

Antibiotic use and knowledge in the community of Yemen, Saudi Arabia, and Uzbekistan

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Abstract

Introduction: Inappropriate use of antibiotics has resulted in a dramatic increase of antimicrobial resistance in developing countries. We examined knowledge, attitudes, and practices of antibiotic use in three Asian countries.

Methodology: A nationwide cross-sectional study of teachers in large cities of Yemen, Saudi Arabia, and Uzbekistan was conducted. A random sample of 1,200 teachers was selected in each country. Data were collected through a questionnaire-based survey and then analyzed using descriptive and multivariate statistical methods.

Results: The prevalence of non-prescription antibiotic use ranged from 48% in Saudi Arabia to 78% in Yemen and Uzbekistan. Pharmacies were the main source of non-prescribed antibiotics. The most common reasons for antibiotic use were cough (40%) and influenza (34%). Forty-nine percent of respondents discontinued antibiotics when they felt better. Although awareness of the dangers of antibiotic use correlated inversely with self-medication, understanding of the appropriate use of antibiotics was limited.

Conclusions: The prevalence of antibiotic self-medication in the educated adult population in the studied countries was found to be alarmingly high. Effective strategies involving regulatory enforcement prohibiting sales of antibiotics without prescription should be implemented along with educational interventions for health professionals and the public.

Key words: antibiotics; drug resistance; self-medication; developing countries

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Introduction

Antimicrobial resistance is dramatically increasing worldwide in response to inappropriate antibiotic use [1]. Antimicrobial resistance to most common pathogens has reached alarming levels in developing countries, and trends show further increase. The main reasons for the increase of antimicrobial resistance include unregulated drug availability, inadequate antimicrobial drug quality assurance, inadequate surveillance, and widespread attitude to antimicrobial misuse, including self-medication [2]. It is estimated that approximately two-thirds of all oral antibiotics used worldwide are obtained without a prescription and are inappropriately used for diseases such as tuberculosis, malaria, pneumonia, and for mild childhood infections [3]. In less affluent countries,

antibiotic consumption appears to be increasing steadily due to expanded population, rising incomes, and improved access to health care. In contrast with developed countries, where outpatient antimicrobials are largely restricted to prescription-only use, non-prescription access to antimicrobials is common in less affluent countries, resulting in uncontrolled use and self-medication [2,4,5].

Relatively few studies on antibiotic use in Western and Central Asian countries are available, and published data are scarce or absent. Here, we report on a study performed in Yemen, Saudi Arabia, and Uzbekistan on antibiotic use and knowledge in a sample of educated adults.

Methodology

Study design

A national population-based cross-sectional survey was designed and conducted during November 2012 in three countries of Western and Central Asia: Yemen, Saudi Arabia, and Uzbekistan. The study's participants were 400 general education teachers from each country. To perform multiple logistic regression analysis, the total sample size was determined at 1,200 study subjects, owing to the large number of studied variables. The selected cities were Ibb (Yemen), Najran (Saudi Arabia), and Tashkent (Uzbekistan). From the initial sample size of all secondary schools in each of the cities, 10 schools were selected using the probability proportional to size sampling technique. Forty teachers were then randomly selected from the list of employee names obtained from the school.

Respondents were interviewed based on the questionnaire developed in English by the project group of Charles University, Czech Republic. The questionnaire was pre-tested and translated into the local language of each country and then back-translated into English to validate the translation. An explanation of the purposes of the research and assurance of anonymity was provided to participants and verbal informed consent was obtained.

The questionnaire was administered to the respondents face-to-face by public health research assistants and consisted of three parts. Part one was designed to evaluate the recent use of antibiotics in the past three months, the source of the prescription, intent to use antibiotics without consulting a physician, reason for taking the antibiotic, and duration of use. Part two of the questionnaire assessed knowledge and attitudes towards antibiotics and storage of antibiotics at home. Part three included the demographic characteristics of the respondents such as sex, age, and highest degree obtained (BS, MS, or other).

Statistical analysis

All data were analyzed using PASW Statistics version 18. Descriptive results for the quantitative variables were evaluated according to mean \pm standard deviation. Results regarding binary variables (sex, questions with yes/no answers) were applied with frequencies into percentages. Kendall's correlation was used to investigate association between ordinal variables.

