Original Research Article

Self-medication with oral antibiotics among University students in United Arab Emirates

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Abstract

Purpose: To investigate the prevalence of antibiotic use without prescriptions and to identify factors associated with this behavior among university students using oral non-prescription drugs (ONPD).
Methods: A cross-sectional study was conducted among the students of major universities in UAE. A multistage sampling technique was used in the present study.
Results: Out of 2875 students, only 2355 (81.9 %) questionnaire were fully answered and included. Of 2355, more than half (1348; 57.2 %) of the participants reported using ONPD. More than one-third (484, 35.9 %) of 1348 participants used antibiotics without a prescription during the 90 days prior to the present study. Binary logistic regression identified nine statistically significant variables: nationality (OR = 0.471, 95 % CI: 0.326 - 0.681, p < 0.001); cost-influence behavior (OR = 1.716, 95 % CI: 1.175 - 2.508, p < 0.005); belief in ONPD effectiveness (OR = 0.332, 95 % CI: 0 .135 - 0.815, p < 0.05); year of study (OR = 0.310, 95 %, CI: 0.141 - 0.681, p < 0.004); medication knowledge (OR = 0.619, 95 % CI: 0.443 - 0.866, p < 0.005); self-care orientation (OR=1.878, 95 % CI: 1.304 - 2.706, p < 0.001); using ONPD helps to save money (OR=1.665, 95 % CI: 1.047-2.649, p<0.04); and urgency of use (OR = 1.644, 95 %, CI: 1.144 - 2.363, p < 0.007); as well as being healthcare students (OR = 1.465, 95 %, CI: 1.012 - 2.120, p < 0.05).
Conclusion: There is a need for educational intervention to improve students' knowledge, attitude, and awareness regarding the risk of using antibiotics without prescriptions.

Keywords: Antibiotics, Prescriptions, Self-medication, University students, Awareness

INTRODUCTION

Bacteria have specific genetic characteristics, which enable the microorganisms to develop resistance to antibiotics. Irrational and overuse of antibiotics can increase the speed of this process [1]. Consequently, lack of awareness of rational antibiotic use and self-medication with these medications has been identified as a major factor for the development of antibiotic resistance [2]. Nevertheless, antibiotic use is highly prevalent, with statistics [3] estimating a 66 % global rate of

antibiotic use. Purchase of antibiotics without a prescription is estimated to account for 50 % worldwide [4]. This implies that users are self-medicating and are likely to misuse these products. Such irresponsible use of non-prescribed antibiotics is a major global public health problem [5]. Self-medication has been identified as a key cause for increased antimicrobial resistance [2] and this trend constitutes a global public health concern. This again is of particular interest in developing countries [3,6] as it contributes to the spread of antimicrobial resistance, cross-resistance and treatment failure on a global level [7]. Self-medication of antibiotics has been reported to be high among university students, with the highest (77 and 80 %) prevalence reported among Pakistani students and Sudanese general public respectively [8-9]. On the other hand, lower (about 40%) prevalence rates were reported for students in Palestine, Iran and UAE [10-12]. Antibiotics are sold with and without a prescription in the UAE [13,14]. It has been argued that the prevalence rates of antibiotic use without prescriptions in UAE are considered high and are due to the lack of enforcement of laws and regulations, which would otherwise prohibit this practice [12]. Therefore, the aim of this study is to measure the present prevalence of using antibiotic without prescription and identify the risk factors associated with this behaviour among university students in UAE.

METHODS

Study design

A cross sectional study was conducted among the students of major universities in UAE. A multistage sampling technique was used in the present study. In step 1, three out of five UAE universities that offer medical and non-medical programs were randomly selected. In step 2, three medical and non-medical colleges from each university were selected by stratifying on medical and non-medical colleges and then a simple random sampling technique was used to select three colleges including one medical and two non-medical colleges within each university. In step 3, random sample from each year of program were selected using simple random table.

