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A Cross-Sectional Survey of Knowledge, Perceptions and Practice of Antimicrobial Stewardship Concepts Among University Non-Health Professional Undergraduate Students in Southwest Nigeria

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A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of article.

Abstract

Background: Non-health professional students (NHPS) can be a veritable tool in the advocacy for antimicrobial stewardship in a community if imbued with adequate knowledge and correct perceptions. However, little is known about the knowledge, perceptions, and practice (KPP) of antimicrobial stewardship among NHPS.

Objective: This study aimed to evaluate the KPP of antimicrobial stewardship among NHPS.

Methods: A cross-sectional survey of KPP of antimicrobial stewardship was carried out among 600 consecutively selected NHPS at Olabisi Onabanjo University, Nigeria, using a pretested 30-item self-administered questionnaire with varying options and a 5-point Likert scale. Each correct answer in the knowledge domain was scored "1" and incorrect "0" and a total of eleven points were available. The modified Bloom's cut-off points were used to grade the knowledge into good (≥9 points), moderate (7-8 points) and poor (≤6 points). The Kruskal-Wallis test was used to assess the differences in perceptions among the groups.

Results: Many of the respondents (319;53.2%) were male, 274 (45.7%) had used antimicrobials without advice from physicians or pharmacists. The respondents (387; 64.5%) scored ≤ 6.0 of the total 11.0 on the knowledge scale and 430 (71.7%) with a significant difference between faculties (p<0.001) strongly agreed or agreed that "everyone needs to take responsibility for using antimicrobials responsibly".

Conclusions: Many of the non-health professional students had poor knowledge of antimicrobial stewardship and had practices that are antithetical to the concept. However, the majority perceived correctly, that appropriate use of antimicrobials was a collective responsibility.

Keywords: Antimicrobial; stewardship; non-health professional; knowledge; Nigeria

INTRODUCTION

Antimicrobial stewardship is a coherent set of actions to promote responsible use of antimicrobials not only in the organized level of care but also at the individual non-healthcare professional level (Tamma et al., 2014; Dyar et al., 2017). It describes the careful and responsible management of antimicrobials through appropriate use, disposal (expired or unused), distribution and control at the individual, national and global levels to reduce antimicrobial resistance (AMR) (Dyar et al., 2017). Antimicrobial resistance is a growing public health challenge, contributing to increased morbidity, mortality and healthcare costs worldwide (World Health Organization (WHO), 2017). In the United States of America, AMR is directly responsible for at least 23,000 death each year (Centre For Diseases Control and Prevention (CDC), 2013). The burden is expected to be greater in many low and middle-income countries (LMICs) including Nigeria, which are the hubs of AMR due to lack of awareness, poor regulation and enforcement of

legislation concerning the sales and prescriptions of antimicrobials (Auta et al., 2013; Mendelson et al., 2016).

Advocacy is an important component of the global antimicrobial stewardship framework (Federal Ministry of Agriculture, Environment and Health (FMAEH), 2017), however, it is important to identify behaviors fueling AMR in the community, discover the target population for this intervention, and raise awareness among them (Mendelson et al., 2017). Until recently, many studies have focused on the evaluation of knowledge, attitudes, and practice of AMR among University health professional students in recognition of the cardinal roles they can play in curbing the menace of AMR (Scaioli et al., 2015; Burger et al., 2016; Hu et al., 2018). However, addressing AMR is complex and studies have shown that despite the knowledge and the willingness to adhere to prescription guidelines, the pressure from the society can be more compelling and can influence physicians to prescribe antimicrobials when unnecessary (van Buul et al., 2014; Fletcher-Lartey et al., 2016). The larger community, therefore, needs to be aware, involved and take responsibility for the fight against AMR. University non-health professional undergraduate students (NHPS) especially potential educators, communicators and managers, and those that can influence legislation in the future can be a veritable tool in the advocacy for antimicrobial stewardship if knowledgeable and have the right perceptions. There is, therefore, the need to target this group of population in interventions towards the promotion of antimicrobial stewardship.

