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Original Research Article

Assessment of knowledge, attitude and practices on antibiotic resistance among undergraduate medical students in the school of medicine at the University of Zambia

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ABSTRACT

Background: The issue of antibiotic resistance has become a global public health concern, with an extensive clinical and economic burden. The study aimed to assess the knowledge, attitude, and practices of antibiotic resistance among undergraduate medical students at the University of Zambia.
Methods: This cross-sectional study was conducted at the University of Zambia Ridgeway Campus. A structured questionnaire was administered to 260 randomly selected undergraduate medical students. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 22.0. Associations between dependent and independent variables were done using a Chi-square test. The statistical significance was done at 95% confidence level ($p<0.05$). Ethical approval was done by the University of Zambia Health Sciences Research Ethics Committee.
Results: The study found that 227 of 260 (87.3%) of the medical students had good knowledge on antibiotic use and resistance. The majority of the medical students 252 of 260 (96.9%) had positive attitudes and 195 of 260 (75%) had good practices towards antibiotic resistance. There was a significant difference between the year of study and the level of knowledge ($\chi^2=16.333$, $p=0.003$). There was no significant difference between the year of study and the attitude of the participants ($\chi^2=4.061$, $p=0.398$). A significant difference was found between the year of study and the practices of the respondents ($\chi^2=10.926$, $p=0.027$).
Conclusions: The medical students had good knowledge, a positive attitude, and good practices towards antibiotic resistance. Final year students had higher levels of knowledge and attitude but lower levels of practice compared to other years of study.

Keywords: Antibiotic resistance, Attitude, Knowledge, Medical students, Practices, Zambia

INTRODUCTION

The problem of antibiotic resistance is a global public health concern that causes increased morbidity, mortality, and economic burden.[1,2] Medical students should not only be made aware of the current emerging health issues but also be directed towards rational antibiotics prescribing behavior as future medical practitioners.[3] It has been recommended that adequate training on antimicrobial prescribing and resistance should be provided to the undergraduate medical students to reduce antibiotic resistance (ABR).[4]

Antimicrobial resistance (AMR) occurs when infectious agents' adaptation to exposure to antimicrobials used in human and veterinary medicine.[5] Some factors leading to

AMR include self-medication, absence of diagnostic tools, dispensing of antibiotics without prescriptions, inappropriate prescribing of antimicrobials by doctors.[6] Many factors could influence doctors' decisions, leading them to breach the principles of good clinical practice.[7] Factors such as patients' demands, doctors' personal experiences and preferences, lack of culture and sensitivity results leading to uncertain diagnosis, sale of antibiotics without prescription are some of the most common contributors towards antibiotic resistance, poor knowledge and lack of knowledge on rational prescribing and AMR.[8,9]

Knowledge and beliefs influence health-related behavior with regards to using antibiotics.[10] Inappropriate attitudes and lack of knowledge towards the use of antibiotics is a high-risk factor contributing to the rise of AMR cases.[11]

AMR has bought about challenges to the effective prevention and treatment of infections caused by bacteria, fungi, parasites, and viruses.[1] Some of the multi-drug resistance (MDR) microorganisms that are a global public health challenge include *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli* bearing extended-spectrum β-Lactamases (ESBL).[12] These strains of microorganisms are resistant to the common antibiotic classes such as penicillins, cephalosporins, tetracyclines and polymyxins.[13] Bacterial resistance to antimicrobial agents is classified as intrinsic resistance and acquired resistance.[14] The intrinsic resistance of a species of bacteria to an antibiotic is the ability to resist the bactericidal or bacteriostatic effects of antibiotics.[15] Acquired resistance is attributed to the reduced cell permeability, production of drug-inactivating enzymes, and acquisition of a target by-pass system drug removal from the cell, and modification of an existing target.[16]

Antimicrobial Stewardship Program (ASP) is one major strategy used in the prevention and reduction of AMR.[1,17,18] The cardinal aims of ASP include prevention or slowing the emergence of AMR, optimize antibiotic selection, promote rational prescribing, reduce hospital stay, emphasize the completion of antibiotic therapy, reduce adverse drug events, reduce morbidity and mortality.[1,19]

Future prescribers such as medical students need to have adequate information on antimicrobial resistance to tackle AMR adequately.[20,21] However, to the best of our knowledge, there are no published studies that have been done in Zambia to assess these aspects.

