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Knowledge, Attitudes, and Practices towards Antibiotic Use and Antimicrobial Resistance among Pharmacy Students at the University of Zambia: Implications for Antimicrobial Stewardship Programmes

Steward Mudenda[1*], Mirriam Mukela[1], Scott Matafwali[2], Michelo Banda[1], Ronald Kampamba Mutati[1], Lungwani Tyson Muungo[1], Victor Daka[3], Shereen Ahmed Mohammed Saad[4], Flavien Nsoni Bumbangi[5], Billy Chabalenge[6]

[1]Department of Pharmacy, School of Health Sciences, University of Zambia, Lusaka P.O. Box 50110, Zambia
[2]Clinical Research Department, Faculty of Infectious and Tropical Diseases, London School of Hygiene & Tropical Medicine, London, United Kingdom
[3]Department of Public Health, Michael Chilufya Sata School of Medicine, Copperbelt University, Ndola, Zambia
[4]College of Veterinary Science, P.O Box 10739, University of Bahr El- Ghazal, Wau, South Sudan
[5]School of Medicine and Health Sciences, Eden University, Lusaka P.O Box 37727, Zambia
[6]Department of Medicines Control, Zambia Medicines Regulatory Authority, Lusaka, Zambia

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***Corresponding author:** Steward Mudenda
Department of Pharmacy, School of Health Sciences, University of Zambia, Lusaka P.O. Box 50110, Zambia

Abstract **Original Research Article**

Background: Antimicrobial resistance (AMR) is a global public health problem affecting healthcare systems. There is little information on undergraduate pharmacy students' knowledge, attitude, and practices regarding antibiotic use (AMU) and AMR in Zambia. This study assessed knowledge, attitude, and practices on AMU and AMR among undergraduate pharmacy students at the University of Zambia. ***Materials and Methods:*** This cross-sectional study was conducted among172 randomly selected participants using a structured questionnaire. Data were analysed using IBM Statistical Package for Social Sciences version 20. ***Results:*** Of the 172 total participants, 55.2% (n = 95) were male. Most participants were between 21 and 25 years old (n=110, 64 %). Most of the pharmacy students had good knowledge (n=155, 90% average score), positive attitude (n=145, 84% average score) but suboptimal practices (n=110, 64% average score) about AMU and AMR. Despite these good scores, the prevalence of self-medication using antibiotics was 41% (n=70).***Conclusion:*** Undergraduate pharmacy students had good knowledge, and a positive attitude, but suboptimal practices towards AMU and AMR. A low-average practice score is of great concern and requires urgent attention. There is a need to improve the details of the undergraduate pharmacy curriculum regarding AMU, AMR and antimicrobial stewardship programmes.

Keywords: Antibiotics; Antibiotic use; Antimicrobial resistance; Antimicrobial Stewardship; Attitude; Knowledge; Pharmacy students; Practices; Self-medication; Zambia.

INTRODUCTION

Antibiotics are medicines used to treat infectious diseases and have proven to be a cornerstone in this area [1,2]. Since their discovery, antibiotics have continued playing a vital role in treating infections and preventing morbidity and mortality that arise from infectious diseases [1-4]. However, the challenging part has been the development of antimicrobial resistance (AMR) [5, 6]. AMR is a global public health problem that has continued affecting healthcare systems across the globe [6-9]. AMR may cause the treatment of infections to be difficult or impossible and increases morbidity and mortality associated with such infections [10, 11].

Inappropriate use of antibiotics in both humans, animals and the environment has been reported to be a contributing factor to the development of AMR [7,12-15]. Some factors that promote the emergence of antibiotic-resistant bacteria include overprescribing antibiotics, empirical treatment and non-prescription sale of antibiotics [16-21]. Additionally, self-medication with antibiotics (SMA) among community members [22], healthcare workers (HCWs), and students has continued to worsen AMR [23-25].

