British Journal of Healthcare and Medical Research - Vol. 10, No. 3
Publication Date: June 25, 2023
DOI:10.14738/jbemi.103. 14684.
Idoko, L. O., Okafor, K. C. & Lolo, N. S. (2023). Knowledge of Antimicrobial Drug Resistance (AMR) Among Patients in a General Outpatient Clinic in Abuja Municipal Area Council (AMAC), Federal Capital Territory, Nigeria. British Journal of Healthcare and Medical Research, Vol - 10(3). 126-143.

Knowledge of Antimicrobial Drug Resistance (AMR) Among Patients in a General Outpatient Clinic in Abuja Municipal Area Council (AMAC), Federal Capital Territory, Nigeria

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ABSTRACT

Background: Antimicrobial resistance (AMR) is currently prevalent and has the potential to affect everyone, of any age, in any country. In humans,animals, and the environment, antimicrobial-resistant microbes are quickly emerging and spreading. This study aims to assess the knowledge of Antimicrobial Drug Resistance (AMR) among patients in a General Outpatient Clinic in Abuja Municipal Area Council (AMAC), Federal Capital Territory, Nigeria. Methods: This was a descriptive cross-sectional study among 400 clients in district hospital done in 2022. A multistage sampling technique was adopted for this study. Data was collected using self-administered structured questionnaire and analyzed and presented as tables, proportions, and percentages using the IBM SPSS 28 (Statistical Package for the Social Sciences) computer software (IBM SPSS Inc. 2021) Ethical approval was granted by Bingham University Teaching Hospital Ethical Research Committee, Jos, Plateau State. Results: The study revealed that the knowledge of antimicrobial resistance between male and female respondents. 8.5% of female respondents had good knowledge, 20.75% had fair knowledge while 27.75% had poor knowledge. Of all the male respondents, 8.5% had good knowledge, 13% had fair knowledge and 21.5% had poor knowledge. Summarily, only 68 (17.0%) of participants had good knowledge of antimicrobial resistance, 135 (33.75%) had fair knowledge of antimicrobial resistance, while 197 (49.25%) had poor knowledge of antimicrobial resistance. Test of association between knowledge of antimicrobial resistance and Sociodemographic showed that Marital Status ($\chi^2_{(2, N=400)} = 44.28$, $p < 0.045$), Education ($\chi^2_{(2, N=400)} = 123.80$, $p < 0.001$) and Age ($\chi^2_{(2, N=400)} = 112.95$, $p < 0.001$) were statistically significant. Conclusion: The Federal, State, and Local governments, health care providers, and community health workers should focus on increasing awareness of AMR risk factors through health campaigns and program that will aid behavioural change.

Keywords: Knowledge, Antimicrobial Drug Resistance (AMR), antimicrobial use, Abuja Municipal Area Council (AMAC)

INTRODUCTION

Antimicrobial resistance (AMR) is the resistance of microorganisms (Bacteria, Virus, fungi, and parasitic) to an antimicrobial medicine that was originally sensitive and/or effective for treatment of infections thereby making infections harder to treat and increasing the risk of disease spread, severe illness and death)[1,2]. Although AMR strains can arise naturally due to genetic changes in microorganisms, it is accelerated by the inappropriate use of antimicrobial medicines in the health,animal, food, agriculture, and other sectors; lack of access to health services, including to diagnosticsand laboratory capacity; and antimicrobial residues in soil, crops and water, poor infection control practices[1,2].

Antimicrobial resistance (AMR)is currently prevalent and has the potential to affect everyone, of any age, in any country. In humans,animals, and the environment, antimicrobial-resistant microbes are quickly emerging and spreading.While novel antimicrobials become scarcer, these resistant microbes continue to outsmart current generations of critical human and animal treatments, posing serious health risks[3]. The consequences of ignoring it are far-reaching and expensive, not only in terms of money but also in terms of global health, food security, environmental well-being, and socio-economic growth [4,5,7]. AMR is a worldwide health emergency that, if not addressed, will have major health consequences (such as prolonged illnesses due to failure to effectively treat infections resulting in increased mortality) as well as negative economic consequences including productivity losses, diminished livelihoods, and food security. [4,6,7]. AMR also indirectly leads to Higher treatment and health-care expenditures. The healthrepercussions and economic costs of AMR are expected to be 10 million human deaths per year anda 2 to 3.5 percent reduction in global GDP (USD 100 trillion) by 2050[7,8] .This analysis included only6 pathogens and acknowledged that the true number is probably already far higher, especially giventhat more of the burden of disease falls on poor communities that often have incomplete disease surveillance systems and limited access to relevant diagnostic technology [2,7,8]However, the true cost ofAMR is difficult to estimate, and the true global burden of death and diseases due to AMR remains unknown, and from an ethical and scientific point of view, there is an urgent need for more accurateestimates. Infectious diseases continue to be a major source of morbidity and mortality around the world, affecting more countries where health services are insufficient. Geographical and ecological boundaries are irrelevant to resistant microorganisms and genes as the resistance that emerges in onegeographical region or species can easily travel to other geographical locations via food, water, animals, and/or humans; it can also transfer to other species, affecting both developed and developingcountries [9, 10,].