METHODS

Study setting and design

This was a cross-sectional study design that was conducted from October 2018 to June 2019 at the University of Zambia, Ridgeway campus in the School of Medicine in Lusaka, Zambia**.**

Target population

The study population consisted of 742 medical students from 3rd to 7th year. Participants were selected for the study using a simple random sampling method.

Sample size determination

Among total no. of population of 742, third years was 175; fourth years was 152; fifth years was 140; sixth years was 149; seventh years was 126.

Sample size of the study was 260 medical students.

Distribution of sample size

(Sample size ÷ total population) × number of students in each class

3rd year students (260 ÷ 742) ×175 =61

4th year students (260 ÷ 742) ×152 =53

5th year students (260 ÷ 742) ×140 =49

6th year students (260 ÷ 742) ×149 =52

7th year students (260 ÷ 742) ×126 =45

Data collection tool

The data collection tool was developed according to a previous questionnaire used in China.[22] The questionnaire was adapted to the setting of Lusaka and piloted among 15 undergraduate medical and 15 Bachelor of Pharmacy students. The dependent variables included knowledge, attitude, and practices whereas the independent variables include age, year of study, gender and religion.

Data collection, analysis and presentation

Data was collected from every questionnaire that was returned from participants. This was double-checked for accuracy and the data was sorted out manually. Microsoft Excel 2013 was used to enter and code data. Analysis of data was done using Statistical Package for Social Science (SPSS) version 22.0. A Chi-square test was used to test the relationship between the dependent and independent variables. The Statistical significance was set at 95% confidence level ($p<0.05$).

Determining the knowledge of participants towards antibiotic resistance

The participants who scored >57% were classified as having good knowledge while those who scored ≤57% were considered as having poor knowledge of antibiotic resistance.

Determining participants attitudes towards antibiotic resistance

Participants who scored >51% were classified as having a positive attitude and those that scored ≤51% were classified as having a negative attitude towards antibiotic resistance.

Determining participants practices towards antibiotic resistance

Participants who scored >51% were classified as having good practices and those that scored ≤51% were classified as having poor practices towards antibiotic resistance.

Ethical consideration

This study was conducted after ethical approval by the University of Zambia School of Health Sciences Research Ethics Committee (UNZAHSREC). Permission to conduct the study at the University of Zambia (UNZA) was obtained from the School of Medicine management.

RESULTS

Socio-demographic characteristics of participants

The study had a total of 260 undergraduate medical students of which the majority were male 177 of 260 (768.1%). The majority of the participants were from the age group of 20-25 years 194 of 260 (74.6%).

Table 1: Baseline characteristics of participants (n=260).

Variable	Characteristics	Frequencies	%
Sex	Female	83	31.9
	Male	177	68.1
Age (in years)	20-25	194	74.6
	26-30	61	23.5
	31-38	5	1.9
Year of study	3rd year	61	23.5
	4th year	53	20.4
	5th year	49	18.8
	6th year	52	20.0
	7th year	45	17.3
Religion	Christian	254	97.7
	Islam	2	0.8
	Others	4	1.5

Table 2 shows that 258 out of 260 (99.2%) responded correctly that antibiotics can cure bacterial infections while 243 out of 260 (93.5%) responded that antibiotics can cure viral infections.

Table 3 shows that the majority of the participants 227 of 260 (87.3%) had good knowledge and while 33 of 260 (12.7%) had poor knowledge.

Table 2: Knowledge of participants on antibiotic use and resistance.

