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Original Article

Knowledge, attitude, behaviour of the future healthcare professionals towards the self-medication practice with antibiotics

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Abstract

Introduction: Self-medication with antibiotics (SMA) is a major health problem in the developing world including the kingdom of Saudi Arabia (KSA). This practice remains an emerging challenge for the healthcare providers. A few previous studies have estimated the prevalence of SMA among the general population of KSA, but there had been no such studies on healthcare students.
We aimed to estimate the prevalence of SMA among medical, non-medical students and to evaluate its determinants.
Methodology: A survey-based cross-sectional study using validated questionnaire was conducted amongst students at King Faisal University in KSA. Chi-square test and logistic regression analysis were applied to identify the determinants of SMA.
Results: The prevalence of SMA was 58.4% with significantly lower proportion among medical students. Tonsillitis was the most common symptom for which SMA was used and was reported by a significantly higher proportion of medical (54.1%) students. Despite, the awareness of medical students about SMA is unsafe and mal-practice (79.9%), the prevalence of SMA practice remains high. Logistic regression analysis showed that students who incorrectly, identified the effectiveness of antibiotics in treating bacterial infections, the reasons of the antibiotics discontinuation had a higher likelihood to SMA. (OR = 2.16, 95% CI: 1.52-4.503, P = 0.001), (OR = 1.575, 95% CI: 0.923-2.686, P = 0.09), respectively.
Conclusions: SMA remains noticeably high among the medical students. To overcome this problem, we highly recommend improving the health education to better address this malpractice and improve the students' knowledge, attitudes and awareness towards the antibiotics use and prescription pattern.

Key words: self-medication; antibiotic; knowledge; practice; attitude; behavior.

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Introduction

Self-medication involves the use of medicines by individuals to treat self-recognized illnesses, symptoms, recurrent diseases or minor health problems [1]. Despite its importance in the healthcare system, self-medication with antibiotics (SMA) remains one of the major worldwide public health problems that can lead to antibiotics resistance due to inappropriate use. With the widespread of multidrug resistant bacteria, the antibiotic-resistant infections have spread across the globe [2]. This can dramatically affect the therapeutic effectiveness, leading to higher mortality rate [3].

Moreover, several factors including age, gender, monthly income, place of residence, past successful experience with antibiotics [4], lack of advice regarding rational use of antibiotics, overwork of health professionals, unrestricted availability of antibiotics, high consultation fees, patient attitudes and the education level have been reported among the common determinants of SMA [5–7]. However, these factors vary among different populations [8]. Recent studies carried out in Middle-eastern countries including Saudi Arabia reported high prevalence of SMA ranging from 19-82% [9–15]. In addition, the SMA rate ranges between 24-90% among University students [16–20]. Intriguingly, high prevalence of SMA has also been reported among medical students regardless of their level of knowledge was reported in Jordan and Saudi Arabia [15,21]. However, these and other studies have mainly focused on antibiotics prescribing behaviors rather than attitudes and associated predictors of antibiotic self-use among student population. In Saudi Arabia, very few studies have assessed the knowledge about antibiotics and attitudes towards the use of antimicrobial drugs, but such studies were conducted on representative samples of the general population

[17,22–25]. Indeed, research studies focusing on healthcare students are lacking.

The medical students, as a future prescribers and behavioral models for patients have the potential to help addressing the antimicrobial resistance in their hospitals and communities. They play an essential role in increasing the public awareness, alleviating the spread of antibiotic resistance and limiting the irrational use of antibiotics [20,26]. Additionally, they showed better knowledge, and awareness about SMA [27]. SMA is a common practice among university students worldwide [28]; with higher rate among undergraduate students [29]. In Saudi Arabia, SMA practice is an emerging challenge for the healthcare providers. However, the prevalence of SMA and its determinants among the university students remain unknown, particularly among medical who are exposed earlier to knowledge about diseases and drugs.

Estimating the prevalence of SMA among student population is of high importance because this population represents highly educated segment of the community with better access to healthcare-related information.

Therefore, the present study aimed at estimating the prevalence of SMA among medical and non-medical students at King Faisal University, in the Eastern Province of Saudi Arabia, and evaluating their knowledge, attitudes, practices and behaviors towards SMA as well as the impact of enabling factors on self-medication practices with antibiotics.

Methodology

Study design

A cross-sectional survey was designed based on a validated anonymous self-administered questionnaire. The study was carried out amongst convenience sample of medical students and non-medical students.

The interviewed population was 150 medical students and 150 non-medical students. The questionnaire was pretested for content, readability, comprehension and design in a pilot study on 20 randomly selected students from the survey's intended population. After piloting and analyzing the respondents' feedback, the questionnaire was finalized after ambiguous and unsuitable questions were improved or removed based on the results of pretest. The pretest data were discarded after preliminary analysis and were not included in the final data analysis. The study was conducted at the college of medicine at King Faisal University in the Eastern province of Saudi Arabia.

Study instrument

The questionnaire was developed to measure the prevalence, attitude, practice of students based on a bibliographical review of previous comparable studies and taken into account questionnaires previously validated in other countries [8,30]. A total of 24 questions were included in the final pretested questionnaire containing both dichotomous (yes or no) and multiple-choice closed-ended questions, divided into four parts:

-The first part consisted of eight questions related to the respondents' characteristics including age, gender, marital status, educational level, monthly income, complementary health insurance, place of residence and specialty.

