Original Research

Knowledge of pharmacists and parents towards antibiotic use in pediatrics: a cross-sectional study in Lebanon

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Abstract

Objectives: to assess the knowledge of both parents and community pharmacists regarding antibiotics use and resistance in pediatrics in Lebanon.

Methods: A cross-sectional study was conducted between June and August 2017 in community pharmacies. A pre-established questionnaire targeting knowledge of parents and pharmacists regarding antibiotics use/misuse was carried out. An index of knowledge was computed to assess factors associated with good knowledge on antibiotics use/misuse.

Results: The study showed that 28.7% of pharmacists did not know which factors may contribute to antimicrobial resistance. Concerning the misuse of antibiotics, pharmacists blamed at first parents (90.1%), at second level physicians (72.8%), and third themselves (59.4%). Furthermore, pharmacists believed that the socioeconomic problems of the country (86.1%), the level of resistance to the molecule of choice (80.8%), the lack of consultation time (71.2%) and the lack of national guidelines/recommendations (66.3%) might be additional factors contributing to antimicrobial resistance. In case of acute otitis media, the majority of pharmacists chose the correct treatment, dose and duration according to international guidelines; this was in contrast to the results obtained in case of pharyngitis. Female pharmacists had a significantly higher knowledge score compared to their male counterparts (ORa=2.51). Half of parents (42.6%) declared that antibiotics act against both viruses and bacteria, 55.9% still believe that the presence of fever requires the administration of antibiotics, 50% didn't know the consequences of antibiotics misuse, 58.4% said that it is okay to give their child antibiotics without a physician's advice or based on a pharmacist's recommendation, and 66.7% trusted the pharmacist in the antibiotic prescription. Parents with a university level of education or a master's degree had significantly better knowledge compared to illiterate ones (ORa=9.04 and ORa=16.46, respectively).

Conclusions: Based on the results obtained, it would be necessary to implement educational campaigns in order to increase awareness on antibiotics misuse and resistance in pediatrics.

Keywords

Health Knowledge, Attitudes, Practice; Anti-Bacterial Agents; Awareness; Pharmacies; Pharmacists; Parents; Surveys and Questionnaires; Multivariate Analysis; Lebanon

INTRODUCTION

Since their discovery decades ago, antibiotics brought lifesaving benefits and constitute today a major source of drug-related health expenditures.[1] They were behind the eradication of many serious bacterial infections, particularly in pediatrics.[2] Indeed, children are major consumers of antibiotics, with findings showing a higher intake among children aged 1 to 5 years (65%), in comparison with teenagers (38%). However, antibiotics consumption, whether in adults or children, has not been always rational or appropriate and errors could be encountered in the antibiotic indication, choice, dose or duration, administration or even adherence to therapy.[3,4]

Thus, 'antibiotics misuse', referring to the irrational use or overuse of antibiotics, might threaten any patient from all age groups and might concern any antibiotic.[5-7] It is increasingly contributing to antibiotic resistance, and is currently considered a serious public health concern globally, with a particular focus on developing countries.[8] In fact, self-medication with antibiotics, considered a major driver of antibiotics misuse, is highly prevalent in the latter countries where awareness and regulations often lack reinforcement.[9]

In Lebanon, similarly to other developing countries, although by law antibiotics are prescription drugs only, they are being dispensed by community pharmacists as over-the-counter drugs.[10,11] Patients from all ages (even children and elderly) can easily buy antibiotics (local, oral or injectable) from pharmacies without any medical prescription. Socioeconomic and cultural issues are particularly challenging in reducing antibiotics misuse in the country since half of the population has no social security coverage[10] and people frequently tend to self-medicate due to misconceptions or difficulties to afford a medical visit.[11,12] Moreover, the number of community pharmacies is continuously increasing, inversely to the price of medicines, making the situation even worse. Relevant studies estimated that around 40% of the population self-medicate with antibiotics[11-14]; they tend to acquire antibiotics for self-medication from a local community

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pharmacy or a friend or relative. They might also use an old prescription or some leftovers from a previous prescription-based dispensing.[13]

As for antibiotic misuse in pediatrics, although critical, it has been rarely tackled in epidemiological studies. It could be related to several factors, such as the medication itself (e.g. taste acceptability, dilution and conservation), or the treating pediatrician (e.g. watchful waiting approach) or even the pharmacist (e.g. referral to pediatricians). Moreover, parents or caregivers could contribute to antibiotics misuse through their poor compliance to treatment, lack of knowledge and general negative attitudes towards the disease and treatment.[15-17]

In this context, we conducted the present study to evaluate the knowledge of both community pharmacists and parents towards antibiotics use and resistance among pediatrics in Lebanon. We also aimed to identify factors associated with poor knowledge among parents and community pharmacists in order to identify gaps and priorities in public health interventions against antibiotics misuse in the country.

