# Antimicrobial resistance: Nurse's knowledge and perception in a tertiary level care hospital in North-Eastern Nigeria

Farouq Muhammad Dayyab,[1] Garba Iliyasu,[2] Yusuf Ahmad Ibrahim,[3] Abdulrazaq Garba Habib[2]

[1]Infectious Diseases Hospital, Kano; [2]Department of Medicine, College of Health Sciences, Bayero University Kano; [3]Department of Medicine, Federal Medical Center Nguru, Yobe State, Nigeria

## Abstract

Nursing staff has a significant role to play in the control of Antimicrobial Resistance (AMR) through infection control and patient education. We studied the knowledge of nurses on AMR for purpose of planning AMR control efforts. A cross-sectional study was conducted between 21st June and 30th July 2017, among nurses working at Federal Medical Center Nguru, Yobe State. Responses were presented as frequencies and percentages. Relative risks and 95% confidence intervals were computed to describe factors associated with knowledge of AMR. Only 37.2% of the respondents had good knowledge of AMR. Age more than or equal to 40 years versus less than 40 years (RR=2.66, 95% CI: 1.253-5.662), work experience greater than or equal to 10 years versus less than 10 years (RR=2.94, 95% CI: 1.518-5.686) predicted good knowledge of AMR. A significant knowledge gap on AMR among nurses has been identified. We recommend a robust AMR awareness initiative to educate nursing staff on AMR. Further studies among other cadre of healthcare workers should be conducted to define and address the AMR knowledge gap among all Nigerian healthcare workforces.

## Introduction

Antimicrobial therapy is an important medical advancement of the twentieth century.[1] Prior to the development of antibiotics, the case-fatality rate of *Streptococcus pneumoniae* pneumonia, *Staphylococcus aureus* bacteremia and bacterial endocarditis were 40%, 80%, and 97% respectively.[2] With the discovery of antibiotics, tuberculosis and syphilis are curable, complex surgeries could be performed and organ transplantation could be undertaken successfully.[2] However, Antimicrobial Resistance (AMR) is threatening to reverse the gains thus made.[3]

Globally, it is estimated that 700,000 deaths occur annually due to infections caused by drug resistant bacteria.[4] A global plan of action to tackle AMR was unanimously approved by World Health Organization member states in 2015.[5] The action plan was subsequently endorsed by head of states with the aim of putting a concerted action to tackle AMR.[6] African states are being supported by the WHO regional office for Africa, in developing national action plans for efficient and coordinated action to tackle AMR.[7]

The Nigerian National Action Plan for AMR was developed in 2017 by the Nigerian Federal Ministry of Health, Federal Ministry of Agriculture, and Federal Ministry of Environment and Rural Development, with the aim of addressing the problem posed by AMR in the country.[8]

Antimicrobial drugs are the most commonly prescribed drugs in hospital settings and the emergence of AMR is promoted by the excessive and indiscriminate use of antibiotics.[9] AMR leads to increased duration of hospital stay among inpatients, increased healthcare costs and increased morbidity and mortality.[10]

A national survey on public awareness of AMR in Nigeria revealed that 56.5% of the respondents were familiar with the term "antibiotic resistance".[11] However only 8.3% were reported to have good knowledge of AMR.[11] Another survey in Northwestern Nigeria revealed that self-medication with antibiotics is common in Nigeria with a significant gap in knowledge of AMR among community members.[12] Innovations are urgently needed to combat AMR. A large proportion of the global healthcare workforce comprises of nursing and midwifery staff.[13] Patients contact with nursing staff is greater than their contact with any other healthcare worker during hospital admission.[13] Nurses are critical to the pre-

vention of spread of resistant bacteria through instituting infection control measures. Furthermore, nurses could potentially avert AMR by educating the inpatient on all aspects of AMR especially its causes and prevention.[14] Previous studies in developed countries have assessed the level of knowledge of medical doctors on AMR.[8,15,16] There is paucity of data on knowledge of AMR among nursing staff in resource-limited settings including Nigeria. Our objective was to gain an insight into the knowledge and perception of nurses on AMR. The information obtained from this study, is useful for the purposes of planning AMR control efforts.