A few studies have assessed the Knowledge Practice and Perceptions (KPP) of AMR among University undergraduate NHPS (Suaifan et al., 2012; Ghaieth et al., 2015; Asogwa et al., 2017). In Nigeria, studies that investigated KPP of antimicrobial stewardship among NHPS before the introduction of the antimicrobial stewardship concept revealed that many consumed antimicrobials without physicians' prescriptions (Sanya et al., 2013), were not knowledgeable about the right source to purchase and had poor perceptions of AMR (Igbeneghu, 2013; Asogwa et al., 2017). Antimicrobial stewardship concept has been adopted in Nigeria (FMAEH, 2017), however, there is a dearth of information about the KPP of NHPS in the country. This study aimed to evaluate the KPP of antimicrobial stewardship among NHPS in a Nigerian University.

METHODOLOGY

Study setting and Design

This study was a cross-sectional quantitative survey of KPP of antimicrobial stewardship among consecutively selected NHPS of Olabisi Onabanjo University (OOU), Southwest, Nigeria. The University is a public institution that operates a multi-campus system located in Sagamu, Aiyetoro, Ibogun with the Main Campus at Ago-iwoye. Four faculties; Arts, Law, Social and Management Sciences (SMS), and Education were domiciled at Ago-iwoye at the time of the study.

Study population/Eligibility criteria

In this study, only NHPS (100 level-500 level) in the different departments of the four faculties that were domiciled on the Main campus of the University was included. The departments in the four faculties were listed and allocated numbers and were selected for inclusion in this study using a single sequence of random assignment (simple randomization technique). The participants in the selected departments were consecutively selected. Non-consenting, not available for selection at the time of the study and those that participated in the pre-test were excluded from this study.

Questionnaire Design and Data Collection

A pretested 30-item self-administered questionnaire developed after a literature review of similar studies (Auta et al., 2013; Scaioli et al., 2015; Hu et al., 2018) was used to explore the three domains of antimicrobial stewardship; knowledge about AMR, rational antimicrobial use and public perceptions about collective responsibility for the prevention of AMR (Dyar et al, 2017). The questionnaire which was sectioned into six dimensions utilized eight questions to explore the participants' socio-demographics including age, level of study and places where they were brought up. Eleven questions using varying options assessed the respondents' knowledge of antimicrobial use and AMR, three questions assessed the sources of the respondents' knowledge about AMR, three questions evaluated their perceptions of responsibility towards AMR prevention using a 5-point Likert-scale whose responses ranged from "Strongly agree" to "Strongly disagree" while the remaining five questions explored the participants' practices of antimicrobial use.

The construct validity of the questionnaire was supported by the Health Belief Model (HBM) which was anchored on four constructs, posits that the individual perception regarding susceptibility, severity, benefits, and barriers accounts for their readiness to act to reduce the risk of threat associated with that unhealthy behavior (National Institutes of Health, 2005). The questionnaire was evaluated for content validity among three academics in the

Faculties of Social Science and Pharmacy of the Olabisi Onabanjo University and pretested among 10 students in the faculties of Law and Social Sciences. Certain questions considered ambiguous based on the feedback from the content validity and pre-test were rephrased for better comprehension while a few considered redundant were removed. The internal consistency of the final questionnaire was evaluated using Cronbach alpha test. The paper-based questionnaire which took about 10 minutes to complete was administered by the principal researcher to the participants in their classrooms after lectures between 3 April and 31 August 2017.

Sample Size Determination
The sample size was estimated using a formula previously described (Charan and Biswas, 2013). Using the total number of 5642 undergraduate students that registered for the 2016/2017 academic year at Ago-iwoye Campus, a margin error of 4%, a power of 95% and 50% response distribution, a minimum sample size of 543 was calculated. With an additional 10% included for attrition, yielding a maximum sample size of 598 which was rounded up to 600.