In resource-constrained countries, AMR has been reported to cause increased morbidity and mortality [26, 27]. In addition, it increases healthcare medical costs and economic burdens [28, 29]. This is not good for countries that are already constrained economically. Therefore, healthcare workers and students must promote the rational use of antibiotics and educate the public on the consequences of inappropriate use of these precious drugs [30-32]. Besides, strategies that can be employed to curb the problem of AMR include implementing and promoting antimicrobial stewardship (AMS) programmes [33-36]. AMS programmes reduce the inappropriate use of antibiotics and improve patient outcomes and care [33, 37]. Pharmacy students are future pharmacists and must be educated about antibiotic use (AMU) and AMR and engaged in AMS programmes [38]. This is also true for other healthcare students who require AMR and AMS training as they are the future healthcare workers responsible for disease prevention and treatment using antibiotics [8, 39].

Zambia is a low-income country affected by the AMR challenge [7, 12, 17, 40]. Studies have shown that the inappropriate use of antibiotics in humans has contributed to the development of AMR [23, 41, 42].Besides, accessing antibiotics without a prescription has been reported to be among the common causes of AMR [17]. Further, inappropriate prescribing continues to be a significant driver of AMR. Similarly, the inappropriate use of antibiotics in animal husbandry among Zambian farmers has also contributed to the rise of AMR [43-46]. Therefore, this calls for strategies to arrest or curb the inappropriate use of antibiotics and prevent infections caused by antibiotic-resistant microorganisms [7].

Studies have shown that poor knowledge and a negative attitude towards antibiotic use may promote the development of AMR [38,47-49]. Pharmacy students' knowledge and attitude toward antibiotics affect their practices regarding antibiotic AMU and AMR [47]. Students who have little information about the inappropriate AMU and consequences of AMR usually tend to SMA [50-53]. In Zambia, there is insufficient information on the knowledge, attitude and practices (KAP) towards AMU and AMR among undergraduate pharmacy students at the University of Zambia.

MATERIALS AND METHODS

Study Design and Site

This descriptive cross-sectional study was conducted among undergraduate pharmacy students at the University of Zambia (UNZA) from January 2018 to July 2018. UNZA was the first university in Zambia to train pharmacists in 2001 [54]. At the time of the study, the University of Zambia was the only public university offering a degree programme in pharmacy. This study was conducted in the School of Health Sciences at Ridgeway Campus.

Sample Size Determination and Sampling

The sample size was calculated using Yamane's formula [55]. The total population of undergraduate pharmacy students at UNZA during the period of the study was 301. A margin error of 5% was used at a 95% confidence interval giving a total sample size of 172 students. A simple random sampling method was used to select participants based on their class registers. Regarding the year of study, the survey enrolled 59second year, 44thirdyear, 34 fourth year and 35 fifth year students.

Data Collecting Tool

Data was collected using a structured self-administered questionnaire adapted from a similar study [56]. The questionnaire was modified after validation by experts from the University of Zambia. The validation included checking for internal consistency, ease, simple, and understandable questions. The questionnaire was then piloted among 20 undergraduate pharmacy students who later did not participate in the main study. Besides, the results obtained from the pilot study were not used in the analysis of the main study. The questionnaire had four sections that were used to collect data on participants' socio-demographic characteristics, knowledge, attitude, and practices (KAP) towards AMU and AMR. The participants' responses on knowledge, attitude, and practice (KAP) questions were measured using a 5-point Likert-scale as follows; 5= 'strongly agree', 4= 'agree', 3= 'neutral', 2= 'disagree', and 1= 'strongly disagree'. The questions on knowledge were 5 and scores ranged from 5 to 25, scores equal to or above 20 indicated good knowledge while scores below 20 indicated poor knowledge. The questions for attitudes were 5, and scores ranged from 5 to 25, scores equal to or above 16 indicated positive attitudes while scores below 16 indicated negative attitudes. The questions regarding practices were 5, and scores ranged from 5 to 25, scores equal to or above 15 indicated good practices, while scores below 15 indicated poor practices.

Data Analysis

Data were initially entered into Microsoft Excel Spreadsheet and then transferred into Statistical Package for the Social Sciences (SPSS) version 20 for analysis. We used descriptive statistics to analyse the data. The results were presented in the form of frequencies and percentages in tables.

Ethical Approval

This study was approved by the University of Zambia School of Medicine Undergraduate Research Ethics Committee (UNZASOMUREC). All participants voluntarily consented to be part of the study.

