American Journal of Pharmacological Sciences, 2017, Vol. 5, No. 2, 49-56
Available online at http://pubs.sciepub.com/ajps/5/2/5
©Science and Education Publishing
DOI:10.12691/ajps-5-2-5

Community Usage Pattern of Antibiotics within Lebanese Population: A Prospective Study

Malak Khalifeh[1,2,*], Nicholas Moore[1], Pascale Salameh[2]

[1]Pharmaco-épidémiologie et évaluation de l'impact des produits de santé sur les populations, University de Bordeaux, Bordeaux, France
[2]Clinical & Epidemiological Research Laboratory, Faculty of Pharmacy, Lebanese University, Beirut, Lebanon
*Corresponding author: malak.k9@hotmail.com

Abstract **Introduction:** Antibiotic misuse is a worldwide public health problem and a major cause of antibiotic resistance. **Objective:** The aim of this study therefore was to describe the usage pattern of antibiotics in Lebanon. **Method:** It is a prospective study in a community-based pharmacy setting in Lebanon. It uses a structured random interview to patients visiting community pharmacy seeking for antibiotics. Baseline characteristics and reason for self-medication were collected. Completing a self-administered questionnaire after 30 days provided information on safety, efficacy and usage pattern. Data were analyzed using descriptive statistics and Chi-square test. **Results:** 62.7% of 501 participants bought antibiotic without prescription. Pharmacists were the main helpers (34.7%). Amoxicillin/clavulanic acid was the most used antibiotic as self-medication (33.7%). The overall average dispensation was 9.07 DDD for short term use (< 2 weeks). In the follow up, the average DDD consumed by patient was7.07 DDD and 62.5% were consumed between 1 to 7 DDD. The average request per year was 3.35 which was significantly higher in patients without prescription than with prescription (p= .029).Males were dispensed more DDDs than females but the result was not significant. Patients with ages from 25-50 years old had significantly consumed more than 1 DDD per day (61.7%) compared to patients with age above than 50 years old (41%, p=.002). **Conclusion:** Antibiotic consumption in Lebanon is uncontrolled. Educational programs should be implemented for the public to reduce the usage of antibiotic.

Keywords: *self-medication, antibiotic, Lebanon, usage pattern, DDD*

Cite This Article: Malak Khalifeh, Nicholas Moore, and Pascale Salameh, "Community Usage Pattern of Antibiotics within Lebanese Population: A Prospective Study." *American Journal of Pharmacological Sciences*, vol. 5, no. 2 (2017): 49-56. doi: 10.12691/ajps-5-2-5.

1. Introduction

Antibiotic misuse is a worldwide public health problem and a major cause of antibiotic resistance [1]. Antibiotic resistance is one of the most relevant problems in the healthcare: the growth of resistant microorganisms in healthcare settings is a worrisome threat, raising length to stay (LOS), morbidity and mortality in those patients [1].

The main reasons for the increase of antimicrobial resistance include unregulated drug availability and widespread attitude to antimicrobial misuse, including self-medication [2].

The use of antibiotics has therefore been frequently studied in different countries all over the world. Antibiotic use has been studied and compared in hospitals and in primary care [3,4,5,6]. However, the use of antibiotics at an individual level has until recently been studied in smaller groups of patients.

In Lebanon, like most other developing countries, having a valid prescription is not always enforced for receiving prescription-only medications (POM). Previous researches in Lebanon shows that the prevalence of self-medication of antibiotic is alarmingly high [7].

However, no researches were done to study the usage pattern of antibiotics in Lebanon. The aim of this study therefore was to describe the usage pattern of antibiotic within Lebanese population living in Lebanon and to explore patterns of age and gender specific use.

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 the six districts in Lebanon: Beirut, South Lebanon, Nabatiyeh, Mount Lebanon, Bekaa, and North Lebanon.

Eligible participants were recruited randomly from consumers presenting at CPs in Lebanon after they had purchased antibiotic medication with or without prescription. The patients included were from both genders, aged 16 years and older, coming to purchase antibiotic. The patients were divided into two groups:

those buying antibiotic with a prescription versus those buying them without prescription.

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 gave their voluntary informed oral consent 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. [7] The minimal sample size necessary to show a twofold increase in the risk of exposure to non-prescribed antibiotics consists of 442 subjects: 186 patients for those buying antibiotic with prescription and 256 without prescription.

2.3. Procedure and Data Collection

Data on antibiotic use was collected using a structured random interview conducted by pharmacists or interviewers who had been briefed about the study's aims and methods. Consecutive customers arriving at CPs seeking antibiotic were interviewed. Data was collected from the participants twice, first at purchase for data about drug used and the condition for which it was to be used, then by calling the patient 30 days after starting the medication, for usage patterns.