## Materials and Methods

### Study design

We conducted a cross-sectional analytical study between 21st June and 30th July 2017 among nursing staff of Federal Medical Center, Nguru.

### Study setting and site

It was undertaken among nursing staff working at Federal Medical Center Nguru, Yobe State, a major tertiary referral hospital in North-Eastern Nigeria. The hospital is situated in a semi-urban metropolis located in the North-Eastern Nigeria. The hospital has a bed capacity of about 150 and served as a tertiary referral center in North-Eastern Nigeria.

### Study participants and data collection

These comprised of nurses working in the wards of the hospital recruited by convenience sampling. We targeted at least 40% of the nurses.[17] Data was obtained using pretested, self-administered, hard copy questionnaires developed based on a previous study.[17] The questionnaires provided in English language, were distributed by research asistants. The research asistants explain the purpose of the study and obtained written informed consent from the participants. The participants returned the completed questionnaire within 1 hour or at the end of the work day. The research asistants were available to provide clarification on the questions in the questionnaire when needed. Participants knowledge of AMR was assessed by 20-items questions. Three additional questions were included to assess participants perception of AMR globally, nationally and in their hospital. Here, we used a 5-point Likert-response scale. The scale ranges from "strongly agree" to "strongly disagree". Only closed ended questions were included.

### Scoring

Correct and wrong/no response were scored 1 and 0 respectively. The section on sociodemographic information was not scored. Knowledge on AMR scores for each participant were obtained out of a possible maximum of 20 scores. Scores of >13 were considered good for knowledge based on the distribution of respondents scores that was higher than the mean score.

### Statistical analysis

Data was entered into Microsoft Excel (Version 2013; Microsoft Corporation, Redmond, WA, USA) spreadsheet and cleaned. Data from the excel sheet was then exported to and analysed using JMP Pro software (JMP Version 12.0.1, SAS Institute Inc., Cary, N. C., USA). Responses were presented as frequencies and percentages. Relative risks and 95% confidence intervals were computed to describe factors associated with good knowledge of AMR.

## Results

### Demographic and occupational characteristics

Out of the 55 questionnaires distributed, 12 were excluded due to missing data or non-response (78.2% response rate). Of the 43 participants included in the analysis, 31 (72.1%) were males. The median age was 35 years (interquartile range: 30-45 years), 29 (67.4%) were less than 40 years old, 37 (86%) were ever married. The median number of the years of service of the participants was 9 years (interquartile range: 6-19 years), and 34 (79%) had less than 10 years of service (Table 1). Respondents were stationed at different wards of the hospital: 16% in medical wards, 16% in surgical wards, 14% in pediatrics wards, 7% obstetrics and gynecology, and other participants from surgical specialty, emergency and ophthalmology wards.

### Knowledge of AMR

As shown in Table 2, the responses of the study participants regarding the effects of indiscriminate use of antibiotics were; thus, it can lead to ineffective treatment 32/34 (94.1%), increased adverse effects 18/30 (60%), prolongation of illness 24/30 (80%), AMR 34/36 (94.4%), and added medical cost to the patient 31/32 (96.9%). Majority of the respondents 31/37 (83.8%) reported that if taken too often, antibiotics will not work in the future. Fewer respondents reported bacteria as the causative agents of common cold and flu 14/38 (36.8%). The term "Antimicrobial stewardship programs" is not known to 34/38 (89.5%) of the respondents. The participants responses to the cause of AMR were thus; use of antibiotics for self-limited, non – bacterial infections 26/34 (76.5%), use of broader spectrum antibiotic than required 24/33 (72.7%), giving antibiotic for shorter than the recommended duration 30/34 (88.2%), poor infection control practices 23/32 (71.9%), use of antibiotic for self-limited infections caused by bacteria 24/33 (72.7%), empiric antimicrobial therapy 18/33 (54.5%), mutation in the microbes 28/36 (77.8%), lack of antibiotic restriction 27/32 (84.4%), antimicrobial use in food animals 21/33 (63.3%), giving antibiotic for longer than the recommended duration 25/31 (80.7%), prophylactic antibiotic use 22/31 (70.9%) and use of antibiotics for viral infections 25/33 (75.8%).

