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CLINICAL & BASIC RESEARCH

Knowledge of Antibiotics Use among Lebanese Adults

A study on the influence of sociodemographic characteristics

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abstract: ***Objectives:*** This study aimed to evaluate the association between sociodemographic characteristics and antibiotic knowledge in the Lebanese population. ***Methods:*** A questionnaire-based survey was conducted in community pharmacies across all Lebanese governorates. Data were collected by well-trained pharmacists through face-to-face interviews from January until March 2017. The survey tool was adapted from a questionnaire developed by the World Health Organization. A knowledge index was computed for comparative purposes and a linear regression model was performed to assess factors associated with knowledge. ***Results:*** A total of 623 participants were included in the analysis of this study (response rate: 90.6%). The mean antibiotic knowledge index was 12.5 ± 3.2 (minimum score: 3 and maximum score: 19). Higher knowledge score was inversely correlated with age (r = –0.118; P = 0.003), but no gender differences were reported (females: 12.6 versus males: 12.3; P = 0.191). However, statistically significant differences were found for residence type (P = 0.002), educational level (P <0.001) and total household income categories (P <0.001). The linear regression model showed a significant association between residence type and knowledge (urban versus rural: β = 0.793; P = 0.011). Furthermore, a higher knowledge index was significantly associated with a higher income combined with higher education (additive scale/β = 1.590; P = 0.025). Finally, interactions between income and age, gender and residence type were not significant. ***Conclusion:*** Individuals residing in urban areas, with combined high income and educational levels, are more knowledgeable about antibiotics use and resistance compared to other groups. More studies are needed to assess the interaction of sociodemographic interactions with health literacy.

Keywords: Knowledge; Socioeconomic Factors; Attitude to Health; Educational Achievements; Lebanon.

Advances in Knowledge

- *Despite several information campaigns in Lebanon targeting the appropriate use of antibiotics, knowledge about the correct use of antibiotics is still mediocre, resulting in reflected high levels of bacterial resistance and treatment failures.*
- *Particularly vulnerable groups are mainly rural populations and those with low education and income levels. On its own, better education was not significantly associated with antibiotic awareness, but when coupled with a higher household income, there was a significant association.*

Application to Patient Care

- *Awareness campaigns on antibiotics misuse and the risk of bacterial resistance should target specific groups in the country, using appropriate tools.*

Bacterial resistance to antibiotics is a pressing public health problem that continues to spread globally at an alarming rate, resulting in antibiotic-resistant infections that cause high morbidity and mortality.[1,2] It is associated with social and economic consequences and increased healthcare expenditure.[1–5] Several factors are involved in the emergence of antibiotic resistance such as inadequate patients' expectations, lack of education among patients and healthcare providers, pharmaceutical marketing, dispensing of antibiotics without prescription in pharmacies, improper dosage, overuse of broad-spectrum antibiotics, non-completion of the antibiotic course, prescribing antibiotics for viral infections and the high prevalence of self-medication.[4–8]

Although antibiotics are prescription-only medicines, it is essential to empower the general population with adequate knowledge regarding the antibiotics spectrum of action, indication, administration and malpractice that may induce resistance to these medications.[9] Indeed, individuals tend to self-administer antibiotic 'leftovers', share antibiotics or even purchase them abroad or online.[9] A systematic review found that the mean compliance to the antibiotic regimen was 62.2% and 28.6% reporting that they use leftover antibiotics.[10] Moreover, a study revealed that whenever patients or their caregivers expected an antibiotic prescription, the likelihood that a physician will prescribe one was higher.[11]

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Reducing antibiotic misuse and overuse prevents further increases in antibiotic resistance.[12,13] It is essential to have a solid understanding of knowledge, attitudes and practices towards antibiotics among populations by age, gender, education, economic status and type of residence, to improve the rational use of antibiotics and reduce the resistance to antibiotics. A large Swedish study on knowledge of and attitudes towards antibiotics showed that the male gender, a higher level of education and younger age were associated with more knowledge about antibiotics, with males exhibiting less restrictive behaviour towards antibiotic use and effects; respondents with high levels of knowledge were more likely to have appropriate restrictive attitudes.[14] Moreover, several regional studies found high rates of antibiotic misuse, with a lack of knowledge related to sociodemographic factors in particular.[15–17] In Syria, lack of knowledge was associated with socioeconomic disparities, with only 10% of participants knowing that antibiotic misuse leads to antibiotic resistance and 15% knowing that it is harmful.[16] A Jordanian study reported that 39.5% of self-medication with antibiotics was significantly correlated with social and economic factors, i.e. age, income and education.[4] Improved awareness of antibiotics among the general population can help individuals reach appropriate use, improved adherence to treatment and outcomes and consequently less resistance.