Simple statistical analysis verifying the difference between countries in response to questions about the respondent's knowledge and attitude towards antibiotics was estimated using contingency tables and

frequency comparison. A generalized linear model (Bernoulli distribution with logistic link function) was used for more complex dependence of issues on the summary of socio-demographic factors (gender, age, country of respondent) and their interactions. The level of statistical significance was set at $p < 0.05$.

Results

Four hundred residents in each state were approached for participation. All of them provided complete information. The demographic characteristics of the respondents are presented in Table 1. Most of the participants were females.

The prevalence rates of prescribed and non-prescribed use of antibiotics are presented separately for each country (Table 2). Among the respondents ever treated with antibiotics, 31% reported using prescribed antibiotics, while 69% reported non-prescribed use following the recommendation of a pharmacist or friend, their own initiative, or using a leftover prescription. The prevalence rates for taking antibiotics without a prescription were the highest in Yemen and Uzbekistan and lower in Saudi Arabia, where half of respondents preferred to use prescribed antibiotics. The main source of non-prescribed antibiotics in Yemen and Uzbekistan was pharmacies, followed by a high rate of using a previous prescription and administering alone in Saudi Arabia.

About 81% of respondents had used antibiotics in the previous three months. Cough, influenza, and gynecological inflammations were the most frequent reasons, followed by gastrointestinal infections and respiratory inflammations (Table 3). Treatment with antibiotics for cough symptoms and influenza tended to be the highest in Saudi Arabia and Yemen. In Uzbekistan, respiratory inflammations were reported as the main indications for antibiotics use.

Nearly 44% of respondents prescribed an antibiotic completed the course; however, half reported that they did not finish their last antibiotic course as prescribed because they felt better. Seven percent changed the antibiotic if did not make them feel better (Table 4).

Country, age, and teacher education were significantly associated with storage, attitudes, and knowledge of antibiotic use, while gender had no significant effect. The interaction with education can be explained by different teacher education levels among the studied states, where, along with an advanced and bachelor's degree, special secondary education is eligible for a teaching certificate.

Table 1. Demographic characteristics of respondents

Characteristics	Yemen	Saudi Arabia	Uzbekistan	Total
	No. respondents (%) (N = 400)	No. respondents (%) (N = 400)	No. respondents (%) (N = 400)	No. respondents (%) (N = 1200)
Gender				
Male	161 (40.2)	64 (16.0)	186 (46.5)	411 (34.3)
Female	239 (59.8)	336 (84.0)	214 (53.5)	789 (65.8)
Age				
< 20	73 (18.3)	42 (10.5)	58 (14.5)	173 (14.4)
20-30	190 (47.5)	110 (27.5)	102 (25.5)	402 (33.5)
31-40	114 (28.5)	202 (50.5)	87 (21.8)	403 (33.6)
41-60	21 (5.3)	44 (11.0)	89 (22.3)	154 (12.8)
> 60	2 (0.5)	2 (0.5)	64 (16.0)	68 (5.7)
Education				
Master's/Ph.D.	15 (3.8)	42 (10.5)	169 (42.3)	226 (18.8)
Bachelor's degree	263 (65.8)	189 (47.3)	117 (29.3)	569 (47.4)
Secondary	122 (30.5)	169 (42.3)	114 (28.5)	405 (33.8)

Table 2. Source of antibiotics

	Yemen	Saudi Arabia	Uzbekistan	Total
	No. (%) (N = 367)	No. (%) (N = 353)	No. (%) (N = 369)	No. (%) (N = 1089)
Prescribed				
By physician	80 (21.8)	182 (51.6)	80 (21.7)	342 (31.4)
Non-prescribed				
Pharmacist's advice	158 (55.1)	37 (21.6)	130 (45.0)	325 (43.5)
Friend's advice	21 (7.3)	33 (19.3)	53 (18.3)	107 (14.3)
Self	49 (17.1)	54 (31.6)	93 (32.2)	196 (26.2)
Old prescription	59 (20.6)	47 (27.5)	13 (4.5)	119 (15.9)