**Table 1. Baseline characteristics of the study participants.**

| Variable | Frequency (N=43) | Percent (%) |
|---|---|---|
| Gender | | |
| Male | 31 | 72.1 |
| Female | 12 | 27.9 |
| Age | | |
| <40 years | 29 | 67.4 |
| ≥40 years | 14 | 32.6 |
| Marital status | | |
| Single | 6 | 13.9 |
| Ever married | 37 | 86.1 |
| Years of service | | |
| <10 years | 34 | 79.1 |
| ≥10 years | 9 | 20.9 |
| Station | | |
| Medical Wards | 21 | 48.8 |
| Surgical Wards | 22 | 51.2 |

[Annals of African Medical Research 2020; 3:85]

### Perception of AMR

As shown in Table 3, the participants perceptions regarding the scope of AMR were; thus, AMR is a serious public health issue globally 33/35 (94.3%), in our nation 34/35 (97.1%) and in our hospital 27/34 (79.4%).

### Predictors of good knowledge of AMR

Overall, only 16/43 (37.2%) of the respondents had good knowl-edge of AMR. Age more than or equal to 40 years versus less than 40 years (RR=2.66, 95% CI: 1.253-5.662), work experience greater than or equal to 10 years versus less than 10 years (RR=2.94, 95% CI: 1.518-5.686) predicted good knowledge of AMR in a univariate analysis. Male gender versus female gender (RR=2.71, 95% CI: 0.721-10.177) and been ever married versus single (RR=1.14, 95% CI: 0.34-3.786) were not significant predictors of good knowledge of AMR in the univariate analysis (Table 4).

**Table 2. Responses regarding knowledge of AMR among the study population.**

| Knowledge of AMR | Responses, n (%) | | |
| --- | --- | --- | --- |
| | Yes | No | I don't know |
| Indiscriminate and injudicious use of antibiotics can lead to: | | | |
| Ineffective treatment | 32 (94.1) | 2 (5.9) | - |
| Increased adverse events | 18 (60) | 9 (30) | 3 (10) |
| Exacerbation or prolongation of illness | 24 (80) | 2 (6.7) | 4 (13.3) |
| Emergence of bacterial resistance | 34 (94.4) | 1 (2.8) | 1 (2.8) |
| Additional burden of medical cost to the patient | 31 (96.9) | 1 (3.1) | - |
| Antibiotic use: | | | |
| If taken too often, antibiotics are less likely to work in the future | 31 (83.8) | 6 (16.2) | - |
| Bacteria are germs that cause common cold and flu | 14 (36.8) | 24 (63.2) | - |
| Do you know about 'antibiotic stewardship' programs? | 4 (10.5) | 34 (89.5) | - |
| Causes of antibiotic resistance: | | | |
| Use of antibiotics for self-limited non-bacterial infections | 26 (76.5) | 6 (17.7) | 2 (5.9) |
| Use of antibiotics with a broader than necessary spectrum | 24 (72.7) | 9 (27.3) | - |
| Use of antibiotics for shorter than necessary duration | 30 (88.2) | 3 (8.8) | 1 (2.9) |
| Poor infection control measures | 23 (71.9) | 9 (28.1) | - |
| Use of antibiotics for self-limited bacterial infection | 24 (72.7) | 9 (27.3) | - |
| Empiric antibiotic therapy | 18 (54.5) | 10 (30.3) | 5 (15.2) |
| Mutational and evolutional changes in the microorganism | 28 (77.8) | 6 (16.7) | 2 (5.6) |
| Lack of restrictions in antibiotic usage | 27 (84.4) | 3 (9.1) | 2 (6.3) |
| Excessive antibiotic use in livestock | 21 (63.6) | 9 (27.3) | 3 (9.1) |
| Use of antibiotics for longer than standard duration | 25 (80.7) | 5 (16.1) | 1 (3.2) |
| Prophylactic use of antibiotics | 22 (70.9) | 8 (25.8) | 1 (3.2) |
| Use of antibiotics for non-bacterial infections *e.g.* viral infections | 25 (75.8) | 6 (18.2) | 2 (6.1) |