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 the following sections: socio-demographic data (age, sex, occupation, educational and marital status, monthly income, medical insurance, and the presence of a care provider at home), lifestyle data (smoking status, alcohol status, and involvement in sport activities), complaint for which the antibiotic is taken, the medication details (name, dose, duration and mode of administration as recommended to be taken), presence of comorbidities (defined as long-term diseases diagnosed by physicians) and background medications, as well as reasons and sources of self-medication.

Thirty days after starting the medication, patients were assessed about adherence and duration of antibiotic consumed, direction of use, and reasons for misuse.

2.4. Antibiotic Use Data

This study included antibiotics used for systemic infections, excluded antivirals, antifungals, antiprotozoans and topical antimicrobial treatments. The trade names of the dispensed antibiotics were converted to their equivalent generic names using the Lebanese Medical Index. Antibiotics were classified according to the Anatomical Therapeutic Chemical class (ATC, http://www.whocc.no/ atc_ddd_index/).

2.5. Data Analysis

The usage pattern of antibiotics was described by the number of defined daily doses (DDD) dispensed to each patient and used during the follow up, as well as the number of request of antibiotic/year.The usage pattern was described using Anatomical Therapeutical Chemical Classification/Defined Daily Doses (ATC/DDD) system. (Table S1).

All data were entered and analyzed using SPSS version19 (the IBM Corporation, Armonk, NY). The explanatory variables were: socio-demographic, lifestyle, the condition for which antibiotic was used, source of antibiotic medication, reason for self-medication and frequency of antibiotic consumed per year. An appropriate bivariate analysis was done for every explanatory variable: Chi-2 for dichotomous variables to compare 2 percentages, T-test or ANOVA for nominal and ordinal variables to compare 2 means of 2 groups or more, and Pearson correlation for continuous variables. A p-value of 0.05 or less was considered to be statistically significant in all tests.

3. Results

3.1. Baseline Characteristics

Of a total of one thousand questionnaire distributed to CPs data from a total of 501 patients were recorded in the study. Among participants, 314 (62.7%) requested an antibiotic without prescription while 187 (37.3 %) had a medical prescription for their antibiotic. Both groups were homogenous regarding gender (p=0.154), age (p=0.532), education (p=0.285), Income (p=0.051), and presence of comorbidities (p=0.548) (Table 1).

A total of 392 patients (78.2%) had no associated medical conditions, while 109 (21.8%) suffered from chronic diseases, among which 21.8% had hypertension, 3.2% had asthma or COPD, 5.8% had dyslipidemia, 3.8% diabetes, 2.4% gastric diseases, and 3.6% osteoarthritis. 3 participants were pregnant and one had an allergy to penicillin.

Amoxicillin–clavulanic acid (coamoxiclav) combination was the most purchased antibiotic (33.7 %) followed by cephalosporins (21.2%). 33.9% of participants used antibiotics once per year. Coamoxiclav was the most frequently dispensed antibiotic without prescription (37.3%) followed by cephalosporins (21%), penicillins (17.2%), macrolides (6.1%) and fluoroquinolones (3.8%) respectively. The antibiotics dispensed with a prescription were, in the following descending order: coamoxiclav (27.8%), cephalosporins (21.4%), fluoroquinolones (17.6%), macrolides (14.4%) and penicillins (5.3%). (Table 2)

The most concern indications were for respiratory tract infections mainly tonsillitis (27.5%) and flu (17.6%), followed by oral and gastrointestinal tract infections (18.6%) and urinary tract infection (12.4%). Most patients bought antibiotic to treat respiratory tract infections: tonsillitis (30.3%), cold (22%) and cough (6.4%), oral and gastrointestinal tract infections: diarrhea (13.4%) and teeth infections (5.1%), skin and urinary tract infections (8.3%). Patients buying antibiotics for urinary tract infections had significantly more prescriptions (p<0.05) (Table 2)