Table 3. Clinical indications for antibiotic use

Reasons	Yemen	Saudi Arabia	Uzbekistan	Total
	No. (%) (N = 304)	No. (%) (N = 334)	No. (%) (N = 239)	No. (%) (N = 877)
Cough	125 (41.1)	175 (52.4)	53 (22.2)	353 (40.3)
Influenza	98 (32.2)	136 (40.7)	62 (25.9)	296 (33.8)
Respiratory inflammations	16 (5.3)	19 (5.7)	90 (37.7)	125 (14.3)
After surgery	14 (4.6)	3 (0.9)	14 (5.9)	31 (3.5)
Gastrointestinal	81 (26.6)	18 (5.4)	27 (11.3)	126 (14.4)
Gynecological inflammations	86 (28.3)	181 (54.2)	12 (5.0)	279 (31.8)
Orthopedic inflammations	21 (6.9)	10 (3.0)	17 (7.1)	48 (5.5)
Urinary inflammations	15 (4.9)	6 (1.8)	20 (8.4)	41 (4.7)
Ear infection	25 (8.2)	2 (0.6)	18 (7.5)	45 (5.1)
Other	-	1 (0.3)	23 (9.6)	24 (2.7)

Table 4. Self-reported principles of antibiotic use

Statement	Yemen	Saudi Arabia	Uzbekistan	Total
	No. (%) (N = 367)	No. (%) (N = 353)	No. (%) (N = 369)	No. (%) (N = 1089)
I stop taking the antibiotic when I feel better	163 (44.4)	137 (38.8)	236 (64.0)	536 (49.2)
I change the antibiotic if do not feel better immediately	14 (3.8)	46 (13.0)	15 (4.1)	75 (6.9)
I take antibiotics as prescribed by my physician/pharmacist	190 (51.8)	170 (48.2)	118 (32.0)	478 (43.9)

Respondents from Yemen and Saudi Arabia that were more likely to self-medicate with antibiotics were younger women ($p = 0.010$) and those with a lower level of education ($p = 0.017$), whereas in Uzbekistan, age and education did not affect self-medication.

Almost 46% of respondents with higher preponderance in Saudi Arabia reported that they retain antibiotics at home regardless of the source. A significant relationship was found between storage and country and age ($p < 0.001$). Being younger and less educated in Yemen and Saudi Arabia was associated with keeping inventory at home. In contrast, older respondents in Uzbekistan reported appropriate storage of antibiotics.

Respondents' knowledge of antibiotic bacteria resistance were assessed; typically, knowledge was found to increase with age in all the studied countries ($p = 0.031$). Paradoxically, however, more educated respondents were less knowledgeable about bacteria resistance in Yemen. Similar results were obtained regarding the statement "awareness that antibiotics kill off the normal flora" (country *vs.* education $p < 0.001$). Respondents in Yemen with lower qualifications more frequently responded affirmatively than respondents with a degree level of education.

Respondents were less knowledgeable about the principles of prudent use of antibiotics, as 54% believed that it did not matter if the prescribed course of antibiotics was not completed. Poor level of knowledge was found in the younger generation of Yemeni and Saudi Arabian participants and among all age brackets in Uzbekistan ($p = 0.006$) with primary or lower educational levels ($p = 0.033$).

However, it is important to note that knowledge about allergies and adverse reactions associated with taking antibiotics were the highest when compared with other statements of knowledge. In fact, 57% of respondents expected adverse reactions. Strong knowledge was mostly found among respondents of older, well-educated age groups in all the studied countries ($p = 0.001$, $p < 0.001$ for country/age and country/education, respectively). Participants aware of adverse reactions associated with antibiotic use were more likely to have obtained antibiotics according to a physician's prescription ($p < 0.001$, $\tau = 0.110$).

Discussion

The present study demonstrated the high prevalence of self-medication and inappropriate use of antibiotics among well-educated populations of Yemen, Saudi Arabia, and Uzbekistan. Up to 70% of

respondents administered unprescribed antibiotics and more than half of these unprescribed medications were inappropriate. Our findings contribute to the evidence of the growing tendency for self-medication among the general population in both developed and developing countries. Nonetheless, Asian estimates [6-10] are higher compared with those from studies conducted in Europe and the United States [11-16], with prevalence rates of self-medication ranging from 3% to 60%.