**Table 3. Perception of AMR among the study participants.**

| Antimicrobial resistance is an important and serious public health issue in | Somewhat disagree or strongly disagree (%) | Undecided (%) | Somewhat agree or strongly agree (%) | n |
| --- | --- | --- | --- | --- |
| The world | 94.3 | 5.71 | 0 | 35 |
| Our country | 97.1 | 2.86 | 0 | 35 |
| Our hospital | 79.4 | 5.9 | 13.7 | 34 |

**Table 4. Predictors of good knowledge of AMR in a bivariate analysis.**

| Predictor | Category | Good Knowledge | Poor Knowledge | Relative risk (95% CI) | Pearson chi square | p |
| --- | --- | --- | --- | --- | --- | --- |
| Age | ≥ 40 years | 9/16 | 5/27 | 2.66 (1.253-5.662) | 6.5 | 0.0107 |
| | <40 years | 7/16 | 22/27 | | | |
| Gender | Male | 14/16 | 17/27 | 2.71 (0.721-10.177) | 3.0 | 0.0829 |
| | Female | 2/16 | 10/27 | | | |
| Marital Status | Single | 2/16 | 4/27 | 1.14 (0.34-3.786) | 0.04 | 0.8323 |
| | Ever Married | 14/16 | 23/27 | | | |
| Years of Service | ≥ 10 years | 7/16 | 2/27 | 2.94 (1.518-5.686) | 8.0 | 0.0046 |
| | <10 years | 9/16 | 25/27 | | | |
| Station | Medical Wards | 9/16 | 12/27 | 1.34 (0.613-2.957) | 0.56 | 0.454 |
| | Surgical Wards | 7/16 | 15/27 | | | |

## Discussion and Conclusions

Nurses are very important stakeholders in the fight against AMR especially through infection control and promotion of patient awareness. Therefore, our study described the nurse's knowledge on AMR at a tertiary level care hospital in North-Eastern Nigeria, in order to recognize existing gaps with the objective of providing useful information for policy makers. The majority of the respondents reported that indiscriminate use of antibiotics can lead to ineffective treatment, increased adverse effects, prolongation of illness, AMR, and added medical cost to the patient. Fewer respondents reported bacteria as the causative agents of common cold and flu. Most respondents believed that AMR is a problem globally, nationally and in their hospital. Majority of the participants have poor knowledge of AMR. Age more than 40years and longer duration of work experience predicted good knowledge of AMR among nursing staff.

## Knowledge of AMR

The participants in our study reported that indiscriminate and injudicious use of antibiotics can lead to ineffective treatment (94.1%), increased adverse events (60%), exacerbation or prolongation of illness (80%), emergence of bacterial resistance (94.4%) and additional burden of medical cost to the patient (96.9%). Similarly, the majority (71.6%) of community pharmacists in Jordan reported that overuse of antibiotics causes AMR.[18] Among 42 nurses studied at the university of Sao Paulo at Ribeirao Preto Brazil, only 49.1% mentioned indiscriminate use of antibiotics as the cause of AMR.[19] The differences between our findings and those of the Brazilian researchers may be attributed to the different socio-demographic characteristics of the participants and differences in study design.