-The second part included four questions related to the prevalence of SMA among the students, the main reasons for practicing SMA, the antibiotics names used for self-medication to counter symptoms and the main sources of the antibiotics supply.

-The third part consisted of seven questions related to the respondents' beliefs and knowledge about (antibiotics indication, symptoms for which they have used antibiotics, the reason for discontinuation of antibiotics use, the possible adverse drug reactions and the common side effects of antibiotics including resistance). The beliefs of respondents about the safety of the SMA practice and the effectiveness of SMA *versus* the antibiotics prescribed by the health care provider were also assessed.

-The fourth part contained five questions analyzing the students' practices and attitudes towards SMA. They were asked to indicate the main sources of information before using antibiotics. There were also questions regarding the respondents practice towards antibiotics use such as keeping leftover antibiotics from the previous course for future use, reviewing the package leaflet for instructions, checking the expiry date before self-use. The respondents had to evaluate themselves and assess their knowledge of antibiotics.

Participation was voluntary without compensation. The students were encouraged to participate without any undue pressure. Returning of the completed questionnaire for each participant was accepted as consent by the participating students. Informed consent was obtained from all individual participants in the study.

Statistical analysis

A descriptive and comparative statistical data analysis was performed with the SPSS 22.0 software package. Frequencies and cross tables of preselected

variables were calculated and χ^2 tests were performed to identify variables associated with dependent variables, knowledge of antibiotics and self-medication. Variables associated with self-medication at a level of significance $P < 0.05$ were entered into logistic regressions analysis, which was used to compute adjusted odds ratio (OR) and 95% confidence intervals (95% CI) to assess the independent associations of the variables with SMA.

Ethical Statement

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The anonymity of participants was maintained, and ethical principles were followed.

Results

General characteristics of the respondents

A total of 300 students agreed to participate in the questionnaire. Of these, 128 (85%) were medical respondents and 107 (71.3%) were non-medical students.

The mean age of the respondents was 20.96 ± 0.148 (SD) (median 20; range 18–30). The majority of respondents (70.6%) were males; of these 54.5% were medical students and 45.5% were from non-medical specialty. Most (71.5%) of respondents were from urban areas with undergraduate level (94.5%). The general characteristics of the respondents are summarized in Table 1. Of the total participants, about six out of ten respondents reported that they self-medicated with antibiotics. Half of them were medical students. An association between the prevalence of SMA and specialty was found (P = 0.01).

Prevalence of SMA and its association with respondents' characteristics

As shown in Table 2, in terms of SMA, there was a significant difference between respondents' groups by their specialty (P = 0.011). Self-medication was higher among non-medical students (67.3%). For other characteristics, no significant differences were detected, despite the fact that self-medication was higher among single students (58.7%), male students (59.1%), with higher monthly income (77.8%), without complementary health insurance (61%) and those who are living in urban areas (61.4%).

Respondents' self-directed use of antibiotics

The respondents were asked about the antibiotics they were using for self-medication and about the source of supply. Despite the common usage of amoxicillin for self-medication purposes, its use was significantly higher among medical students (40%), (P = 0.003). Amoxicillin usage followed by Penicillin and Augmentin was significantly higher among medical 14.7% than non-medical students (5.1%) (P = 0.04).

Table 1. Socio-demographic characteristics of the respondents.

	Characteristics	Number (n) Frequency (%)
Gender	Female	69 (29.4)
	Male	166 (70.6)
Age	< 20	56 (24.66)
	20-24	154 (67.84)
	> 24	17 (7.48)
Marital status	Single [1]	203 (86.38)
	Married	32 (13.61)
Educational level	Undergraduate	222 (94.5)
	Postgraduate	7 (3)
	Other	6 (2.6)
Specialty	Medical	128 (54.46)
	Non-medical	107 (45.53)
Monthly income	< 1000 SR	166 (70.94)
	1000-4000 SR	50 (21.36)
	> 4000 SR	18 (7.7)
Complementary health insurance	Yes	62 (26.4)
	No	173 (73.6)
Place of residence	Urban	168 (71.5)
	Rural	67 (28.5)
Self-medication with antibiotics	Yes	136 (58.4)
	No	97 (41.6)

[1]: Single included divorced.

Table 2. Respondents' characteristics according to the use of self-medication with antibiotics.

	User of self-medication n (%)	Non-user of self-medication n (%)	*P value*
Gender			
Female	39 (56.5)	30 (43.5)	0.711
Male	97 (59.1)	67 (40.9)	
Marital status			
Single [1]	118 (58.7)	83 (41.3)	0.793
Married	18 (56.3)	14 (43.8)	
Education level			
Undergraduate	125 (56.8)	95 (43.2)	0.068
Postgraduate	7 (100)	0 (0)	
Other	4 (66.7)	2 (33.3)	
Specialty			
Medicine	64 (50.8)	62 (49.2)	**0.011**
Non-medicine	72 (67.3)	35 (32.7)	
Monthly income			
< 1000 SAR	95 (57.9)	69 (42.1)	0.163
1000-4000 SAR	26 (52)	24 (48)	
> 4000 SAR	14 (77.8)	4 (22.2)	
Complementary health insurance			
Yes	31 (50.8)	30 (49.2)	0.164
No	105 (61)	67 (39)	
Place of residence			
Urban	102 (61.4)	64 (38.6)	0.134
Rural	34 (50.7)	33 (49.3)	

[1]: Single included divorced; P < 0.05 was considered to be statistically significant.