METHODS

Study and population

A cross-sectional study was carried out between June and August 2017 in a representative sample of Lebanese community pharmacies distributed all over the country (Beirut, Mount Lebanon, North, South and Bekaa).

First, an exhaustive list of pharmacies was provided by the Lebanese Order of Pharmacists in order to select a random sample of community pharmacies all across Lebanon (via Microsoft Excel random function). We selected the minimum required sample size to which we added a 30% expected refusal rate.

Second, we aimed to recruit one pharmacist (i.e. owner or employee) and one parent (i.e. first eligible participant) from each selected pharmacy. Thus, at each pharmacy visit, we invited the pharmacist to participate in the study and after taking his written consent, we interviewed him to fill in a pre-established questionnaire. Then we waited for the first eligible parent to enter the community pharmacy and accept to take part in the study to fill another questionnaire.

Eligible parents are mothers or fathers of at least one child aged 12 years or less, and having administered an oral antibiotic to their child at least once in the last 12 months. Excluded were those not completing the questionnaire, and parents who only had children aged more than 12 years.

Sample size calculation

We fixed our expected frequency of adequate knowledge at 50% in the absence of similar studies and chose a precision level of ±7%. The Epi-info software version 7.2 (population survey) calculated a minimum sample size of 196 for each group (pharmacists and parents) to ensure a confidence level of 95%. Thus, we selected 280 community pharmacies from the list of pharmacies to take into account a 30% refusal rate.

Compliance with Ethical Standards

The Institutional Review Board of the Lebanese University waived the need for an approval based on the facts that it was an observational study that respected participants' autonomy and confidentiality and induced minimal harm to them. A written informed consent was obtained from all parents and pharmacists prior to the beginning of the data collection.

Data collection

A face-to-face interview was conducted with the participants by two well-trained PharmD candidates, after explaining the study objectives to them. Separate questionnaires were used to evaluate knowledge in parents and pharmacists respectively; a mean duration of ten minutes was needed to fill the questionnaire.

Misuse of antibiotics

The European Centre for Disease Prevention and Control (ECDC) definition was used to evaluate antibiotics misuse. The latter englobed (1) the unnecessary prescription of antibiotics for viral infections, against which they have no effect; (2) the too frequent prescription of broad-spectrum antibiotics, in place of a better targeted antibiotic, through more precise diagnosis; and (3) the inadequate use by the patient, not respecting either dosage or duration of the treatment.[18]

Community pharmacists' questionnaire

The pharmacists' questionnaire was prepared in French and English, the two languages used in Lebanese universities during pharmacy studies. The first part of the questionnaire included sociodemographic characteristics (sex, age, educational level, years of experience, pharmacy location). The second part was comprised of 4 questions, which evaluated the pharmacist's knowledge regarding antibiotics use in pediatrics, antibiotic resistance and the factors promoting it, duration of use of antibiotics after reconstitution, preservation, the reasons that would affect the proper use of antibiotics in children (i.e., inappropriate behavior of parents, doctors, pharmacists, lack of time to update the knowledge, socioeconomic problems of the country, the level of resistance to first choice molecules, etc.). In addition, small case scenarios concerning ear infection and pharyngitis in pediatrics were set to assess their knowledge update, and the conformity to guidelines of the chosen antibiotic, dose, and duration of treatment. Guidelines used to assess conformity were those of the Infectious Disease Society of America (IDSA) (Streptococcal pharyngitis 2012 guidelines)[19] and the American Academy of Pediatrics (AAP) (Acute Otitis Media 2013 guidelines).[20]

Parents' questionnaire

The parents' questionnaire was prepared in Arabic, the native language in Lebanon. It first included a section on sociodemographic characteristics (i.e., gender, age, region, marital status, educational level, profession, family income, number of children). The second section evaluated the knowledge of parents regarding antibiotics use, spectrum of activity, side effects and risks, reconstitution and conservation, along with antibiotics misuse (i.e., definition, causes and consequences). Finally, we added some opinion

Table 1. Questions assessing pharmacists' knowledge about antibiotics use in children.