Study population

Specified precision method was used to determine the sample size as described previously [15] where the desired level of confidence was set at 95% and the desired level of precision was set at 0.03 on either side, such

that the estimated proportion of inappropriate use was within 3%. In the present study, the questionnaire was distributed to 3346 students and identified 2875 eligible students, giving a response rate of 85.9%. A total of 471 students were excluded, as they have had no prior experience ever with the use of ONPD. Furthermore, 356 students were unwilling to participate in the study and only 2,519 students were identified as both ONPD user and non-user in the past 90 days before the study. Of 2,519 participants, 164 questionnaires were excluded due to incomplete status or the fact that most outcomes variables were not answered. Of 2,355 completed surveys, 1,007 respondents reported that that they have not used ONPD during the past 90 days before conducting the study. The remaining 1,348 ONPD users in the past 90 days were collected and analyzed throughout the study period.

Questionnaire development

A self-administered questionnaire was used in this study. The questionnaire was constructed and developed based on Andersen behavioral model that guided the present study [16]. The questionnaire comprised three types of questions that were divided into three categories: predisposing factors, enabling factors and need factors, accordingly, the survey ended up with more than 25 explanatory variables. Independent variables were grouped into predisposing factors (three demographic characteristics, one social structural characteristic and fifteen health belief characteristics), enabling factors (colleges, year of study, medication knowledge, source(s) of ONPD–information [17], income and employment) and need factors (self-care orientation and perceived-health).The survey was completed in a paper-and-pencil survey instead of an online form. The researcher provided a personal introduction and briefing of the study, informing the students of the nature of the study, the purpose of the study, and the expected time to complete the questionnaire. Appropriate drug use was assessed based on five assessment criterion namely self-diagnosis, self-selection of ONPD, dose, frequency of use and food-drug administration [15]. For the purpose of this study, participants were asked whether they used oral antibiotics without prescription in the past 90 days before conducting the study.

Data analysis

The data were analyzed using Statistical Package for the Social Sciences (SPSS, version

20, Chicago, IL, USA). Descriptive statistics was used to describe the study variables using frequencies and percentages. Binary Logistic Regression (BLR) was conducted to identify the risk factors of using antibiotics without prescription using enter method.

Ethics

The present study was conducted after the approval of the Institutional Ethics Committees (approval no. DFCM/08/01/14/739, University of Sharjah) in UAE and Gloucestershire University, UK, approval no. REC.4113).

RESULTS

A total of 2875 students were approached from different universities in UAE for the survey of utilization of non-prescription drugs. Only 2355 questionnaire were fully answered, returned and included in the present study. Among these, majority were females (1797; 76.3 %), single (2151; 91.3 %), and not employed during the study period (2190; 93%). Majority of the responders (2158; 91.6 %) were in the age group of 18-23 years as shown in Table 1. More than half of them (1348; 57.2 %) reported using ONPD in the past 90 days before conducting the study and were asked to complete the survey. Among the 1348 users of ONPD, more than one third (484, 35.9 %) of the ONPD users reported using antibiotics without a prescription during the 90 days prior to the present study. Healthcare students accounted for 492 (36.5 %) of participants with more than a third (181, 36.8 %) of them reporting using antibiotics without a prescription. On the other hand, of the total non-healthcare (856, 63.5 %) respondents, 303 (35.4 %) were using the antibiotics without a prescription. Hence, the difference between healthcare and non-healthcare respondents was statistically not significant ($p = 0.608$).

A binomial logistic regression was performed to ascertain the effects of 41 potential predicators on the likelihood that participants will use antibiotics without prescriptions. The logistic regression model was not statistically significant, $\chi^2(8) = 5.637$, $p = 0.688$. The model explained 25 % (Nagelkerke R^2) of the variance in using antibiotics without prescriptions and correctly classified 71.4 % of cases. Sensitivity was 52.2 %, specificity was 83.4 %, positive predictive value was 66.5 % and negative predictive value was 73.4 %. Of the 41 predictor variables only 9 were statistically significant: nationality, cost-influence behaviour, the belief in ONPD-effectiveness, year of study, medication knowledge, self-care orientation cutting costs,

emergency use, as well as being healthcare students.