Figure 1. Main antibiotics used for self-medication to counter symptoms. Respondents could select more than one statement. P < 0.05 was considered statistically significant.

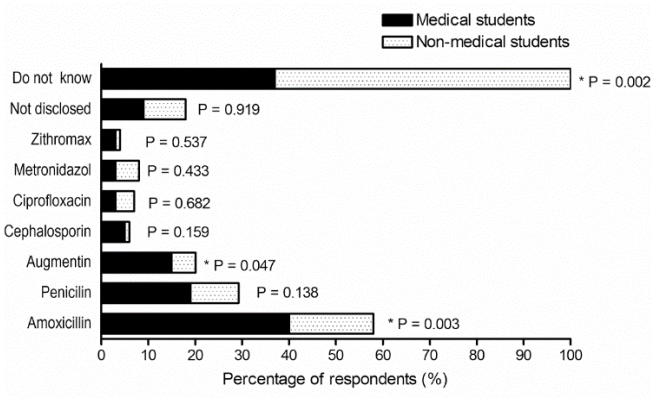

Figure 2. Main sources of antibiotics supply for self-medication. P < 0.05 was considered statistically significant.

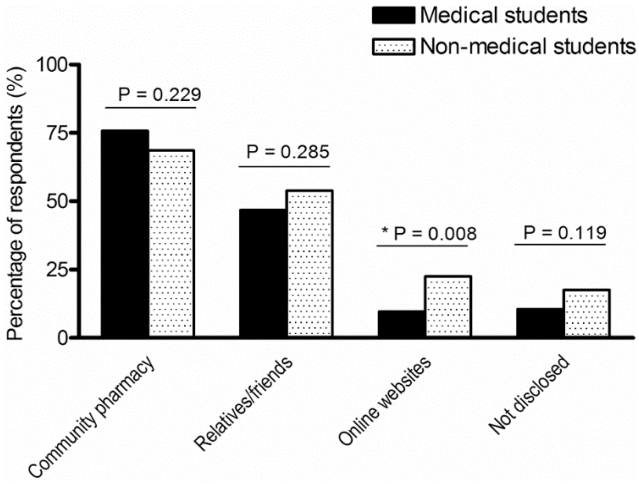

Table 3. Main reasons for practicing self-medication with antibiotics among respondents.

Statements	Medical students n (%)	Non-medical students n (%)	*P value*
Advice of friends/relatives	41 (57.7)	36 (46.8)	0.181
Ease of obtaining drugs	31 (43.7)	34 (44.2)	0.952
Past experience	26 (36.6)	39 (50.6)	0.086
Mild illness	21 (29.6)	39 (50.6)	**0.009**
Lack of time	14 (23.9)	19 (24.7)	0.917
Long waiting time	8 (11.3)	19 (24.7)	**0.035**
Clinic/hospital distance	7 (9.9)	12 (15.6)	0.298
Not disclosed	7 (9.9)	5 (6.5)	0.454
High consultation fees	1 (1.4)	4 (5.2)	0.203

Frequency and percentage of respondents agreeing on statements; Respondents could agree on more than one statement; P < 0.05 was considered to be statistically significant.

Surprisingly, more than 37% of the medical students' did not know the name of the antibiotics they had used without prescription. However, as shown in Figure 1, this proportion was significantly lower (P = 0.002) than that (63%) of non-medical students.

The main sources of SMA for medical and non-medical students were community pharmacies 75.8% and, 68.6% and friends/relatives 46.8% and 53.9%, respectively. As illustrated in Figure 2, there was a notable difference between the proportions of respondents who obtained antibiotics from sources other than community pharmacy such as online websites (9.7% of medical vs 22.5% of non-medical students; P < 0.008).

Reasons for SMA among respondents

Table 3 shows several reasons for practicing SMA. The common reasons reported by medical *versus* non-medical students were advice from friends (57.7% , 46.8%), followed by the ease of obtaining drugs (43.7%, 44.2%), past experience (36.6%, 50.6%), mild illness (29.6%, 50.6%), lack of time for GP consultation (23.9%, 24.7%) and long waiting time (11.3%, 24.7%), respectively. Less than one third of medical respondents

Table 4. Respondents' knowledge and beliefs about antibiotics.