RESULTS

Socio-Demographic Characteristics of the Participants

A total of 172 students participated in this study of which 95(55.2%) were male, and most (64%)

were aged between 21 – 25 years, as presented in table 1.

Table 1: Socio-demographic characteristics of the participants

Variable	Category	Frequency	Percentage %
Sex	Male	95	55.2
	Female	77	44.8
Age	15 - 20	18	10.5
	21 - 25	110	64
	26 - 30	23	13.4
	31 - 35	7	4.1
	36 - 40	13	7.6
	> 40	1	0.6
Year of Study	Second	59	34.3
	Third	44	25.6
	Fourth	34	19.8
	Fifth	35	20.3
Marital status	Married	28	16.3
	Single	144	83.7
Religion	Christianity	168	97.7
	Islam	4	2.3

Table 2 shows that pharmacy students had good knowledge, positive attitudes and suboptimal practices regarding AMU and AMR.

Table 2: Overall knowledge, attitude and practices regarding AMU and AMR

Variable	Good (n, %)	Poor (n, %)
Knowledge (mean scores)	155 (90)	17(10)
Attitude (mean scores)	145 (84)	27(16)
Practice (mean scores)	110(64)	62(36)

Most students knew the use of antibiotics (87.2%), agreed that AMR is a public health problem (54.1%), and discarded leftovers of antibiotics (61%). The prevalence of self-medication with antibiotics (SMA) was 41% (Table 3).

Table 3: Participants' knowledge, attitudes and practices regarding AMU and AMR

Variable	Questions	Agree	Disagree	Neutral	Strongly Agree	Strongly Disagree
Knowledge	Antibiotics are used to treat infections caused by bacteria	13 (7.6)	5 (2.9)	0 (0.0)	150 (87.2)	4 (2.3)
	Antibiotics are effective against urinary tract infections	21 (12.2)	7 (4.1)	11 (6.4)	133 (77.3)	00 (0.0)
	Antibiotics should be stopped after completion of the prescribed course	22 (12.8)	1 (0.6)	5 (2.9)	144 (83.7)	00 (0.0)
	AMR occurs when bacteria stop responding to antibiotic treatment	47 (27.3)	18 (10.5)	2 (1.2)	84 (48.8)	21 (12.2)
	Infections caused by antibiotic-resistant bacteria are impossible or difficult to treat	6 (3.5)	15 (8.7)	6 (3.5)	133 (77.3)	12 (7)
Attitude	AMR is a global public health problem	93 (54.1)	3 (1.7)	1 (0.6)	71 (41.3)	4 (2.3)
	Antibiotic resistance increases with increased consumption of antibiotics	91 (52.9)	17 (9.9)	17 (9.9)	44 (25.6)	3 (1.7)
	The development of new antibiotics will solve the problem of AMR	79 (45.9)	17 (9.9)	10 (5.8)	64 (37.2)	2 (1.2)
	The inappropriate use of antibiotics in animal medicine may lead to AMR	66 (38.4)	14 (8.1)	15 (8.7)	72 (41.9)	5 (2.9)
	Patients must be advised to adhere to antibiotic treatment	26 (15.1)	00 (0.0)	1 (0.6)	141 (82)	4 (2.3)
Practices	I self-prescribe antibiotics whenever I feel sick	43 (25)	20 (11)	00 (0.0)	27 (16)	82 (48)
	I take antibiotics when I have a cold and fever	60 (35)	62 (36)	2 (1.2)	10 (5.8)	38 (22)
	I educate the public on antibiotic use and AMR	100 (58)	18 (11)	00 (0.0)	38 (22)	16 (9)
	I take part in antibiotic awareness campaigns	50 (29)	57 (33)	6 (3)	18 (11)	41 (24)
	I discarded leftover antibiotics after recovering	62 (36)	1 (1)	00 (0.0)	106 (61)	3 (2)

DISCUSSION

This study was conducted to evaluate the knowledge, attitude and practices of undergraduate pharmacy students on AMU and AMR at the University of Zambia. The study found that the students had good knowledge, positive, attitudes, and suboptimal practices towards AMU and AMR. The prevalence of SMA in our study was found to be 41%.