Table 1. Characteristics of the study population

	Total participants N=501	Participants with medical prescription N= 187	Participants without medical prescription N= 314	p-value
Gender				
Male	153 (30.5%)	50 (26.7%)	103 (32.8%)	0.154
Female	348 (69.5%)	137 (73.3%)	211 (67.2%)	
Age group				
16-25	244 (48.7%)	85 (45.5%)	159 (50.6%)	0.532
25-50	196 (39.1%)	78 (41.7%)	118 (37.6%)	
>50	61 (12.2%)	24 (12.8%)	37 (11.8%)	
Educational level				
Primary and less	153 (30.5%)	65 (34.8%)	88 (28%)	0.285
Secondary	69 (13.8%)	24 (12.8%)	45 (14.3%)	
University	279 (55.7%)	98 (52.4%)	181 (57.6%)	
Marital status				
Single	259 (51.7%)	90 (48.1%)	169 (53.8%)	0.217
Married	242 (48.3%)	97 (51.9%)	145 (46.2%)	
Currently working				
Yes	173(34.5%)	134 (71.7%)	194 (61.8%)	0.025
No	328 (65.5%)	53 (28.3%)	120 (38.2%)	
Family income (LL)				
<2000000	134 (74.4%)	38 (20.3%)	95 (30.3%)	.051
>2000000	46 (9.2%)	18 (9.6%)	27 (8.6%)	
No answer	323 (64.5%)	131 (70.1%)	192 (61.1%)	
Presence of comorbidities				
Yes	109 (21.8%)	38 (20.3%)	71 (22.6%)	0.548
No	392 (78.2%)	149 (79.7%)	243 (77.4%)	
Data presented as number (%) were performed using Chi2 respectively and a p-value < 0.05 is considered significant.				

Table 2. Self-medication practice among participants

	Total participants N=501	Participants with medical prescription N= 187	Participants without medical prescription N= 314	p-value
Antibiotic Classes:				
coamoxiclav	169(33.7%)	52 (27.8%)	117 (37.3%)	<.001
Amoxicillin or penicillins	64 (12.8%)	10 (5.3%)	54 (17.2%)	
Cephalosporins	106 (21.2%)	40 (21.4%)	66 (21.0%)	
Fluoroquinolones	45 (9%)	33 (17.6%)	12 (3.8%)	
Macrolides	46 (9.2%)	27 (14.4%)	19 (6.1%)	
Others	71 (14.2%)	25 (13.4%)	46 (14.6%)	
Ab request/year				
1st time	170 (33.9%)	70 (37.4%)	100 (32.2%)	.132
More than 1 time	328 (65.5%)	117 (62.6%)	211 (67.8%)	
Types of infection				
Respiratory tract infections:				
Tonsillitis	138 (27.5%)	43 (23%)	95 (30.3%)	.629
Cold	88 (17.6%)	19 (10.2%)	69 (22%)	.629
Sore throat	42 (8.4%)	6 (3.2%)	36 (11.5%)	.001
Cough	34 (6.8%)	14 (7.5%)	20 (6.4%)	.631
Otitis	32 (6.4%)	13 (7%)	19 (6.1%)	.320
Sinusitis	21 (4.2%)	10 (5.3%)	11 (3.5%)	.690
Chest tightness	14 (2.8%)	7 (3.7%)	7 (2.2%)	<.001
Runny nose or sneezing	10 (6.8%)	3 (1.6%)	7 (2.2%)	.079
Gastrointestinal infections:				
Diarrhea	60 (12%)	18 (9.6%)	42 (13.4%)	.394
Teeth infections	33 (6.6%)	17 (9.1%)	16 (5.1%)	.211
Urinary tract infections:	62 (12.4%)	36 (19.3%)	26 (8.3%)	.022
Skin infections:				
Skin infection	21 (4.2%)	12 (6.4%)	9 (2.9%)	.319
Acne	9 (1.8%)	6 (3.2%)	3 (1%)	.055
General:				
Fever	7 (1.4%)	3 (1.6%)	4 (1.3%)	.750
Pain	18 (3.6%)	5 (2.7%)	13 (4.1%)	.179
Others	35 (7%)	14 (7.4%)	17 (5.3%)	.750
Data presented as number (%) were performed using Chi2 respectively and a p-value < 0.05 is considered significant.				

3.2. Antibiotic Utilization Patterns

The drugs were dispensed according to prescriptions from physician (37.3%), or through self-medication (62.7%). Self-medication practice was based mainly on pharmacist recommendation (34.7%). Of the self-medicated antibiotics, 25.2% were requested by the patients themselves based on previous experience with the same antibiotic. The remaining was based on advice from a friend and/or family member (18.5%) or physician on phone (21%). (Figure 1)

The main reason reported by patients for self-medication was previous successful use of antibiotic (40.4%), followed by saving time (25.2%), and ease access of medication from the community pharmacy (22.9%). The remaining reported reasons were fear of the disease to become worse (18.5%) or saving cost of physician prescription (18.5%). (Figure 2)

Males bought significantly more coamoxiclav (43.8%, p=.003) followed by cephalosporins (16.3%), and fluoroquinolones (12.4%) while females bought more coamoxiclav (29.3%) and other penicillins (14.9%) followed by cephalosporins (23.3%) and macrolides (10.1%). Younger patients received more coamoxiclav (35.2%) while older patients more cephalosporins (29.5%) and fluoroquinolones (26.2%) and the result was statistically significant (p<.001). (Figure 3)