Statements	Medical students n (%)	Non-medical students n (%)	*P value*
Antibiotics are effective in treating bacterial or viral infections			
Correct answer	96 (75.6)	29 (27.1)	**P < 0.001**
Incorrect answer	31 (24.4)	78 (72.9)	
Symptoms/ailments for which antibiotics were self-medicated			
Sore throat	46 (54.1)	22 (26.2)	**P < 0.001**
Fever	39 (45.9)	25 (31)	**0.046**
Coughs	38 (44.7)	33 (39.3)	0.475
Runny nose	30 (35.3)	23 (27.4)	0.268
Ear infection	13 (15.3)	14 (16.7)	0.808
Stomach ache	9 (10.6)	14 (16.7)	0.249
Diarrhea	9 (10.6)	21 (25)	**0.014**
Upper respiratory tract infection	8 (9.4)	9 (10.7)	0.778
Burning micturition	3 (3.5)	7 (8.3)	0.186
Unintentional injury	3 (3.5)	10 (11.9)	**0.041**
Do not know	4 (4.7)	12 (14.3)	**0.033**
Not disclosed	10 (11.8)	5 (6)	0.184
Skin diseases	9 (10.6)	3 (3.6)	0.076
The reason of discontinuation of antibiotics use			
Correct answer	62 (48.8)	20 (18.7)	
Incorrect answer	65 (51.2)	87 (81.3)	**P < 0.001**
Antibiotics can cause adverse drug reactions			
Correct answer	82 (64.1)	54 (50.5)	**0.036**
Incorrect answer	46 (35.9)	53 (49.5)	
Common side effects of antibiotics			
Allergy	45 (35.4)	24 (23.1)	**0.041**
Antibiotics resistance	64 (50.4)	13 (12.5)	**P < 0.001**
Diarrhea	34 (26.8)	26 (25)	0.760
Skin rash	15 (11.8)	15 (14.4)	0.557
Vomiting	30 (23.6)	23 (22.1)	0.786
Nausea	31 (24.4)	30 (28.8)	0.447
Do not know	22 (17.3)	39 (37.5)	**0.001**
Self-medication with antibiotics is as effective as prescribed by the physician			
Yes	59 (46.5)	26 (24.5)	**0.002**
No	34 (26.8)	41 (38.7)	
Do not know	34 (26.8)	39 (36.8)	
Self-medication with antibiotics is safe and good practice			
Correct answer	102(79.9)	52 (48.6)	**P < 0.001**
Incorrect answer	26 (20.3)	55 (51.4)	

P < 0.05 was considered to be statistically significant.

were self-medicated with antibiotics when they had mild illness compared to higher proportion (50.6%) of non-medical students (P = 0.009). Moreover, the long waiting time for GP consultation affected significantly (P < 0.05) the self-medication frequency of the non-medical students (24.7%) compared to the medical participants (11.3%).

Respondents' knowledge and beliefs about antibiotics

The participants' level of knowledge about the effectiveness, resistance and safety of antibiotics are depicted in Table 4. Most (75.6%) of surveyed medical students answered correctly the statement about the effectiveness of antibiotics with a significant difference (P < 0.001) between medical and non-medical students. When asked about the symptoms for which SMA was used, tonsillitis (sore throat) was the most common reported symptom followed by fever and cough. Tonsillitis was reported by a significant (P < 0.001) higher proportion of medical (44.1%) than non-medical (26.2%) students. Similarly fever and cough were reported by a significantly greater proportion (P < 0.05) in both cases) of medical and non-medical students (45.9% medical vs 31% non-medical for fever, and 44.7% medical vs 39.3% non-medical for cough). Other significant differences between medical and non-medical students were observed when reporting other indications for SMA such as diarrhea (P < 0.05) and unintentional injury (P < 0.05), although the difference was less marked. Furthermore, only 51.2% of medical students were aware that they should complete the full course of treatment (P < 0.001). Almost two-thirds of medical students *vs* half of non-medical students were aware of the adverse drug reactions associated with SMA (P = 0.005). In the matter of knowledge about antibiotics' side effects, only half of medical students knew that antibiotics resistance is one of the most common side effects of antibiotics misuse followed by allergy (35.4%). Perhaps not surprisingly even a smaller proportion of non-medical respondents were aware of these side effects.

There is uncertainty over this issue: 37.5% of the non-medical students do not know that antibiotics can produce side effects. 46.5% versus 24.5% of non-medical respondents incorrectly believed that antibiotics without medical prescription are as effective as prescribed by healthcare provider (P < 0.01). Of these, (20.3%) of medical respondents thought that antibiotics self-use is safe and good practice compared

Table 5. Respondents' practices and attitudes towards self-medication with antibiotics.

Statements	Medical students n (%)	Non-medical students n (%)	*P value*
Before using antibiotics what are your sources of information			
Medical sources	68 (54.8)	32 (29.9)	**P < 0.001**
Non-medical sources	9 (7.3)	33 (30.8)	**P < 0.001**
Only drug leaflet	36 (29)	34 (31.8)	0.651
No sources	29(23.4)	21 (19.6)	0.489
Keeping leftover antibiotics from the previous course for future use			
Yes	51 (40.8)	50 (47.6)	0.352
No	57 (45.6)	38 (36.2)	
Uncertain	17 (13.6)	17 (16.2)	
Before using antibiotics do you review the package leaflet for instructions			
Necessary	2 (1.6)	8 (7.5)	0.082
Always	32 (25)	31 (29.2)	
Sometimes	71 (55.5)	47 (44.3)	
Never	23 (18)	20 (18.9)	
Checking the expiry date of antibiotics before self-use			
Always	67 (52.3)	37 (34.6)	**0.022**
Sometimes	45 (35.2)	45 (42.1)	
Never	15 (11.7)	21 (19.6)	
Not important	1 (0.8)	4 (3.7)	
Self-evaluation of antibiotic knowledge			
Poor	10 (7.9)	14 (13.1)	
Average	65 (51.2)	53 (49.5)	0.564
Good	35 (27.6)	29 (27.1)	
Excellent	17 (13.4)	11 (10.3)	

P < 0.05 was considered to be statistically significant.

with the significantly (P < 0.01) higher proportion of non-medical respondents (51.4%).