Ethical Consideration
The participants were briefed about the objectives and procedures of the study. Participation in the study was anonymous, entirely voluntary and without inducement. Verbal consent was obtained from the participants before the administration of the questionnaire. This study was carried out in line with
RESULTS
Table 1 shows the socio-demographics of the respondents. The Cronbach alpha value for the questionnaire was 0.792. Of the 650 questionnaires distributed, 96.5% (627) were returned but only the

the ethical stipulation by the OOU Health Review Committee.

Data Management and Statistical Analysis
The data were fed into the Statistical Packages for the Social Sciences version 25 (IBM Corporation, Armonk, NY, USA) for statistical analysis. The questionnaires that were incompletely filled were removed before analysis and counted as a non-response. The data were manually cleaned and primarily analyzed using descriptive statistics including frequency and percentage. The difference in the mean ages of the groups was determined using Student t-test and ANOVA as appropriate. Chi-squared test or Fisher's exact test as appropriate was used to assess associations between knowledge and respondents' socio-demographics while Kruskal-Wallis was used to assess differences in perceptions among the groups. The participants' responses to knowledge questions were dichotomized into "correct" and "incorrect" depending on the meaning of the question. Each correct response was scored 1 and incorrect 0, the "I don't know" and "no opinion" were also scored 0. A total of 0-11 points were available on the knowledge domain. The percentages of participants with correct answers were calculated for each of the responses. The modified Bloom's cut-off points were used to grade the participants' knowledge into good ($\geq$9 points), moderate (7-8 points) and poor ($\leq$6 points) (Bloom, 1956).

600 (92.3%) properly filled were analyzed. The respondents' mean age was 21.35 (SD=1.79) years, 319 (53.2%) were male and 513 (85.5%) were brought up in urban areas.

Table 1: The socio-demographic characteristics of the respondents (n=600)

Variables	Group	Frequency	Percentage
Age (years)	18-20	211	35.2
	21-23	308	51.3
	24-27	81	13.5
Gender	Male	319	53.2
	Female	281	46.8
Marital status	Single	568	94.7
	Married	32	5.3
Highest qualification	O' level	457	76.2
	National diploma	95	15.8
	Higher national diploma	16	2.7
	BSC	32	5.3
Faculty	Social & Management sciences	140	23.3
	Law	136	22.7
	Arts	140	23.3
	Education	184	30.7

Place of upbringing	Urban	513	85.5
	Semi-Urban	4	0.7
	Rural	83	13.8
Monthly stipend	₦10,000 ($27.8)*	323	53.5
	₦15,000 ($41.7)	243	40.5
	>₦15,000 (>$41.7)	34	5.7
Level of study	100 level	153	25.5
	200 level	152	25.3
	300 level	98	16.3
	400 level	97	16.2
	500 level	100	16.7

*$ calculated at ₦360

Table 2 shows the participants' responses to the questions on knowledge of antimicrobial use and resistance. The mean ages (years) of participants in the faculties of SMS, Law, ART and Education were 21.04 (SD=1.77), 20.95 (SD=1.84), 21.44 (SD=2.06) and 21.82 (SD=1.42) respectively, with a significant difference between the faculties (p<0.001). The majority of the respondents (592; 98.7%) with a significant difference in the faculty (p=0.001) answered incorrectly the question "Antimicrobials resistance occurs when your body becomes resistant to antimicrobials and they no longer work as well".

Table 2: The respondents' knowledge of antimicrobial use and antibiotic resistance

