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Knowledge, awareness, and attitudes toward antibiotic resistance and practice of self-medication among university students in Bangladesh: A cross-sectional study

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Abstract:

BACKGROUND: The prevalence of self-medication is high in Bangladesh due to easy access and poor regulatory controls over these drugs. Our study aimed to assess the attitude of university students in Bangladesh toward antibiotic usage, especially their knowledge and awareness about antibiotics and their resistance. We also evaluated the determinants behind their attempts at drug intake without prescription.

MATERIALS AND METHODS: A cross-sectional study was conducted in Mawlana Bhashani Science and Technology University that included information from randomly selected 200 students from 15 departments using a structured questionnaire. The statistical analyses were performed by using SPSS software (version 21) and R programming.

RESULTS: The study revealed that 61.0% of the students use self-medication at different times or always; 32.5% of the respondents keep antibiotics for future use, and 38% of the students think it is right to stop antibiotics when symptoms are improving. Half of the participants (47.5%) use antibiotics based on their previous experience. The criteria of antibiotic selection have a significant relationship with knowledge about antibiotic resistance ($P = 0.017$) and altered prescribed medicine without doctor's advice ($P < 0.001$). The multivariate analysis indicates that respondents who know about antibiotic resistance select antibiotics from the community pharmacists with respect to their own experience 5.102 times higher than those who do not know about antibiotic resistance.

CONCLUSIONS: The study mainly explored the knowledge gaps of the students on the options that are responsible for antibiotic resistance in the community and found that students have mid-level knowledge (66%) about antibiotic resistance.

Keywords:

Antibiotics, Bangladesh, knowledge, prescription, prevalence, resistance, self-medication, student

Introduction

Antibiotics have a profound public health impact on combating bacterial infections for a long time. However, pathogenic bacteria acquire resistance to these antimicrobials for several valid reasons. One of the most important is improper self-medication with a lack of knowledge in the low- and low-to-middle-income countries.[1] A study from secondary data showed that most people think antibiotic resistance is a global problem.[2] The pharmacy customers in Norway showed a mid-level knowledge of antibiotics and a strong knowledge of antibiotic resistance.[3] About 80% of the respondents agreed with the notion that the unnecessary use of antibiotics could

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increase the resistance of bacteria.[3,4] However, a study conducted in northern Uganda showed that a high proportion (75.7%) of the respondents practiced antimicrobial self-medication.[5] A similar outcome was reported in Ethiopia (67.3%), southern Spain (41.0%), Iran (84.9%), and rural people in Lithuania (53.2%).[6-9] Colombian people were found to buy amoxicillin by the advice of the drug seller. Most of them are male and take amoxicillin if they have respiratory problems.[10] The most common indication for antibiotic use in Spain was the common cold.[7] Abduelkarem *et al*. revealed that previous experience with the disease was the main reason behind self-medication with antibiotics in the UAE.[11] It was reported that the self-medication behavior can be reduced by social cognitive theory-based self-care intervention by enhancing awareness in target group.[12]

Developing countries are more threatened by excessive use of antibiotics, nonhuman use of antibiotics, poor drug safety, insufficient monitoring, and factors related to the person and national deprivation.[13] Bangladesh, a South Asian developing country with a high degree of antibiotic resistance, poses a regional and global threat.

The people of Bangladesh have an exiguous amount of knowledge about antibiotic resistance. Researchers found that almost 97.5% of the general people of Bangladesh have never heard of the term antibiotic resistance.[14] Numerous studies have been conducted on the prevalence of antibiotic resistance in Bangladesh; no attempts had yet been made to effectively unify them.[15] The present study attempted to interpret the knowledge, awareness, and attitude toward antibiotic self-medication and their resistance in university-level students in Bangladesh to point out the necessity to enhance the consciousness about antibiotic resistance among the students.