Respondents' practices and attitudes towards SMA

In this set of questions (Table 5), respondents' practices and attitudes regarding SMA demonstrated that the main source of information before purchasing antibiotics was healthcare professionals. This source was used by higher proportion of medical students (72.6%, P < 0.001). Alarmingly, 40.8% of medical *vs* 47.6% non-medical participants expressed negative attitude to keeping leftover antibiotics for future use. The majority (79.9%) of the medical students correctly identified, that SMA is neither safe nor a good practice; significantly lower percentage was observed among non-medical students (48.6%). Also, (52.3%) of medical students checked regularly, the expiry date prior to use compared to only (34.6%) of non-medical respondents. This attitude was not affected by the medical knowledge.

Factors associated with SMA

Logistic regressions analysis was performed to ascertain the effects of specialty, knowledge and beliefs on the likelihood that participants self-medicate with antibiotics. Our findings showed that non-medical students self-medicated with antibiotics 1.993 (OR) times more frequently than medical students did (95% CI 1.168–3.399, P < 0.05). The rate of self-medication was significantly affected by specialty (P < 0.05; Chi-square test).

The absence of sourcing the information from medical sources or healthcare professionals showed how participants had higher likelihood to self-medicate than those with adequate information from medical sources or healthcare professionals (OR = 2.54, 95% CI 1.131–5.715, P < 0.05); (OR = 3.74, 95% CI 2.074-6.764, P < 0.001), respectively. Therefore, SMA is significantly affected by the lack of information from medical sources or from healthcare professionals (Table 6).

Table 6. Logistic regression analysis of factors associated with self-medication with antibiotics.

	Coefficient (β)	OR (odds ratio)	CI 95 %
Specialty			
Medical	1	1	-
Non-medical		1.993	
Where do you source information before you purchase antibiotics for self-medication :	0.690		1.168-3.399
Healthcare professionals			
Yes	1	1	-
No	1.32	3.745	2.074-6.764
Medical sources			
Yes	1	1	-
No	0.933	2.542	1.131-5.715
Antibiotics are effective in treating bacterial or viral infection			
Correct answer	1	1	-
Incorrect answer	0.962	2.167	1.520-4.503
The reason of antibiotics discontinuation			
Correct	1	1	-
Incorrect	1.471	4.355	2.467-7.688
Complementary health insurance			
Yes	1	1	-
No	0.416	1.517	0.842-2.731
Self-medication with antibiotics is safe and good practice			
Correct answer	1	1	
Incorrect answer	1.958	7.083	3.547-14.147
Antibiotics can cause adverse drug reactions			
Correct answer	1	1	-
Incorrect answer	0.454	1.575	0.923-2.686

P < 0.05 was considered to be statistically significant.

Regarding the respondent's knowledge and beliefs about antibiotics and their propensity to self-medicate, our results showed that students who incorrectly identified the effectiveness of antibiotics in treating bacterial infections, the reasons of the antibiotics discontinuation or the possible adverse drug reactions had higher likelihood to self-medicate. (OR = 2.16, 95% CI: 1.52-4.503, P < 0.01), (OR = 1.575, 95% CI: 0.923-2.686, P < 0.05), (OR = 4.35, 95% CI: 2.467-7.688, P < 0.001), respectively.

The responses to the statement about the respondents' belief about safety of antibiotics and self-use practice, showed that respondents with an incorrect belief had higher risk to self-medicate (OR = 7.083, 95% CI: 3.547-14.147, P < 0.001). This is consistent with our findings (Table 4) where four fifths of medical students answered correctly this question compared to non-medical students (P < 0.001).

Besides, being unaware of the adverse drug reactions of antibiotics seems to increase 1.5 times the risk to use antibiotics without medical prescription (OR = 1.575, 95% CI: 0.923-2.686, P < 0.05). (Table 6)

Discussion

To the best of our knowledge, this is the first study that was conducted in the Eastern Province of Saudi Arabia that aimed at evaluating the prevalence, knowledge, attitudes, beliefs and practices of SMA and identifying the determinants of SMA among King Faisal University students. Our major findings showed: (i) High prevalence of self-medication practice with antibiotics among all the respondents and particularly higher among non-medical student; the specialty affected significantly self-medication prevalence, knowledge and beliefs about antibiotics self-use; (ii) The main sources of antibiotics supply were the community pharmacy, relatives or friends or online websites (iii) Medical students showed fair good and better knowledge in terms of effectiveness, possible adverse drug reactions and side effects of antibiotics in comparison with non-medical students with some exceptions that might be explained by the higher proportion of undergraduate students; (iv) Most medical students showed negative behavior on practices, attitudes and behavior towards SMA.