Table 1: Demographic characteristics of the participants (n = 2355)

Demographics	N	%	95% CI	
			Lower	Upper
Age				
18-20	1033	43.8	41.9	45.9
21-23	1125	47.8	45.7	49.8
24-26	171	7.3	6.2	8.4
27-29	12	0.5	0.3	0.8
≥30	14	0.6	0.3	0.9
Gender				
Female	1797	76	74.6	78.0
Male	558	24	22.0	25.4
Marital Status				
Single	2151	91.3	90.2	92.4
Married	186	7.9	6.9	9.0
Divorced	11	0.5	0.2	0.8
Others	7	0.3	0.1	0.6
Ethnicity				
UAE	1073	45.5	43.5	47.6
National	1068	45.4	43.4	47.4
Arab	86	3.7	2.9	4.4
Asian	88	3.7	3.0	4.5
Iranian	40	1.7	1.2	2.3
Others				
Universities				
SoU	681	28.9	27.0	30.8
UAE	837	35.5	33.6	37.5
Ajman	837	35.5	33.6	37.5
Year of study				
1st year	175	7.4	6.4	8.5
2nd year	560	23.8	22.1	25.5
3rd year	713	30.3	28.5	32.2
4th year	670	28.5	26.6	30.2
5th year	190	8.1	7.0	9.2
6th year	47	2	1.4	2.6
Employment status				
Yes	165	7	5.9	8.1
No	2190	93	91.9	94.1
Total	2355	100		

SoU, Sharjah University

Nationality was a significant predictor variable. Participants of UAE nationality were 47 % times less likely than expatriates' to use ONPD with the true population effect between32 and 68 % and this result was statistically significant (OR = 0.471, 95% CI: 0.326 - 0.681, $p < 0.001$). Furthermore, the cost of drugs was a risk factor for misusing antibiotics without a prescription. Participants who reported that the cost of drugs affect their decision to use them had 1.7 times higher odds of using antibiotics without a prescription compared to those who were not influenced by the cost of ONPD (OR = 1.716, 95 % CI: 1.175 - 2.508, $p < 0.005$). Therefore,

cost influences behavior might be a risk factor for misusing antibiotics.

Belief is another factor that has been shown in our study to be related to individual health behavior, especially using antibiotics without a prescription. Participants believing that ONPD are only moderately effective were 33 % times less likely to use ONPD than those who believed that ONPDs are effective (OR = 0.332, 95% CI: 0 .135 - 0.815, p<0.05). Similarly, participants believing that ONPD are ineffective were 40 % times less likely to use ONPD than those who believed that ONPDs are effective (OR = 0 .400, 95 % CI: 0.161-0.994, p<0.05). Therefore the belief about the effectiveness of ONPD might be a prescription factor against using antibiotics without prescription.

Participants with poor-moderate medication knowledge had significantly lower odds of using antibiotics without prescription compared to users with good medication knowledge (OR = 0.619, 95 % CI: 0.443-0.866, p< 0.005). Also, participants in their fourth year of study (OR = 0.310, 95 %, CI: 0.141-0.681, p < 0.004), fifth year of study (OR = 0.243, 95 %, CI: 0.088-0.666, p< 0.01), or sixth year of study (OR = 0.101, 95 %, CI: 0.015-0.678, p < 0.02) had lower odds of using antibiotics without prescription compared to participants in their first year of study.

Being a Healthcare participant was a significant variable for using antibiotics without a prescription. Healthcare participants had 1.4 times higher odds of using antibiotics without prescription compared to non-healthcare participants (OR = 1.465, 95 %, CI: 1.012 - 2.120, p < 0.05). Therefore being a healthcare participant might be a risk factor for misusing antibiotics without prescription.

Urgency of the health situation and financial reasons were also significant predictors. Participants who frequently used ONPD in order to save money had 1.6 times higher odds of using antibiotics without a prescription compared to participants who did not (OR = 1.665, 95 % CI: 1.047 - 2.649, p < 0.04). Furthermore, participants who use ONPD because of urgent heath situation had 1.6 times higher odds of using antibiotics without prescription compared to those who did (OR = 1.644, 95 %, CI: 1.144 - 2.363, p < 0.007). Therefore, urgency of situation and financial reasons might be risk factors for misusing antibiotics without prescription. Participants with a high self-care orientation had significantly 1.8 times higher odds of using antibiotics without prescription compared to a low self-care orientation's participants and this result was statistically significant (OR = 1.878, 95 % CI: 1.304-2.706, p<0.001). Therefore, high level of self-care orientation might be a risk factor for using antibiotics without prescription. Logistic regression model for associations with antibiotic's use without prescription is summarized in Table 2.