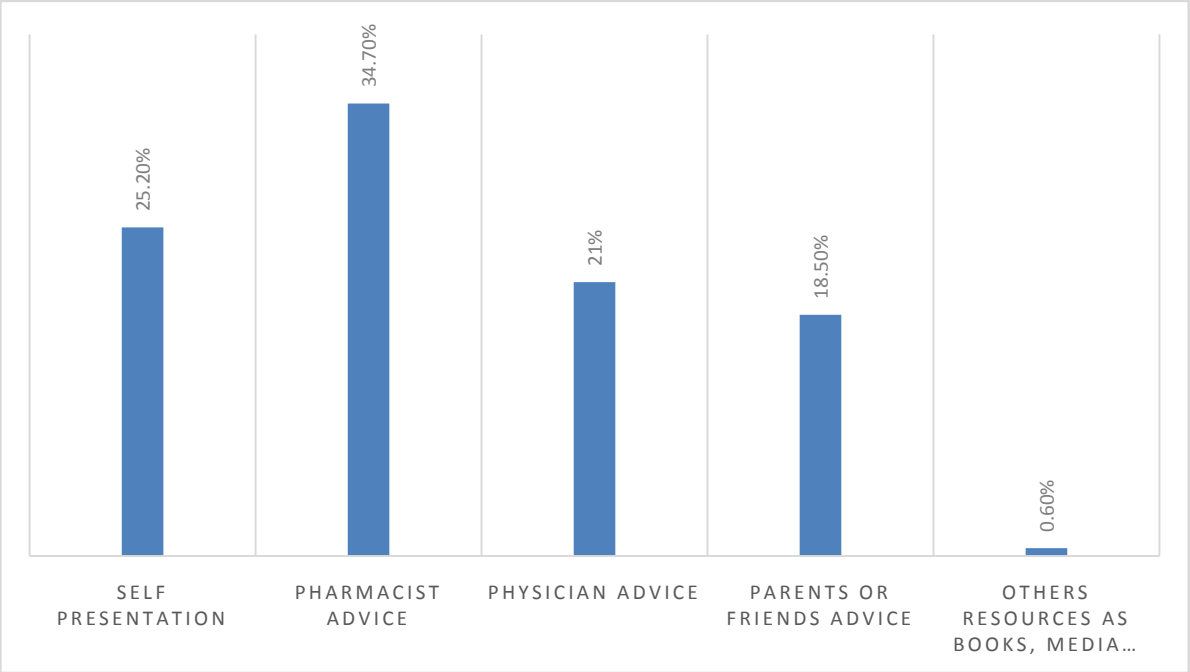

Figure 1. Sources of self-medication among participants requesting antibiotic without prescription

Figure 2. Reasons for self-medication among participants requesting antibiotic without prescription