People's attitudes, beliefs and visions concerning antibiotics can affect their practices. Public knowledge is considered a requirement for adequate use of antibiotics.[18] The over-prescription of antibiotics is associated with higher odds of side effects and higher medicalisation of self-limiting situations, leading to more frequent re-attendance to hospitals. A common problem in primary care resides in the fact that viruses are responsible for the majority of infections. General practitioners prescribe approximately 90% of all antibiotic prescriptions, with respiratory tract infections being the leading cause of those prescriptions.[19] Interventions should include several measures such as enforcing laws that forbid the sale of antibiotics without a valid prescription (over-the-counter), applying antimicrobial stewardship programmes, involving clinicians in audits, using valid rapid point-of-care tests, promoting policies that delay the prescription of antibiotics, improving the healthcare professional-patient communication through information brochures and performing more realistic studies in primary care that may be of importance to clinicians.[3,13]

In Lebanon, few studies have addressed the influence of sociodemographic factors on the knowledge and attitudes of the general population towards antibiotic use and resistance. A cross-sectional study on a random convenience sample of 500 participants in Lebanon showed that knowledge and attitudes of participants were significantly associated with income, educational level and place of residence.[20] Another study conducted among the general population in community pharmacies revealed that women had better knowledge of antibiotic use and that a sufficient level of knowledge was higher among participants aged 25–50 years compared to older adults.[21] Moreover, in a research conducted in two major cities of Lebanon (Beirut and Tripoli), education was the only factor to show a significant association with self-medication.[22] As per the recommendations of the World Health Organization (WHO) and the 2018 Guidelines of the Lebanese Society of Infectious Diseases and Clinical Microbiology, improved knowledge and adequate antibiotic use among people would help decrease the emergence of antimicrobial resistance and curtail other adverse outcomes.[23,24] Hence, the present study aimed to assess the influence of socioeconomic and demographic factors on public awareness of antibiotic use and resistance in Lebanon.

Methods

This cross-sectional study was carried out via a face-to-face questionnaire distributed to participants in community pharmacies across all the Lebanese governorates over a period of three months from January to March 2017. Lebanese people aged 18 years and above, visiting community pharmacies and those who consented to participate in the study in the presence of the interviewer were included. The Lebanese Order of Pharmacists (OPL) provided the list of pharmacies from which a random sample of 500 pharmacies, out of a total of 3,500, was selected (using Microsoft Excel's random function) to ensure geographic representativeness. The first two eligible people were then systematically recruited from each pharmacy.

The G*Power software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) calculated a minimum sample of 351 participants for a 0.05 increase in R^2, 80% study power, 95% confidence interval (CI) and 13 predictors. The sample size was doubled for possible stratified analysis (multivariable analysis on subgroups) and the number of 700 participants was set as a reasonable number to cover all studied sociodemographic factors and interactions between income and other variables (total of 13 predictors). Thus, 500 community pharmacies were selected and visited to recruit two participants from each and allow for potential refusal and missing values within the questionnaire.

Data were collected by five well-trained OPL registered pharmacists (one pharmacist for each Lebanese governorate) through face-to-face interviews. The survey tool was adapted from the 'Antibiotic Resistance Multi-country Public Awareness Survey' conducted by the WHO in 2015 and developed by a specialised research agency, Good Business, in collaboration with the WHO.[25] It was then translated into Arabic and back-translated into English by two different native speakers. The questionnaire targeted public knowledge on antibiotic use and resistance with questions related to demographic and socioeconomic factors.[25]

Questions related to knowledge were used to compute a knowledge index as follows: correct answers were coded as 1 and incorrect and 'don't know' answers were coded as 0. Overall, 20 knowledge questions/statements were selected for this purpose from a previous study.[22] The Kuder Richardson 20 (KR20), a specific Cronbach's alpha for dichotomous tools, was used to measure how closely related a set of items are as a group; the reliability of the index was considered acceptable (0.65).