Table 2: Logistic Regression model for associations with antibiotic's use without prescription

Variable	Response	Exp (B)	OR	95% CI		P-value
Nationality (ref-Expatriate)	UAE national	-0.753	0.471	0.326	0.681	<0.001
Cost -influence behavior (ref-No)	Yes	0.540	1.716	1.175	2.508	0.005
Effectiveness of ONPD belief (ref-effective)	Moderately	-1.103	0.332	0.135	0.815	0.016
	Ineffective	-0.917	0.400	0.161	0.994	0.048
Medication knowledge (ref-good)	Poor-moderate	-0.480	0.619	0.443	0.866	0.005
Healthcare versus non-Healthcare(ref-non-Healthcare)	Healthcare	0.382	1.465	1.012	2.120	0.043
Self-care orientation (ref-low)	High	0.630	1.878	1.304	2.706	0.001
Reason- saves money (ref-yes)	No	0.510	1.665	1.047	2.649	0.031
Reason-urgency of ONPD use (ref-yes)	No	0.497	1.644	1.144	2.363	0.007
Year of study (ref-first year)	Second	-0.193	0.824	0.415	1.636	0.580
	Third	-0.608	0.544	0.265	1.117	0.097
	Fourth	-1.170	0.310	0.141	0.681	0.004
	Fifth	-1.417	0.243	0.088	0.666	0.006
	Sixth	-2.293	0.101	0.015	0.678	0.018

DISCUSSION

In the present study, more than one third of users reported misusing antibiotics without a prescription during the 90 days prior to the study. It might be possible that such trend is due to easy access to antibiotics in UAE and the economic status of participants who find medical

consultation rather expensive (saving money). Another possible reason is a false sense of confidence in self-diagnosis and self-treatment among participants who use antibiotics without prescription and this speculation is consistent with that of Pan *et al* [18] who concluded that a false sense of confidence in self-treatment and easy access to antibiotics without prescription had encouraged Chinese students to self-medicate with antibiotics without medical consultation.

One of the associated factors of concern was nationality, which was connected with medical insurance. UAE nationals had lower odds of using antibiotics without prescription compared to expatriates. This data was retrieved from information provided by Zaghloul *et al* [19] arguing that non-UAE nationals have limited or no health insurance in comparison to UAE nationals who have access to premium health care. Our study indicated that non-UAE students had statistically significant increased odds of using antibiotics without prescription.
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Again, participants who were influenced by the cost of drugs had a higher probability of using antibiotics without a prescription than those who were not influenced. This can be attributed to the belief that more expensive drugs are more effective because higher cost signals higher quality. Microbial infections were perceived by participants as a serious health condition and they may buy more expensive antibiotics with the misconception that these are more effective than their cheaper alternatives. We also observed that participants who believed that ONPDs had moderate to no effect were less likely to take antibiotics without a prescription. This belief is attributed to the availability of oral non-prescription drugs and ease of gaining access to antibiotics without prescription in the UAE [14]. As no other study has engaged with these variables it is not possible to compare our findings with those of other researches and it is recommended that future research should explore this gap. Participants with poor-to-moderate medication knowledge had a lower probability of using antibiotics without a prescription than participants with good medication knowledge of ONPD. This finding could be attributed to a false sense of confidence among university students with good medication knowledge, such that they misused antibiotics at a higher prevalence than students with poor-to-moderate medication knowledge. This finding supports previous research that showed that a false sense of confidence in self-treatment and easy access to antibiotics without a prescription

had encouraged Chinese students to use antibiotics without a prescription [18].

Nevertheless, the Chinese study also reported that "prior" medication knowledge of the university students was a risk factor for using antibiotics without a prescription [18]. This inconsistency with the final findings between our study and the Chinese study might be attributed to the differences in the method of measuring, classifying and coding the medication knowledge variable. Furthermore, the number and the types of predictors which entered the multivariate statistical analysis in our study are larger and broader than that of Pan *et al* [18]. Therefore, there is a need for further studies to more fully investigate the relationship between knowledge and antibiotic misuse among students in the UAE.