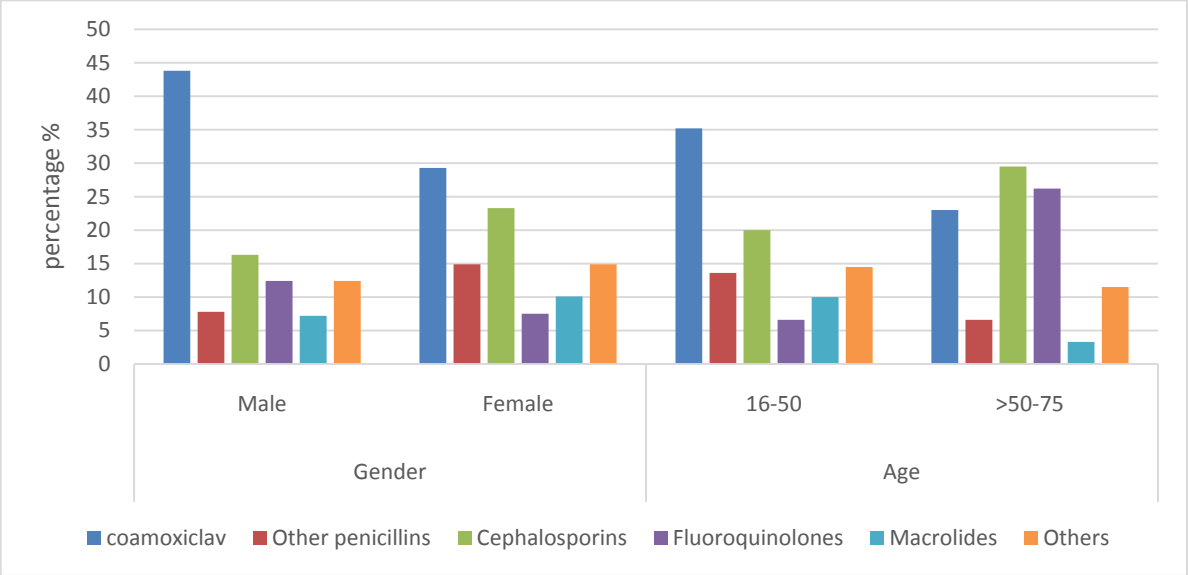

Figure 3. Dispensing pattern of individual antibiotic

Table 3. Usage Pattern of antibiotics

	Total participants N=357 (100%)	Participants with medical prescription N= 99 (30%)	Participants without medical prescription N= 258 (70%)	p-value
Number of DDD/request				
Mean	9.07 +-5.06 (Min=1.5, Max=48)	9.23 (5.35)	8.97 (4.87)	.588 (95%CI=-.68-1.2)
1-7	244 (48.7%)	93 (49.7%)	151 (48.1%)	0.936
8-14	222 (44.3%)	81 (43.3%)	141 (44.9%)	
15-29	35 (7%)	13 (7%)	22 (7%)	
Number of DDD/follow-up				
Mean	7.07 +-4.93 (Min=0.2, Max=48)	7.93 (5.4)	6.54 (4.55)	.004 (95%CI=.45-2.33)
1-7	313 (62.5%)	107 (58.2%)	206 (68.4%)	.070
8-14	151 (30.1%)	67 (36.4%)	84 (27.9%)	
15-28	21 (4.2%)	10 (5.4%)	11 (3.7%)	
Number of DDD/day				
Mean	1.47+-.75 (Min=0.2, Max=4)	1.42 (.66)	1.49 (.79)	.29 (95%CI=-.19- .06)
<1	244 (48.7%)	95 (50.8%)	149 (47.5%)	.128
1.1-2	217 (43.3%)	83 (44.4%)	134 (42.7%)	
2-4	40 (8.0 %)	9 (4.8%)	31 (9.9%)	
Number of request/ year				
Average:	**3.35 +-3.48(min=1, max 12)**	**3.08 (3.4**	**3.51 (3.52)**	**.182 95%CI (-1.1-.166)**
1	186 (37.1%)	83 (44.6%)	103 (33.2%)	.060
2-3	149 (28.7%)	51 (27.4%)	93 (30.0%)	
4-6	100 (21%)	31 (16.7%)	74 (23.9%)	
7-12	61 (12.2%)	21 (11.3%)	40 (12.9%)	

At each dispensing patients received an average of 9.07 DDD. There was no significant difference in the number of DDDs dispensed between patients requesting antibiotic with or without prescription. 51.7% of females were dispensed between 1 to 7 DDD, while 58.2% of males were dispensed more than 8 DDD, however, the results were not statistically significant (p=.117). More patients above 50 years old were dispensed between 1 -7 DDD (55.7%) while only 47.7% of patients less than 50 years old were dispensed 1-7 DDD. (Table 3)

The average number of dispensings per year was 3.35. More than 50% requested antibiotics more than twice per year. Patients requesting antibiotic without prescription requested more antibiotic per year than patients with prescription. Only 33.2%of those requesting antibiotic without prescription were dispensed antibiotic once per year, compared to 44.6% for patients with prescription. (Table 3)

Males were dispensed significantly more antibiotics over year than females (p=.003). More males were dispensed antibiotics between 2-3 times over a year (36.6%) while females were dispensed mainly once per year (42.9%).Younger patients received an average of 3.09 dispensings over year, less than older patients (average=5.18) (p<.001). (Table S2)

3.3. Follow-up usage pattern of antibiotic

In the follow up, patients' consumption of DDD decreased to an average of 7.07 DDD; 62.5% used between 1 to 7

DDD. The average number of DDD per day was 1.47 DDD. Patients with medical prescription used more DDDs (average=7.93) than patients without prescription (average=6.54) (p=.0.04). There was no significant difference in the number of DDDs used per day between patients requesting antibiotic with or without prescription. (Table 3)

In the follow up, the results show no statistical difference between the DDD consumed between gender groups. The percentages of patients consuming 1-7 DDD increased to 62.9% in younger patients, and to 77.2% in older patients (>50 years old)(p.009). Patients aged25-50 years used significantly more often more than 1 DDD per day (61.7%) than patients above 50 (41%, p=.001). (Table S2)

The average consumption per day of coamoxiclav, amoxicillin, or macrolides was 2.0, 1.4 and 1.41 DDD respectively. Amoxicillin, coamoxiclav, and clarithromycin had mean administered daily doses twice the number of DDD while the average number of DDD consumed per day of other antibiotics was 1.

