

Antimicrobial use and resistance: An assessment of tertiary institution students' knowledge, attitude, and practices in North Central Nigeria

Mercy I Aboh^{1*}, Ibukunle A. Jegede², Obi P Adigwe³ and Peters O Oladosu¹

¹Department of Microbiology and Biotechnology, National Institute for Pharmaceutical Research and Development (NIPRD), Idu Industrial Area, PMB 21, Garki, Abuja, Nigeria.

² Planning, Monitoring and Evaluation Unit, Office of the Director General/Chief Executive Officer, National Institute for Pharmaceutical Research and Development (NIPRD), Idu Industrial Area, PMB 21, Garki, Abuja, Nigeria

³Office of the Director General, National Institute for Pharmaceutical Research and Development (NIPRD), Idu Industrial Area, PMB 21, Garki, Abuja, Nigeria.

ARTICLE INFO

Article history:

Received 27 August 2022
Revised 2 Sept 2022
Accepted 10 Sept 2022
Online 30 October 2022
Published

Keywords:

Antimicrobial resistance,
young scientists,
antimicrobial agents,
knowledge,
attitude and practice.,
Students' Industrial
Work Experience Scheme

* Corresponding Author:

mercybenaboh@gmail.com
[https://orcid.org/0000-0003-3171-1318?](https://orcid.org/0000-0003-3171-1318?lang=en)
lang=en
+2348061586188

ABSTRACT

Background: Antimicrobial Resistance (AMR) is a global health and development treat that requires urgent multisectoral action in order to achieve Sustainable Development Goals (SDGs). The menace of antimicrobial resistance has however only just become a significant public health issue in recent times due to a combination of the use patterns of antimicrobial agents and the rate of development of new, effective and unique antimicrobial agents. There is therefore need to ensure that efforts are made to determine and improve the knowledge, attitude and practices about AMR among students in the country towards improved health outcomes.

Methods: A cross-sectional study was conducted among one thousand and twenty-four (1024) undergraduate and postgraduate students through administration of either electronic questionnaires (via a link to Google forms) or hard copy of the questionnaires depending on their choices. The data was then analyzed by descriptive analysis using one-way analysis of variance ANOVA.

Results: Percentages of fully correct answers was between 18.0 – 83.0 % regarding knowledge to antibiotic use and resistance. The response on practice revealed that self-medication by the respondents was observed in 47.7 % while 60.2 % discontinued the antimicrobial medication as soon as they felt better.

Conclusion: Most of the participants had fair knowledge on antimicrobial resistance however showed poor attitude and practice towards drug use.

1. Introduction

Antimicrobial Resistance (AMR) is a natural phenomenon and the genes that code for mechanisms of resistance in microorganisms have been in existence since before the discovery and development of antimicrobial agents.¹ AMR is a global health and development treat that requires urgent multisectoral action in order to achieve sustainable

development goals (SDGs).

AMR which was once a problem predominantly associated with hospital and care home settings has now become a problem of the wider community, complicating the handling of conditions like tuberculosis, HIV/AIDS, auxiliary use of antibiotics in chemotherapy, in post-surgical prophylaxis and other situations where antibiotics are required to treat/prevent routine infections.¹ According

to O'Neill² 700,000 deaths occur every year due to drug-resistant strains of common infectious agents and in associated therapeutic failure in malaria, HIV, and Tuberculosis. Studies extrapolating current rates of development of antimicrobial resistance report that if not significantly controlled, antimicrobial resistance could account for up to 10 million deaths yearly and a global annual economic cost about \$100 trillion by 2050.¹

Incorrect prescriptions, inappropriate consumption and excess use of antimicrobial drugs, especially antibiotics, are possibly the main factors contributing to the wide spread of antibiotic resistant bacteria.³ Data needs to be collected and insights drawn to develop an understanding of the knowledge, attitude and practice of undergraduate scientists in Nigeria, so that the roles antimicrobial use patterns of this population play in the development antimicrobial resistance in the country can be adequately profiled.

Hence, the objective of this study was to evaluate the level of knowledge, attitude and practice of young scientists in tertiary institutions and students undergoing industrial training at The National Institute for Pharmaceutical Research and Development (NIPRD) towards antimicrobial agents use and resistance in the country.

2. Method

2.1 Study Area and Sample Size

The volunteers were Science students (undergraduate and post graduate below the ages of 35 years) selected from 6 tertiary Institutions from 3 States in the North Central Zone of Nigeria (Nasarawa, Niger, Kogi) and NIPRD, Federal Capital Territory. The survey was designed to assess the level of awareness, knowledge, attitudes and practices on antimicrobial use and antimicrobial resistance.

