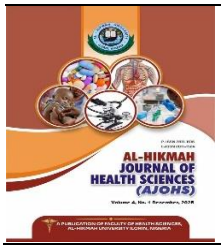
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Original Article

Awareness and Knowledge of Antimicrobial Resistance Among Undergraduate Students at Al-Hikmah University, Ilorin, Kwara State

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ABSTRACT

Introduction: Antimicrobial resistance (AMR) is a growing global public health threat driven by the misuse and overuse of antibiotics. This study assessed the awareness and knowledge of AMR among undergraduate students.

Methods: A descriptive cross-sectional study was conducted among 422 undergraduate students using a structured, self-administered questionnaire while 404 were correctly completed and analyzed, representing a 95.7% response rate. Data were analyzed using descriptive statistics and the chi-square test. Statistical significance was set at $p < 0.05$.

Results: Nearly half (48.8%) were aged 20–24 years, and 50.2% were female. Almost all (99.5%) had heard of antibiotics, but only 50.5% had heard of AMR. Social media (52.0%) and school lectures (45.0%) were key information sources. Although 93.3% correctly identified antibiotics as effective against bacterial infections, 52.2% had poor AMR knowledge, 10.1% moderate, and 37.6% good knowledge. Faculty was significantly associated with antibiotic-use behaviour ($\chi^2 = 11.307$, $p = 0.023$).

Conclusion: Although awareness of antibiotics was high, awareness and knowledge of antimicrobial resistance were inadequate. Educational interventions and antimicrobial stewardship programs should be strengthened to improve understanding and promote the appropriate use of antibiotics among undergraduate students.

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Introduction

Antimicrobial resistance (AMR) remains one of the greatest threats confronting global public health today worldwide. It occurs when microorganisms develop mechanisms enabling survival despite exposure to previously effective antimicrobial medicines administered. Consequently, infections become increasingly difficult treating, causing prolonged illness, treatment failure, escalating healthcare costs, and mortality (WHO, 2023). Globally, bacterial antimicrobial resistance directly caused approximately 1.27 million deaths during 2019, demonstrating substantial health impacts. Additionally, antimicrobial resistance was associated with nearly 4.95 million deaths worldwide during the same period (Murray *et al.*, 2022). Consequently, the World Health Organization recognizes AMR among humanity's ten greatest global public health threats (WHO, 2023).

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Antimicrobial resistance disproportionately affects low- and middle-income countries, particularly nations across sub-Saharan Africa today. Weak healthcare systems, inadequate surveillance, poor antimicrobial regulation, and limited diagnostics worsen antimicrobial resistance challenges regionally (Belachew *et al.*, 2021). Furthermore, inadequate public awareness significantly contributes toward accelerating resistant microorganisms across many African communities today. A systematic review reported suboptimal antimicrobial resistance knowledge, attitudes, and practices among African populations overall (Atalay & Abebe Gelaw, 2024). Nigeria implemented the National Action Plan prioritizing antimicrobial stewardship, surveillance strengthening, and public awareness initiatives (Federal Ministry of Health Nigeria, 2017). Nevertheless, national evidence demonstrated considerable public knowledge gaps regarding antimicrobial resistance and its consequences (Chukwu *et al.*, 2020).

University students represent important populations because independent healthcare decisions increasingly influence future antibiotic-related practices significantly. Asogwa *et al.* (2017) reported non-medical students recognized antibiotics but demonstrated inadequate antimicrobial resistance knowledge overall. Similarly, healthcare students demonstrated reasonable awareness despite persistent antimicrobial resistance knowledge gaps requiring educational reinforcement (Akande-Sholabi & Ajamu, 2021). Comparable findings emerged among university students from Zambia, Tanzania, and Ethiopia despite increasing awareness initiatives (Lubwama *et al.*, 2021; Mudenda *et al.*, 2023; Shitindi *et al.*, 2024; Dagnew *et al.*, 2025). However, evidence regarding antimicrobial resistance awareness and knowledge among private university undergraduates remains considerably limited. Therefore, this study assesses antimicrobial resistance awareness and knowledge among undergraduate students attending Al-Hikmah University, Ilorin.

Methods

Study Design

This study employed a descriptive cross-sectional design to assess awareness and knowledge of antimicrobial resistance (AMR) among undergraduate students at Al-Hikmah University, Ilorin, Kwara State. The design enabled data collection at a single point in time to determine respondents' level of awareness and knowledge of AMR and describe their socio-demographic characteristics.

Study Setting and Population

The study was conducted among registered undergraduate students of Al-Hikmah University, Ilorin, Kwara State, Nigeria.