A bivariate analysis was first conducted between the knowledge index (dependent variable) and sociodemographic variables (age, gender, residence type, total household income and education level). Residence type was categorised into rural, suburban and urban areas, income into low (≤1.500.000 Lebanese pound [LBP]) and high (>1.500.000 LBP) and education into low (12th grade or less), medium (high school graduate/some college credit/technical/vocational training or associate degree) and high levels (bachelor's degree/master's/professional degree/doctorate). One-way analysis of variance with further Bonferroni *post hoc* analyses was used to test statistical differences between multiple groups and an independent t-test was used to compare two groups. Pearson correlation coefficients were reported for the relationship between age and knowledge index, after checking for statistical assumptions (level of measurement, outliers, normality, linearity and homoscedasticity).[26] Means and 95% CI were reported.

The same analysis was repeated after stratification over income categories to detect its modifying effects; it tested the effect of income combined with age, gender, residence type and education level on antibiotic knowledge, based on previous studies conducted in Lebanon, showing the independent effects of sociodemographic factors.[22,27,28]

Finally, for multivariable analysis, a multiple linear regression was performed to assess factors related to the knowledge index while testing for interactions between income and other socioeconomic factors. Unstandardised predicted values were plotted against significant interaction terms to further illustrate results. A *P* value <0.05 was considered statistically significant for all tests. All statistics were performed using the Statistical Package for the Social Sciences (SPSS), Version 20.0 (IBM Corp., Armonk, New York, USA).

The ethics committee of the Psychiatric Hospital of the Cross approved the study protocol (approval code: HPC-007-2020). Participants gave their oral consent to take part in the study after the study's objectives were explained.

Results

Out of 1,000 targeted participants, 906 agreed to participate (response rate: 90.6%); however, 623 were included in the analysis after excluding participants whose data were incomplete for the variables of the knowledge index. Thus, an antibiotic knowledge index

Table 1: Characteristics of study participants compared to antibiotic knowledge index (N = 623)

Characteristic	N*	Mean knowledge index (95% CI)	*P* value
Age	616	r = −0.118	0.003
Gender			
Female	319	12.6 (12.2–13.0)	0.191
Male	301	12.3 (11.9–12.7)	
Residence type			
Urban	333	12.8 (12.5–13.1)	0.002
Suburban	138	12.5 (11.9–13.1)	
Rural	148	11.7 (11.2–12.2)	
Education level			
Low	154	11.2 (10.7–11.7)	<0.001
Medium	185	11.9 (11.5–12.3)	
High	280	13.5 (13.2–13.8)	
Total household income in LBP			
≤1.500.000 (Low)	252	11.8 (11.4–12.2)	<0.001
>1.500.000 (High)	339	13.0 (12.7–13.3)	

CI = confidence interval; LBP = Lebanese pound.
**Total number without missing data.*

Table 2: Stratification by total household income categories and mean knowledge index (N = 623)

Characteristic	Low income			High income		
	N*	Mean knowledge index (95% CI)	*P* value	N*	Mean knowledge index (95% CI)	*P* value
Age	252	r = 0.003	0.959	339	r = −0.198	<0.001
Gender						
Female	142	11.9 (11.4–12.4)	0.651	160	13.4 (12.9–13.9)	0.010
Male	109	11.7 (11.1–12.3)		179	12.6 (12.1–13.1)	
Residence type						
Urban	109	12.1 (11.5–12.7)	0.026	199	13.2 (12.8–13.6)	0.371
Suburban	50	12.4 (11.4–13.4)		85	12.7 (11.9–13.5)	
Rural	92	11.1 (10.4–11.8)		54	12.7 (11.9–13.5)	
Education level						
Low	100	11.3 (10.7–11.9)	0.110	42	11.2 (10.2–12.2)	<0.001
Medium	89	12.0 (11.4–12.6)		90	11.8 (11.2–12.4)	
High	63	12.3 (11.5–13.1)		206	13.8 (13.4–14.2)	

**Total number without missing data.*

was computed for 623 participants, with a minimum score of 3 and a maximum score of 19 (mean score: 12.5 ± 3.2). A negative correlation was found between the knowledge index and age (r = −0.118; *P* = 0.003), but no gender differences were reported (females: 12.6 versus males: 12.3; *P* = 0.191). However, differences were statistically significant for residence type (*P* = 0.002), education level (*P* <0.001) and total household income categories (*P* <0.001). Indeed, residents in urban areas had a higher mean score compared to those in rural areas (12.8 versus 11.7; *P* = 0.002 after Bonferroni adjustment) and higher education and income levels were significantly associated with a higher knowledge index (*P* <0.001 each after Bonferroni adjustment) [Table 1].