Antimicrobial resistance's influence on mortality and public health costs is difficult to quantify, and few research have been conducted on the subject. Antibiotic-resistant illnesses impact more than twomillion individuals in the United States each year, according to the US Centers for Disease Control and Prevention (CDC), with at least 23 000 people dying because of the infection[11]. Recorded data also shows that about 2 million cases of resistant bacteria infection are reported in the United States(US) each year, resulting in a $20 billion direct healthcare cost increase[12, 13]. In Europe, the number of infections and deaths caused by the most common multidrug-resistant bacteria (S. aureus, E. coli, Enterococcus faecium, Streptococcus

URL: http://dx.doi.org/10.14738/jbemi.103.14684.

pneumoniae, Klebsiella pneumoniae, and Pseudomonas aeruginosa) were estimated to be 400 000 and 25 000, respectively, in 2007[14]. According to estimates from the European Medicines Agency (EMA) and the EuropeanCentre for Disease Prevention and Control (ECDC), 25,000 people die each year as a direct result ofMDR infection, with a total cost of €1.5 billion[12, 15]. Southeast Asia might be regarded a global Centrefor AMR emergence due to its high frequency of infectious diseases and limited diagnostic capabilities, particularly in primary healthcare settings as antimicrobial usage (AMU) and antimicrobial resistance (AMR) are on the rise, reducing therapeutic efficacy and jeopardizing the future of human and animal medical treatments[16,17,18]. To understand AMR growth in Southeast Asia, data on AMU in humans, agriculture, and aquaculture is essential. Unfortunately, no credible AMU estimates exist in humans or animals. According to a study conducted by the Indian Network for Surveillance of Antimicrobial Resistance (INSAR), India has a 41 percent prevalence of methicillin-resistant Staphylococcus aureus (MRSA) [19]. India has also been observed to have a high incidence of Gram–negative bacterial resistance [20]. MDR-TB is expected to be present in 3.7 percent of new cases and 20% of previously treated patients worldwide, according to the World Health Organization (WHO) [21.]

Many African countries and regions suffer from a lack of health-care resources, such as human and infrastructure capacity, a high burden of infectious diseases, insufficient prevention and control methods, and other socioeconomic conditions [22]. As a result, an elevated risk of AMR and its effects exists [21,23]. In fact, AMR has been linked to HIV, malaria, tuberculosis, typhoid, cholera, meningitis,gonorrhoea, and dysentery within the region.

The true burden of AMR in Nigeria is unknown due to a lack of systematic surveillance and insufficient data on its actual prevalence and epidemiology. Human behavior is claimed to contributeto the overuse and misuse of antimicrobials, which has resulted in the development of antimicrobial resistance (AMR) in Nigeria, Africa's most populous country, because many citizens use antimicrobials to treat illnesses in humans and animals[27] Separate research and reports have revealedthe introduction of AMR-resistant microorganisms in southwest Nigeria, such as methicillin-resistantStaphylococcus aureus and fluoroquinolone-resistant Escherichia coli[28,29].In a tertiary hospital in Nigeria, researchers found substantial antibiotic resistance rates across common Gram-positive and Gram-negative isolates from various clinical specimens.

Nigeria is already experiencing the effects of AMR. According to NCDC (2017), Nigeria has seen high levels of antimicrobial resistance in humans, particularly in sepsis, respiratory infections, and diarrheal illnesses[27]. Due to the disproportionately high infectious diseases burden, overburdened health-care systems across most countries, poor economies and living situations, and inadequate healthcare infrastructures, AMR is expected to have the greatest impact in Asia and Sub-Saharan Africa including Nigeria. The increasing occurrence of multi-drug-resistant (MDR) organisms causingtreatment failures, antibiotic residues in food, and the public health dangers it entails have brought AMR to the forefront of global attention[28] . Antibiotic misuse, the expansion of unlicensed pharmacystores, sub-therapeutic antibiotic use in animals' food for prophylaxis and growth promotion, low AMR awareness, and a lack of stewardship programs have all hampered efforts to manage AMR in the human and animal health sectors in the Country[27]. The overall outpatient antibiotic prescription rate in Nigeria was 49.1%, according to the antibiotic usage and resistance status report[28,29] An antibiotic course was

prescribed to 80 percent of all hospitalized patients, according to a point prevalence study[30]Nigeria had the largest number of respondents who said they got antibiotics froma stall or street vendors in a 2015 global study conducted by the World Health Organization (WHO) [31].Another alarming AMR report from University of York researchers found that hundreds of rivers throughout the world are contaminated with antimicrobials, potentially escalating the development of resistance among environmental microbes, with repercussions for human and animal health[32]. Despite the fact that contamination was identified in rivers from affluent countries, the majority of the contamination burden was attributed to rivers in Africa (Nigeria—Lagos), according to this study. As a result, the importance of stewardship initiatives in combating AMR cannot be overstated. According to the Africa CDC, many factors contribute to the emergence, persistence, and transmission of AMR. Although AMR strains arise naturally due to genetic changes in microorganisms, their emergence is accelerated by inappropriate use of antimicrobial agents in humans, animals, and the environment; including self-treatment of illness by lay persons, non- indicated administration by healthcare providers, and the addition of antibiotics to animal feed to "promote growth" and prevent illness among livestock reared for food consumption. AMR emergence may be further amplified by substandard and/or counterfeit antibiotics, which impair thetreatment of existing infections and may help select for AMR strains. Transmission of AMR is accelerated by inadequate infection prevention and control in healthcare facilities, by contaminationof the food supply with AMR bacteria, by impaired access to potable water, and by limitations in public health prevention programmes, including immunisation, sanitation, and sexual health. Globally, drug resistance causes an estimated 700,000 deaths each year, and, if current trends continue, AMR could result in over 10 million deaths per year and over 100 trillion USD in lost output globally by 2050[33].

Antimicrobial resistance has both a direct and indirect impact, according to the global action plan on antimicrobial resistance [34]. The direct effect is an increase in infection intensity, which prolongs illness, raises mortality, lengthens hospital stays, and reduces the effectiveness of preventive in surgical and chemotherapeutic procedures. The indirect effect is related to an increase in health risksfor both humans and animals, as well as an increase in the economic burden due to decreased production and higher treatment and prevention expenditures. Solutions to AMR require knowledge and strategies for the prevention of its adverse outcomes and so Knowledge of AMR entails havinga clear understanding of the prevalence and outcomes of AMR, alongside the risk factors associated with inappropriate antimicrobial use, and appropriate control measures. Presently, antibiotic resistance is a complicated problem that has an impact on the entire society andthe irrational and excessive use of antibiotics by the general population greatly influences it.[34]

The prevalence of AMR varies globally depending on factors like the use of antibiotics, access to clean water and proper sanitation, immunization rates, and access to high-quality healthcare. An estimated 700,000 fatalities worldwide occur each year as a result of drug resistance with projections showing that by 2050, AMR could cause more than 10 million deaths annually and morethan USD 100 trillion in lost global production if current trends continue [33].