Questions	Answers	Points
In your opinion, which factor contributes the most to antibiotic resistance?	Low dose	1
	Long duration	1
For how long are antibiotics used after reconstitution?	According to antibiotics/ manufacturer	1
Should all antibiotics be placed in the refrigerator after reconstitution?	No	1
A children <2 years presenting with severe painful earache and fever> 39 ° C, does he require an antibiotic in your opinion?	Yes	1
First choice antibiotic?	Amoxicillin/ Amoxicillin-clavulanic acid	1
Dose?	80-90 mg/kg/day	1
Duration?	10 days	1
A child> 2 years presenting with earache and fever > 39°C, does he require an antibiotic in your opinion?	It depends on other factors	1
First choice antibiotic?	Amoxicillin/ Amoxicillin-clavulanic acid	1
Dose?	80-90 mg/kg/day	1
Duration?	5 to 7 days	1
A child presenting with pharyngitis (intense sudden onset) and fever> 39 ° C, does he require an antibiotic in your opinion?	It depends on other factors	1
First choice antibiotic?	Amoxicillin/ Amoxicillin-clavulanic acid	1
Dose?	50 mg/kg/day	1
Duration?	10 days	1
Maximum total score		16

questions on giving an antibiotic without a medical prescription.

We mainly used closed-ended questions in both questionnaires, particularly those related to antibiotics knowledge, and few open-ended questions (i.e. dose and duration of treatment).

Knowledge index

Several questions were used to calculate the pharmacists' knowledge index, with the correct answers identified according to the IDSA and AAP guidelines.[19,21] Answers choices were given a numerical value of 1 if correct (good knowledge) and 0 if incorrect (bad knowledge). The total pharmacists' knowledge index ranged between 0 (reflecting low knowledge) and 16 (reflecting high knowledge) (Table 1), whereas the parents' total knowledge index ranged between 0 and 18 (Table 2). Since there was no cut-off point to assess poor and good knowledge, we used the index median as a cut-off point. Scores above the median would reflect a good knowledge, while scores below the median would reflect a poor knowledge.

Statistical analysis

Data entry was performed by one lay person who was not involved in the data collection process. Descriptive statistics were calculated for all study variables. This includes means and standard deviations (or medians and interquartile ranges IQR) for continuous variables, counts and percentages for categorical variables. A bivariate analysis was done to assess factors associated with a good knowledge index using Pearson Chi-Square test or Fisher's exact test when applicable for categorical variables, and Student t-test for quantitative variables. Multivariate logistic regressions reporting adjusted Odds Ratios (ORa) were carried out using variables that showed a $p<0.2$ in the bivariate analysis[22,23]; potential confounders may be eliminated only if $p>0.2$, in order to protect against residual confounding.[24] In the logistic regression, the dichotomous knowledge index was used as the dependent variable, taking the median as the cut-off point. Moreover, Cronbach's alpha was recorded for reliability analysis for the knowledge index used in pharmacists and parents. The statistical package SPSS version 23 was used for all

Table 2. Questions assessing parents' knowledge about antibiotics use in children.

Questions	Answers	Points
In your opinion, antibiotics :		
Act on:	Bacteria	1
Treat all diseases of your children:	No	1
Could affect your children if given incorrectly:	Yes	1
Could have side effects even if administered properly:	Yes	1
Can be kept after reconstitution for:	7 to 10 days	1
Should be kept in the fridge	According to antibiotics/ manufacturer	1
In your opinion, misuse of pediatric antibiotics:		
Includes a bad:	Indication	1
	Choice	1
	Dose	1
	Duration	1
	Dilution	1
	Preservation	1
	Adherence	1
Leads to:	Side effects	1
	Treatment failure	1
	Recurrent infections	1
	Loss of immunity	1
	Bacteria resistant to antibiotics	1
Maximum total score		18