We found a considerably high prevalence of SMA practice among all respondents, which is comparable to other studies where similar and even higher prevalence of SMA was reported [8,15]. In particular, it was found that self-medication in Saudi Arabia ranged between 51 and 75% [18,31]. In addition, meta-analysis of 24 studies on this topic reported similar observations on an international level [32].

Consistent with previous studies, no significant association between SMA and gender was found [33,34].

Many factors contribute to the high frequency of SMA including mild illness, long waiting time, distance from healthcare providers. In congruence with previous studies [33,34], the most common predictors of self-medication reported by a large number of medical students were advice from relatives or family, past experience , ease of dispensing drugs by community pharmacist. This is alarmingly high despite the well-established regulations by Saudi health authorities not to dispense antibiotics without prescription [14,35].

This remains alarming practices particularly in the light of the awareness of half of the medical respondents about bacterial resistance associated with irrational self-use of antibiotics. Despite the observed differences, the knowledge's level about antibiotic resistance remains low compared with other studies [27]. Given the fact that antibiotic resistance become the major public health concern worldwide, medical students must be fully aware of this problem, since they will be the future potential antibiotics prescribers [36–38].

Students' Knowledge about SMA

In the present study, medical students showed better knowledge about the effectiveness of antibiotics, their side effects, adverse drug reactions and safety, when compared to non-medical students. Despite this good knowledge, a high rate of incorrect behavior was noticed.

There was a variation in the percentage of medical students who answered correctly the statements about the symptoms for which they have self-medicated. These observations reflect that most of the participants are undergraduate students. This is in accordance with a previous large-scale survey of Chinese students [27]. In pre-clinical years, students acquire basic knowledge needed to understand the core issues but not attained the necessary background to better understand the antibiotics use at different levels.

Respondents' practices and attitudes towards SMA

In consonance with a recent study conducted in Lithuania [30], healthcare professionals represent the main source of information before purchasing antibiotics. Taken together, healthcare professionals have an important impact on the patients' attitudes; they should be encouraged to enhance the good practices and improve the attitudes of patients towards the proper use

of antibiotics. Despite the fair good level of knowledge, high rates of inappropriate practices and some negative attitudes were observed among medical respondents'. It seems that medical students were not practicing what they learned, or they need to acquire higher level of knowledge about the proper use of antibiotics. This is comparable to the recent observations [37]. In another study, no association between self-medication and higher medical knowledge was found [33]. Furthermore, the pro-attitude to self-medicate with leftover antibiotics was significantly associated with storing antibiotics (data not shown). This is similar to the results of previous studies [39,40].

Regression analysis of the associated factors to SMA

Logistic regressions analysis showed interesting findings in terms of identifying the most relevant factors influencing attitudes and behaviors of the interviewed students. Hence, specialty and absence of complementary health insurance are significantly associated with the increased likelihood of self-medication. Students without complementary health insurance have higher probability to self-medicate with antibiotics, in agreement with the findings of a previous study in Italy [37]. Other important factors that influenced SMA practices include the knowledge about the adverse drug reactions, source of information before purchasing antibiotics, belief about the safety of practicing SMA [41]. The major source of information for most of those respondents who practiced self-medication was reading material. This supports the impact of medical education and knowledge on SMA practice [42], and point to the urgent need to improve understanding the appropriate use of antibiotics and increase the awareness about antibiotics resistance. Students should be aware that keeping remaining antibiotics for future use is not a safe practice and should be discouraged. We believe that it is necessary to enlighten not only the medical students but also the students from different disciplines about the proper disposal of antibiotics. In line with previous observations [42–44], our research urges to increase the awareness towards the proper use of antibiotics and correct the negative behavior. A large-scale study is warranted to better address the attitudes and determinants of SMA among the future health professionals from different Universities with various curriculum models across the kingdom of Saudi Arabia. Limitations of this study included a recall bias in terms of the self-reporting of antibiotics self-prescription and practices. It is possible that the study population was not representative of all university students in Saudi Arabia, thus limiting the generalization of our results. This study is limited to self-medication practices with antibiotics only. It was not extended to other drugs categories.

Conclusions

Our present study has shed some lights on the medical students' understanding of SMA and their attitudes, knowledge and beliefs towards self-medication practices with antibiotics. We suggest implementing tailored clinical trainings, enhancing the medical students' knowledge on SMA, organizing extracurricular activities and raising their awareness. The observed negative behavior should be properly addressed and considered an alarming problem. This suggested the importance of health education to reduce self-prescription with antibiotics and consequently reduce the threat of antibiotics resistance.

We highly recommend an early involvement of medical students in the antimicrobial stewardship program not only as active learners but also as active medical team players, since commitment to give patients the best care should start earlier by preparing doctors through medical education.

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References

1. World Health Organization (2000) Guidelines for the regulatory assessment of medicinal products for use in self-medication. Available: http://apps.who.int/medicinedocs/en/d/Js2218e/ Accessed: 17 June 2012.
2. Ventola CL (2015) The antibiotic resistance crisis: part 1: causes and threats. Pharmacol. Ther: 40: 277–283.
3. Renwick MJ, Brogan DM, Mossialos E (2016) A systematic review and critical assessment of incentive strategies for discovery and development of novel antibiotics. J Antibiot 69: 73–88.
4. Chowdhury N, Matin F, Chowdhury SF (2009) Medication taking behavior of students attending a private university in Bangladesh. Int J Adolesc Med Health 21: 361–370.