Globally, there are considerable knowledge gaps about antimicrobial resistance AMR, particularly in LMICswith limited clinical and laboratory resources. According to the most recent WHO study, which is based on AMR datafrom 66 countries, an increasing number of nations are now reporting significant rates of resistance to antimicrobials used to treat common

URL: http://dx.doi.org/10.14738/jbemi.103.14684.

diseases. For example, in 2 nations, the resistance rates to the drug ciprofloxacin, which is frequently used to treat urinary tract infections, ranged from 8.4 percentto 92.9 percent for E. coli and from 4.1 percent to 79.4 percent for K. pneumoniae, respectively[35]. This study aims to assess the knowledge of Antimicrobial Drug Resistance (AMR) among patients in a General Outpatient Clinic in Abuja Municipal Area Council (AMAC), Federal Capital Territory, Nigeria.

METHODS

Abuja Municipal Area Council (AMAC) is in the Federal Capital Territory (FCT)'s , where this survey was conducted, has a population of 2,702,443 people[36, 37] .The FCT hastwo weather seasons each year: a warm, humid rainy season and a dry season[38].

Abuja Municipal Area Council (AMAC) is divided into five districts namely Asokoro, Garki, Karu, Maitama, and Wuse Districts and twelve Wards: City Centre, Garki, GUI, Gwagwa, Gwarimpa, Jiwa, Karshi, Kabusa, Karo, Nyanya, Orozo, and Wuse. The area council is a home to a number of indigenous peoples includingthe Habe, Gbagyi, Gwandara, Gade, Basa, Hausa, and Fulani[39,40]. The city of Abuja was selected for this study because it is currently one of Nigeria's ten most populous cities and one of the fastest growing cities in the world, with a growing population that represents all of Nigeria's tribes and has easy access to antibiotics. Antimicrobials and other antibacterials should only be prescribed in Nigeria, according to the country's legislation[41].The nation, however, faces serious access issues in addition to a crisis of uncontrolled drug use due to a number of factors, including an insufficient number of licensed medical professionals, pharmacies, and access to quality medications as well as the proliferation of poorly regulated patent medicine vendors, drug markets, and hawkers[41]. The ease with which antimicrobials are available and can be bought over the counter thrives in a setting where the antimicrobial market is inadequately controlled and where there is insufficient enforcement of the need for prescription-only access to antibiotics. The critically essential class of antimicrobials, which are "peddled" across the nation's streets and even while certain antimicrobials are prescribed, are frequently available over-the-counter in addition to first- or second-line antibiotics. All of these issues with drug use are worsening resistance and making infectious disease managementin Nigeria more difficult.

This research was carried between out between August and September, 2022 at Maitama District Hospital, one of the largest government-owned hospitals in Abuja. Outpatient services, as well as Surgical, Medial, Pediatrics, Obstetrics, and Gynecology services, are available at the two-story, 101-bed hospital. Laboratory, X-ray services andAccident & Emergency service are also available. All in-patients, including children, adult males and females, and VIP wards, are housed on the first floor of the hospital. The inpatient pharmacy, surgery theatre, labor, post-natal, and surgical wards are also on the first level. Administrative officesand record archives predominantly occupy the second floor. Maitama District Hospital (MDH) has a high patient load (average general outpatient attendance of over 1,500/month i.e., 160 per clinic day). The GOPD is visited daily by anaverage of 160 patients presenting with all kinds of symptoms and illnesses including hypertension cases, Typhoid and Malaria, Diabetes, STDs, Ulcers, etc., with Mondays and Fridays receiving the highest number of patients because ENT and GOPD clinic runs on these days. It also provides full- scale clinical and diagnostic services in various areas of specialties to patients from all the districts within AMAC as well as other area councils within the Federal Capital Territory (FCT)[42].

This was a descriptive, cross-sectional study, involving patients attending the Maitama district Hospital Abuja's General Out-Patient Clinic. The Sample Size was determined using the Cochran's formula[43] $\mathbf{n = Z^2pq/e^2}$

$$n= \mathbf{Z^2Pq/e^2}$$

n = the desired sample size
Z = the standard normal deviate usually set at 1.96 which corresponds to a 95% confidence level.P = prevalence of residents (18 and above) = 50%
q = 1-P
E = degree of accuracy desired, set at 0.05Therefore N = 1.96^2 *(0.5) *(0.5) /0.005^2
Thus, the minimum sample size obtained for this study population was 384

A multistage sampling technique was adopted for this study.

- **Stage 1:** Simple random sampling (balloting without replacement) was used in selection of wards in Abuja Municipal Area Council (AMAC). The sampling frame was a list of five districts in AMAC LGA namely Asokoro, Garki, Karu, Maitama, and Wuse Districts. And Maitama district was selected.
- **Stage 2**: The only General hospital from Maitama District. Maitama district hospital was selected as it was the only general hospital in this district.
- **Stage 3:** Selection of Participants involved, one in every two patients who came seeking care at the Maitama hospital general outpatient clinic was systematically recruited into the study from all eligible adult patients found in the waiting area of the outpatient clinic before the commencement of consultation. 800 patients were expected basedon the average weekly attendance at OPD, so 20 people were interviewed daily giving a sampling interval of 2 (i.e., formula K= N/n was used,

whereby N=the total number of patients attending OPDper week and n=the estimated sample size. K = 800/423, K = 1.89 which was approximated to 2). thesystematic sampling technique was carried out as follows: Simple random sampling was done for the first two patients in the waiting room to get the startingpoint. Thereafter, every 2nd patient was selected and recruited into the study if consent was given until the required sample size was obtained

Inclusion Criteria:
The criteria for eligibility for the study included (1.) Adults (18 years and above) visiting the OPD as patients (2.) both males and females who were medically stable and willing to participate.