Table 3. Case scenarios

Questions \ Case		Child < 2 years old severe painful Otalgia, and Fever > 39°C	Child > 2 years old of Otalgia, and Fever > 39°	Child painful Pharyngitis (intense with a sudden onset), and Fever> 39 ° C
Require an antibiotic	Yes	117 (57.9%)	73 (36.1%)	85 (42.1%)
	No	22 (10.9%)	20 (9.9%)	25 (12.4%)
	Depends on other factors	48 (23.8%)	97 (48.0%)	78 (38.6%)
	I do not know	15 (7.4%)	12 (5.9%)	14 (6.9%)
First choice of antibiotics		N=138	N=137	N=127
	Amoxicillin	**27** (19.6%)	**14** (10.2%)	**8** (6.3%)
	Co-amoxiclav	**97** (70.3%)	**101** (73.7%)	**60** (47.2%)
	Cefdinir	3 (2.2%)	6 (4.4%)	10 (7.9%)
	Cefuroxime	-	-	6 (4.7%)
	Cefixime	1 (0.7%)	3 (2.2%)	26 (20.5%)
	Cefpodoxime	1 (0.7%)	5 (3.6%)	8 (6.3%)
	Ceftriaxone	3 (2.2%)	-	-
	Azithromycin	-	-	1 (0.8%)
	Clarithromycin	-	-	4 (3.1%)
	Any antibiotic	6 (4.3%)	8 (5.8%)	4 (3.1%)
Dose		N=118	N= 120	N=107
	In ml / per spoon	26 (22.0%)	34 (28.3%)	34 (31.8%)
	According to the instructions	10 (8.5%)	13 (10.8%)	17 (15.9%)
	According to the weight	9 (7.6%)	14 (11.7%)	18 (16.8%)
	According to age	3 (2.5%)	-	-
	According to the physician	4 (3.4%)	-	-
	In mg\kg	66 (55.9%)	59 (49.2%)	38 (35.5%)
Dose of amoxicillin		**N=124**	**N=115**	**N=68**
	50 mg/kg/d	2 (1.6%)	3 (2.6%)	4 (6%)
	80-90 mg/kg/d	57 (46%)	41 (36%)	3 (4.4%)
Duration of treatment	5-7 days	16 (12.9%)	80 (69.5%)	50 (73.5%)
	10 days	93 (75%)	19 (16.5%)	7 (10.3%)

statistical analysis. Statistical significance was set at $p<0.05$.

RESULTS

Pharmacists' results

The study population consisted of 202 community pharmacists (giving a response rate of 72.1%) among whom 51.5% females (median age 30 years; IQR 26 to 37 years). Half of them had a post-graduate degree (Pharm.D. or Master's or both), 39.6% were working in a pharmacy located in Mount Lebanon and 50% had a six-year work experience or more (IQR 2 to 11 years).

Fifty two percent of pharmacists declared that a low antibiotic dose would promote more antimicrobial resistance, while 37.1% reported the same for high doses, 37.1% for longer treatment durations and 39.6% for shorter durations (data not shown). It is important to note that 28.7% of pharmacists did not know which factors may contribute to antibiotic resistance. Moreover, 39.6% of pharmacists declared that antibiotics should be discarded 14 days after reconstitution, and 48% that not all antibiotics need to be refrigerated after reconstitution.

The majority of the pharmacists confessed that the inappropriate parental behavior (90.1%), the inappropriate behavior of physicians (72.8%), and that of pharmacists (59.4%) were the major causes of antibiotics misuse. Furthermore, pharmacists declared that the socioeconomic problems of the country (86.1%), the level of resistance to the molecule of choice (80.8%), the lack of consultation time (71.2%) and the lack of national guidelines/recommendations (66.3%) might be additional factors contributing to antibiotics resistance.

More than half of the pharmacists (57.9%) declared that a child <2 years, with severe painful otalgia, and fever >39°C requires an antibiotic. Amoxicillin/clavulanic acid was the first choice for 70.3% of pharmacists. Concerning the dose, 55.9% of the pharmacists confessed that the dose would be calculated according to the weight of the child. For amoxicillin or amoxicillin/clavulanic acid, 46% of pharmacists gave a dose of 80-90 mg/kg/day, for a duration of 10 days (75%).

In case of otalgia with a fever of > 39°C for a child aged more than 2 years, half of the pharmacists (48%) confirmed that the need for antibiotics depends on other factors. For those who gave an antibiotic, amoxicillin/clavulanic acid remained the first choice (73.7%), at a dose of 80-90 mg/kg/day (36%) and a duration of 5-7 days (69.5%).