Materials and Methods

Research design

A cross-sectional study was conducted using a structured questionnaire. The information was collected using a structured questionnaire developed by a research team consisting of researchers having expertise in conducting questionnaire-based studies from August 2019 to January 2020. The inclusion criteria for participants were as follows: (i) students of Mawlana Bhashani Science and Technology University (MBSTU) and (ii) those who agree to participate in the interview and share their opinion. Students who are not willing to share their information were excluded from the study.

Study setting and sample size

In general, university students were supposed to be more conscious about antibiotic resistance in comparison to the common people with a lower level of education. There are 42 public universities in Bangladesh. MBSTU is the 12th government-financed public university and 2nd science and technology specialized public university in Bangladesh. The university was established in a remote area of Tangail district. Currently, the university has 15 departments, where 6 departments are under life science faculty. The students of this university come from different corners of the country, similar to most public universities. Hence, we primarily aimed to evaluate the knowledge base of the students of MBSTU, which will also point out the condition in other universities.

First, a pilot survey was conducted, and based on that information, the questionnaire was reformed in some cases. Finally, a sample of 200 students was randomly selected from different departments of MBSTU.

Data collection

The field investigator team comprised a research assistant conducting the personal interview. After obtaining the informed consent, the information was collected through a structured questionnaire and documented. We have maintained the confidentiality of their information strictly.

Outcome measures

To identify the relationship between the dependent variable and the independent variable, several statistical techniques were used. Correspondence analysis (CA) was performed to analyze the categorical data when the variables have the same categories. Chi-square test was performed in the correspondence table to show the relationship between the respective variables. Biplot of CA represents the association between the categories and different variables. Multivariate analysis exhibits a comparison among the category of the dependent variable with one or more than one independent variable. Multinomial logistic regression analysis was performed when the dependent variable is on a nominal scale, and more than one category was used. The entire analysis was done by a statistical software called Statistical Package for the Social Science (SPSS version 21.00, Chicago, IL, USA) and R programming.

Results

Frequency distribution of different variables

The students of MBSTU are from different districts of Bangladesh. We have included 200 students from 15 departments of MBSTU, who are from 7 districts of Bangladesh. The frequency distribution of the sample respondents is described in Table 1. The data show that 68.5% of the respondents are male, and the majority of them belong to the ages of 20–24 (67.5%). About half of the respondents (48.0%) think that the incomplete

Table 1: Frequency distribution of different variables

Variables	Frequency (%)
Gender	
Male	137 (68.5)
Female	63 (31.5)
Age	
18-20	45 (22.5)
20-22	66 (33.0)
22-24	69 (34.5)
>24	20 (10.0)
Cause of being antibiotic resistance	
Self-medication	38 (19.0)
Not completing the dosages	96 (48.0)
Using antibiotic repeatedly	43 (21.5)
Others	23 (11.5)
Antibiotic satisfaction level	
Excellent	6 (3.0)
Satisfactory	109 (54.5)
Good result	78 (39.0)
No result	7 (3.5)
Reason to use antibiotic without prescription	
Previous experience	95 (47.5)
Mild disease	11 (5.5)
Save time and money	34 (17.0)
Emergency use	60 (30.0)
Last use antibiotic	
<3 month	36 (18.0)
Between 3 and 6 months	49 (24.5)
Between 6 to 12 month	27 (13.5)
>1 year	88 (44.0)
Steps in adverse reaction of antibiotic	
Did not face adverse reaction	83 (41.5)
Consult with a doctor	68 (34.0)
Consult with pharmacy stuff	12 (6.0)
Stop taking antibiotic	15 (7.5)
Nothing	22 (11.0)
Total	200 (100.0)