Variables	Correct response	SMS (140) n(%)	LAW(136) n(%)	ART(140) n(%)	EDU(184) n(%)	Chi-squared p-value
When did you think you should stop taking antimicrobials once you have begun treatment						
When you feel better		79(56.4)	79(58.1)	74(52.9)	129(70.1)	
When you have taken all of the antimicrobials as directed	Correct	61(43.6)	56(41.2)	63(45.0)	55(29.9)	0.005*
I don't know		0(0.0)	1(0.7)	3(2.1)	0(0.0)	
It's okay to use antimicrobials that were given to a friend or family member						
True		85(60.7)	92(67.6)	84(60.0)	137(74.5)	
False	Correct	27(19.3)	30(22.1)	43(30.7)	47(25.5)	0.001*
I don't know		28(20.0)	14(10.3)	13(9.3)	0(0.0)	
It's okay to buy the same antimicrobials, or request these from physician						
True		33(23.6)	61(44.9)	45(32.1)	112(60.9)	
False	Correct	74(52.9)	58(42.6)	66(47.1)	65(35.3)	<0.001
I don't know		33(23.6)	17(12.5)	29(20.7)	7(3.8)	
Antimicrobials resistance occurs when your body becomes resistant to antimicrobials and they no longer work as well						
True		138(98.6)	130(95.6)	140(100.0)	184(100.0)	
False	Correct	2(1.4)	6(4.4)	0(0.0)	0(0.0)	0.001*
Many infections are becoming increasingly resistant to treatment by antimicrobials						
True	Correct	80(57.1)	77(56.6)	127(90.7)	103(56.0)	
False		60(42.9)	59(43.4)	13(9.3)	81(44.0)	<0.001
If bacteria are resistant to antimicrobials, it can be very						

difficult or impossible to treat the infections they cause						
True	Correct	20(14.3)	23(16.9)	41(29.3)	24(13.0)	
False		120(85.7)	113(83.1)	99(70.7)	160(87.0)	0.001
It is appropriate to use antimicrobials only when they are prescribed by physicians						
True	Correct	119 (85.0)	87 (64.0)	83 (59.3)	92 (50.0)	
False		21 (15.0)	45 (33.1)	42 (30.0)	92 (50.0)	
I don't know		0 (0.0)	4 (2.9)	15 (10.7)	0 (0.0)	<0.001*
Feeding animals with antimicrobials can lead to resistance						
True	Correct	107(76.4)	62 (45.5)	45 (33.0)	74 (40.2)	
False		25 (17.9)	30 (22.0)	48 (34.2)	102 (55.4)	
I don't know		8 (5.7)	44 (32.4)	46 (32.9)	8 (4.3)	0.001
It's okay to keep left-over antimicrobials and use in the future for other illnesses						
True		91 (65.0)	81 (59.6)	96 (68.6)	98 (53.3)	
False	Correct	49 (34.9)	53 (38.9)	36 (25.7)	86 (46.7)	
I don't know		0 (0.0)	2 (1.5)	8 (5.7)	0 (0.0)	0.042*
Antimicrobials can be used to treat Catarrh						
True		81 (57.9)	58 (42.6)	64 (45.7)	111(60.3)	
False	Correct	56 (40.0)	67 (49.2)	68 (48.6)	72 (39.1)	
I don't know		3 (2.1)	11 (8.1)	8 (5.7)	1 (0.5)	0.1*
Antimicrobial resistance is one of the biggest challenges to population health						
True	Correct	45 (32.2)	40 (29.4)	46 (32.9)	17 (9.2)	
False		86 (61.4)	61 (44.80	76 (54.3)	136 (73.9)	
I don't know		9 (6.4)	35 (25.7)	18 (12.9)	31 (16.8)	0.049

*__Fisher's exact__ p-value. In a few cases, the option "I don't know" was not included because they were not picked by the respondents.
SMS= Social and Management Sciences, EDU=Education

Table 3 shows the knowledge score of the respondents of the antimicrobial stewardship. The total mean score for the respondents was 5.38 (SD=2.45), the majority (387; 64.5%) scored ≤ 6 points, 168 (28.0%) scored 7-8 points and 45 (7.5%) scored ≥9 points on the knowledge scale. The respondents' knowledge scores were significantly associated with gender ($p<0.001$), highest qualification ($p=0.011$) and faculty of study ($p<0.001$).