In the case of a child with pharyngitis (intense with sudden onset) and a fever of >39°C, 42.1% of pharmacists confirmed the need to give an antibiotic; again, amoxicillin/clavulanic acid was the first choice for 47.2% of them (Table 3).

Before conducting the bivariate analysis to assess variables significantly associated with poor/good overall antibiotics knowledge among pharmacists, we calculated the reliability of the knowledge index to assess the quality of our data. High Cronbach's alpha was obtained (0.768). Based on fairly adequate internal consistency, we believe that the findings were relatively reliable.

The bivariate analysis, taking the dichotomous pharmacists knowledge index (low vs high knowledge) as the dependent variable, showed that a significantly higher percentage of males had poor knowledge compared to their female counterparts ($p<0.001$), whereas a significantly higher percentage of pharmacists in Beirut and South had poor

Table 4. Bivariate analysis of sociodemographic factors associated with the knowledge index among pharmacists.

Variables	Good knowledge (N = 95)	Poor knowledge (N = 107)	P-value
Sex			<0.001
Male	32 (32.7%)	66 (67.3%)	
Female	63 (60.6%)	41 (39.4%)	
Educational level			0.377
Bachelor degree	45 (46.9%)	51 (53.1%)	
PharmD.	33 (53.2%)	29 (46.8%)	
Master's degree	11 (34.4%)	21 (65.6%)	
PharmD. and Master	6 (50%)	6 (50%)	
District			0.006
Beirut	13 (38.2%)	21 (61.8%)	
Mount Lebanon	45 (56.2%)	35 (43.8%)	
North	7 (46.7%)	8 (53.3%)	
Bekaa	15 (68.2%)	7 (31.8%)	
South	15 (29.4%)	36 (70.6%)	
Age	33.42 ± 8.64	31.34 ± 7.53	0.076
Years of experience	6.96 ± 6.78	9.20 ± 8.03	0.034

knowledge (p=0.006). In addition, a significantly higher mean number of years of experience was found in pharmacists with poor knowledge (p=0.034). No significant difference was found for the educational level nor age (Table 4).

Table 5. Sociodemographic characteristics of the parents.

Variables	N	%	
Sex			
Mother	128	62.7	
Father	76	37.3	
Region			
Beirut	19	9.3	
Mount Lebanon	116	56.9	
Bekaa	12	5.9	
North	7	3.4	
South	50	24.5	
Nationality			
Lebanese	166	81.4	
Other	38	18.6	
Marital status			
Married	177	86.8	
Divorced	19	9.3	
Widowed	8	3.9	
Educational level			
Illiterate	12	5.9	
Primary	36	17.6	
Secondary	40	19.6	
University	80	39.2	
Higher education	19	9.3	
Technical	17	8.3	
Occupation			
Working full time	76	37.3	
Part-time contract	46	22.5	
Retired	4	2.0	
Student	11	5.4	
Housewife	52	25.5	
Physician/other health professional	6	2.9	
Unemployed	9	4.4	
Family income			
<$ 1,000	25	12.3	
$ 1000 $ -2000	36	17.6	
$ 2000 $ -4000	22	10.8	
> $ 4000	5	2.5	
No answer	116	56.9	
Medical coverage (Yes)	136	66.7	
Drugs coverage (Yes)	132	64.7	
	Median	IQR	
Age (in years)	31	27	38
Number of children per family	2	1	3

IQR: Interquartile range

Parents' results

The sociodemographic characteristics of the parents are summarized in Table 5. Two hundred and four parents were finally included (62.7% females; median age 31 years, IQR 27 to 38 years) into the study. Half of them were university graduates or postgraduates and 13% were divorced or widowed.

The results showed that 19.2% of parents still believe that antibiotics are active against viruses, whereas 42.6% thought they act against both viruses and bacteria. More than half of the parents thought antibiotics were given to treat fever (55.9%), cold (26%), sore throat (49.5%) and diarrhea (29.4%). The majority (95.1%) confessed that antibiotics should be administered following a physician's prescription, whereas 51.5% following the pharmacist's advice. Moreover, 38.2% knew that antibiotics could have the same side effects even when administered correctly, whereas more than half of them (52.5%) did not know the correct length of antibiotics storage after reconstitution. Only 21.6% knew that antibiotics should be kept in the fridge following the manufacturer recommendations.