dosage of antibiotics is the main reason behind antibiotic resistance. However, only 19.0% and 21.5% of the students thought that self-medication and repeats of antibiotics, respectively, are responsible for antibiotic resistance. The respondents were asked about the satisfaction level of antibiotics. Over half of the respondents (54.5%) gave satisfactory feedback, and 39.0% supposed that antibiotics have a good result. On the other hand, only 3.5% of the respondents think antibiotics have no result. We tried to disclose the reasons to consume antibiotics without a prescription. Near about 50% (47.5%) of the respondents stated that they used antibiotics based on previous experience. The next major reason was the emergency condition of the student (30.0%). Only a small portion of the respondents (5.5%) consumed antibiotics without prescription in the case of mild disease. It exhibited that 44.0% of the respondents had used antibiotics last time more than 1 year ago. The rest of them used antibiotics within 1 year. Surprisingly, 41.5% of the respondents did not face any adverse reaction after taking antibiotics. The rest of the respondents who encountered adverse reactions after taking antibiotics either got a consultation from a doctor (34.0%) or received consultation from pharmacy staff (6%) and stoped taking antibiotics (7.5%). However, in this situation, 11.0% of the respondents did not take any necessary steps.

Graphical representation of different factors of antibiotic use

It has been found that 32.5% of the respondents keep antibiotics for future use [Figure 1a]. Figure 1b shows that 34.0% of the respondents do not hear the term antibiotic resistance, whereas the rest of them (66.0%) know this term. Figure 1c illustrates that the majority 42.21% of the total respondents use antibiotics last time for fever and around 10.05%, 8.04%, 9.55%, and 4.02% were for the common cold, diarrhea, typhoid, and asthma, respectively. In Figure 1d, the pie chart shows that 54.5% of the respondents think that "sometimes" self-medication with an antibiotic is not a problem. On the other hand, 39.0% of the respondents supposed that it is wrong to take an antibiotic by self-medication. While the remaining 6.5% of the respondents think antibiotic use by self-medication is always right.

Correspondence analysis

The correspondence table [Table 2] illustrates that 130 respondents (65.0%) strongly agreed with the opinion that people should use antibiotics prescribed by a doctor all the time. Similarly, 137 respondents (68.5%) strongly believe that the unnecessary use of antibiotics makes them inactive. Whereas, 153 students (76.5%) assert that people should not change the dosage of antibiotics without a doctor's advice. However, 114 respondents (57.0%) strongly agreed that excessive use of antibiotics on poultry and livestock might be responsible for the spread of antibiotic in the human body; and 113 students (56.5%) strongly agreed that antibiotic resistance would arise if a full course of antibiotics is not complete. There is a strong relationship among different variables with the opinion of the respondents about antibiotics as $P < 0.001$ and the Chi-square test is 58.922.

The summary table [Table 3] is important, which provides the output of CA. From the summary table, the first dimension accounts for 2.9% of the total variable, the second dimension accounts for 2.8%, and so on. The total inertia found is only 5.9%, which is not a great deal of the whole inertia. The cumulative column gives the proportion that is accounted for the variability by the dimension. The first dimension is accounted for 49.8% of the total variability, the second dimension is accounted for 48.0% of the total variability, and so on. Here, 97.8% of the total variability is accounted for in