Knowledge questions	Correct response N (%)	Wrong response N (%)
Antibiotics can cure bacterial infections	258 (99.2)	2 (0.8)
Antibiotics cannot cure viral infections	243 (93.5)	17 (6.5)
Use of antibiotics will speed up recovery of a cold	130 (50)	130 (50)
I have heard of antibiotic resistance	253 (97.3)	7 (2.7)
Frequent use of antibiotics can lead to ABR and reduce the effectiveness of treatment	242 (93.1)	18 (6.9)

Table 3: Participants knowledge response.

Knowledge of antibiotic resistance	Frequency (N)	Percentage (%)
Good knowledge	227	87.3
Poor knowledge	33	12.7
Total	260	100

Table 4: Attitude of participants regarding antibiotic use and resistance (n=260).

Participants Attitude	Frequency (N)	Percentage (%)
Abuse of AB has become the main cause of leading bacterial resistance?		
Disagree	19	7.3
Neutral	15	5.8
Agree	155	59.6
Strongly agree	71	27.3
Is it necessary to get more education about antibiotics?		
Disagree	10	3.8
Neutral	1	0.4
Agree	125	48.1
Strongly agree	124	47.7
Is there a need to establish a course on the "rational use of antibiotics?		
Disagree	29	11.2
Strongly disagree	10	3.8
Neutral	21	8.1
Agree	126	48.4
Strongly agree	74	28.5
Do you find it necessary to carry out large scale antibiotics campaign promotion?		
Disagree	21	8.1
Strongly disagree	2	0.8
Neutral	23	8.8
Agree	138	53.1
Strongly agree	76	29.2

Table 4 shows that the majority of the participants 155 of 260 (59.6%) agreed that the abuse of antibiotics has become the main cause leading to antibiotic resistance. The participants also agreed that it is necessary to get more education about antibiotics and there is a need to establish a course on the rational use of antibiotics.

Table 5 below shows that the majority of the participants 252 of 260 (96.9%) exhibited a positive attitude and while the minority 8 of 260 (3.1%) had a negative attitude towards antibiotic resistance.

Table 5: Participants attitude response.

Attitude towards antibiotic resistance	Frequency (N)	Percentage (%)
Positive attitude	252	96.9
Negative attitude	8	3.1
Total	260	100

Table 6 shows that 137 of 260 (52.7%) of the participants disagreed that they took antibiotics when they had a congested nose and headache. When asked if they at one point asked doctors to prescribe antibiotics when they caught a common cold, 131 of 260 (50.4%) disagreed.

Table 6: Practices of participants towards antibiotic use and resistance (n=260).

Participants practice	Frequency (N)	Percentage (%)
Do you take antibiotics when you have a congested nose and headache?		
Strongly agree	7	2.7
Agree	47	18.1
Neutral	23	8.8
Disagree	137	52.7
Strongly disagree	46	17.7
Have you asked doctors to prescribe antibiotics for your common cold?		
Strongly agree	7	2.7
Agree	45	17.3
Neutral	17	6.5
Disagree	131	50.4
Strongly disagree	60	23.1
Better to stop course of antibiotics once symptoms of illness get resolved		
Strongly agree	7	2.7
Correct response (no)	212	81.5
Wrong response (yes)	48	18.5

Table 7: Practices of participants towards antibiotic resistance.

Practices on antibiotic resistance	Frequency (N)	Percentage (%)
Good practices	195	75
Poor practices	65	25
Total	260	100

Table 7 shows that 195 or 260 (75%) of the participants had good practices while 65 of 260 (25%) had poor practices towards antibiotic resistance.

Relationship between the year of study and level of knowledge on antibiotic resistance

The results were significant with a Chi-square of 16.333 and a p value of 0.003. This meant that there was a significant difference in knowledge about antibiotic resistance and year of study. The seventh-year medical students were more knowledgeable about antibiotic resistance compared to the other years of study.