Half of parents declared that antibiotics misuse is due to a bad indication or bad choice, whereas 40.2% and 39.7% declared that it is due to a bad dose or lack of adherence, respectively. Moreover, 58.8% said that antibiotics misuse would lead to loss of immunity, 38.7% to treatment failure and 44.6% to recurrent infections. More than half of respondents blamed parents for antibiotics misuse (56.4%), whereas 52.5% and 37.3% blamed physicians and pharmacists, respectively.

More than half of parents (58.4%) reported that it is okay to give antibiotics without a prescription if they were unable to visit a pediatrician, 23.6% if they had enough experience with children, 66.7% if they trusted their community pharmacist and 22.1% if they knew how to administer the antibiotic.

Before conducting the bivariate analysis to assess variables significantly associated with good overall antibiotics knowledge among parents, we calculated the reliability of the knowledge index to assess the quality of our data. We obtained a high Cronbach's alpha (0.788). Based on fairly adequate internal consistency, we believe that the findings were relatively reliable.

Table 6. Bivariate analysis of sociodemographic factors associated with the knowledge index among parents.

Variables	Good knowledge (N = 87)	Poor knowledge (N = 117)	P-value
Age	31.89 ± 7.13	32.78 ± 8.47	0.431
Number of children per family			0.026
≤ 2 children	63 (48.5%)	67 (51.5%)	
> 2 children	24 (32.4%)	50 (67.6%)	
Gender			0.480
Mother	57 (44.5%)	71 (55.5%)	
Father	30 (39.5%)	46 (65.5%)	
District			0.121
Beirut	9 (47.4%)	10 (52.6%)	
Mount Lebanon	56 (48.3%)	60 (51.7%)	
North	4 (57.1%)	3 (42.9%)	
Bekaa	4 (33.3%)	8 (66.7%)	
South	14 (28.0%)	36 (72%)	
Nationality			0.001
Lebanese	80 (48.2%)	86 (51.8%)	
Other	7 (18.4%)	31 (81.6%)	
Marital status			0.583
Married	73 (41.2%)	104 (58.8%)	
Divorced	10 (52.6%)	9 (47.4%)	
Widowed	4 (50.0%)	4 (50%)	
Educational level			<0.001
Illiterate	2 (16.7%)	10 (83.3%)	
Primary	5 (13.9%)	31 (86.1%)	
Secondary	14 (35.0%)	26 (65.0%)	
Technical	7 (41.2%)	10 (58.8%)	
University	46 (57.5%)	34 (42.5%)	
Master degree	13 (68.4%)	6 (31.6%)	
Occupation			0.231
Full-time work	37 (48.7%)	39 (51.3%)	
Part-time work	17 (37%)	29 (63%)	
Retired	1 (25%)	3 (75.0%)	
Student	6 (54.5%)	5 (45.5%)	
Housewife	21 (40.4%)	31 (59.6%)	
Physician/health professional	4 (66.7%)	2 (33.3%)	
Unemployed	1 (11.1%)	8 (88.9%)	
Monthly family income			0.424
<1000 $	9 (36.0%)	16 (64.0%)	
1000 $ -2000 $	16 (44.4%)	20 (55.6%)	
2000 $ -4000 $	13 (59.1%)	9 (40.9%)	
> 4000 $	3 (60%)	2 (40.0%)	
No answer	46 (39.7%)	70 (60.3%)	
Medical coverage			0.001
Yes	68 (51.5%)	64 (48.5%)	
No	19 (26.4%)	53 (73.6%)	

The bivariate analysis, taking the dichotomous parental knowledge index (low vs high knowledge) as the dependent variable, showed that a significantly higher percentage of parents with more than 2 children had poor knowledge compared to parents who had 2 children or less (p=0.026), whereas a significantly higher percentage of parents with poor knowledge was seen among illiterate or those with a primary level of education (p<0.001). No significant association was found between knowledge and age, gender, district, marital status, occupation, or monthly family income (Table 6).

The results of a first logistic regression, taking the dichotomous pharmacists' knowledge index as the dependent variable, showed that female pharmacists had a significantly higher knowledge index compared to their male counterparts (ORa=2.51), whereas those working in Mount Lebanon and Bekaa had a significantly higher knowledge index than those working in other regions (ORa=2.5 and ORa=3.77, respectively). The results of a second logistic regression, taking the dichotomous parents' knowledge index as the dependent variable, showed that parents with a university level of education or a master's degree had a significantly better knowledge compared to illiterate ones (ORa=9.04 and ORa=16.46, respectively) (Table 7).