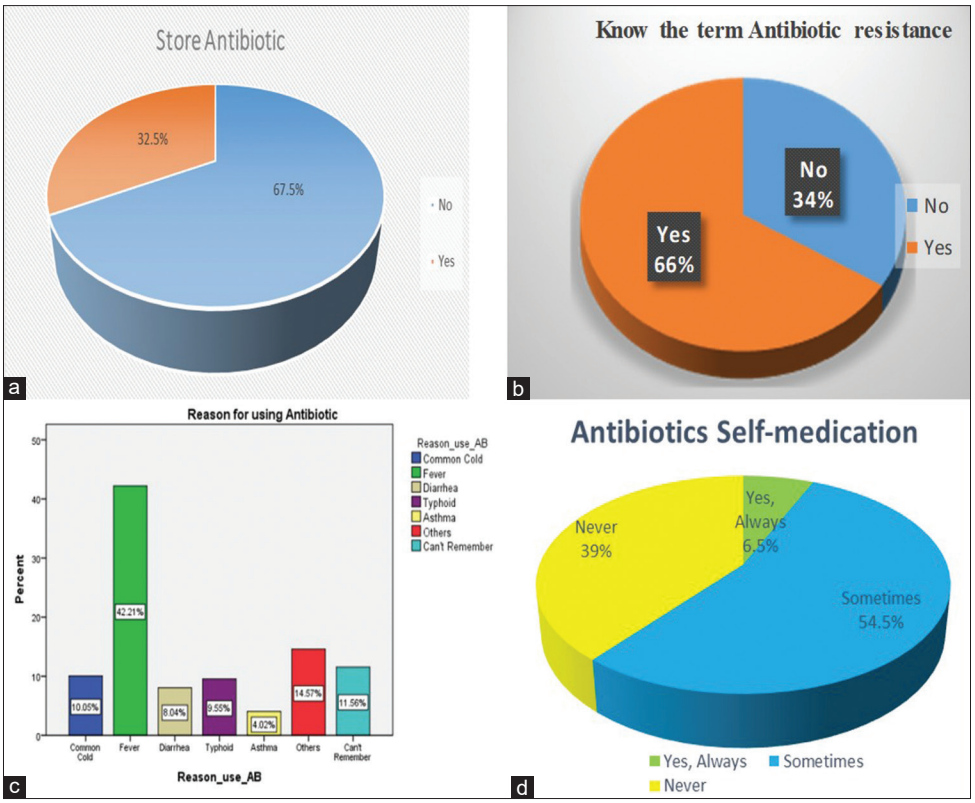

Figure 1: Frequency distribution of different factors for antibiotic use. (a) Keep antibiotic for future use, (b) Know the term antibiotic resistance, (c) Reasons for using antibiotic last time, and (d) Antibiotics used by self-medication

Table 2: Correspondence analysis to understand the knowledge about antibiotic resistance

Variables	Opinion					χ^2	*P*
	Disagree strongly	Disagree slightly	Neutral	Agree slightly	Agree strongly		
People should use antibiotic prescribed by a doctor all the time	14	8	11	37	130	58.922	<0.001
Unnecessary use of antibiotic makes them inactive	3	9	17	34	137		
People should not change the dosage of antibiotic without doctor advice	1	7	18	21	153		
Excessive use of antibiotics on poultry and livestock is responsible for the spread of antibiotics in the human body	0	8	23	55	114		
Antibiotic resistance would arise if a full course of antibiotic was not complete	7	7	23	50	113		

Table 3: Summary table of correspondence analysis

Dimension	Singular value	Inertia	Proportion of Inertia		Confidence singular value	
			Accounted for	Cumulative	SD	Correlation 2
1	0.171	0.029	0.498	0.498	0.031	0.156
2	0.168	0.028	0.480	0.978	0.027	
3	0.035	0.001	0.021	0.998		
4	0.011	0.000	0.002	1.000		
Total		0.059	1.000	1.000		

SD: Standard deviation

the first two dimensions. Finally, we observed from the correlation matrix that the obtained dimensions are not highly correlated. The correlation coefficient between dimension 1 and dimension 2 was 0.156.

The biplot in Figure 2, which was obtained from R programming, depicts a scatter plot of the coordinates with dimensions 1 and 2 for both knowledge-type variable and response category. Two points (inactive_AB and agree strongly) are very close to each other in the middle of the biplot, which concludes that the respondents strongly agreed with the opinion that unnecessary use of antibiotics makes them inactive. From the right side of the biplot, it has been shown that respondents are neutral about the opinion that excessive use of antibiotics on poultry and livestock is responsible