Relationship between the year of study and their attitude towards antibiotic resistance

The results were non-significant with a Chi-square test of 4.061 and a p value of 0.398. This meant that there was no significant difference in attitude on antibiotic resistance and the year of study. Third-year medical students had a better attitude towards antibiotic resistance compared to the other years of study.

Relationship between the year of study and the practices towards antibiotic resistance

The results were significant with a Chi-square of 10.926 and a p value of 0.027. This meant that there was a significant difference in practices about antibiotic resistance and year of study. Seventh-year medical students had better practices towards antibiotic resistance compared to the other years of study.

DISCUSSION

The present study assessed the knowledge, attitude, and practices of medical students about antibiotic resistance. In the current study, 68.1% were male while 31.9% were female. This is different from a study done in Malaysia, there was more female participation representing 72% while 28% were male.[23] In Nepal, the majority of the participants in the study were female representing 63.7% while 36.3% were male.[24] In China, a female predominance was observed of which females were 63.7% while 36.3% were male.[25] The difference could be attributed to the fact that Malaysia, Nepal, and China enroll more female than male students in their medical Universities.

The current study had the largest participation from the third year (23.5%), this was followed by fourth-year students 20.4%, sixth year students 20.0%, the fifth year students had 18.8% and the least was seventh year class 17.3%. This trend in Zambia indicates that many students are enrolling in medical studies. This differs from a study that was done by Huang and colleagues among Chinese medical students in which the majority of participants were from the fourth year.[22] The difference could be due to differences in sample size.

Most of the respondents were Christians 97.7% because Zambia is a Christian nation, followed by others 1.5% this encompassed Buddhism, mixed Buddhism and Hinduism and also those who are not religious and the least was Islam 2 of 260 (0.8%). In contrast, a study done in Malaysia found that 84% were Muslim, Hindu 8%, Buddhist 6%, and Christian 1%. The difference could be attributed to the fact that Malaysia is a Muslim-majority nation thus you would not find many Christians or Hindus.[23]

Knowledge of participants of antibiotic use and resistance

In this present study, 99.2% responded correctly that antibiotics are used to treat bacterial infections. The present study thus reported an overall good knowledge of antibiotic use and resistance which was similar to what Dutt and colleagues reported in India.[26] In Italy, similarly, the majority of the participants were aware that antibiotics are useful for treating bacterial infections (95.2%).[7] Another study in India reported a high level of knowledge on the usefulness of antibiotics in treating bacterial infections.[27] Khajuria et al in India similarly reported that 90% of the medical students knew the indication of antibiotics.[28] The reason for this could be because participants might have come across this topic in medical microbiology, pharmacology, and practicals for clinical students.

A high level of correct response (93.5%) in the present study was observed to the statement that antibiotics cannot cure viral infections. This is similar to a study that was done in Saudi Arabia in which the majority of the medical students denied that antibiotics are very useful in the treatment of viral infections.[29] Some studies also reported that medical students denied that antibiotics are very useful in the treatment of viral infections.[27,30,31] This disagreement with the use of antibiotics in treating viral infections could be because students have learned about this in courses such as pharmacology.

In the present study, half of the students (50%) said that antibiotics speed up recovery from a cold while half of them refused. In India, a study reported that 38% of the participants agreed that antibiotics are useful in treating viral infections and 60% of these participants further agreed that antibiotics must be taken for someone to recover from a common cold.[4]

All the students in the present study accepted that they have heard of antibiotic resistance. This is similar to the findings by Gupta et al among medical students in India.[27] In Nigeria, Ajibola et al found similar findings.[32]

In our study, 93.1% of the medical students correctly responded that frequent use of antibiotics can lead to antibiotic resistance and reduced effectiveness of treatment. Our findings are similar to a study by Khan et al who reported that 85% of the medical students correctly responded that the frequent use of antibiotics can lead to antibiotic resistance and hence lead to ineffective treatment and the additional burden of medical cost to the patient.[4]