Table 3: The association of participants' socio-demographic and knowledge scores

Variables	Grouping (n)	Scores (0-6) n(%)	Scores (7-8) n(%)	Score (9-11) n(%)	Chi-squared p-value
Gender	Male (319)	252(42.0)	42 (7.0)	25(4.2)	
	Female (281)	135(22.5)	126(21.0)	20(3.3)	<0.001
Faculty	SMS (140)	103(17.2)	27(4.5)	10(1.7)	
	LAW(136)	121(20.2)	9(1.5)	6(1.0)	
	ARTS (140)	92(15.3)	43(7.2)	5(0.8)	
	EDU (184)	71(11.8)	89(14.8)	24(4.0)	<0.001
Highest qualification	O' level (457)	296(49.3)	137(22.8)	24(4.0)	
	OND (95)	58(9.7)	24(4.0)	13(2.2)	
	HND (16)	12(2.0)	1(0.2)	3(0.5)	
	BSC (32)	21(3.5)	6(1.0)	5(0.8)	0.011*

*__Fisher's exact p-value, SMS=Social and Management Sciences, EDU= Education__

Table 4 shows the sources of the respondents' knowledge of antimicrobial use and resistance. The majority of the respondents (589; 98.2%) had not taken a course in antimicrobial resistance, 273 (45.5%)

heard the AMR terms through the healthcare professionals and 233 (38.8%) through the media while the remaining 94 (15.6%) heard it through family and friends.

Table 4: The source of information about antimicrobial resistance among the respondents in different faculties

Questions	SMS(140) n(%)	LAW(136) n(%)	ART (140) n(%)	EDUCATION(184) n(%)	Chi-squared p-value
Ever taken a course relating to antimicrobials use and resistance					
Yes	2(1.4)	0(0.0)	0(0.0)	9(4.9)	
No	138(98.6)	136(100.0)	140 (100.0)	175(95.1)	0.002*
Which of these phrases have you heard of					
Antimicrobial resistance	90(64.3)	80 (58.8)	72 (51.4)	97 (52.7)	
Antimicrobial resistance	8 (5.7)	8 (5.9)	18 (12.9)	6 (3.3)	
Antimicrobial stewardship	2 (1.2)	0 (0.0)	0 (0.0)	(0.0)	
Drug resistance	40 (28.6)	48 (35.3)	50 (35.7)	81 (44.0)	0.002*
Where did you hear about the term					
Physicians or nurses	28 (20.0)	24 (17.6)	40 (28.6)	33 (17.9)	
Pharmacists	34 (24.3)	34 (25.0)	50 (35.7)	30 (16.3)	
Family members or friends	25 (17.9)	34 (25.0)	12 (8.6)	23 (12.5)	
Media	53 (37.9)	44 (32.4)	38 (27.1)	98 (53.3)	<0.001

Fisher's exact p-value. SMS= Social & Management Sciences

Table 5 shows the respondents' perceptions of responsibility towards AMR. The majority of the respondents (430; 71.7%) with a significant difference in the faculties (p<0.001) strongly agreed or agreed that "everyone needs to take responsibility for using antimicrobials responsibly".

Table 5: The respondents' perceptions of responsibility toward antimicrobial resistance

Variables	SMS(140) n(%)	LAW(136) n(%)	ART(140) n(%)	EDU(184) n(%)	Median (IQR)
Everyone needs to take responsibility for using antimicrobials responsibly					
Strongly agree	26(18.6)	22(16.2)	26(18.6)	9(4.9)	
Agree	101(72.1)	78(57.4)	63(45.0)	105(57.1)	
No opinion	1(0.7)	12(8.8)	0(0.0)	2(1.1)	
Disagree	11(7.9)	16(11.8)	45(32.1)	43(23.4)	2.0 (2.0-4.0)
Strongly disagree	1(0.7)	8(5.9)	6(4.3)	25(13.6)	
I am worried about the impact that antimicrobials resistance will have on my health and that of my family					
Strongly agree	46(32.9)	33(24.3)	6(4.3)	24(13.0)	
Agree	39(27.9)	32(23.5)	67(47.9)	41(22.3)	
No opinion	4(3.0)	24(17.6)	29(20.7)	11(6.0)	
Disagree	20(14.3)	25(18.4)	32(22.9)	77(41.8)	3.0 (2.0-4.0)
Strongly disagree	31(22.1)	22(16.2)	6(4.3)	31(16.8)	
I am not at risk of getting antimicrobials resistance infection as long as I take my antimicrobials correctly					
Strongly agree	98(70.0)	67(49.3)	67(47.9)	76(41.3)	
Agree	34(24.3)	42(30.9)	21(15.0)	36(19.6)	
No opinion	0(0.0)	6(4.4)	8(5.7)	10(5.4)	
Disagree	1(0.7)	14(10.3)	44(31.4)	31(16.8)	1.0 (1.0-3.0)
Strongly disagree	7(5.0)	7(5.0)	0(0.0)	31(16.8)	

