (26.7%)	136 (39.4%)	117 (33.9%)	
Does your insurance cover medication?	No	30 (22.1%)	55 (40.4%)	51 (37.5%)	0.058
	Yes	62 (29.7%)	81 (38.8%)	66 (31.6%)	
	Not applicable	55 (36.7%)	65 (43.3%)	30 (20.0%)	

[a] Significant at 95% confidence interval.

guidance. Additionally, the percentage of people who answered that they choose to take an antibiotic on their own was 22.4%, which is an alarming number for a society lacking appropriate public medical education. Additionally, the presence of counterfeit antibiotics in Lebanon may also contribute to the consequences that are already at hand.

Approximately 53.1% of the participants know that they should complete the full course of

antibiotics even when their symptoms improve. On the other hand, 48.5% of respondents said that they would not stop taking their course of antibiotics if their symptoms improved, leaving an alarmingly large number (51.5%) who may stop their course of antibiotics. This high percentage of people who stop their antibiotic course may be a major contributor to the rapid increase in resistant bacterial infections in Lebanon.

Furthermore, 23.0% of individuals said that they directly start an antibiotic course once they get sick while 10.7% would wait more than 4 days before starting an antibiotic regimen. This suggests a lax mentality in administering or starting an antibiotic that does not allow sufficient time for the natural body defense systems to act.

Only 27.5% of participants always consult a doctor when sick. When asked about the reason, 55.4% believed that a doctor is not needed in such cases. Others (19.4%) attributed not seeing a doctor due to financial hardships, emphasizing the financial burden of medical care on patients. The availability of doctors is not an issue in our community due to the high ''doctor to patient ratio'' [30], which is consistent with the lowest frequency for the answer ''doctor unavailability'' (0.8%).

Of those who consult a doctor, 56.0% expect the doctor to prescribe an antibiotic for the common cold, and 24.4% actually ask the doctor to prescribe an antibiotic for such a case. This might put the doctor under pressure to prescribe the antibiotic in order to meet the patient's expectations, even if the doctor thinks the prescription is unnecessary. Several studies have revealed that the patient's expectation is an important determinant of antibiotic prescription and that antibiotics are more likely to be prescribed under pressured clinical context [27].

Unfortunately, the damage caused by the misuse of antibiotics goes beyond the damage caused by the drug itself. The damage includes killing the beneficial bacteria in our body (e.g., in the GI tract), disruption of the immune system's normal functioning, and many other side effects. Furthermore, the increase in number of physician visits, absenteeism, duration of disease and suffering, and increasing costs of medicine and therapy are some of the adverse effects associated with antibiotic misuse.

It is imperative that we no longer take the availability of effective antibiotics for granted. The WHO has become concerned about the rising levels of resistant bacteria around the world. To provide global coordination, the WHO issued its Global Strategy for Containment of Antimicrobial Resistance, a document aimed at policy-makers that urges governments to take action.

South Korea created the National Antimicrobial Resistance Experts Committee (NAREC) in 2003, which in turn has implemented a number of national educational campaigns on the appropriate use of antibiotics in various ways targeted to the general public [26]. The results of this study show that Lebanon has to implement a similar campaign or else face consequences associated with the misuse of antibiotics. The result of insufficient federal funding, insufficient surveillance, prevention, and control, and insufficient research and development activities could result in a literal return to the pre-antibiotic era for many types of infections [3] in Lebanon.

Winning the race against antibiotic resistance requires immediate action on different fronts. The misuse of antibiotics by healthcare practitioners and patients can be targeted by developing prescription guidelines, informing the public more thoroughly, regulating the use of antibiotics more strictly, investing more resources in developing new antibiotics, urging physicians to continue going through medical education programs and promoting the use of alternatives (vaccination, general hygiene, and healthy lifestyles). Vaccination reduces the need, and thus the use, of antibiotics by preventing or reducing infections. General hygiene plays an important role in preventing the dissemination of resistant bacteria. Moreover, adopting healthy lifestyles (healthy diet and exercise) enhances physical strength and immunity, and thus reduces the need for antibiotics.

Future aims

It is important to analyze the efficacy of different educational programs and methods designed to reduce antibiotic misuse. This study should be extended to emergency rooms, clinics, pharmacies and other healthcare settings. Demographics affecting KAP must be specifically targeted by education and media campaigns. By focusing on the social and psychological factors that influence patients' decisions and relations with the physician, this study provides effective and useful data for future work aiming to target the roots of the antibiotic resistance problem.

Limitations

This study had several limitations, one of which was that we used a convenience sample. Another limitation is that we had a limited amount of time (2 months) with a limited number of students (11 students) to recruit respondents. Moreover, some locations were unreachable due to political and

safety reasons. We assumed that choosing Beirut would provide a fairly representative convenience sample because it is the largest, most highly populated city where people from all over Lebanon come for residence, work and recreation. Finally, we should consider that not all answers were given honestly due to respondent bias. There were a few instances when people knew at the end of the interview that they had wrong answers and requested to change their answers, but no responses were changed.

Conclusion

The majority of the sample had a moderate level of knowledge and moderate attitudes in relation to antibiotics. Unfortunately, some people were using antibiotics for the wrong reasons and in the wrong way. It is important to initiate a nation-wide intervention to raise awareness regarding the consequences of antibiotic misuse and to implement restrictions on the haphazard antibiotic usage and distribution to decrease the spread of antibiotic-resistant bacteria.

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Competing interests

None declared.

Ethical approval

The study was approved by the American University of Beirut Institutional Review Board, Lebanon.

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