Overall the results of the study showed that 87.3% had good knowledge while 12.7% had poor knowledge regarding antibiotic use and resistance. Final year students had a higher level of knowledge than the other years of study. Other studies have also reported good knowledge on antibiotic use and resistance among medical students.[3,4,7,24,33]

The attitude of participants towards antibiotic use and resistance

In our study, 86.9% of the participants agreed that the abuse of antibiotics is one of the factors leading to bacterial resistance. These results are similar to the results obtained in China in which 83.88% of the medical students considered the abuse of antibiotics as one of the main causes of bacterial resistance.[22] Abuse of antibiotics has been reported by many other researchers as one of the main factors leading to antibiotic resistance.[4,24,28,34]

Regarding the necessity to get more education about antibiotics and antibiotic resistance, 95.8% of the participants in our study agreed that it was necessary. Further, 76.9% of the participants in our study agreed that education on the rational use of antibiotics is very cardinal. This is consistent with a study that was done in South Africa in which most of the medical students reported that they would appreciate more education on the appropriate use of antibiotics.[35] Other studies have reported that adequate education on the rational use of antibiotics and antibiotic resistance is very important for medical students as they are the future prescribers.[36,37]

In the present study, 82.3% of the participants agreed that it is necessary to carry out large scale antibiotics campaign promotion. This is similar to a study done by Huang and colleagues in which 81.96% of the medical students thought it was necessary to launch certain large scale publicity to promote understanding of antibiotics.[22] The similarity could be linked to the fact that there are no large scale campaigns that could alert people on antibiotic use and antibiotic resistance.

Overall the results of the study showed that 96.9% of the participants had a positive attitude while 3.1% had a negative attitude towards antibiotic use and resistance. The third-year medical students had a better attitude towards antibiotic resistance compared to the other years of study. In Nepal, a higher level of attitude towards antibiotic use and resistance was reported among final year medical students than first-year medical students.[24]

Practices of participants with regards to antibiotic use and resistance

Our study reported that 70.4% of the participants disagreed with the statement that they take antibiotics when experiencing a headache. In China, a study reported that the majority of the participants disagreed that they take antibiotics when they have a headache.[25] This shows that very few medical students wrongly use antibiotics to treat headaches.

Regarding the participants' practice on whether they asked doctors to prescribe antibiotics when they caught a common cold, 73.5% disagreed, 17.3% agreed, 6.5% neutral, and 2.7% strongly agreed. The majority of the students disagreed but there was a minority who believed that antibiotics are used to treat a common cold. This is similar to a study done in western China where more than 10% of students incorrectly believed that antibiotics should be used for common colds.[38] In China, it was reported that 13.6% of the medical students used antibiotics for a common cold.[22] Similarly, other studies have also reported that usage of antibiotics among medical students for treatment of a common cold.[3,7,39]

In the present study, the majority of the medical students (81.5%) disagreed that it is better to stop a course of antibiotics immediately when symptoms of illness get resolved. The findings of our study are similar to the findings of Bharath et al who reported that the majority of the medical students (75%) were aware that it is important to complete a course of antibiotics.[40] Scaioli et al reported that 94.8% while Kanneppady et al reported that 87.6% of the medical students were aware that it is mandatory to complete the full course of antibiotics even if the symptoms resolved.[7,37]

Overall the results of the study showed that 75% of the participants had good practices while 25% had poor practices towards antibiotic use and resistance. Seventh year medical had better practices towards antibiotic resistance compared to the other years of study. In Nepal, a very low practice was reported with first-year students having a higher level of practice than final year students.[24] Antibiotic resistance can be reduced by improving the knowledge, attitude, and practices of healthcare providers on antibiotic use and resistance.

CONCLUSION

This study showed that medical students had good knowledge concerning antibiotic resistance. The study also showed that medical students had a good attitude and practices towards antibiotics antibiotic resistance. The study reported a high score in attitude than knowledge and practices. Lastly, improvements in antibiotic usage and prescribing must be made in the medical curriculum for undergraduate students to reduce the emergence of antibiotic-resistant bacteria.

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