3.4. Efficacy Follow up

Most patients (91.7%) had complete relief and only 1.2% didn't improve on antibiotic. In general, 86.4% have assessed the treatment with antibiotic as very good. 10.9% have described it as sufficient and 3.5% as bad. Most patients have experienced relief of symptoms after 1-4 days (70.7%). This might explain the under use of antibiotic treatment. 19.8% experienced relief of symptoms after 5-7 days and only 8.3% had experienced relief after 2 weeks. 17 (3.5%) participants switched to another antibiotic for reasons of not feeling better (n=16, 94.1%) or due to side effects (n=1, 0.2%). The major antibiotics switched to were ceftriaxone injection (n=3) or oral coamoxiclav (n=4).

3.5. Follow up on Safety

Only 30 (6.6%) participants reported side effects. Gastrointestinal side effects were the main reported side effects (n=9), including diarrhea (n=5), abdominal pain (n=3), and vomiting (n=1). Skin allergic reactions and herpes were also reported in 13 cases. Other side effects reported were laziness (n=2), sedation (n=2), headache (n=2), and increasing appetite (n=1).One case of hospitalization was reported as due to exacerbation of the disease.

4. Discussion

This study found a high rate of antibiotic self-medication (62.7%) originating from pharmacist advice or relatives' recommendations. The overall average dispensing of antibiotics was 9.07DDD, indicating short term use (<2 weeks). The usage pattern of antibiotics was not different between patients buying antibiotics with or without prescription; however, the number of request per year of antibiotic was significantly higher in patients practicing self-medication. Antibiotics were commonly dispensed in different infectious diseases and were commonly dispensed with cough or flu medicines, or analgesics (paracetamol, NSAIDs).

Easy availability of antibiotics without prescription from community pharmacies and the low price of some antibiotics explain the wide use of antimicrobial drugs whether needed or not. Moreover, the use of antibiotics is relatively safe and rarely associated with adverse effects. The prevalence of self-medication was relatively higher than that reported by Cheaito et al study (40%) which was restricted to Beirut and its suburbs [7].

The average number of DDD per dispensing was not different between participants with or without prescriptions. Males had non-significantly higher average DDD consumption of antibiotics than females. In this study and in the study of Lombardy region, a greater prevalence was found in males than in females [8,9] This finding contrasts with another study done in the USA that showed that females were the main consumers of antibiotics in 2013. [10] Females used more broad spectrum antibiotics, including cephalosporins and macrolides, concomitantly with more symptomatic infections of the genital and urinary tract system than males [11].

Higher use of antibiotics was observed in younger patients. Differences in patterns of use with regards to age could be explained by different types of infections. The shift from beta-lactams to more broad spectrum antibiotics such as cephalosporins and fluoroquinolones in the older age (>50 years), is not unexpected because the immune response lessens with age and the prevalence of UTIs increases with age. The use of more DDD in younger age should raise awareness regarding the increase risk of bacterial resistance over time.

The average number of requests per year was considered high i.e. 3.35 times. More than 50% requested antibiotics more than twice per year. This average rises significantly in patients requesting antibiotic without prescription. This could be attributed to therapeutic failure or to increase in bacterial resistance. Other problems with self-medication are self-diagnosis and buying of antibiotics in sub-therapeutic quantities tend to become cultural norms in countries with few regulations on the acquisition of non-prescribed antimicrobial drugs [12]. Moreover, antibiotic therapy was often used by patients without ruling out the possibility of viral infections which is more common in these cases of respiratory tract infections. This finding is consistent with results of other studies in Abu-Dhabi, [13] Iran, [14] Jordan, [15] Lebanon [7] and Northern and Western Europe [16]. This explains the rapid relief of signs and symptoms of many complaints. So, patients stop the antibiotic just when the symptoms of illness disappear.

Coamoxiclav was highly used among patients in this population. This result replicates findings reported in Lebanon (48.9%) [7]. Similarly, in United Arab Emirates, it was the most commonly used (48.9%) [17] and in Pakistan. (62.8%) [18]. Although broad spectrum of antibiotics is effective against many bacterial infections and are relatively safe, this does not justify their uncontrolled use: prudent use of antibiotics promotes the use of narrow-spectrum targeted drugs when appropriate, to decrease the chance of emergence of drug-resistant microbial strains. Incorrect use could cause the development of resistant bacteria and diminish the ability of the

endogenous flora to resist colonization of harmful microorganisms, thereby leading to super infections by multi-resistant bacteria and yeasts [19].

The average consumption per day of coamoxiclav, amoxicillin, or macrolides was 2.00, 1.4 and 1.41DDD, respectively. Amoxicillin, coamoxiclav, and clarithromycin have mean daily doses twice the number of DDD. This study highlights the limits of DDD in estimating the daily doses consumed by patients per day. The effect, if any, of this increased dosage on bacterial resistance is unknown. Estimates of antibiotic use using DDD methods will remain open to criticism because the prescribed dosage, especially of antibiotics, often deviates from the "theoretical" daily dose, depending for instance on the location of the infection, pathogen susceptibility, or the excretory status of the patient [20].