SMS= Social and Management Sciences, EDU= Education, IQR=interquartile range

Table 6 shows the relationship between the participants' faculties of study and their perceptions of responsibility toward antimicrobial stewardship.

There was a significant difference in the participants' opinions on taking responsibility for rational use of antimicrobials (p<0.001).

Table 6: Relationship between the participants' faculties of study and their perceptions of responsibility towards antimicrobial stewardship

Perceptions of responsibility towards antimicrobial stewardship	Faculty of participants	Frequency (%)	Mean rank	K-W p-value
Everyone needs to take responsibility for using antimicrobials responsibly	SMS	140 (23.3)	240.0	
	LAW	136 (22.7)	286.16	
	ART	140 (23.3)	310.01	<0.001
	EDUCATION	184 (30.7)	349.89	
I am worried about the impact that antimicrobials resistance will have on my health and that of my family	SMS	140(23.3)	267.65	
	LAW	136(22.7)	286.63	
	ART	140(23.3)	287.29	<0.001
	EDUCATION	184(30.7)	345.80	
I am not at risk of getting antimicrobials resistance infection as long as I take my antimicrobials correctly	SMS	140(23.3)	231.77	
	LAW	136(22.7)	294.23	
	ART	140(23.3)	316.55	<0.001
	EDUCATION	184 (30.7)	345.22	

K-W = Kruskal-Wallis, SMS=Social and Management Sciences
Lowest mean rank suggests participants who mostly agreed with the statement while the highest ranks indicate those who least agreed with the statement.

Table 7 shows the respondents' practice of antimicrobial use based on gender. The majority of the respondents (361; 60.2%) had used antimicrobials in the last one month before the study and 274 (45.7%) used it without advice from physicians or pharmacists.

Table 7: Association of gender with the practice of antimicrobial utilization among the respondents

Question	Response	Male n(%)	Female n(%)	Chi-squared p-value
When last did you take antimicrobials?	Last one month	197 (32.8)	164 (27.3)	
	Last 6 months	63 (10.5)	74 (12.3)	
	I can't remember	59 (9.8)	43 (7.2)	0.134
Did you get the antimicrobials from a physician or a nurse?	Yes	122 (20.3)	142 (23.7)	
	No	147 (24.5)	122 (20.3)	
	I can't remember	50 (8.3)	17 (2.8)	<0.001
Did you get advice from a physician, nurse or pharmacist?	Yes	108 (18.0)	142 (23.7)	
	No	151 (25.2)	123 (20.5)	
	I can't remember	60 (10.0)	76 (12.7)	<0.001
Where did you get the antimicrobial?	Pharmacy	80 (13.3)	124 (20.7)	
	PMV	135 (22.5)	59 (9.8)	
	Family or friend	20 (3.3)	37 (6.2)	
	Left-over	84 (14.0)	61 (10.2)	<0.001
Why would you take antimicrobials without a prescription?	Health professional as a friend	59 (9.8)	70 (11.7)	
	Parents are health professionals	114 (19.0)	96 (16.0)	
	Health centers do not give effective antimicrobials	49 (8.2)	16 (2.7)	
	Hospitals are too crowded	97 (16.2)	99 (16.5)	0.001