The reasons for self-administration of non-prescribed antibiotics are varied. Although poor regulation of antimicrobials resulting from policies not being enforced is the major factor influencing self-medication, it is not the only one accounting for this behavior [4,17]. Poverty, lack of access to health care, cultural beliefs, and practice of obtaining antimicrobials without prescriptions, particularly for viral respiratory infections, are other driving factors behind antibiotic self-medication in the community of participating countries.

Non-prescription use is frequently associated with very short courses and inappropriate drug and dose choices [18-26]. Extrapolating from the survey results, we estimate that every second respondent did not complete the course of antibiotic therapy, thereby promoting antibiotic resistance. Non-compliance was lower in Yemen and Saudi Arabia than in Uzbekistan. These findings correspond to other studies confirming that patients often do not adhere to their treatment. A patient survey in 11 countries across the world showed that 22.3% of patients who received antibiotic medication admitted to not finishing the therapy [27]. Moreover, patients may store antibiotics from uncompleted courses, even beyond the expiration date, and later self-administer these drugs for self-diagnosed conditions or dispense them to family members and friends [28-30].

Self-medication is associated with little guidance regarding appropriate antibiotic selection for individual syndromes and safe practices to minimize adverse drug effects even when provided by a pharmacist [21,31-33]. In our study, the majority of respondents who self-medicate identified a private pharmacy as the main source of medicine and information. The potential for adverse events is known. Generally, pharmacy staff did not inquire about patient's allergies, did not explain potential side effects, and dispensed contraindicated antimicrobials such as tetracyclines and fluoroquinolones or parenteral antimicrobials for home use. Other risks factors include masked diagnosis of infection disease,

drug interactions, and superinfection [12]. Furthermore, financial concerns often guide selection of low-quality antibiotics and result in short durations of treatment [17].

Several studies, [32,34,35] already provided evidence of inappropriate antimicrobial use for the treatment of bacterial infections; our results are similar. The most common reasons for antibiotic use were colds and upper respiratory tract infections, where the cause is likely to be viral. For a condition to be considered a minor ailment and self-managed depended not only upon the severity, but on previous experience and knowledge as well [36]. The teachers who responded to this survey had less knowledge about appropriate antibiotic use than one would expect, considering their high literacy rate in comparison with other groups of these developing countries. We found a consistent direct link between irrational antibiotic use and lower educational levels. Younger, less educated women were most inclined to self-medicate and lacked knowledge about the dangers associated with antibiotic use. However, there was a very robust correlation between awareness of adverse reactions and antibiotic prescription. This correlation suggests that respondents who were apprehensive about antibiotic side effects did not attempt to self-medicate and consulted their physician. A possible explanation is that those respondents may have learned about the adverse impact of antibiotic use from their physician or pharmacist or from personal experience with antibiotic side effects. General education teachers may not be critical consumers of medicine research or may not have time to keep up with professional journals. However, they are primary transmitters of knowledge, and if their health behavior is inappropriate, it may have an effect on instilling health values and beliefs in children.

Our findings should be interpreted within the context of several limitations to our study. First, the sample was confined to nations' teachers, thereby limiting the generalizability of the results. A second significant limitation was the possibility of sample bias. The respondents were all from urban areas with higher socio-economic status and may not be representative of the rest of the countries. Future studies should be undertaken to investigate antibiotic use in rural regions. Third, the results are based on self-reported behavior, which may not represent actual behavior. Finally, the high male-to-female ratio found in this study is not a truly representative value for actual gender distribution in the population.

Our study confirms that the availability of non-prescription antibiotics leads to inappropriate self-medication in the communities of Yemen, Saudi Arabia, and Uzbekistan. There is great concern surrounding the development and spread of resistance resulting from poor knowledge about the dangers of self-medication and misuse of antibiotics. This study highlights the need to take decisive policy action to reduce non-prescribed antibiotic use. Measures may include restricting the dispensing of antibiotics to prescription only, enforcing supervision by regulatory authorities, and implementing effective public information campaigns to encourage appropriate use of antibiotics.

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