Exclusion Criteria:
Clients who were very sick and could not understand the study, mentally impaired clients, and those not willing to participate were excluded from the study.

Data was collected using open ended structured questionnaire to assess the key areas of antimicrobials indication, identification, prescription dangers and administration; the fourth domain consisted of questions related to knowledge of AMR (Yes/No and True/False) answers. The independent variables included in this study are the socioeconomic status of the respondent

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(age, location, gender, ethnicity, education, marital status, and occupation) while the dependent/outcome variables include knowledge of antimicrobial resistance. Definition of Outcome Variables; Knowledge of AMR include,

Good Knowledge:
Respondents who have heard about any or all of these terms; antimicrobial resistance, antibiotic resistance, or drug resistance and get the right definition. respondents who realize the risk factors for AMR i.e., Overuse/underuse of antibiotics, failure to complete the full course of therapy, sharing antibiotics with other people, obtaining antibiotics without prescription.

Poor Knowledge:
Respondents who have not heard about any of the terms, or the definition and whodo not realize the risk factors for AMR.

Average Knowledge:
Respondents who have heard about some of the above terms and are aware of the definition and some of the risk factors.

Measurement of Outcome Variables include to compute these outcome variables, respondents' responses to questions asked were scored as "correct" or "incorrect" and transformed as "1" or "0", respectively. Knowledge of AMR was also determined based on the results of the questions set. The questions explored levels of awareness of the issue of antimicrobial resistance and its levels of understanding and how to address it. The first question comprised a multiple-choice question with three options, allof which are terms commonly used in relation to AMR, the other questions relate to where the respondents had heard the terms from, Respondents with two or fewer correct answers were regardedas lacking awareness about the term AMR whereas those with three or more correct responses were regarded as having sufficient awareness about the term AMR. In order to explore levels of understanding of the issue of antimicrobial resistance, respondents were presented with a list of statements to answer true or false to fourteen knowledge questions which was used to grade the respondents' knowledge with a score of one for correct answer and zero for incorrect answer. The percentage scores were determined and then used to classify respondents' knowledge levels. Those whose scores were ≤ 35% were considered to have low AMR knowledge while those whose scores were ≥ 75% were considered to have good AMR knowledge. Respondents whose knowledge scores were between 35 and 75% were regarded to have a fair knowledge level. The data generated in this study was analyzed using the IBM SPSS 28 (Statistical Package for the Social Sciences) computer software (IBM SPSS Inc. 2021). The data was summarized usingdescriptive statistics which include the percentages, frequencies, and also mean. For bivariate analysis, the chi-square test (χ 2) was used to assess associations between independentand dependent variables at 95% Confidence Intervals (95% CIs). At this point, any p-value less than 0.05 was considered statistically significant.

The study protocol as well as other study materials were reviewed and approved by the BHUTH Ethical Research Committee. Approval and Permission from Maitama district hospital, Abuja was sought before thecommencement of this study.

RESULTS

Assessment of Antimicrobial Resistance (AMR)

Table 1a: Knowledge of Antimicrobial Resistance among Maitama general hospital out-patients, Abuja

Knowledge assessment item	Response option	Gender	Correct response n (%)	Incorrect response n (%)	Total (%) N=400
Antimicrobial resistance occurs when your body becomes resistant to antibiotics, and they no longer work as well.	**False**	**Female**	**22 (5.5%)**	206 (51.5%)	228 (57%)
		Male	**17 (4.25%)**	55 (38.75%)	172 (43%)
Antimicrobial resistance occurs when bacteria become resistant to antibiotics, and they no longer work as well.	**True**	**Female**	**116 (29%)**	112 (28%)	228 (57%)
		Male	**106 (26.5%)**	66 (16.5%)	172 (43%)
Many infections are becoming increasingly resistant to treatment by antimicrobials	**True**	**Female**	**115 (28.75%)**	113(28.25%)	228 (57%)
		Male	**95 (23.75%)**	77 (19.25%)	172 (43%)
If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause	**True**	**Female**	**149 (37.25%)**	79 (19.75%)	228 (57%)
		Male	**103 (25.75%)**	69 (17.25%)	172 (43%)
Antimicrobial resistance is an issue in other countries but not here	**False**	**Female**	**126(31.5%)**	102 (25.5%)	228 (57%)
		Male	**91 (22.75%)**	81 (20.25%)	172 (43%)

Table 1b: Knowledge o f Antimicrobial Resistance among Maitama general hospital out-patients, Abuja

Knowledge assessment item	Respons eoption	Gender	Correct response n (%)	Incorrect response n (%)	Total (%) N=400
Antimicrobial resistance is only a problemfor people who take antibiotics regularly	**False**	**Female**	**61 (15.25%)**	167 (41.75%)	228 (57%)
		Male	**48 (12%)**	124 (31%)	172 (43%)
Bacteria that are resistant to antibiotics canbe spread from person to person	**True**	**Female**	**71 (17.75%)**	157 (39.25%)	228 (57%)
		Male	**47(11.75%)**	126 (31.5%)	172 (43%)
Antimicrobial-resistant infections could make medical procedures like surgery, organ transplants and cancer treatment much more	**True**	**Female**	**112 (28%)**	116 (29%)	228 (57%)
		Male	**73 (18.25%)**	99 (24.75%)	172 (43%)