An important concern should be raised about residual antibiotics, i.e., antibiotics that were dispensed but not used. These may result in uncontrolled self-medication and inappropriate use. This could be quantified by comparing the overall DDD of antibiotic dispensed during episode to that actually used, during follow-up. The average DDD dispensed during the episode was 9.05, greater than that used during the follow-up. The average DDD used for each antibiotic class was less than what had been dispensed. Patients probably stopped the medication as soon as the symptoms disappear, either because of poor medical knowledge or use of the antibiotic for conditions for which the medication was not indicated. This results in using the antibiotic beyond the scope and increasing the daily dose of antibiotic and increasing the risk of antibiotic resistance.

This study is the first prospective study done in the Lebanese population of the usage pattern of antibiotic consumption. However, our study suffers from several limitations. To begin with, since not all pharmacists accepted to participate to the study, the sample may not be representative of Lebanese population. We might also expect a change in behavior of the pharmacists in the presence of researchers, since the study addresses an illegal practice; Our results may be under estimating the reality of antibiotic self-medication. Second, there could also be a possibility of respondent and information bias, since the results of our study are based on a face-to-face questionnaire. Many persons did not agree to fill it out, which may also introduce a selection bias. Our study was limited to patients aged > 15 years old. Pediatric patients are also an important category group to measure extent of antibiotic use that could influence antibiotic resistance.

This study suffers from most consumer-based surveys issues, mostly the willingness or not of subjects coming to the pharmacy to spend tie filling a questionnaire or speaking to an interviewer. Patients may also be reluctant divulge information about disease of socioeconomic factors. As such our results represent only the part of the population that participated; mostly young, relatively healthy subjects who may have better educational level than older subjects. However, subjects in this study were recruited in various parts of the country. And difference in the spectrum of ages and professional status one might expect. The results are found were not unexpected and confirm to another studies done in the same area [7,15]. The fact that we did find two third non-prescribed dispensing of antibiotics shows the respondents answer making information bias unlikely.

5. Conclusion

This study reflects on the fact that antibiotic consumption in Lebanon is poorly controlled, with much misuse, often related to self-medication and non-prescribed use. To prevent this practice, health authorities have to implement educational programs for patients and pharmacists to emphasize the need for careful medical control of antibiotic prescriptions and regulations to reduce the usage of antibiotics.

Conflicts of Interest

The authors declare no conflicts of interest.

Funding

Malak Khalifeh received a grant from Lebanese University for her PhD research.

Acknowledgements

The authors thank the Lebanese University for funding this project.

References

[1] Ricciardi, W., G. Giubbini, and P. Laurenti, *Surveillance and Control of Antibiotic Resistance in the Mediterranean Region.* Mediterr J Hematol Infect Dis, 2016. 8(1): p. e2016036.

[2] Okeke, I.N., et al., *Antimicrobial resistance in developing countries. Part I: recent trends and current status.* Lancet Infect Dis, 2005. 5(8): p. 481-93.

[3] Ferech, M., et al., *European Surveillance of Antimicrobial Consumption (ESAC): outpatient penicillin use in Europe.* J Antimicrob Chemother, 2006. 58(2): p. 408-12.

[4] MacKenzie, F.M., et al., *Relationship between the number of different antibiotics used and the total use of antibiotics in European hospitals.* J Antimicrob Chemother, 2006. 58(3): p. 657-60.

[5] Molstad, S., et al., *Antibiotic prescription rates vary markedly between 13 European countries.* Scand J Infect Dis, 2002. 34(5): p. 366-71.

[6] Ronning, M., et al., *Problems in collecting comparable national drug use data in Europe: the example of antibacterials.* Eur J Clin Pharmacol, 2003. 58(12): p. 843-9.

[7] Cheaito, L., et al., *Assessment of self-medication in population buying antibiotics in pharmacies: a pilot study from Beirut and its suburbs.* Int J Public Health, 2014. 59(2): p. 319-27.

[8] Bronzwaer, S.L., et al., *A European study on the relationship between antimicrobial use and antimicrobial resistance.* Emerg Infect Dis, 2002. 8(3): p. 278-82.

[9] Majeed, F.A. and D.G. Cook, *Age and sex differences in the management of ischaemic heart disease.* Public Health, 1996. 110(1): p. 7-12.

[10] Centers for Disease Control and Prevention. *Outpatient antibiotic prescriptions— United States, 2013*. Available from: http://www.cdc.gov/getsmart/community/pdfs/annual-reportsummary_2013.pdf.

