

# Knowledge, belief and practice of interventions to contain antimicrobial resistance among nurses in Sokoto, Northwestern Nigeria

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## ABSTRACT

**Background:** Antimicrobial Resistance (AMR) continued to be a major public health problem worldwide. The present study assessed the knowledge, belief and practice of intervention to contain AMR among nurses in Sokoto state, Northwestern Nigeria.

**Aims and Objectives:** To assess the knowledge, belief and practice of interventions to contain AMR among nurses in Sokoto State, Northwestern Nigeria.

**Methodology:** This is a cross-sectional study involving 333 nurses sampled from the current population of 1350 nurses working across the state. A multi-stage sampling technique was used to select eligible participants for this study. Using self-administered questionnaire relevant data were obtained from the respondents. This study receives ethical approval from Usmanu Danfodiyo University Teaching Hospital, Sokoto. Data analysis included mean and proportions.

**Results:** Overall, all the participants were knowledgeable about AMR. We found that 73.1% of the participants lack an up-to-date information on AMR. Majority of the participants (90.1%) had no training on AMR. Over 2/3<sup>rd</sup> (62.3%) did not use results of anti-microbial sensitivity test (AST) to guide patient's anti-microbial treatment and 93.3% of the respondents were aware of general interventions to contain AMR. However, 76.3% of the respondents were not aware of the WHO Global strategy for the containment of AMR. Majority of participants agreed AMR as a worldwide and also considered AMR as a problem in their own hospitals.

**Conclusion:** Majority of nurses lack knowledge on the WHO Global Strategy for the containment of AMR and up to-date knowledge on AMR. Self-prescription by patients and poor awareness on WHO global strategy for the containment of AMR are areas of interventions for prevention and control of AMR.

**Keywords:** anti-microbial, resistance, interventions, nurses, knowledge, belief and practice

## INTRODUCTION

Antimicrobial Resistance (AMR) is a natural phenomenon in which microorganisms acquire genes that enables resistance to antimicrobial agents [1]. Consequently, lots of antibiotics are losing their ability to treat infectious diseases. AMR occurs in all microbes such as bacteria, viruses and parasites. Examples of AMR includes multidrug resistant and extensively drug resistant tuberculosis, multidrug resistant malaria, Methicillin resistant *Staphylococcus aureus* (MRSA). Resistance genes can be shared between microbes either via vertical transmission or horizontal transmission. In vertical transmission, resistance gene is transferred from the parent microbe to its offspring when it replicates while in horizontal transmission the transmitted resistance gene can be chromosomal or extrachromosomal such as plasmid. Plasmid transfer resistance between bacteria because they are extrachromosomal strands of deoxyribonucleic acid (DNA) that carry resistance genes [2].

Antimicrobial Resistance (AMR) continued to be a major public health problem throughout the world [3]. However, it is more serious in developing countries due to antibiotic use without medical guidance and inadequate regulation of antibiotics [4,5]. This is evident by a survey on the prevalence of Methicillin Resistant *Staphylococcus aureus* (MRSA) among health care workers in Anambra State Nigeria, which was found to be 30%.<sup>6</sup> The problem of AMR is accelerated by proliferation of antimicrobial agents and their abundant use and misuse by humans in the form of irregular and inappropriate treatment by health care workers as well as self-medication by the patients [5,6,8]. Furthermore, lacking are the proper legal frameworks that support quality and appropriate use of antimicrobials and implementing poor managerial mechanisms for proper selection, procurement, distribution, and use of these valuable medicines [1].

Antimicrobial resistance results in increased morbidity, loss of productivity, increased mortality, increased period of infectivity and cost of care [7]. However, changes in antimicrobial prescribing patterns will demand changes in nurses' behavior towards the magnitude of AMR problem [8]. Thus, information on nurses' knowledge, belief and practice on interventions to contain AMR will permit the development of more effective interventions for the containment of

AMR. Numerous surveys have been conducted to assess physicians' knowledge and beliefs about antimicrobial use and resistance in USA and Europe [9-11]. However, these studies are scarce in Sokoto state and extrapolations of the results from studies in developed world are not necessarily applicable to the situation in countries like Nigeria.

The World Health Assembly passed a resolution in support of the containment of AMR among member countries. In response to this is the WHO Global Strategy (WHO-GS) for the Containment of Antimicrobial Resistance. This WHO document contained interventions which are reducing disease burden and spread of infection, improving access and use of appropriate antimicrobials, strengthening health systems and surveillance capabilities, enforcing regulations and legislation, encouraging development of appropriate new drugs and vaccines.<sup>12</sup> More so, the global strategy interventions target the general public, patients, health care professionals and, hospital managers. Coordinated efforts to implement the WHO-GS at the country level have been limited, particularly in countries such as Nigeria [12].

This study aimed to assess the knowledge, belief and practice of interventions to contain AMR among nurses in Sokoto State, Northwestern Nigeria.