5. Yousef AM, Al-Bakri AG, Bustanji Y, Wazaify M (2008) Self-medication patterns in Amman, Jordan. PWS 30: 24–30.
6. Esimone CO, Nworu CS, Udeogaranya OP (2007) Utilization of antimicrobial agents with and without prescription by out-patients in selected pharmacies in South-eastern Nigeria. PWS 29: 655–660.
7. Ocan M, Obuku EA, Bwanga F, Akena D, Richard S, Ogwal-Okeng J, Obua C (2015) Household antimicrobial self-medication: a systematic review and meta-analysis of the burden, risk factors and outcomes in developing countries. BMC Public Health 15: 742.
8. Zhu X, Pan H, Yang Z, Cui B, Zhang D, Ba-Thein W (2016) Self-medication practices with antibiotics among Chinese university students. Public Health 130: 78–83.
9. Alhomoud F, Aljamea Z, Almahasnah R, Alkhalifah K, Basalelah L, Alhomoud FK (2017) Self-medication and self-prescription with antibiotics in the Middle East-do they really happen? A systematic review of the prevalence, possible reasons, and outcomes. Int J Infect Dis 57: 3–12.
10. Abasaeed A, Vlcek J, Abuelkhair M, Kubena A (2009) Self-medication with antibiotics by the community of Abu Dhabi Emirate, United Arab Emirates. J Infect Dev Ctries 3: 491–497. DOI: https://doi.org/10.3855/jidc.466
11. Awad AI, Aboud EA (2015) Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. PLoS One 10: e0117910.
12. Al Rasheed A, Yagoub U, Alkhashan H, Abdelhay O, Alawwad A, Al Aboud A, Al Battal S (2016) Prevalence and predictors of self-medication with antibiotics in Al Wazarat health center, Riyadh City, KSA. Biomed Res Int 2016: 3916874.
13. Belkina T, Duvanova N, Karbovskaja J, Tebbens JD, Vlcek J (2017) Antibiotic use practices of pharmacy staff: a cross-sectional study in Saint Petersburg, the Russian Federation. BMC Pharmacol Toxicol 18: 11.
14. Emeka PM, Al-Omar M, Khan TM (2014) Public attitude and justification to purchase antibiotics in the Eastern region Al Ahsa of Saudi Arabia. Saudi Pharm J 22: 550–554.
15. Harakeh S, Almatrafi M, Ungapen H, Hammad R, Olayan F, Hakim R, Ayoub M, Bakhsh N, Almasaudi SB, Barbour E, Bahijri S, Azhar E, Damanhouri G, Qari Y, Kumosani T, Harakeh Z, Ahmad MS, Cals JW (2015) Perceptions of medical students towards antibiotic prescribing for upper respiratory tract infections in Saudi Arabia. BMJ Open Respir Res 2: e000078.
16. Pan H, Cui B, Zhang D, Farrar J, Law F, Ba-Thein W (2012) Prior knowledge, older age, and higher allowance are risk factors for self-medication with antibiotics among university students in southern China. PLoS One 7: e41314.
17. El Zowalaty ME, Belkina T, Bahashwan SA, El Zowalaty AE, Tebbens JD, Abdel-Salam HA, Khalil AI, Daghriry SI, Gahtani MA, Madkhaly FM, Nohi N, Khodari RH, Sharahili RM, Dagreery KA, Khormi M, Habibah SA, Medrba BA, Gahtani AA, Hifthi RY, Zaid JM10, Amshan AW, Alneami AA, Noreddin A, Vlček J (2016) Knowledge, awareness, and attitudes toward antibiotic use and antimicrobial resistance among Saudi population. Int J Clin Pharm 38: 1261–1268.
18. Aljadhey H, Assiri GA, Mahmoud MA, Al-Aqeel S, Murray M (2015) Self-medication in Central Saudi Arabia. Community pharmacy consumers' perspectives. Saudi Med J 36: 328–334.
19. Abobotain AH, Sheerah HA, Alotaibi FN, Joury AU, Mishiddi RM,. Siddiqui AR, Bin Saeed A (2013) Socio-demographic determinants of antibiotic misuse in children. A survey from the central region of Saudi Arabia. Saudi Med J 34: 832–840.
20. Adam C, Sujal P, Eunice Yu (2009) The role of medical student sin limiting the spread of antimicrobial resistance. PLoS BLOG. Available: https://blogs.plos.org/speakingofmedicine/2009/11/17/the-role-of-medical-students-in-limiting-the-spread-of-antimicrobial-resistance/. Accessed: 17 November 2009.
21. Alkhatatbeh MJ, Alefan Q, Alqudah MA (2016) High prevalence of self-medication practices among medical and pharmacy students: a study from Jordan. Int J Clin Pharmacol Ther 54: 390–398.
22. Al Rasheed A, Yagoub U, Alkhashan H, Abdelhay O, Alawwad A, Al Battal S (2016) Prevalence and Predictors of Self-Medication with Antibiotics in Al Wazarat Health Center, Riyadh City, KSA. Biomed Res Int 2016: 3916874.
23. Aljadhey H, Assiri GA, Mahmoud MA, Al-Aqeel S, Murray M (2015) Self-medication in Central Saudi Arabia. Community pharmacy consumers' perspectives. Saudi Med J 36: 328–334.
24. Emeka PM, Al-Omar M, Khan TM (2014) Public attitude and justification to purchase antibiotics in the Eastern region Al Ahsa of Saudi Arabia. Saudi Pharm J 22: 550–554.
25. World Health Organization (1998) The Role of the Pharmacist in Self-Care and Self-Medication. Report of the 4th WHO Consultative Group on the Role of the Pharmacist: 1–17. Available: http://apps.who.int/medicinedocs/en/d/Jwhozip32e/ Accessed: 8 August 1998.
26. Abbo LM, Cosgrove SE, Pottinger PS, Pereyra M, Sinkowitz-Cochran R, Srinivasan A, Webb DJ, Hooton TM (2013) Medical students' perceptions and knowledge about antimicrobial stewardship: how are we educating our future prescribers? Clin Infect Dis 57: 631–638.
27. Huang Y, Gu J, Zhang M, Ren Z, Yang W, Chen Y, Fu Y, Chen X, Cals JW, Zhang F (2013) Knowledge, attitude and practice of antibiotics: a questionnaire study among 2500 Chinese students. BMC medical education 13: 163.
28. Shah SJ, Ahmad H, Rehan RB, Najeeb S, Mumtaz M, Jilani MH, Rabbani MS, Alam MZ, Farooq S, Kadir MM (2014) Self-medication with antibiotics among non-medical university students of Karachi: a cross-sectional study. BMC Pharmacol Toxicol 15: 74.
29. Albasheer OB, Mahfouz MS, Masmali BM, Ageeli RA, Majrashi AM, Hakami AN, Hakami Z H, Hakami AA, Douf TA (2016) Self-medication practice among undergraduate medical students of a Saudi tertiary institution. Trop J Pharm Res 15: 2253–2259.
30. Pavyde E, Veikutis V, Maciuliene A, Maciulis V, Petrikonis K, Stankevičius E (2015) Public knowledge, beliefs and behavior on antibiotic use and self-medication in Lithuania. Int J Environ Res Public Health 12: 7002–7016.
31. Ibrahim LM, Hadjia IS, Nguku P, Waziri NE, Akhimien MO, Patrobas P, Nsubuga P (2014) Health care workers' knowledge and attitude towards TB patients under Direct Observation of Treatment in Plateau state Nigeria, 2011. Pan Afr Med J 18 Suppl 1: 8.
32. Gualano MR, Gili R, Scaioli G, Bert F, Siliquini R (2015) General population's knowledge and attitudes about antibiotics: a systematic review and meta-analysis. Pharmacoepidemiol Drug Saf 24: 2–10.
33. Correa da Silva MG, Soares MC, Muccillo-Baisch AL (2012) Self-medication in university students from the city of Rio Grande, Brazil. BMC Public Health 12: 339.