DISCUSSION

To our knowledge, this is the first study in Lebanon to evaluate the knowledge of both community pharmacists and parents towards antibiotics use and resistance in pediatrics. It sheds light on important issues that should be addressed in order to enhance antibiotics appropriate use in children.

Pharmacists' results

The results showed that according to 52% of pharmacists, low doses play a major role in antibiotic resistance while little importance was given to the duration of treatment (37.1% longer and 39.6% shorter durations). What is true for the dose is wrong for the duration of treatment since

Table 7. Multivariable analyses of factors related to a good knowledge index.

Logistic regression 1 taking the dichotomous poor/good knowledge index among pharmacists.			
Covariates	**ORa**	**95% CI**	**p-value**
Age	1.04	0.94-1.14	0.487
Years of experience	0.94	0.84-1.05	0.260
Gender			
Males	1	-	-
Females	2.51	1.32-4.76	0.005
Region			
Beirut	1	-	-
Mount Lebanon	2.50	1.03-6.09	0.043
North Lebanon	1.59	0.44-5.70	0.479
Bekaa	3.77	1.15-12.32	0.028
South Lebanon	1.06	0.39-2.89	0.907
Logistic regression 2 taking the dichotomous poor/good knowledge index among parents.			
Covariates	**ORa**	**95% CI**	**p-value**
Educational Level			
Illiteracy	1	-	-
Primary	1.12	0.17-7.55	0.906
Secondary	3.95	0.44-35.36	0.219
Technical college	4.41	0.42-46.60	0.218
University	9.04	1.00-81.62	0.050
Master degree	16.46	1.57-172.41	0.019
Nationality			
Syrian	1	-	-
Lebanese	0.54	0.11-2.79	0.466
Region			
Beirut	1	-	-
Mount Lebanon	1.10	0.38-3.15	0.867
Bekaa	0.33	0.06-1.69	0.182
South Lebanon	0.59	0.18-1.96	0.384
North Lebanon	0.69	0.11-4.22	0.685
Number of children			
≤ 2	1	-	-
> 2	0.63	0.31-1.26	0.186
Medical coverage			
No	1	-	-
Yes	1.61	0.69-3.76	0.272

lower doses allow low-resistant bacteria to multiply and increase their chances of being resistant, while a long treatment duration (10 days or more) has a more negative effect by exposing bacteria to antibiotics for longer periods, thus promoting the survival of more resistant bacteria.[19]

Concerning antibiotics misuse, pharmacists mainly blamed parents for self-medicating their children with antibiotics to treat "all problems", a result similarly found in a Saudi Arabian study.[20] At a second level, both pharmacists and parents blamed physicians to misuse antibiotics in pediatrics. Furthermore, the majority of pharmacists believed that socioeconomic issues contribute to antibiotic resistance, in agreement with a previous study.[11]

For the otitis case scenario, our findings showed that the majority of pharmacists followed the AAP 2013 guidelines, with amoxicillin/clavulanic acid remaining the first choice of prescription for the majority of pharmacists for a period of 10 days for children <2 years old and 5 to 7 days for those >2 years old, in line with a previous study.[14] However, only half of pharmacists knew and followed the right dose. For the pharyngitis case scenario, a very small percentage of pharmacists followed the 2013 IDSA guidelines. It is plausible that they follow other guidelines or lack knowledge on recent guidelines.

Our findings revealed that female pharmacists had an increased knowledge concerning antibiotics use in children compared to males, in contrast to another study[25] that showed no gender differences. Unfortunately, we did not inquire pharmacists about their parental status which might be of interest to explain the results. In fact, a higher percentage of mothers among female pharmacists would lead to a better knowledge and expertise in pediatrics.

A significant negative association was also noted between years of experience and good knowledge towards antibiotics use; poor knowledge was found in pharmacists with a higher number of years of experience. Similar results were found in a Saudi Arabian study, showing that pharmacists with a job experience ranging between three to four years had better knowledge towards the appropriate use of drugs compared to those with a nine to ten-year experience.[26] Thus, continuous education and regular interventions are required to update and improve pharmacists' knowledge towards antibiotics use in pediatrics.