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dangerous					
Over or underuse of antibiotic is a risk factor of antimicrobial resistance	**True**	**Female**	**126 (31.5%)**	102 (25.5%)	228 (57%)
		Male	**98 (24.5%)**	74 (18.5%)	172 (43%)
Failure to complete the course of therapy is a risk factor of antimicrobial resistance	**True**	**Female**	**130 (32.5%)**	98 (24.5%)	228 (57%)
		Male	**95 (23.75%)**	77 (19.25%)	172 (43%)

Knowledge Features o f Antimicrobial Resistance Among Respondents

The term Drug resistance was the most common as indicated by 74.6% of respondents, this was closely followed by "Antibiotic resistance or Antibiotic-resistant bacteria (69.5%)" and 42.9% had heard the term "Antimicrobial resistance or AMR". The participants had heard about the terms from a doctor (56%), Pharmacist (41.1%), Nurse (31.9%), Family member or friend/social media (26.1%), and 27.1% had heard this term from the media (newspaper, TV, radio).

Only 9.75% of respondents (5.5% female and 4.25% male) correctly responded False to the statement ''Antimicrobial resistance occurs when your body becomes resistant to antibiotics, and they no longer work as well.'' While 48% (29% female and 26.5% male) responded True to the question ''Antimicrobial resistance occurs when bacteria become resistant to antibiotics, and they no longer work as well.'' 52.5% of respondents (28.75 female and 23.75% male) correctly indicated that many infections are becoming increasingly resistant to treatment by antimicrobials and 63% (37.25%,25.75% female and male) responded True to the statement ''If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause. 54.25% (31.5% female and 22.75% male) responded correctly to the statement "antimicrobial resistance is an issue in other countries but not here" while 45.75% responded falsely or didn't know the answer. Only 27.25% (15.25% female and 12% male) correctly responded True to the question ''Antimicrobial resistance is only a problem for people who take antibiotics regularly'', while 72.75% responded falsely or didn't know the answer.

Only 29.5% of respondents (17.75% female and 11.75% male) correctly believe that bacteria that are resistant to antibiotics can be spread from person to person, while 70.5% responded falsely or didn't know the answer.

46.25% of respondents believe that Antimicrobial-resistant infections could make medical procedures like surgery, organ transplants, and cancer treatment much more dangerous, 56% of the respondents corresponded that Over or underuse of antibiotics is a risk factor for antimicrobial resistance'', and 56.25% Truly agree that Failure to complete the course of therapy is a risk factor of antimicrobial resistance.

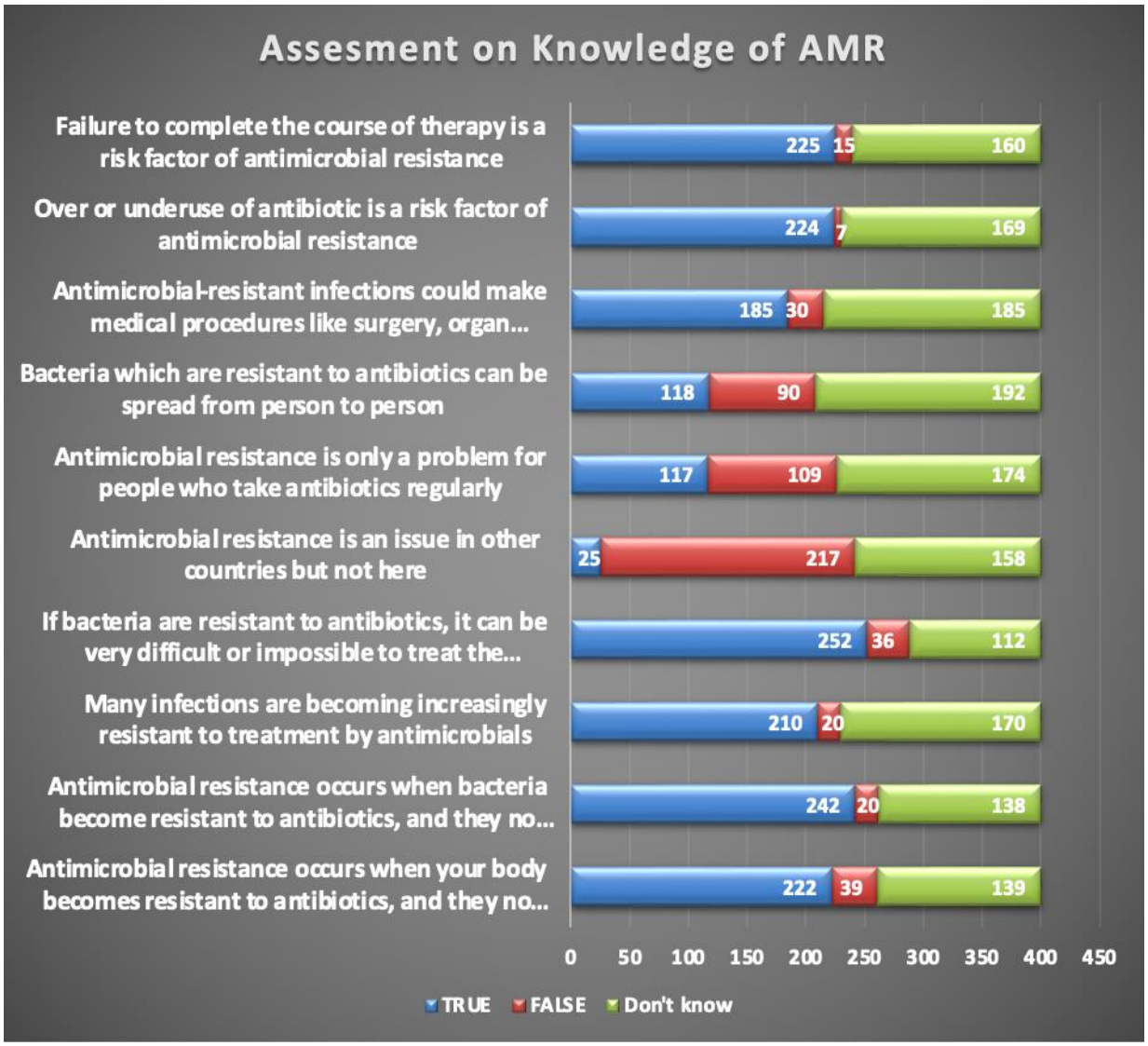

Figure 1: **A Stacked-bar chart showing Proportion of participants with correct identification of true and false statements on knowledge of antimicrobial resistance among Maitama general hospital out-patients, Abuja.**