## **MATERIALS AND METHODS**

The study was conducted among nurses practicing in health facilities in Sokoto State. A cross sectional descriptive study was used. The sample size was calculated from OpenEpi, Version 3, open source calculator--SSPropor and a sample size of 333 was obtained from the current population of 1350 nurses practicing in Sokoto state. Standard normal deviate at 95% confident level =1.96, prevalence of good knowledge of interventions to contain AMR was 50%, precision of 5 % (tolerable alpha error of 0.05) and attrition factor of 15% were applied. A multi-stage sampling technique was used to select eligible participants for this study. A semi structured self-administered questionnaires on the knowledge, believe and practice of interventions to contain AMR was used. Written informed consent was obtained from each study participant. Utmost confidentiality of identity of participant was maintained in the analysis and subsequent write- up

Data analysis was performed using the Statistical Package for Social Sciences for windows version 21.0. The choice of statistical test was guided by the normality of the data distribution. Normally distributed data were summarized using mean and standard deviations while proportions and percentages were used to summarize categorical data. Ethical clearance was obtained from the ethics committee of UsmanuDanfodiyo University Teaching Hospital, Sokoto (UDUTH/HREC/2014/No.244).

## RESULTS

### Participants' profiles and sources of information on AMR

Table 1 presented the participants profile and sources of information on AMR. From the table, a total of 223 nurses filled and returned the questionnaire representing 67% response rate. The mean service year (s) was 8.4 (SD  $\pm$  7.8). Participant's commonest current sources of information about AMR were from relevant books 30.5%, 24.7% from sources such as university courses and trainings workshops and 11.2% from internet. However, 73.1% of the participants lacks an up-to-date information on AMR. Majority of the participants (90.1%) had no training on AMR while only 8.5% had training on AMR.

Participants' use of antimicrobial susceptibility test (AST) result, training status on AMR and working departments are illustrated in (Table 1). Of the study participants, 62.3% replied that they hardly wait for the results of AST test before commencing anti-microbial treatment for their patients.

### Knowledge on causes and prevalence of antimicrobial resistance

The most important perceived contributing factors to the development of antimicrobial resistance according to the study participants were: Patient poor adherence to prescribed antibiotics (74.0%), poor infection control in hospitals (70.0%), substandard quality of antibiotics (68.2%) and widespread/overuse of antibiotics (66.4%) (Table 3). Similarly, assessment of respondents' knowledge on local factors that lead to the spread of AMR revealed that the most important local factors identified were: Self-prescription by patients (74.9%), prescriber's poor awareness on AMR was responded by 73.1% and lack of access to local anti-biogram data was responded by

55.6%. Participants were also asked to identify some of the common drug resistant bacteria in hospitals from local to global levels by open questions. Multidrug resistant tuberculosis (MDR-TB) 33.6%, Vancomycin resistant *Staphylococcus aureus* (VRSA) (35.0), Methicillin resistant *Staphylococcus aureus* (MRSA) was rated 30.9%, while *Pseudomonas aeruginosa* was rated 22.0% (Table 3).

### **Nurses beliefs on causes of avoidable widespread/overuse of antibiotics**

According to participants, the leading factors were: treatment failure, critically ill or immune compromised patients and patient push. Respondents were also asked to rate bacterial infections in which avoidable use of antibiotics are common. Unknown febrile illness 57.0%, diarrheal diseases was rated 47.5%, urinary tract infection 42.6% and upper respiratory tract infection 38.6% (Table 4).

### **Nurses' knowledge on interventions to contain AMR**

About 93.3% of the respondents were aware of general interventions to contain AMR while 6.7% were not aware. Their major source of knowledge is the internet (61.4%). Similarly, 73.3% of the respondents were not aware of the WHO Global strategy for the containment of AMR while only 23.7% were aware of the strategy and their major source of knowledge is the internet (13%).

### **Beliefs on potential interventions for antimicrobial resistance**

Antimicrobial usage policy and educational training on antimicrobial therapy for prescribers were considered strong interventions for antimicrobial resistance. However, reduction of antibiotic use for outpatient setting was considered not strong intervention (Table 5).

## **DISCUSSION**

Nurses are one of the major stakeholders in the prevention and control of antimicrobial resistance through their wise prescribing of antibiotics, controlling transmission of drug resistant bacteria and promoting appropriate awareness. Hence, the current study demonstrated the knowledge,

belief and practice of interventions to contain AMR among hospitals in Sokoto State, Northwestern Nigeria.

Regarding the scope of AMR problem, majority of the nurses strongly agreed that AMR is a global and national public health problems and also recognized AMR as a problem in their hospitals. These findings are similar to other studies [1, 13-15]. This is in contrast to findings from studies conducted in Spain, Brazil, Peru where 90% of physicians perceived AMR as global and national problem [13,16,17].

Majority of nurses were unaware of the existence of antibiotic resistant bacteria. For instance, 30.9% of nurses had information with regards to MRSA. This is however lower than physician's knowledge of MRSA documented in Ethiopia [5]. Although, MDR-TB is not a hospital pathogen, a few number of the nurses (33.6%) mentioned it as one of the most prevalent resistant bacteria in the hospitals. The gaps in knowledge on local antibiotics resistant can be attributable to the gross unavailability of bacteriological culture and susceptibility testing in most hospitals [11]. Also, only 8.5% of nurses have had training on antimicrobial stewardship education.