PMV= patent medicine vendor

DISCUSSION

Antimicrobial misuse is a growing public health menace worldwide (WHO, 2017). This study evaluated the knowledge, perceptions and practice of antimicrobial stewardship among NHPS and found a generally poor knowledge of the concept among the respondents, with the majority scoring below seven points. This observation is consistent with similar studies among non-medical students in Jordan, Pakistan, and Nigeria (Suaifan et al., 2012; Sanya et al., 2013; Shah et al., 2014). The result of this study may be because the current University curriculum for NHPS did not include topics on antimicrobial stewardship. This assertion is supported by the fact that almost all the participants claimed not to have taken any course on antimicrobial stewardship. However, it is expected that the participants' knowledge should have been adequate with many public enlightenment programmes on antimicrobial resistance in the media. The result of this study probably indicates that the present approach of public enlightenment in Nigeria may not be adequate to curb the menace of antimicrobial misuse. It is, therefore important that pragmatic approaches should be adopted towards the fight against antimicrobial misuse and antimicrobial resistance. These approaches should include the incorporation of courses on antimicrobial stewardship in the country's secondary and tertiary schools' curricular. It is observed that gender and qualification were associated with the participants' knowledge similar to previous studies in Nigeria and Jordan (Suaifan et al., 2012; Asogwa et al., 2017).

In this study, almost all the participants answered incorrectly the question "antimicrobial resistance occurs when your body becomes resistant to antimicrobials and they no longer work as well". This is consistent with the finding of a previous qualitative study that used a similar phrase in the United Kingdom (Brookes-Howell et al., 2012). Many participants in this study misinterpreted antimicrobial resistance to be a function of the human body rather than bacterial cells. This is a serious knowledge gap which may have an implication on the fight against AMR and can underplay the individual contribution toward curbing the menace of AMR. However, it is noted that technical areas of AMR such as the assertion above are not always covered during public enlightenment. There is, therefore a need to incorporate this in future public awareness programmes. A previous study reported that healthcare profession students had a better knowledge of AMR than their non-professional counterparts (Suaifan et al., 2012). They can, therefore, be a veritable tool toward educating their non-professional colleagues about the risk factors and transferability of antimicrobial resistance in the community.

The majority of the participants claimed not to have heard the term "antimicrobial resistance" from their healthcare providers. This observation, although surprising may probably be due to the providers adopting simple language in their explanation of AMR. It is also possible that this aspect of care is being neglected or relegated due to excessive workload on the healthcare providers. The healthcare force in Nigeria is excessively burdened due to inadequate providers/client ratio (FMAEH, 2017). Studies in the developed countries specifically the United Kingdom and the Netherlands have shown that education of clients by healthcare providers is an effective approach toward reducing AMR in the community (Butler et al., 2012; Cals et al., 2013). It is imperative, therefore, that healthcare providers in Nigeria consider clients' enlightenment about AMR a professional responsibility.

Many of the study participants claimed to have heard the term "antimicrobial resistance" from the media which corroborates the hypothesis of this study on the importance of the NHPS in the fight against antimicrobial misuse and resistance. However, most of the participants had not heard the term "antimicrobial stewardship" similar to the finding of a previous report (Dyar et al., 2017). This is probably because the concept is still relatively new and has been largely restricted to the healthcare system with little publicity in the media.

In this study, many participants had incorrect perceptions about the risk factors for AMR judging from their responses to the assertion "I am not at risk of getting antimicrobials resistance infection, as long as I take my antimicrobials correctly". This result is in line with a study among non-medical students in Pakistan (Shah et al., 2014). Antimicrobial stewardship entails collective responsibility towards reducing AMR (WHO, 2017). The perception of this study participants is therefore contrary to the stewardship concept and if not corrected among the populace may undermine the battle against AMR. Extensive information including presentation of data to support documented risk factors for AMR may be needed during awareness campaigns to convince especially the educated people.