[11] Blix, H.S., et al., *Age- and gender-specific antibacterial prescribing in Norway.* J Antimicrob Chemother, 2007. 59(5): p. 971-6.
[12] Drug Utilization Research Group, L.A., *Multicenter study on self-medication and self-prescription in six Latin American countries.* Clin Pharmacol Ther, 1997. 61: p. 488-93.
[13] Abasaeed, A., et al., *Self-medication with antibiotics by the community of Abu Dhabi Emirate, United Arab Emirates.* J Infect Dev Ctries, 2009. 3(7): p. 491-7.
[14] Heidarifar, R., et al., *Self-medication with Antibiotics among Iranian Population in Qom State.* Journal of Scientific and Innovative Research 2013. 2(4): p. 785-789.
[15] Sawair, F.A., et al., *Assessment of self-medication of antibiotics in a Jordanian population.* Med Princ Pract, 2009. 18(1): p. 21-5.
[16] Grigoryan, L., et al., *Determinants of self-medication with antibiotics in Europe: the impact of beliefs, country wealth and the healthcare system.* J Antimicrob Chemother, 2008. 61(5): p. 1172-9.
[17] Sharif, S.I. and R.S. Sharif, *Antibiotics Use With and Without a Prescription in Healthcare Students.* American Journal of Pharmacological Sciences, 2013. 1(5): p. 96-99.
[18] Aslam, M. and T.B. Mirza, *Selfmedication with Antibiotics among Secondary and Tertiary Level Students in Karachi, Pakistan: A Crossectional Study.* Inventi Rapid: Pharmacy Practice, 2013. 3: p. 1-5.
[19] Barbosa, T.M. and S.B. Levy, *The impact of antibiotic use on resistance development and persistence.* Drug Resist Updat, 2000. 3(5): p. 303-311.
[20] Polk, R.E., et al., *Measurement of Adult Antibacterial Drug Use in 130 US Hospitals: Comparison of Defined Daily Dose and Days of Therapy.* CID 2007. 44: p. 664-670.

Table S1. Anatomically Therapeutic Classification system for systemic antibiotics

Antibiotic Class	ATC class
Penicillins :	J01C
Penicillins with extended spectrum	J01CA
Penicillin combination with B-lactamase inhibitors	J01CR
B-Lactamase-sensitive penicillins	J01CE
Cephalosporins:	J01D
First-generation cephalosporins	J01DAa
Second-generation cephalosporins	J01DAb
Third-generation cephalosporins	J01DAc
Fluoroquinolones	J01MA
Macrolides, lincosamides and streptogramins	J01F
Sulphonamides and trimethoprim	J01E
Aminoglycosides	J01G
Metronidazole	J01XD01
Tetracyclines	J01A

Table S2. Dispensing pattern of antibiotic for gender and age groups:

	Gender					Age						
	Male		Female			16-25		25-50		>50-75		
Number of DDD/request	n	%	n	%	P-value	n	%	n	%	n	%	P-value
Mean (SD)	9.83 (5.77)		8.73 (4.67)		.025	8.68 (4.32)		9.86 (6.06)		8.07 (3.77)		.013
1-.7	64	41.8	180	51.7	.117	120	49.2	90	45.9	34	55.7	.097
7.5-14	76	49.7	146	42		112	45.9	85	43.4	25	41	
14.5-29	13	8.5	22	6.3		12	4.9	21	10.7	2	3.3	
Number of DDD/follow-up												
Mean (SD)	7.70 (5.76)		6.80 (4.51)		.095	6.50 (4.16)		8.11 (5.93)		6.05 (3.55)		.001
1-.7	89	61	224	66.1	.326	155	64.9	114	60.3	44	77.2	.009
7.5-14	48	32.9	103	30.4		79	33.1	60	31.7	12	21.1	
14.5-28	9	6.2	12	3.5		5	2.1	15	7.9	1	1.8	
Number of DDD/day												
Mean (SD)	1.56 (.8)		1.43 (.72)		.06	1.36 (.71)		1.63 (.76)		1.37 (.72)		<.001
<1	70	45.8	174	50	.112	135	55.3	75	38.3	34	55.7	.001
1.1-2	65	42.5	152	43.7		95	38.9	97	49..5	25	41.0	
2.-4	18	11.8	22	6.3		14	5.7	24	12.2	2	3.3	
Number of request/ year												
Mean (SD)	3.77 (3.64)		3.16 (3.41)		.073	2.99 (3.38)		3.22 (3.11)		5.18 (4.4)		<.001
1	39	25.5	147	42.9	.003	118	48.8	60	31.1	8	13.1	<.001
2-3	56	36.6	88	25.7		58	24	65	33.7	21	34.4	
4-6	36	23.5	69	20.1		40	16.5	50	25.9	15	24.6	
7-12	22	14.4	39	11.4		26	10.7	18	9.3	17	27.9	