A stratification over the total household income categories (low and high) showed a statistically significant difference in knowledge in the low-income category between residence types (rural: 11.1 versus suburban: 12.4; *P* = 0.026). In the high-income category, significant knowledge difference existed for gender (males: 12.6 versus females: 13.4; *P* = 0.010), age (r = −0.198) and education levels (high: 13.8 versus medium: 11.8 or low: 11.2; *P* <0.001 after Bonferroni adjustment) [Table 2].

A linear regression model demonstrated a significant association between residence type and knowledge index (urban versus rural: β = 0.793; *P* = 0.011). Regarding the studied interactions, a significantly higher knowledge index was found among individuals with combined higher income and higher education versus other categories (additive scale/β = 1.590; *P* = 0.025). Finally, interactions between income and age, gender and residence type were not significant and thus removed from the model for better goodness of fit. In contrast, the interaction term between higher education and income had the highest standardised β, showing the highest effect on knowledge compared with other factors [Table 3].

Unstandardised predicted values of the knowledge index plotted against education levels for income categories illustrate the interaction between income and education [Figure 1].

Discussion

To the best of the authors' knowledge, this is the first population-based survey conducted in Lebanon to evaluate the association between sociodemographic characteristics and antibiotic awareness with a particular focus on potential interactions between socioeconomic factors. This study carried out in community pharmacies distributed over rural, urban and suburban areas of Lebanon collected data on

Table 3: Factors associated with the antibiotic knowledge index (N = 586)*

Model†	Unstandardised β (95% CI)	Standardised β	P value
Intercept	11.464 (9.708 to 13.221)	-	0.000
Age	−0.005 (−0.023 to 0.013)	−0.023	0.578
Male versus female	−0.457 (−0.953 to 0.040)	−0.072	0.071
Urban residence versus rural	0.793 (0.182 to 1.404)	0.125	0.011
Suburban residence versus rural	0.584 (−0.137 to 1.305)	0.077	0.112
Medium education versus low	0.545 (−1.537 to 2.627)	0.079	0.607
High education versus low	−0.686 (−2.858 to 1.485)	−0.107	0.535
High income versus low	−0.174 (−1.278 to 0.929)	−0.027	0.756
High income + medium education	0.015 (−1.400 to 1.430)	0.004	0.983
High income + high education	1.590 (0.202 to 2.978)	0.463	0.025

*The following interactions were not significant and therefore excluded from the table: income*residence type, income*age, income*gender.*

**When performing a multiple regression participants with missing data were removed from the model. †Linear regression model: F (9.576) = 9.155; P <0.001 and R2 = 12.5%.*

sociodemographic characteristics and antibiotic knowledge via interviews with eligible participants. Moreover, the use of a culturally adapted tool makes it more applicable in the Lebanese population and its results closer to reality.[29] Additionally, the KR20 (a version of Cronbach alpha for dichotomous questions) of the knowledge index was 0.65, which can be considered acceptable and shows the internal consistency of the tool in the population.[30]

This study's results showed statistically significant differences in the knowledge index for residence type, education level and total household income categories (low and high). Residents of urban areas had higher knowledge compared to those of rural areas and higher education and income levels were significantly associated with a higher knowledge index. These findings are in agreement with those found in the literature, showing that antibiotic use in human medicine does not only vary according to patient characteristics but also according to geographical location, reimbursement systems, medical education and cultural considerations.[18,31] Overall, participants residing in urban areas had significantly better knowledge and awareness towards antibiotic resistance and antibiotic consumption, which supports this study's hypothesis that socio-demographic factors can be related to antibiotic resistance knowledge and awareness.[25] The results also revealed no gender difference in the level of antibiotic knowledge, probably because both males and females are affected by similar factors related to the environment, culture and economy, as studies from the United Arab Emirates and Egypt have shown.[15,32] Findings from the UK, Kuwait and Lithuania revealed that females have a higher tendency to consume antibiotics than their male counterparts.[17,33,34]