The sample size for this study was estimated using Equation 1

$$n = z^2 p(1-p)/d^2 \dots\dots\dots \text{Equation 1}$$

where z is the critical value from the standard normal distribution (i.e., $z = 1.96$ for a confidence level of 95%) and p is the estimated proportion of the population considering the event under investigation.

Here, the event is antimicrobial resistance (when unknown, $p = 0.5$), and d , the margin error ($d = 0.05$)⁴. Hence, a minimum size of 385 participants was expected for the study. A total of one thousand and twenty-four (1024)

participants were randomly selected and administered either electronic questionnaires (via a link to Google forms) or hard copy of the questionnaires depending on their choices.

2.2 Data Collection

The data was collected using a structured self / online administered questionnaire including use of papers copies. The questionnaire contained several alternatives, some of which were true and others incorrect. The respondents chose between these alternatives and a gradient of responses were provided such as 'yes', 'no', "agree", "disagree" and 'don't know'. Informed consent of each participant was sought and obtained, each participant was required to sign the consent form on the questionnaire and participants were assured of the confidentiality of their response.

2.3 Study Variables

Questions on knowledge was about antimicrobial use and misuse, the causes of antimicrobial resistance as well as myths surrounding its cause. Questions were answered on knowledge as either true or false, with an additional "I don't know" option. Practice questions were on a Yes/No basis with an additional "I don't know" option. Some open-ended questions were also be asked. In the section on attitudes, the questions asked gave answers based on parameters such as "Agree", "Disagree" and "Not sure".

2.4 Ethical Considerations

Ethical approval was obtained from the National Institute for Pharmaceutical Research and Development Review Board (NIPRD-HREC NHREC/039/21A-14). The respondents provided electronic informed consent that appeared on the first page of the survey by answering a "Yes or No" question before being allowed to complete the online self-reporting questionnaire.

2.5 Statistical Analysis

The univariate and multivariate regression data analysis was employed. The frequency of social and demographic statistics was analyzed using univariate analysis while a one-way analysis of variance (ANOVA) was used to assess differences in mean values for KAP scores. The overall correlation was analyzed by Pearson's correlation coefficient. Analysis of identified factors related to knowledge, attitude and practice was done using the multivariable linear regression.

3. Results

The demographic data revealed 53.7 % Females, 46.1 % within the age range of 19- 25 years, 25.5 % residing in rural locations, 57.4% undergraduate students, 37.1 % having first degree.

Table 1: Sociodemographic characteristics of respondents

Sociodemographic characteristics	Total (n=1024)	
	N	%
Gender		
Male	450	44.7
Female	540	53.7
Prefer not to say	8	1.6
Age (year)		
<20	304	29.7
21-25	472	46.1
26-30	182	17.8
31 and above	62	6.4
Educational level		
Primary	20	2.0
Secondary	286	27.9
Diploma	302	29.5
Bachelor's degree	380	37.1
Postgraduate	36	3.5
Residence		
Urban	758	74.5
Rural	260	25.5

3.1 Knowledge on antimicrobial resistance

Over eighty- two (82.8 %) of the respondents have heard about antimicrobial resistance, 73 % agree humans can develop resistance to antimicrobials, 67.4 % agree that resistance develops from drug abuse, 71.3 % agree that antimicrobials may become ineffective against infections they formerly could treat, 52.1 % agree AMR can spread from one person to another, 65.2 % agree that wrong prescriptions can contribute to AMR, 54.9 % believe you should stop antimicrobial medications as soon as one feels better, 57.6 % agree that using other drugs with antimicrobials may render them ineffective, 52.0 % believe antimicrobials are used in treating bacterial infections only, 50.0 % believe AMR is hereditary, 55.5 % agree to financial constraints as a factor that contributes AMR, 55.1 % believe AMR occurs only in mutant strains of microorganisms, 48.4 % believe AMR is a physical disorder.

Table 2 Responses of respondents to knowledge items (%)

SN	Knowledge Questions	Yes (%)	No (%)	I don't know (%)
1	Have you ever heard of antimicrobial resistance?	83.0	17.0	0.0
2	Humans can become resistant to antimicrobials	73.0	9.0	18.0
3	Antimicrobial resistance develops from drug abuse	67.0	11.0	22.0
4	Antimicrobials may become ineffective against infections they formerly could treat	71.0	10.0	19.0
5	Antimicrobial resistance can be spread from one person to another	52.0	25.0	23.0
6	Wrong prescriptions from prescribers can contribute to the development of antimicrobial resistance	65.0	15.0	20.0
7	You should stop taking antimicrobials when you feel better	55.0	25.0	20.0
8	Using other drugs with antimicrobials may render the antimicrobials ineffective	58.0	18.0	24.0
9	Antimicrobials are used in treating only bacterial infections	52.0	27.0	21.0
10	Antimicrobial resistance is hereditary	50.0	25.0	25.0
11	Financial constraints may contribute to the development of antimicrobial resistance	55.0	20.0	25.0
12	Antimicrobial resistance only occurs in mutant strains of microorganisms	55.0	19.0	26.0
13	Antimicrobial resistance is a physical disorder	48.0	24.0	28.0