The year of study of the students was associated with the risk of taking antibiotics without prescription. Students in the first year of study were more likely to take antibiotics without prescription as compared with students in the fourth, fifth and sixth year of study. Senior students might have higher awareness in using antibiotics without a prescription compared to junior students. These findings agree with a study that showed that self-medication with antibiotics was lower among fourth year than second year medical students in Bahrain [20].

There is a distinct difference between awareness and knowledge; awareness is being conscious of the risks attributed to misuse of antibiotics rather than acquiring information to pass examinations and do the job better. Therefore, we need high awareness and right information [21]. Money saving behavior seemed to act as a motivating factor for taking antibiotics without prescription. As stipulated by Zaghloul *et al* [19] participants who had to pay for consultations would renounce this practice and engage in self-medication, including taking antibiotics without prescription. This was also true for the population in our study.

Participants who did not use ONPD for an urgent heath situation had a higher probability of using antibiotics without prescription than those who did. This finding might be explained in the context of health-seeking behavior, which differs from person to person depending on the severity of the illness (low versus high) as shown by Biswas *et al* [22]. It might be possible that participants who perceived their illness as an urgent (e.g. getting a fever at night) would use an ONPD immediately. However, if they get a more severe illness, they would visit a physician to ask for a prescription. This might also suggest that

participants with a high perception of the severity of an illness do not have misconceptions about the use of antibiotics without a prescription. Our observation is in line with earlier descriptive findings, which demonstrated that non-prescription drugs are used in emergency situation among university students [23]. As far as we are aware this is the first time that urgency of drug use is investigated as associated variable for misusing antibiotics without a prescription in the literature. Participants who had a high perception of self-care were more likely to take antibiotics without a prescription as compared to participants of low self-care perception. This is similar to the observation in Palestinian students with high self-care orientation who were found to be more confident in self-medication across a variety of drug categories including antibiotics [11].

In summary, only 9 out of 41 predictor variables were significantly associated with use of ONPDs including antibiotics. These factors include; nationality, cost-influence behavior, the belief in ONPD-effectiveness, year of study, medication knowledge, self-care orientation, saving money, and the emergency of use as well as being healthcare students.

Limitations of the study

A major limitation of this study is the collection of retrospective data about use of medications that may be under-reported by the participants leading to the possibility of a reported lower prevalence rate in this study. Another limitation is that no attempt was made to investigate the influence of the insurance status of participants on the prevalence of self-medication with oral antibiotics.

CONCLUSION

The prevalence of misuse of antibiotics is high among university students in UAE. There is an urgent need for educational intervention to improve students' knowledge of, attitude to, and awareness of the risks of using antibiotics without prescription. In addition, the introduction of a national day on rational use of antibiotics would certainly increase public awareness of such an important health issue.

DECLARATIONS

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Conflict of interest

No conflict of interest is associated with this study.

Contribution of authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. All of the authors contributed equally in the conducting of the study (designed, collected and analyzed the data), preparation and approval of the manuscript.

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REFERENCES

1. *World Health Organization (WHO). United Arab Emirates/Statistics. [2016]. Available from: http://www.who.int/countries/are/en/ (Accessed: 21 January 2016)*

2. *Bennadi D. Self-medication: A current challenge. J Basic Clin Pharm 2014; 5(1):19-23.*

3. *Shehadeh MB, Suaifan GA, Hammad EA. Active educational intervention as a tool to improve safe and appropriate use of antibiotics. SPJ 2015; 24(5): 611-615.*

4. *Cars O, Högberg L. Innovating for antibacterial resistance, Professional affairs [2007] Available from: https://www.reactgroup.org/uploads/publications/react-publications/innovating-for-bacterial-resistance.pdf (Accessed 4 February 2018)*

5. *Togoobaata, G, Ikeda N, Ali M, Sonomjamts M, Dashdemberel S, Mori R, Shibuya K.. Survey of non-prescribed use of antibiotics for children in an urban community in Mongolia. Bulletin of the WHO 2010; 88(12): 930-936.*

6. *Shah S, Ahmad H, Rehan R, Najeeb S, Mumtaz M, Jilani M, Rabbani M, Alam M, Farooq S, Kadir M. Self-medication with antibiotics among non-medical*

university students of Karachi: a cross-sectional study. BMC Pharmacol Toxicol 2014; 15:74. doi: 10.1186/2050-6511-15-74.