Table 2: Distribution of Respondents by the level of knowledge of antimicrobial resistanceamong Maitama general hospital out-patients, Abuja

Level of knowledge of antimicrobial resistance	Total score	% score	No of respondents, (%) Male	No of respondents, (%) Female	Total N (%)
Good Knowledge	**≥ 7**	**>70%**	34 (8.5%)	34 (8.5%)	68 (17%)
Fair Knowledge	**5-6**	**50 – 69**	52 (13%)	83 (20.75%)	135 (33.75%)
Poor Knowledge	**< 5**	**<35%**	86 (21.5%)	111 (27.75%)	197 (49.25%)
Total			**172 (43%)**	**228 (57%)**	**400 (100%)**

Source: Field survey, 2022

URL: http://dx.doi.org/10.14738/jbemi.103.14684.

Respondents by The Level of Knowledge of Antimicrobial Resistance

Information in Table 2 shows the level of knowledge of antimicrobial resistance between male and female respondents. 8.5% of female respondents had good knowledge, 20.75% had fair knowledge while 27.75% had poor knowledge. Of all the male respondents, 8.5% had good knowledge, 13% had fair knowledge and 21.5% had poor knowledge. Summarily, only 68 (17.0%) of participants had good knowledge of antimicrobial resistance, 135 (33.75%) had fair knowledge of antimicrobial resistance, while 197 (49.25%) had poor knowledge of antimicrobial resistance

Their scores were accumulated by adding the total of correct answers (1) and wrong answers (0) to the questions in the survey. Figure 2 and Figure 3 below gives a visual representation on the assessment on level of knowledge about Antimicrobial Resistance.

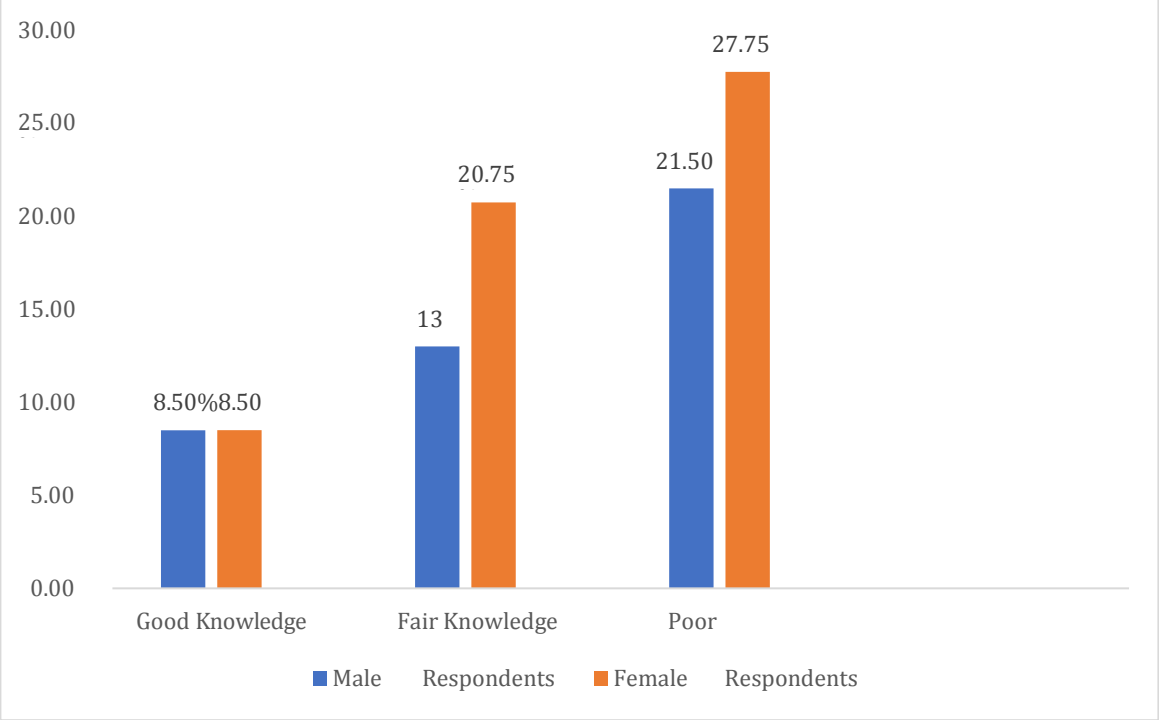

Figure 2: Column chart representation of male and female respondents' Knowledge levels AboutAntimicrobial Resistance among residents in Abuja