3.2 Attitude of respondents on antimicrobial resistance
Majority of the respondents (94.5 %) agree that a law should be enacted to prohibit abuse of antimicrobials, 85.7 % promoted subsidy of antimicrobials by Government, 87.1 % agree that antibiotics sold in community pharmacies and patent medicine shops be effectively regulated, 92.8 % suggested the need for forums to promote awareness of AMR, 88.1 % agree that prescribers should face punishments in the event of wrong prescriptions, 88.9 % agree that drug stores/ pharmacies should not sell antimicrobials without prescription, 84.2 % agree that self-medication and abuse of antimicrobials should attract fines or punishment.

3.3 Practice of respondents on antimicrobial resistance
Over forty-seven percent (47.7 %) of the respondents agree to have taken antimicrobials without prescription, 40.6 % agree to have changed their antimicrobial doses without consulting the prescriber, 49.4 % have shared their antimicrobial medication with other family members, 52.7 % normally keep antimicrobials at home in anticipation of future infections, 56.3 % occasionally leave out some of the prescribed medications due to paucity of funds, 59.8 % had experience of their antibiotic medication being ineffective, 60.2 % stop taking antibiotic treatment as soon as they feel better, 44.3 % share their medication among their family members, 50.0 % often miss their medication doses.

4. Discussion

According to the World Health Organization antimicrobial resistance (AMR) is a global health and development threat that requires urgent multisectoral action to achieve the Sustainable Development Goals (SDGs). It has been rated as one of the top 10 major global public health threats.⁵ Antibiotics are becoming increasingly ineffective as drug-resistance spreads globally leading to more difficult to treat infections and death. The emergence and spread of AMR have been shown to occur through natural means due to an increased selection pressure that is mostly caused by excessive and misuse of antibiotics in both human and animal.⁶ Livestock farming have contributed adversely to the spread of AMR in humans. The use of large amounts of antimicrobials in livestock including penicillins, β -lactams, fluoroquinolones and aminoglycosides as well as its use in animal feeds by farmers have resulted in indiscriminate antibiotic use leading to high resistance rates in bacteria isolated from farm foods.⁷

The participant of the study claimed to have some basic knowledge about antimicrobial use and resistance. It was

noteworthy that majority of the participants claimed to get their source of information on antimicrobial use and resistance development from social media (54.0 %) than from educational institutions (30.0 %). It is therefore advisable for health promotion practitioners to use more of social media to reach out to the youths about dangers of AMR. The findings from this survey results also show that participants knowledge on how antimicrobial resistance spreads as well as its relationship to drug misuse was less than 65 % this means that 4 out of every 10 young scientists as covered by our study does not have adequate knowledge on the spread of antimicrobial resistance. It is disturbing to note that 55 % of the respondents believe that antibiotics treatment should be stopped as soon as you feel better which is clearly reflected in their attitude to drug use. Consequently, 60.2 % of the respondents discontinued their antimicrobial regimen as soon as they felt better while 50.0 % at some point in the course of treatment missed their dose. This attitude and practice towards drug use despite their fair knowledge underscores the need for more efforts in updating students regarding drug use. There is the need for improved enlightenment about the dangers of AMR among students. Several studies have reported poor attitude to drug use among science students despite a good knowledge in drug use and antibiotic resistance.⁸⁻¹³

Also worrisome is the fact that 48.0 % of the participants believe that antimicrobial resistance was a physical disorder. There is therefore need to enlighten youths on the dangers of misuse of antimicrobials. It was also worthy of note that despite the knowledge on antimicrobial resistance and misuse as claimed by the participants, 47.7 % of the population agreed to have taken antimicrobials without prescription while 49.4 % shared their prescribed medications with family members. This agrees with the study by Ayukekbong et al (2017)¹, which reported the increase resistance to poor compliance anti-microbial medication. It is therefore imperative to educate people on proper drug use.

5. Conclusion

Most of the participants have fair knowledge on antimicrobial resistance however showed poor attitude and practice towards drug use and consequently the spread of resistance as some respondent believe it is a hereditary disease or a physical disorder. There is needed for regular awareness campaigns on antimicrobial use and AMR in Tertiary Institutions, Research Institutes and the general public.