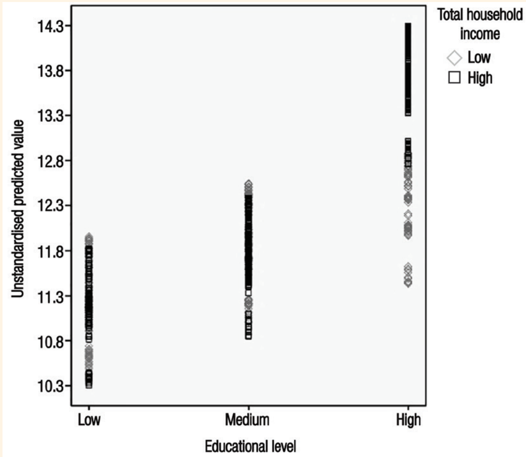

Figure 1: Values of the antibiotic knowledge index predicted from the regression model according to educational level and income category.

Regarding the effect of the educational level on antibiotic utilisation, no such comparable data have been reported to date. A study has shown that people with low education may receive inadequate medical care compared to highly educated people who may be more informed about health care.[35] Hence, educated people are more knowledgeable and careful about appropriate antibiotic use and the impact of antibiotic resistance and, consequently, may utilise antibiotics less.[35]

Differences related to the income were noted in the current study as well; participants with low incomes were more likely to have a lower knowledge index than those with higher incomes. The incidence of infectious diseases tends to be higher and their outcomes worse, in groups with a lower socioeconomic status, a finding similar to that of other studies.[34,36]

Generally, respondents with lower levels of education and in lower-income countries are more likely to have misconceptions about antibiotic use and believe that there is little that they can do to stop antibiotic resistance. The WHO 2015 survey showed that 63% of respondents with no education agree with this statement compared to those with basic (58%), further (58%) and higher education (56%).[25] In this study, those with a low-education level had a knowledge index lower than those of the medium and high education levels, respectively.

Moreover, the impact of occupation, age groups and socioeconomic status (excluding gender) on behaviours of antibiotics use was in agreement with previous findings.[37] The income level is of great importance as antimicrobials are common goods.[38] Therefore, people residing in high-income countries have more access to medical care and thus purchase and utilise more outpatient antibiotics compared to those living in low-income countries.[38] Recent data revealed an association between the income level and inequalities in the use of health-care services, which were less applicable and consistent with primary care.[39] Surveyed individuals from varied economic statuses favoured methods other than asking for a physician's advice since they believed that common diseases are not worth consulting a physician about and that pharmacists remained their first choice since they would save them the expenses of the physician's consultation.

Policymakers have to take into account all the factors described; fighting antimicrobial resistance should be part of a health-system strategy that considers patients' education and economic aspects. Consequently, it is essential to initiate multiple plans to increase public knowledge of antibiotics while focusing on lower socioeconomic areas through public-awareness campaigns, continuing education for pharmacists and implementing restrictions on haphazard antibiotic use and distribution.

The results of this study should be interpreted in light of certain limitations in the design and data collection methods. Participants were selected from community pharmacies, half of which were in urban areas, which may have resulted in selection bias by representing people of slightly higher socioeconomic levels and higher levels of education. Although the sample was random, the self-selection resulting from voluntary participation may lead to the risk of selection bias; however, since the objective was not to calculate a prevalence but to evaluate associations and interactions, the effect of this bias is cautiously expected to be lower and a possible effect could be an overestimation of associations.[40,41] Furthermore, this study used a face-to-face questionnaire, which has its inherent limitations, despite the confidentiality and anonymity of the reporting (Hawthorne effect); participants may either over-report socially desirable behaviours or hide undesirable attitudes. Despite these limitations, the current study provides essential information for assessing the knowledge and attitude towards antibiotics use and resistance. It showed gaps in terms of the knowledge of antibiotics and identified specific groups to target to improve this knowledge. Further national studies with larger representative samples are necessary to confirm these findings.

Conclusion

This study revealed that individuals residing in urban areas, those with combined high income and high educational levels, are more knowledgeable about antibiotics use and resistance compared to other groups. More studies are needed to assess sociodemographic interactions on health literacy.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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AUTHORS' CONTRIBUTIONS

PS and NL were involved in planning the design and supervising the work. A-MH drafted the manuscript. RA and NL performed the analysis and interpretation of the results. RS, JS, MA, IF, RZ and SH aided in interpreting the results and worked on writing the manuscript. HS reviewed the manuscript. All authors discussed the results, commented on the manuscript and approved the final version of the manuscript.

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