Parents' results

Parents are still confused about antibiotics spectrum of activity and only 42% knew that they were used for bacterial infection. This finding is in agreement with the result of another survey conducted in India where more than 45.9% of parents believed that antibiotics can be used to treat both bacterial and viral infections.[15] This may be attributed to the fact that while counseling, physicians

usually use the term 'germs' with antibiotics, rather than specifying bacteria.[27] Also, as mentioned by Rousounidis *et al*.[28], people do not understand the difference between bacteria and viruses and hence, believe that antibiotics are effective against both. Moreover, recent findings showed that pharmacists don't have enough time to counsel patients because of the decreased number of staff and the financial situation of community pharmacists in Lebanon.[29]

A high percentage of parents (55.9%) still believe that the presence of fever requires the administration of an antibiotic, a result consistent with another study.[21]

Only 21.6% of parents were aware that not all antibiotics need fridge after dissolution. The storage conditions are considered important manufacturing instructions and should be strictly followed; while some antibiotic suspensions require refrigeration, some others do not.[30]

Moreover, this study showed that half of parents did not know the consequences of antibiotics misuse (adverse effects, recurrent infection and the emergence of resistant bacteria, etc.). Parents' poor knowledge about the harm of non-selective use of antibiotics is another finding that urges the need to further educate parents about misuse repercussions.

In addition, 52.5% of parents blamed physicians for the misuse; the latter questioning the physician-parent relationship. An ineffective physician-parent communication is found to be incriminated in the unnecessary prescription of antibiotics. In fact, several studies reported short interaction time between pediatricians and parents due to work overload or lack of a regulated procedure to assist patients in understanding the disease and treatment.[31] Thus, it is important to prolong the interaction time and train both parents and pediatricians to adequately communicate in order to improve the child's health.

Another problematic finding is that 58.4% of parents declared that it was okay to give their child antibiotics without a physician's advice or based on a pharmacist's recommendation. This finding raises the issue of over-the-counter sale of antibiotics for children in Lebanon. Strong and urgent policies are needed to reduce this practice. It is better to make these changes in collaboration with pharmacies owners to ensure their commitment. Moreover, 66.7% of parents trusted the pharmacist in the antibiotic prescription, in agreement with another recent survey conducted in Saudi Arabia.[32] The latter result can be used for the delivery of future health education. In addition, the community pharmacy framework can also be a great way to provide good education on antibiotics. The Order of Pharmacists, the Ministry of Public Health and community pharmacists can collaboratively play a crucial role in enhancing public awareness about antibiotics use, misuse and antibiotic resistance.

Finally, a significant association was noted between the educational level and knowledge towards antibiotics use, in line with previous studies where people of lower educational levels were found to lack more knowledge regarding antibiotics use and resistance.[15,33]

Limitations

This study has several limitations. First, pharmacists included in the study were relatively younger than the target population which might overestimate their knowledge level regarding antibiotics use in pediatrics. Second, we included parents of other nationalities which might introduce a selection bias into the study. However, considering the study period, modalities and allowances, and considering the high ratio of refugees to Lebanese in 2017, we were not able to exclude them from the study and we decided to adjust our results in the multivariable analyses according to the participant's nationality. Third, an acquiescence bias might exist in the parents' questionnaire where participants tend to agree or give positive answers on all statements. Finally, knowledge indexes were just conceived to conduct logistic regressions on factors associated with good overall knowledge about antibiotics use in pediatrics. They need to be carefully considered while interpreting results since many knowledge items were not taken into consideration and case scenarios' conformity were based on American guidelines in the absence of national recommendations.

CONCLUSIONS

In a country where self-medication abundantly exists, it was necessary to conduct the present study to assess parents and pharmacists' knowledge towards antibiotics use and resistance in a vulnerable field, i.e. pediatrics. Results revealed gaps in knowledge among community pharmacists and parents on antibiotics misuse and resistance. A high percentage of parents still believe antibiotics work on viruses and find giving antibiotics to their child acceptable without a medical prescription. Higher educational levels among parents and lower years of experience among pharmacists were associated with a better overall knowledge in our study. Practice and patient simulated surveys should be conducted in community pharmacies to assess rates of antibiotics self-medication and misuse in pediatrics. Continuous education and awareness campaigns should mainly target older pharmacists and parents of low educational levels.

CONFLICT OF INTEREST

The authors have nothing to disclose.

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