Eligibility Criteria

Eligible participants were registered undergraduate students aged 18 years and above who had completed at least one academic session and provided informed consent. First-year students, postgraduate students, part-time and sandwich students, students who declined participation, and those unavailable during data collection were excluded.

Sample Size and Sampling Technique

The sample size was determined using Cochran's formula for cross-sectional studies, assuming a 50% prevalence of adequate AMR knowledge, a 95% confidence level, and a 5% margin of error. After adding a 10% allowance for non-response, a sample size of 422 students was obtained. A multistage sampling technique was adopted. Five faculties were selected using simple random sampling. Subsequently, two departments were randomly selected from each faculty, giving ten departments. Proportionate allocation was used to distribute questionnaires according to departmental population, while eligible students were selected using systematic random sampling.

Data Collection Instrument

Data were collected using a structured, self-administered questionnaire adapted from previously validated Nigerian and African studies on antimicrobial resistance. The instrument contained sections on socio-demographic characteristics, awareness of antibiotics and antimicrobial resistance, and knowledge of antimicrobial resistance. Face and content validity were established through expert review, while a pilot study involving 42 students from Muhamad Kamaldeen University assessed clarity and reliability. Cronbach's alpha of 0.75 was considered acceptable.

Data Analysis

Data were entered and analyzed using IBM SPSS version 27. Descriptive statistics, including frequencies, percentages, means, and standard deviations, summarized respondents' characteristics, awareness, and knowledge levels. Knowledge was assessed using six items, with one point assigned for each correct response and zero for incorrect or "Not sure" responses. Total scores ranged from 0 to 6 and were categorized using the modified Bloom's cut-off: poor (0–2), moderate (3–4), and good (5–6) knowledge (Tekel et al., 2021). Chi-square test assessed associations between selected socio-

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demographic characteristics and antibiotic-use behavior. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Kwara State Ministry of Health Ethical Review Committee (Approval No. ERC/MOH/2026/08/846). Participation was voluntary, written informed consent was obtained, and confidentiality and anonymity of respondents were maintained throughout the study.

Results

Table 1: Socio-demographic characteristics of the respondents

Variable	Category	Frequency	Percent (%)
Age (years)	18–19	95	23.5
	20–24	197	48.8
	25–29	112	27.7
Sex	Male	201	49.8
	Female	203	50.2
Faculty	Computer Engineering	85	21.0
	Health Sciences	120	29.7
	Humanities and Social Sciences	105	26.0
	Law	82	20.3
	Natural and Applied Sciences	12	3.0
Department	Computer Science	39	9.7
	Cyber Security	46	11.4
	English Language	36	8.9
	Biochemistry	4	1.0
	Islamic Law	43	10.6
	Islamic Studies	69	17.1
	Medical Laboratory Sciences	53	13.1
	Microbiology	8	2.0
	Public & International Law	39	9.7
	Public Health	67	16.6
Level of Study	200 Level	85	21.0
	300 Level	168	41.6
	400 Level	121	30.0
	500 Level	30	7.4
Place of Residence	Off-Campus	216	53.5
	On-Campus	188	46.5
Healthcare-Related Background	Yes	132	32.7
	No	272	67.3

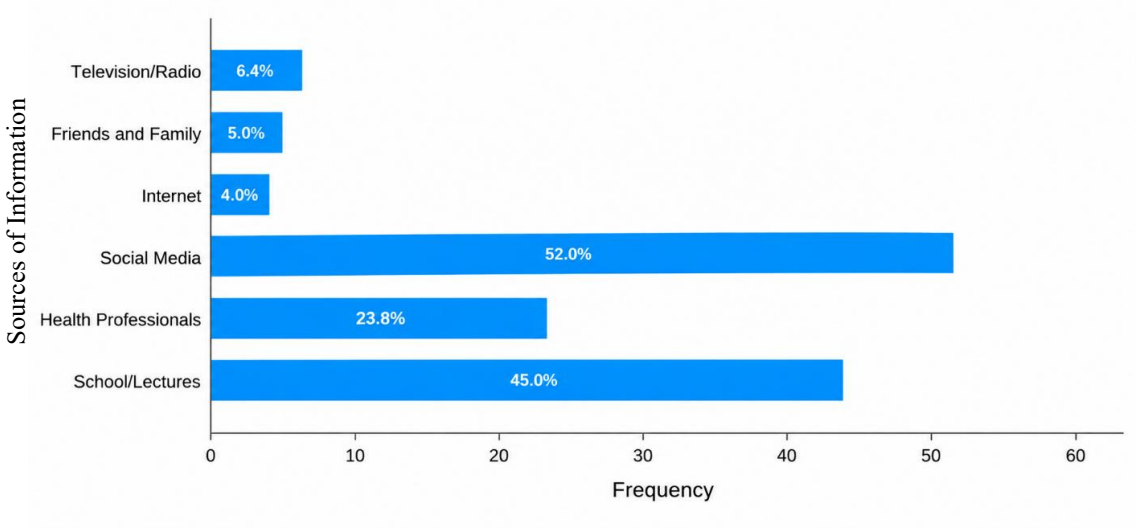
Table 1 shows the socio-demographic characteristics of the respondents. Nearly half of the respondents (48.8%) were aged 20–24 years, while 27.7% were aged 25–29 years and 23.5% were aged 18–19 years. Female respondents (50.2%) were slightly more than males (49.8%). The highest proportion of respondents were from the Faculty of Health Sciences (29.7%), while most respondents were in 300 level (41.6%). More than half (53.5%) resided off-campus, and 67.3% reported having no healthcare-related background.