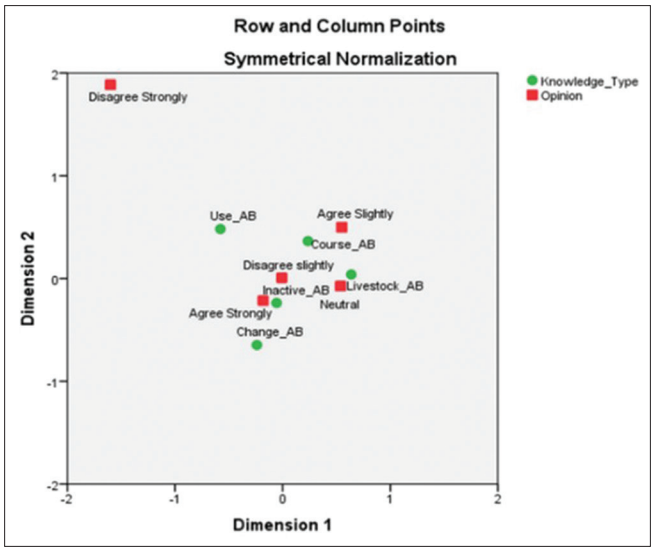

Figure 2: Scatter plot for row and column points, analyzed by R programming. AB, Antibiotics. Here, Course_AB, People should use antibiotic prescribed by a doctor all the time; Use_AB, Unnecessary use of antibiotic makes them inactive; Change_AB, People should not change the dosage of antibiotic without doctor advice; Livestock_AB, Excessive use of antibiotic on poultry and livestock's are spread on human body; and Inactive_AB, Antibiotic resistance would arise if a full course of antibiotic was not complete

for spread of antibiotics in the human body. From the top-left corner of the biplot, respondents disagreed strongly, which is most away from almost all opinions of the respondents.

Multinomial logistic regression analysis

We tried to explore the causes of self-medication and the reasons behind the changes in prescribed antibiotics. We compare each category for the selection of antibiotics against the reference category that is represented in Table 4. Specifically, the regression coefficients explain which predictors significantly discriminate. Knowledge about antibiotic resistance is a significant factor that influences the respondent to select antibiotics. The odds ratio (OR) switching from knowledge about antibiotic resistance no to yes is 1.276 for being doctor's prescription group versus own experience group. In other words, the expected risk of staying in the doctor's prescription group is higher for subjects who know antibiotic resistance. The OR indicates that respondents who know antibiotic resistance select antibiotics from the community pharmacists with respect to their own experience 5.102 times higher than those who do not know about antibiotic resistance. Changing antibiotics without a doctor's advice is another significant factor that is also related to selecting antibiotics. The OR indicates that respondents who change antibiotics without a doctor's advice select antibiotics by taking the opinion of relatives rather than their own experience 1.106 times higher than those who did not change antibiotics without doctor's advice.

Discussion

Antibiotic resistance is emerging in Bangladesh, possibly due to much-reduced awareness. Our study reported the knowledge and awareness about antibiotic usage and causes of the antibiotic resistance of public university students in Bangladesh. Besides, the magnitude of self-medication practice and attitudes toward antibiotic use was identified among the respondents. The study revealed that 61.0% of the students use self-medication at times or always, which is lower than the respondents (67.3%) of Addis Ababa communities[6] and higher than the respondents (25.4%) in the United States.[16] However, it is comparable with the Saudi people (63.6%).[17] Pirzadeh revealed that different factors influenced herbal self-medication including previous experience with similar symptom, simple availability of the medications, mild diseases, good result, and lack of time. There are also some factors related to self-medication such as law, drug availability, education, family, society, and exposure to advertisements.[9]

Khoshgoftar shows that "antibiotics are misused so often because of the belief that these are benign drugs."[18] The students of MBSTU were taking antibiotics for fever, whereas respiratory infection was the common cause in Colombian people.[10] The study found that 32.5% of the respondents keep antibiotics for future use, which is relatively lower compared to Greek (55.0%)[19] and Saudi Arab (44.7%).[17] It is also found that 38.0% of the respondents think it is right to stop antibiotics when symptoms are improving, which is less than the study done among Saudi people that 71.1% reported that they had not finished the course of antibiotics because they felt better.[17] The study revealed that more than 42.0% of the respondents use antibiotics for fever, which is approximately similar (41.2%) to the respondents of self-medication with antibiotics among the rural population in Greece.[20]