A significant number of the participants believed "It's okay to buy the same antimicrobials, or request these from a physician". This belief can put pressure on physicians to prescribe antimicrobials irrationally (van Buul et al., 2014; Fletcher-Lartey et al., 2016). This challenge may be overcome by the implementation of

prescription law in the country which restricts the sale and prescriptions of antimicrobials to the professionals alone. Public campaigns focusing on messages that give the community the confidence to trust their physicians and healthcare professionals should be vigorously pursued. This is especially necessary for those who are on health insurance scheme who may believe they are being denied of services they have paid for. Physicians also need to develop communication skills to manage patients' expectations concerning antimicrobial prescribing.

This study found high use of antimicrobials among the participants consistent with other studies in Nigeria (Sanya et al., 2013; Asogwa et al., 2017). The prevalence of antimicrobial use in the previous six months before this study (83.3%) was higher than (50.1%) previously reported among the non-medical students in Pakistan (Shah et al., 2014). It is, however, observed that many of the cases of antimicrobial use in this study were self-medication. This is evident from the fact that almost half of the participants did not get the antimicrobials from physicians or nurses, the male folks being more associated with this practice. The finding of this study, however, contradicts a study in Nigeria in which the majority of participants reported that they got antimicrobial prescriptions from physicians (Sanya et al., 2013). This present study finding may be due to the participants' desire to save time from the busy hospital procedures and to have rapid relief from sickness. It may also be due to the uncontrolled access to antimicrobials in Nigeria (Asogwa et al., 2017). Self-medication is known to contribute to the indiscriminate and frequent use of antimicrobials leading to AMR especially in LMICs and should, therefore, be discouraged (Núñez et al., 2016; WHO, 2017).

In this study, the majority of the participants demonstrated unacceptable practice with regards to the source of antimicrobial use. Almost two in every three got antimicrobials from wrong sources including

CONCLUSION
Many of the study participants had poor knowledge of AMR and had practices that negate antimicrobial stewardship concept. Although the majority perceived correctly that rational use of antimicrobials was a collective responsibility, many, however, did not perceive others' irrational use of antimicrobials as a risk factor for AMR that can affect them. Self-medication practices accounted for the high utilization of antimicrobials among the evaluated non-healthcare professional students. There is the need to include

patent medicine vendors, leftovers, and friends. This finding which is consistent with studies in Nigeria and Peru (Igbeneghu, 2013; Núñez et al., 2016; Asogwa et al., 2017) may be due to a lack of control in the sales of antimicrobials, improper disposal of left-over medications and poor knowledge of antimicrobial use among the respondents. Nigeria, similar to many other LMICs is bedeviled with chaotic drug distribution and poor regulation (FMAEH, 2017), the observation of this study is therefore not surprising. However, the implication of self-medication for public health is grievous. There is, therefore, the need for the country to begin to sanitize the drug markets and sensitize the public on the danger of this unhealthy practice.

According to many of the respondents, they would take antimicrobials without prescriptions because the hospitals were crowded (32.7%) and the health centers would not give effective antimicrobials (10.9%). This observation which is in line with a previous report (FMAEH, 2017), indicates a lack of trust in the public healthcare sector. It should be noted, however, that antimicrobial stewardship cannot succeed where accessibility is compromised (WHO, 2017). It is therefore important that the governments focus on promoting antimicrobial accessibility and adequately equip the public healthcare facilities.

Strengths and limitations of the study
This study highlighted factors that may be responsible for the non-rational use of antimicrobials among NHPS and gave insights on specific messages that may be needed in a public awareness campaign on AMR. It identified the knowledge gaps that should be filled and certain behaviors in which interventions may be needed amongst future educators, communicators, and advocates. However, the study has some limitations including the use of a survey with a possibility of recall bias. Consecutive selection of the participants may also limit the generalization of the results to the entire non-healthcare professional students.

Courses on antimicrobial stewardship in the undergraduate curricular for non-health professional students while advocacy including awareness campaigns, emphasizing trust in public healthcare and prescribers is needed among this group of students.

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