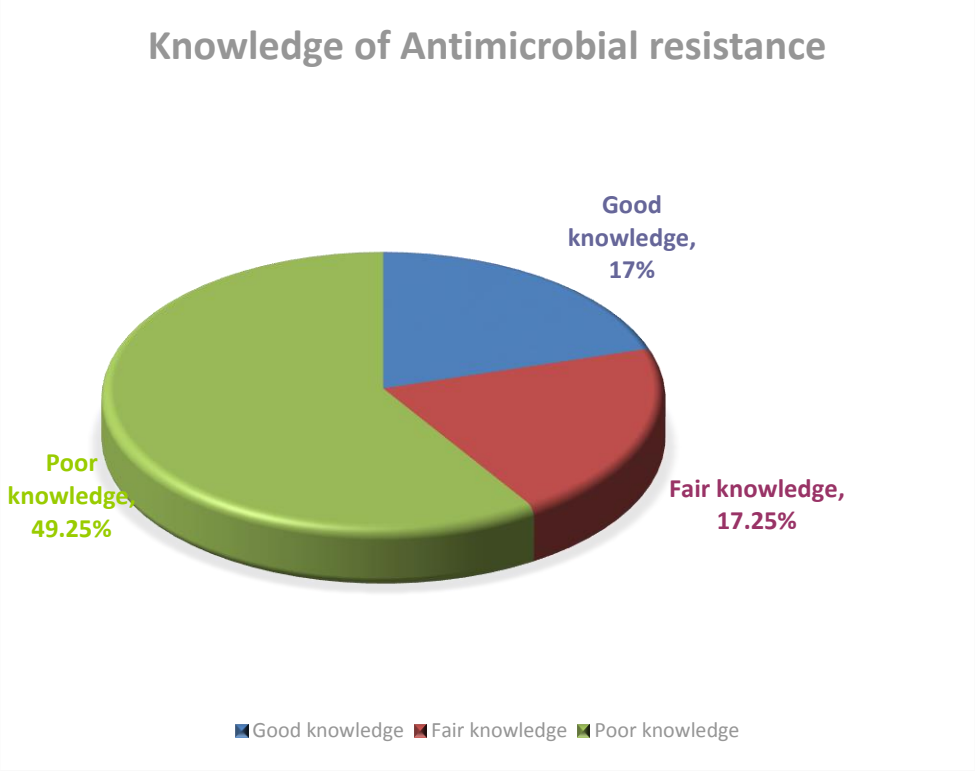

Figure 3: Pie chart presentation of Total percentage Knowledge levels AboutAntimicrobial resistance among Maitama general hospital out-patients, Abuja

Table 3: Bivariate analysis between Age, Marital status, and Education and knowledge of antimicrobial resistance among Maitama general hospital out-patients, Abuja

Variables	Knowledge of Antimicrobial resistance				χ2 Value	P-value
		Good Knowledge	Fair Knowledge	Poor Knowledge		
Age	18- 29	25 (6.25%)	49(12.25%)	106(26.5%)	**112.95**	**< 0.001**
	30-39	26 (6.5%)	50(12.5%)	60 (15.0%)		
	40-49	9 (2.25%)	15(3.75%)	16 (4.0%)		
	50-59	3 (0.75%)	17 (4.25%)	7 (1.75%)		
	60 and above	5 (1.25%)	4 (1%)	8 (2%)		
Marital Status	Single	103(25.75%)	67(16.75%)	39 (9.75%)	**123.8**	**< 0.001**
	Married	79 (19.75%)	62 (15.5%)	25(6.25%)		
	Divorced	9 (2.25%)	3(0.75%)	4 (1%)		
	Widowed	6 (1.5%)	3(0.75%)	0 (0%)		
Education	No schooling received		0	0	**44.28**	**< 0.045**
	Primary	**0**	**2 (0.5%)**	**0**		
	Secondary	3 (0.75%)	1 (0.25%)	48 (12%)		
	Tertiary	35 (8.75%)	77(19.25%)	102(25.5%)		
	Postgraduate	30 (7.5%)	55(13.75%)	47(11.75%)		
Significant at p<0.05, Pearson Chi-square=χ2 χ^2						

URL: http://dx.doi.org/10.14738/jbemi.103.14684.

Bivariate Analysis Between Age, Marital Status, And Education and Knowledge of Antimicrobial Resistance Among Maitama General Hospital Out-Patients, Abuja

A chi-square test conducted to evaluate whether groups (Location, Marital status, Education, Ethnicity, Occupation, Age, and Gender) differed in their knowledge of antimicrobial resistance showed that a significant chi-square was obtained for Marital Status ($\chi^2_{(2, N=400)} = 44.28$, $p < 0.045$), Education ($\chi^2_{(2, N=400)} = 123.80$, $p < 0.001$) and Age ($\chi^2_{(2, N=400)} = 112.95$, $p < 0.001$.

A higher proportion of respondents 18 - 39 years (41.5%) had poor knowledge of antimicrobial resistance than those 40 and above. This finding was statistically significant. ($p = 0.001$)

A higher proportion of respondents who are single (25.75%) had good knowledge of antimicrobial resistance than those who are married or divorced. This finding was statistically significant. ($p = 0.001$)

Table 4: Summary description of scores (outcomes) obtained by respondents (n = 400)

Outcomes	Maximum Obtainable Score	Scores Obtained byRespondents		Good *n(%)*	Fair *n (%)*	Poor *n(%)*
		Lowest	Highest			
Knowledge about antimicrobial resistance	10	0	10	17%	33.75%	49.25%

Table 4 shows a summary of the outcomes obtained by respondents, 17% gave satisfactory answers, 33.75% gave average answers and 49.25% gave unsatisfactory answers to questions regarding knowledge of antimicrobial resistance.

DISCUSSION

The knowledge assessment about antimicrobial resistance shows that overall, "Drug resistance" has the highest level of awareness, with 74.6% of respondents saying theyhave heard the word before. "Antibiotic resistance or antibiotic-resistant microorganisms" came in second (69.5%). The least familiar term is "antimicrobial resistance or AMR" (42.9%). Ten percent of all respondents have never heard any of the terms. This difference may be attributable to the fact that broadly drug resistance has been a topical topic among people especially in malaria treatment, tuberculosis treatment and use of analgesics. Those who stated they were aware of either term were asked from which sources they had heard about it. The source cited by the largest numberof respondents surveyed is a doctor (56%), followed by the Pharmacist (41.1%), and Nurse (31.9%),Family member or friend (including on social media) (26.1%) or Media (newspaper, TV, radio) (27.1%). This finding reiterates the importance of healthcare workers and social media in shaping knowledge of health issues. These channels can be utilized in health education and behavioral change activities for proper antimicrobial use.