Table 2 Awareness of Antibiotics and AMR

Variable	YES (%)	NO (%)
Heard of antibiotics	402 (99.5)	2 (0.5)
Heard of Antimicrobial Resistance	204(50.5)	200(49.5)
Total	404	100.0

Table 2 shows that almost all respondents (99.5%) had heard of antibiotics. However, only 50.5% had heard of antimicrobial resistance, while 49.5% had never heard of it. This indicates high awareness of antibiotics but relatively lower awareness of antimicrobial resistance among the respondents.

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N = 275 (respondents who provided source-information responses; multiple responses allowed)

Figure 1. Sources of Information on Antimicrobial Resistance

Figure 1 presents the reported sources of information on antimicrobial resistance (AMR) among the 275 respondents who provided responses to the source-information item. Multiple responses were allowed; therefore, the percentages do not sum to 100%. The denominator of 275 refers specifically to respondents who provided source-information responses and is distinct from the total study sample of 404 and the 204 respondents who reported having heard of AMR. Social media was the most frequently reported source (52.0%), followed by school lectures (45.0%) and health professionals (23.8%). Television/radio (6.4%), friends and family (5.0%), and the internet (4.0%) were less frequently reported.

Table 3 Knowledge of Antimicrobial Resistance Statements (N=404)

Knowledge Statement	Correct n (%)	Incorrect n (%)
Antibiotics are effective against bacterial infections.	377 (93.3)	27 (6.7)
Antibiotics can treat viral infections such as flu or the common cold.	174 (43.1)	230 (56.9)
Misuse of antibiotics can lead to antimicrobial resistance (AMR).	179 (44.3)	225 (55.7)
Skipping doses of antibiotics can contribute to AMR.	164 (40.6)	240 (59.4)
Using antibiotics without a prescription increases resistance.	151 (37.4)	253 (62.6)
AMR can make infections harder to treat.	184 (45.5)	220 (54.5)

Table 3 shows varying levels of knowledge regarding antimicrobial resistance. Most respondents (93.3%) correctly identified that antibiotics are effective against bacterial infections. However, less than half correctly identified that antibiotics cannot treat viral infections such as flu or the common cold (43.1%), that misuse of antibiotics can lead to antimicrobial resistance (44.3%), that skipping doses can contribute to AMR (40.6%), and that using antibiotics without a prescription increases resistance (37.4%). Similarly, 45.5% correctly recognized that AMR can make infections harder to treat.

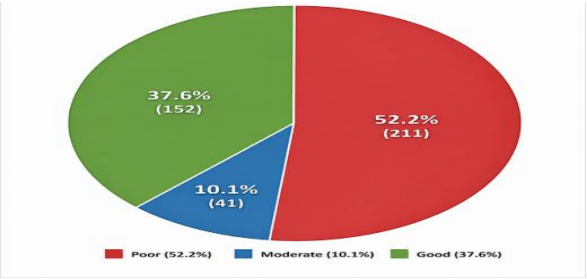


Fig. 2 Pie Chart showing overall Knowledge Level

Figure 2 shows the overall knowledge level of respondents regarding antimicrobial resistance. More than half of the respondents, 211 (52.2%), had poor knowledge, while 41 (10.1%) had moderate knowledge and 152 (37.6%) had good knowledge. The findings indicate that poor knowledge was the most common category.

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Table 4: Association Between Selected Socio-Demographic Characteristics and Antibiotic-Use Behaviour Among Undergraduate Students (N = 404)

Socio-demographic characteristic	χ^2	p-value	Decision
Sex	0.526	0.468	Not significant
Faculty	11.307	0.023	Significant
Department	14.830	0.096	Not significant
Level of study	7.428	0.059	Not significant
Place of residence	3.586	0.058	Not significant
Healthcare-related background	1.681	0.195	Not significant

$p < 0.05$

Table 4 shows that faculty was significantly associated with antibiotic-use behavior ($\chi^2 = 11.307$, $p = 0.023$). However, no significant associations were observed for sex, department, level of study, place of residence, or healthcare-related background ($p > 0.05$).