7. Franchi C, Sequi M, Bonati M, Nobili A, Pasina L, Bortolotti A, Fortino I, Merlino L, Clavenna A. Differences in outpatient antibiotic prescription in Italy's Lombardy region. Infection 2011; 39(4):299-308.

8. Javed MP. Self-Medication of Antibiotics amongst University Students of Islamabad: Prevalence, Knowledge and Attitudes. Int. J. Pharm. Biol. Sci 2013; 6(0): 1-4.

9. Awad A, Eltayeb I, Matowe L, Thalib L. Self-medication with antibiotics and antimalarials in the community of Khartoum State, Sudan. J Pharm Pharm Sci 2005; 8(2):326-331.

10. Sarahroodi S, Arzi A, Sawalha AF, Ashtarinezhad A. Antibiotics self-medication among southern Iranian university students. IJP 2010; 6(1): 48-52.

11. Sawalha AF. A descriptive study of self-medication practices among Palestinian medical and nonmedical university students. RSAP 2008; 4(2): 164-172.

12. Sharif SI, Masalmeh BM, Awad HA, Osama A, Yousra A, Abdulmqasood A, Bugaighis L. Parents' knowledge and attitude to self-medication of children with antibiotics. Arch Pharm Pract 2015; 6(4): 71-76.

13. Abasaeed A, Vlcek J, Abuelkhair M, Kubena A. Self-medication with antibiotics by the community of Abu Dhabi Emirate, United Arab Emirates. J Infect Dev Ctries 2009; 3(7): 491-497.

14. Al Akshar SA, Shamssain M, and Metwaly Z. Pharmacist's perceptions of community pharmacy practice in UAE: An Overview. IOSR J Pharm 2014; 4(6): 47-56.

15. Al-Kubaisi KA, SteCroix MD, Vinson D, Mirza R, Hassan M, Sharif S, Abduelkarem A. Appropriateness assessment and identifying the risk factors of oral non-prescription drugs' use among university students in the United Arab Emirates. AJER 2017; 5 (10): 363-369.

16. Andersen R, Newman JF. Societal and individual determinants of medical care utilization in the United States. Milbank Mem Fund Q Health Soc 1973; 51 (1): 95–124.

17. Chana RC, Bradley H. Sociocultural, economic and regulatory influences on medicine use by consumers in a rural township in Cameroon. Southern Med Review 2011; 4 (1): 9-16.

18. Pan H, Cui B, Zhang D, Farrar J, Law F, Ba-Thein W. Prior knowledge, older age, and higher allowance are risk factors for self-medication with antibiotics among university students in southern China. PloSONE 2012; 7(7):e41314. https://doi.org/10.1371/journal.pone.0041314

19. Zaghloul AA, Elsergany M, El-Enein NA, Alsuwaidi H, Ayoub M. Over-the-counter medication patterns in households in Sharjah, United Arab Emirates. Risk Manag Healthc Policy 2014; 7:19-24.

20. James H, Handu SS, Khaja KA, Sequeira RP. Influence of medical training on self-medication by students. Int J Clin Pharmacol Ther 2008; 46(1): 23-29

21. Gurteen D. Knowledge, Awareness and Understanding [2017]. Available from: http://www.gurteen.com/gurteen/gurteen. (Accessed: 25 May 2017).

22. Biswas M, Roy MN, Manik IN, Hossain MS, Tapu ST, Moniruzzaman M, Sultana S. Self-medicated antibiotics in Bangladesh: a cross-sectional health survey conducted in the Rajshahi City. BMC Public Health 2014; 14:847

23. Ibrahim NK, Alamoudi BM, Baamer WO, Al-Raddadi RM. Self-medication with analgesics among medical students and interns in King Abdulaziz University, Jeddah, Saudi Arabia. Pak J Med Sci 2015; 31(1):14-18