This study expressed that 47.5% of the respondents use antibiotics based on their previous experience, which is relatively similar to the study done in Pakistan among university students (50.1%).[21] Our study also shows that approximately 66.0% of the respondents use antibiotics at least once in the last 12 months, which is fairly high compared to the study of Norwegian pharmacy customers, about 30%.[3] It is revealed from this study that the tendency of collecting antibiotics with advice by relatives instead of their own experience is 9.099 times higher for the respondents who know about antibiotic resistance. Hence, the students who know about antibiotic resistance generally take antibiotics with the help of a doctor's advice. This is relevant to the study performed among Saudi people that the availability of antibiotics without prescription was

Table 4: Multinomial logistic regression to calculate odds ratio of risk factors associated with buying antibiotics

Variable	*B*	SE	Wald	Significant	Exp (B)	95% CI for EXP (B)	
						Lower	Upper
Doctor's prescription							
Intercept	3.270	0.945	11.965	0.001			
Knowledge about antibiotic resistance							
Yes	0.244	0.860	0.080	0.777	1.276	0.237	6.879
No®							
Change the prescribed antibiotic without doctor's advice							
Yes	1.126	0.859	1.717	0.190	3.083	0.572	16.611
No®							
Follow antibiotic course as prescribed							
Yes	-2.572	0.897	8.227	0.004	0.076	0.013	0.443
No®							
Community pharmacist							
Intercept	1.020	1.084	0.885	0.347			
Knowledge about antibiotic resistance							
Yes	1.630	0.994	2.688	0.101	5.102	0.727	35.793
No®							
Change the prescribed antibiotic without doctor's advice							
Yes	0.415	0.937	0.196	0.658	1.514	0.241	9.501
No®							
Follow antibiotic course as prescribed							
Yes	-2.397	1.025	5.467	0.019	0.091	0.012	0.679
No®							
Opinion of relative							
Intercept	-0.524	1.422	0.136	0.713			
Knowledge about antibiotic resistance							
Yes	2.208	1.338	2.722	0.099	9.099	0.660	125.368
No®							
Change the prescribed antibiotic without doctor's advice							
Yes	0.099	1.059	0.009	0.925	1.104	0.139	8.795
No®							
Follow antibiotic course as prescribed							
Yes	-1.435	1.119	1.644	0.200	0.238	0.027	2.135
No®							

Model Fit: −2 Log Likelihood 58.138, LRT *P* (Know_ABR: 0.008, Course_AB: 0.175, Change_AB: 0.015), Classification overall percentage: 77.5. SE=Standard error, CI=Confidence interval; ® indicates reference category.

found to be positively associated with self-medication (OR: 0.238, confidence interval: 0.17–0.33).[15] The majority of the students strongly agreed with the opinion that unnecessary uses of antibiotics make them inactive.

Since this cross-sectional study collects information from a sample of 200 students from only one university, this may affect the precise conclusion. A nationwide representative sample from different universities would help overcome this limitation, but that requires significant funding. The results of the study could be more noteworthy if a sufficiently large sample was included. However, the results of the study could be used by the government to take nationwide initiative on the awareness program among the students on antimicrobial resistance to reduce the practice of self-medication.

Conclusions

This study marked out that the students have mid-level knowledge about antibiotics, especially about antibiotic resistance. This consequence indicates that students of MBSTU were not aware enough of antibiotic resistance. It is common for the students to use antibiotics by self-medication. The study also found that the respondents have some knowledge gap in several perspectives of antibiotic usages, such as 1. taking antibiotics based on previous experience, 2. leftover antibiotics for future use, and 3. changing antibiotics without a doctor's prescription. To eradicate antibiotic resistance, people should follow the antibiotic course strictly following the prescription of a registered doctor. The inappropriate use of antibiotics should be stopped by enforcing regulation to drug sellers by the government authorities, initiating primary care points, and increasing

the facilities of poor people in government hospitals. Finally, an effort by regular seminars and workshops about the negative impact of antibiotic resistance to aware the students as well as common people of the country can alleviate antimicrobial resistance.

Ethics approval statement

This research was approved by the Department of Statistics, MBSTU, Santosh, Tangail-1902, Bangladesh, and was conducted by one of the co-authors of this study for the partial fulfillment of his M. S. Degree requirement. Informed consent was obtained from all individual participants included in the study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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