Discussion

This study assessed the awareness and knowledge of antimicrobial resistance (AMR) among undergraduate students at Al-Hikmah University, Ilorin. The findings revealed that awareness of antibiotics was almost universal, whereas awareness of AMR was substantially lower. Although nearly all respondents had heard of antibiotics, only about half were aware of AMR. This disparity suggests that familiarity with antibiotics does not necessarily translate into an understanding of antimicrobial resistance. Similar findings have been reported in Nigeria, where awareness of antibiotics was high but knowledge of AMR remained limited among university students and the general population (Asogwa et al., 2017; Chukwu et al., 2020). The finding also supports the World Health Organization's assertion that inadequate public awareness remains a major contributor to the continued emergence of antimicrobial resistance (WHO, 2023).

Social media and school lectures were the leading sources of AMR information among respondents, highlighting the growing importance of digital media and educational institutions in health communication. This finding suggests that universities provide an appropriate platform for strengthening AMR awareness through curriculum integration, seminars, and campus-based health campaigns. Similar observations have been reported among African university students, where formal education and digital platforms served as important sources of antimicrobial resistance information (Lubwama et al., 2021; Mudenda *et al.*, 2023). Although most respondents correctly identified that antibiotics are effective against bacterial infections, fewer than half correctly answered the remaining knowledge questions. Consequently, over half of the respondents demonstrated poor overall knowledge of AMR, while only about one-third exhibited good knowledge. This finding is consistent with studies conducted among university students in Nigeria, Zambia, Tanzania, and Ethiopia, which reported persistent knowledge gaps despite increasing awareness initiatives (Akande-Sholabi & Ajamu, 2021; Mudenda *et al.*, 2023; Shitindi *et al.*, 2024; Dagnew *et al.*, 2025).

However, the present finding contrasts with Lubwama *et al.* (2021), who reported relatively better AMR knowledge among final-year medical and pharmacy students in East Africa, likely reflecting their healthcare training and greater exposure to antimicrobial stewardship education. The high proportion of respondents with poor knowledge may be attributed to the inclusion of students from both health-related and non-health-related disciplines, many of whom have limited formal education on antimicrobial resistance. Furthermore, public awareness campaigns in Nigeria have largely targeted healthcare professionals and the general public, with relatively fewer interventions specifically designed for university students. This may explain why respondents were familiar with antibiotics but lacked a comprehensive understanding of antimicrobial resistance.

Poor knowledge of AMR among undergraduates has important public health implications because knowledge is essential for encouraging appropriate antibiotic use and supporting antimicrobial stewardship. Universities should therefore strengthen antimicrobial resistance education by integrating AMR concepts into general studies curricula, organizing regular awareness campaigns, and utilizing social media platforms to disseminate accurate information. Such interventions could improve students' understanding of AMR and contribute to national and global efforts aimed at reducing the burden of antimicrobial resistance.

Study Limitations

The study was descriptive and did not include bivariate or multivariable analyses; consequently, it cannot determine whether knowledge levels differed significantly across faculties, healthcare-related background, or study levels. In addition, the source-information item was a multiple-response question

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answered by 275 respondents, which is reported separately from the total sample and the 204 respondents who had heard of AMR.

Conclusion

This study found that although awareness of antibiotics was almost universal among undergraduate students, awareness and knowledge of antimicrobial resistance remained inadequate. While most respondents correctly recognized the role of antibiotics in treating bacterial infections, important misconceptions about antimicrobial resistance persisted, resulting in a high proportion of students demonstrating poor overall knowledge. These findings highlight the need for strengthened antimicrobial resistance education within universities. Integrating AMR into undergraduate curricula, implementing regular awareness campaigns, and leveraging social media and other educational platforms may improve students' understanding and support national antimicrobial stewardship efforts aimed at combating antimicrobial resistance.

Recommendations

University management should integrate antimicrobial resistance education into general studies and relevant undergraduate curricula to improve students' understanding of AMR.

Regular awareness campaigns, seminars, and workshops on antimicrobial resistance should be organized to enhance students' knowledge and promote responsible antibiotic use.

Social media and other digital platforms should be utilized to disseminate accurate and evidence-based information on antimicrobial resistance, considering their prominence as sources of information among students.

The Federal and State Ministries of Health, in collaboration with universities, should strengthen public awareness programmes and antimicrobial stewardship initiatives targeting young adults and tertiary institution students.

Further multicentre studies involving public and private universities should be conducted to provide broader evidence on antimicrobial resistance awareness and knowledge among undergraduate students in Nigeria.

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