In order to explore levels of understanding of the issue of antimicrobial i.e., antibiotic resistance, respondents were presented with a list of statements and asked whether they were true or false. Overall, some statements are correctly identified by the majority of respondents

whilst others are not (Table 1), suggesting that there are relatively high levels of misunderstanding about certain aspects of the antimicrobial resistance. While 90.25% (51.5% female, 38.75% male) think that the statement 'Antibiotic resistance occurs when your body becomes resistant to antibiotics and they no longer work as well' is true, when this is, in fact, a false statement, as only the bacteria can become resistant to antibiotics. This result was in line with previous survey by Herawati *et al.,*[44] which indicated that people, in general, were still confused about antibiotic resistance and believed that people, not bacteria, would become resistant to antibiotics. Only 55.5% (29% female, 26.5% male) of the respondents were able to correctly identify the correct definition of antibiotic resistance which is higher than findings from a study in Europe by Grigoryan *et al.,*[45] and lower than a study from the United States of America[46] which reported that 50% and 58% of the respondents respectively were aware of antibiotic resistance.This implies that half of respondents did not know about antimicrobial resistance, thus they are prone to misuse and abuse, thus, contributing to the burden of antimicrobial resistance.

About half (52.5%) of respondents overall correctly identify 'Many infections are becoming increasingly resistant to treatment by antibiotics as a true statement, a higher proportion 63% (37.25%,25.75% female and male) responded True to the statement ''If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause. This is a positive finding this will help understanding of the burden of the problem and work toward changes and prevention of antimicrobial resistance. Only 54.25% (31.5% female and 22.75% male) responded correctly to the statement "antimicrobial resistance is an issue in other countries but not here" while 45.75% responded falsely or didn't know the answer. Additionally, 72.75% think that the statement 'Antimicrobial resistance is only a problem for people who take antibiotics regularly' is true, whereas in fact, it is false and only 29.5% of respondents think that the (accurate) statement 'Bacteria which are resistant to antibiotics can be spread from person to person' is true. The indication of "Don't know" for most of the questions in this section was very high which indicates poor knowledge of antimicrobial resistance among the public. 46.25% percent of participants responded True to the statement ''Antimicrobial-resistant infections could make medical procedures like surgery, organ transplants and cancer treatment much more dangerous'', with 53.75% incorrect responses, which shows the lack of perception of most participants about the grave danger that AMR poses to the society. In identifying respondents' knowledge of the risk factors, 56% were aware that over or under-use of antibiotic is a risk factor of antimicrobial resistance'' whilst 44% were unaware, Likewise, the 43.75% who were unaware on the risks associated with failure to complete the course of therapy of antibiotics. Public understanding of the threat of antibiotic resistance may help to reduce inappropriate antibiotic use, therefore large efforts from healthcare professionals are actually required to enhance public understanding of antibiotic use and resistance because multiple studies have shown that public awareness may affect patients' demand for antibiotics[47, 48].

According to the study, just 17% (8.5% female, 8.5% male) of respondents were sufficiently knowledgeable about antimicrobial resistance with 33.75% (20.75% female, 13% male) having fair knowledge leaving 49.25% (27.75 female, 21.5% male) with poor knowledge of AMR.As a result, more has to be done to raise awareness about the issue of antimicrobial resistance.

URL: http://dx.doi.org/10.14738/jbemi.103.14684.

Limitations to the study include the fact that the knowledge of antimicrobials resistance were self-reported, and so the concernof response or recall bias is of consideration. The study was unable to estimate the prevalence of antimicrobial resistance in the study area.

CONCLUSION

The study revealed that the knowledge of antimicrobial resistance between male and female respondents. 8.5% of female respondents had good knowledge, 20.75% had fair knowledge while 27.75% had poor knowledge. Of all the male respondents, 8.5% had good knowledge, 13% had fair knowledge and 21.5% had poor knowledge. Summarily, only 68 (17.0%) of participants had good knowledge of antimicrobial resistance, 135 (33.75%) had fair knowledge of antimicrobial resistance, while 197 (49.25%) had poor knowledge of antimicrobial resistance.

RECOMMENDATION

To the Government

The federal, state, and local governments, should focus on increasing awareness of AMR risk factors through health campaigns and programs targeted at communities, hospitals, pharmacies, and social media.

The federal government should support the development of AMR surveillance to aid in the containment of antibiotic resistance. Surveillance provides data on historical and current antimicrobial consumption as well as AMR, which can be used to monitor existing cases and prevent future threats. It is also vital for revising national essential drug lists (EDLs) and formulating infection control policies.

In order to improve antibiotic stewardship in communities, healthcare facilities, etc., there should be the development and implementation of well-planned, organized, and structured educational programs calling for a multisectoral approach from the medical community, the Agricultural sector, patient advocates, policymakers, Etc., This will positively impact AMR prevention and provide an avenue for information sharing.

To Researchers, Health Care Providers, and Community Health Workers

Data on AMU and AMR are limited in Nigeria. It is necessary to conduct additional studies to enhance the available research and to figure out the most effective ways to promote AMU,AMR, and preventive measures, which may result in better health outcomes.

Researchers, health care providers, and community health workers should organize health education for behavioural change sessions among patients and communities to help curb the emergence of antimicrobial resistance.

To Patients and Community Members

The communities should adopt avoid misuse of antimicrobials and only use antimicrobials based on prescriptions from licensed professionals.

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