Acknowledgment

The Authors acknowledge the support of the the National Institute for Pharmaceutical Research and Development for provision of funding for the research work.

Our deep appreciation also goes out to the participants of the survey which helped in the dissemination of the survey questionnaires. We also appreciate the contributions of Pharm. Khalid Salako for His contributions to the survey especially in the statistical analysis of the data generated.

Special thanks also go out to Miss Biyaya Philemon for her contribution in the uploading of the questionnaires filled manually to the online platform.

References

1. Ayukekbong JA, Ntemgwa M, Atabe AN. (2017): The threat of antimicrobial resistance in developing countries: causes and control strategies. *Antimicrobial Resistance and Infection Control*. 6 (4 7) : 1 - 6 . <https://doi.org/10.1186/s13756-017-0208-x>
2. O'Neill J. (2014): Review on antimicrobial resistance. Antimicrobial resistance: Tackling a crisis for the health and wealth of nations. Available online at: <https://amr-review.org/sites/default/files/160525> (accessed September 02, 2022).
3. Nahar P, Unicomb L, P Lucas PJ, Uddin MR , Islam MA , Nizame FA , Khisa N , Akter S, Rousham EK. (2020): hat contributes to inappropriate antibiotic dispensing among qualified and unqualified healthcare providers in Bangladesh? A qualitative study. *BMC Health Services Research*. 20 : 6 5 6 . <https://doi.org/10.1186/s12913-020-05512-y>
4. Yapi RB, Hounbedji CA, N'Guessan DKG, Dindé AO, Sanhoun AR, Amin A, Gboko KDT, Heitz-Tokpa K., Fokou G, Bonfoh B. (2021): Knowledge, attitudes, and practices (KAP) regarding the COVID-19 outbreak in Côte d'Ivoire: Understanding the non-compliance of populations with non-pharmaceutical interventions. *Int. J. Environ. Res. Public Health*. 18 : 47-57. <https://doi.org/10.3390/ijerph18094757>.
5. World Health Organization (WHO). Antimicrobial resistance. In: Facts sheet [Internet]. 2022 [cited 02 Sep 2022]. Available: <https://www.who.int/news-room/factsheets/detail/antimicrobial-resistance>.
6. Iwu-Jaja CJ, Jaca A, Jaja IF, Jordan P, Bhengu P, Iwu CD, et al. (2021) Preventing and managing antimicrobial resistance in the African region: A scoping review protocol. *PLoS ONE* 16(7): e0254737. <https://doi.org/10.1371/journal.pone.0254737>
7. Van TTH, Yidana Z, Smooker PM, Coloe PJ. (2019): Antibiotic use in food animals worldwide, with a focus on Africa: Pluses and minuses. *J Glob Antimicrob Resist*. 20 : 170–177 . <https://doi.org/10.1016/j.jgar.2019.07.031> PMID: 31401170.
8. Afzal Khan AK, Banu G, Reshma KK (2013): Antibiotic resistance and usage-a survey on the knowledge, attitude, perceptions and practices among the medical students of a Southern Indian teaching hospital. *JCDR*. 7(8):1613.
9. Khajuria K., Sharminder K., Shamiya S. and Vijay K. (2019): *Int J Basic Clin Pharmacol.*, 8(1):68-73.
10. Sakr S, Ghaddar A, Hamam B, Sheet I. (2020): Antibiotic use and resistance: An unprecedented assessment of university students' knowledge, attitude and practices (KAP) in Lebanon. *BMC Public Health*. 20 : 5 3 5 - 5 4 3 . <https://doi.org/10.1186/s12889-020-08676-8>.
11. Scafoli G, Gualano MR, Gili R, Masucci S, Bert F, Siliquini R (2015): Antibiotic use: a cross-sectional survey assessing the knowledge, attitudes and Practices amongst Students of a School of Medicine in Italy. *PLoS One*. 10(4):e0122476.
12. Sharma S, Jayakumar D, Palappallil DS, Kesavan KP (2016): Knowledge, attitude and practices of antibiotic usage and resistance among the second year MBBS Students. *Int J Basic Clin Pharmacol*. 5(3):899-903.
13. Suaifan GA, Shehadeh M, Darwish DA, Al-Ije H, Yousef AM, Darwish RM (2012): A cross-sectional study on knowledge, attitude and behavior related to antibiotic use and resistance among medical and non-medical university students in Jordan. *Afr J Pharmacy Pharmacol*. 15;6(10):763-70.