In our study, the use of antibiotics in certain circumstances was attributed to cause AMR such as self-limited non-bacterial infections (76.5%), broader than necessary spectrum (72.7%), shorter than necessary spectrum (88.2%), longer than standard duration (80.7%). Similarly, 70% of Portuguese secondary and university students are aware that AMR could result from inappropriate antibiotic use.[20] Interestingly, only 29% of the Portuguese university students were aware that antibiotics are used to treat bacterial infections.[20]

The lack of knowledge of the term "Antimicrobial stewardship programs" among the majority of respondents in our study, corroborates the findings of Fadare et al.[21] This is a serious concern given the important roles of nurses in antimicrobial stewardship.[13] However, educational interventions could improve the knowledge of the participants on antimicrobial stewardship. Gillespie et al. assessed the knowledge of nurses on antimicrobial stewardship before and after an education intervention on antimicrobial management.[22] They found that after the intervention, the risks of intravenous treatment were articulated by the nurses and the nurses understood that patients could benefit if they promote switching to oral antibiotics.[22] Furthermore, follow-up studies need to be conducted to ensure healthcare workers put into practice knowledge gained through an education intervention. For instance, in a study on adherence to HIV post-exposure prophylaxis among healthcare workers in Nigeria, up to 27% defaulted the treatment despite knowing its significance.[23]

Similar to our findings, 81.4%, 70%, and 70% of nursing staff in Ethiopia attributed the cause of AMR to poor adherence to antibiotics, overuse of antibiotics and regular prescription of broad-spectrum antibiotics respectively.[14] The findings were similar in China where 81.81% of nursing students correctly answered that antibiotics are effective in treating bacterial infections.[24]

Only 71.9% of the respondents in our study believed that poor infection control measures could lead to AMR. This is not surprising given the suboptimal knowledge of infection control among healthcare workers in Nigeria. Dayyab et al. reported that only 88.14% of healthcare workers always wear gloves while handling blood or blood products of patients in a study conducted in Northeastern Nigeria.[25] Furthermore, Iliyasu et al. reported that 87.96% of healthcare workers in northwestern Nigeria believed that handwashing is the most effective method to prevent healthcare associated infections, with nursing staff significantly having better knowledge compared to doctors.[26]

## Perception of AMR

Our findings are similar to those of researchers in the United States who reported that among 56 nurses studied, more than 90% believed that AMR is a problem globally and nationally.[17] The fact that only 79.4% of the respondents in our study believed that AMR is a problem in their hospital signifies the need for continuous health education on AMR. Furthermore, hospital-wide and national AMR surveillance data should be made available to healthcare workers for educational and decision-making purposes. In a Nigerian hospital, it was reported that among patients that developed hospital-acquired infections, 80%, 84% and 95% of S. aureus, E. coli, and P. aeruginosa isolates respectively were Multi-Drug Resistant (MDR).[27] In another study on agents of bacterial blood stream infections in Nigeria, a high prevalence of AMR against ampicillin, trimethoprim-sulfamethoxazole, tetracycline and cloxacillin was described.[28]

## Predictors of good knowledge of AMR

It is not surprising that work experience of 10 years or longer predicted good knowledge of AMR. Longer years of work experience may be associated with refresher courses and training attendance. The same explanation applies to the association between good knowledge of AMR and age more than 40 years observed in our study. In a study among non-medical students in Nigeria, only 37.2% had good knowledge of AMR with significant association with year of study and age of the participants.

The major limitation of this study is been a single center study. Another limitation is that, as with any other knowledge and perception study, participants are more likely to provide socially acceptable responses. Furthermore, this study is limited by the overall small sample size. Notwithstanding these limitations, our study provided an insight into the knowledge of healthcare staff on AMR.

We have identified a significant gap on knowledge of AMR among nurses working at a tertiary center in resource-limited setting. In a study among 50 Spanish nurses, that aim to promote continuous training and the use of research in clinical practice, an educational intervention resulted in a significantly improved knowledge (pre course score of 70.5% Vs. post course score of 86.6%).[29] Based on these findings, we recommend a robust AMR awareness initiative to educate Nigerian healthcare workers on AMR.

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