The findings of the current study indicated good knowledge, of AMU and AMR among undergraduate pharmacy students at UNZA. These findings corroborate with the results of similar studies in Zambia, Trinidad and Tobago, and at 3 universities in East Africa where the students had good knowledge of antibiotics and AMR [30, 38, 57]. This could be because students are more exposed to these topics in their undergraduate courses such as pharmacology and microbiology. In fact, in another survey among university students about antibiotic resistance, it was revealed that university instructors were a source of information regarding antibiotic resistance [58].The recently instituted World Antibiotic Awareness Week could also contribute to the good knowledge levels observed among the respondents [59].

There was further evidence of good knowledge since most participants knew that antibiotics are used to treat infections caused by bacteria and this has similarly been demonstrated in students from other studies that answered this question correctly [60, 61]. Furthermore, similar to other studies [58, 62], students knew that antibiotics are effective against UTIs and should only be stopped after completion of the prescribed course, similar to what was reported in another study [63]. Additionally, they were aware that AMR occurs when bacteria stop responding to antibiotic treatment and infections caused by antibiotic-resistant bacteria are impossible or difficult to treat. This awareness is similar to what was observed in undergraduate students in Ecuador and Brunei [58, 62]. Evidence has shown that infections caused by antimicrobial-resistant pathogens are difficult or impossible to treat [64]. Therefore, pharmacy students being future pharmacists should join the promotion of rational use of antimicrobials.

Our study found that most participants had positive attitudes towards antibiotic use and AMR. The participants in the current study knew that AMR is a global public health problem that has been worsened by increased consumption and inappropriate use of antibiotics in animals and humans [65,66]. The study is consistent with what was found in previous studies among healthcare students in Rwanda and South Africa who were aware of this global threat [67, 68]. An analysis of the global burden of AMR by Goossens and Lipsitch reported that the problem of AMR is high in countries with high consumption rates [69]. Additionally, participants reported that patients should be advised to follow antibiotic treatment. This attitude is good to have as the next dispensers, and pharmacotherapists will give the best practice advice to patients. Conversely, most of the participants felt that the development of new antibiotics might help to curb AMR. A study in Lebanon among university students had similar findings, with more healthcare students agreeing to this compared to non-healthcare students [48]. Evidence has also shown that AMR has been worsened by a lack of development of new antibiotics, hence, a need for improved drug development to address this issue [70-72].

The current study found that the overall practice score was suboptimal because lower scores were obtained than the knowledge and attitudes scores. This shows that some students had poor practices regarding AMU and AMR. In Nigeria, similar findings were reported in which students had good knowledge of AMU and AMR but suboptimal practices [73]. Some students reported that they used SMA when they felt unwell or when experienced a cold or cough. These findings are in line with other studies similar studies among students [23, 24, 74, 75]. Unfortunately, SMA is a wrong practice and is among the major causes of AMR and has been reported in other studies [52, 76]. Overall, our study found the prevalence of SMA at 41%. The prevalence of SMA reported in our study was lower than what was observed among students in Ghana (76.3%) [52], Sudan (60.8%) [77], Tanzania (57%) [78], Pakistan (50.4%) [79], and Eritrea (45.1%) [80]. However, a lower prevalence of SMA was reported in Malaysia (39.3%) [81], Ethiopia (35.9%) [82], and Rwanda (12.1%) [83]. The practice of SMA among students could be due to the knowledge they acquire in courses such as pharmacology and therapeutics [73] and their level of education [83].

Most of the participants in our study reported that they discarded leftover antibiotics after completion of the antibiotic course. Extant literature has shown that keeping leftover antibiotics at home increases the chances of SMA among students [84]. Some students never participated in antibiotic awareness week and never educated the public about AMU and AMR. Therefore, the SMA reported in our study could be due to a lack of student participation in AMR awareness campaigns. Antibiotic awareness campaigns are critical in raising awareness among students and the public [59, 85, 86]. Therefore, increasing AMS activities across the student population can improve their practices regarding AMU and AMR [87-90].

CONCLUSION

This study revealed that undergraduate pharmacy students had good knowledge, a positive attitude, and suboptimal practices regarding antibiotic use and resistance. Despite this, there were some inconsistencies in practices across students, which require improvement in the undergraduate pharmacy

curriculum to focus on student practices regarding AMU, AMR, and AMS programmes.

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