34. Mona Ehab Aljaouni AAH Hadeel Hadi Alalawi, Ghaida Moazi Alahmadi, Imad AlKhawaja (2015) Self-medication practice among medical and non-medical students at Taibah University, Madinah, Saudi Arabia. IJASR 3: 54–65.
35. Bawazir SA (1992) Prescribing pattern at community pharmacies in Saudi Arabia. Int J Pharm 6: 222–224.
36. Mainjot A, D'Hoore W, Vanheusden A, Van Nieuwenhuysen JP (2009) Antibiotic prescribing in dental practice in Belgium. Int Endod J 42: 1112–1117.
37. Scaioli G, Gualano MR, Gili R, Masucci S, Bert F, Siliquini R (2015) Antibiotic use: a cross-sectional survey assessing the knowledge, attitudes and practices amongst students of a school of medicine in Italy. PloS one 10: e0122476.
38. Hounsa A, De Mol P (2009) Antibiotics dispensed upon the recommendation of staff in private dispensaries in Abidjan in the Ivory Coast. J Pharm Belg 3: 99–104.
39. Kardas P, Pechere JC, Hughes DA, Cornaglia G (2007) A global survey of antibiotic leftovers in the outpatient setting. Int J Antimicrob Agents 30: 530–536.
40. Jassim AM (2010) In-home drug storage and self-medication with antimicrobial drugs in Basrah, Iraq. Oman Med J 25: 79–87.
41. Lv B, Zhou Z, Xu G, Yang D, Wu L, Shen Q, Jiang M, Wang X, Zhao G, Yang S, Fang Y (2014) Knowledge, attitudes and practices concerning self-medication with antibiotics among university students in western China. Trop Med Int Health 19: 769–779.
42. Khan AKA, Banu G, K KR (2013) Antibiotic resistance and usage- a survey on the knowledge, attitude, perceptions and practices among the medical students of a Southern Indian teaching hospital. JCDR 7: 1613–1616.
43. Simpson SA, Wood F, Butler CC (2007) General practitioners' perceptions of antimicrobial resistance: a qualitative study. J Antimicrob Chemother 59: 292–296.
44. Steinberg I (2000) Clinical choices of antibiotics: judging judicious use. Am J Manag Care 23 Suppl 6: 1178-1188.

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