The leading causes of AMR were: patients' poor adherence to prescribed antibiotics, poor infection control in hospitals, substandard quality of antibiotics and widespread use of antibiotics. Similarly, a study conducted in Scotland, France and Spain stated that too many antibiotic prescriptions, too many broad-spectrum antibiotics and inappropriate duration of antibiotic treatments were the leading factors [17,18]. Poor hand washing was however not well recognized in this study as contributing factors to AMR in hospital settings similar to other studies [17,18]. Therefore, emphasis on proper hand washing and infection control measures must be implemented.

This study revealed that the most important local factors for spread and development of AMR were self-antibiotic prescription and prescriber's poor awareness on AMR. Furthermore, lack of access to antimicrobial susceptibility testing was mentioned as local factors. Some other studies also supported this findings [4,19].

Regarding potential interventions to combat AMR, majority of participants believed in the following measures: establishment of national AMR surveillance, establishment of hospital infection control committee and institutional guidelines for antimicrobial use. However, only

52.9% of the nurses were in support of reduction of antibiotic use for outpatient setting. These findings were not in agreement with a previous study on beliefs of physicians [20].

Regarding nurses' beliefs towards the pushing factors for frequent prescription of antibiotics, treatment failure and critically ill/immune compromised patients were the most driving factors. This is consistent with the findings in Ethiopia [8]. Patient's push was only mentioned by 39.0% of respondents [14]. Majority of nurses (57.0%) believed that unknown febrile illness was the leading factor for excessive antibiotic prescriptions.

On nurses' knowledge on interventions to contain AMR. About 93.3% of the nurses were knowledgeable about general interventions to combat AMR but only 23.8% of nurses knew about WHO global strategy for the containment of AMR.

## **CONCLUSION**

This study revealed important information on knowledge, beliefs and practice of interventions to contain AMR by nurses that would be implemented in a resource-poor country like Nigeria. In this survey, nurses working in government and private hospitals had information gap on WHO global strategy for the containment of antimicrobial resistance. Hence, the need to formulate antimicrobial usage policies, programs and training to educate all nurses on this WHO global strategy and to monitor or evaluate this programs periodically. According to nurses' response, self- drug prescription by patients, poor awareness on AMR and unavailability of local anti-bio-gram data are an issues of great concern.

## **Acknowledgment**

We would like to thank the study participants for providing responses.

## **Competing interests**

The authors declare that they have no competing interests.



## References

1. Nelson N, Ramshaw M, Joshi MP (2010). Antimicrobial resistance (Part 1). Global Health e-Learning Center [Internet].
2. Davies J, Davies D (2010). Origins and Evolution of Antibiotic Resistance. *Microbiol Mol Biol Rev* 74 no. 3 p.417-433
3. World Health Organization. Antimicrobial Resistance - Global Report on Surveillance. 2014.
4. Byarugaba DK (2004). A view on antimicrobial resistance in developing countries and responsible risk factors. *Int J Antimicrob Agents* 24:105–110 doi:10.1016/j.ijantimicag.2004.02.015 PMID:15288307.
5. Okeke IN, Laxminarayan R, Bhutta ZA, et al (2005). Antimicrobial resistance in developing countries. Part I: recent trends and current status. *Lancet Infect Dis* 5(8):481-93.
6. Akujobi CN, Ilo IA, Egwuatu C, et al (2013). Prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) among healthcare workers in a tertiary institution in Nigeria. *Orient Journal of Medicine* 25 [3-4]
7. Qavi A, Segal-Maurer S, Mariano N, et al (2005). Increased mortality associated with a clonal outbreak of ceftazidime-resistant *Klebsiella pneumoniae*: a case-control study. *Infect Control Hosp Epidemiol* 26:63–68.
8. Abera B, Kibret M, Mulu W (2014). Knowledge and beliefs on antimicrobial resistance among physicians and nurses in hospitals in Amhara Region, Ethiopia. *BMC Pharmacology and Toxicology* 15:26 <http://www.biomedcentral.com/2050-6511/15/26>. Accessed date: Nov.17, 2014.
9. Abbo L, Sinkowitz-Cochran R, Smith L, et al (2011). Faculty and resident physicians' attitudes, perceptions and knowledge about antimicrobial use and resistance. *Infect Control Hosp Epidemiol* 32:714–728.
10. Pulcini C, Williams F, Molinari N, et al (2011). Junior doctors' knowledge and perceptions of antibiotic resistance and prescribing: a survey in France and Scotland. *Clin Microbiol Infect* 17:80–87.
11. Srinivasan A, Song X, Richard A, et al (2004). A survey of knowledge, attitudes, and beliefs of house staff physicians from various specialties concerning antimicrobial use and resistance. *Arch Intern Med* 164:1451–1456.
12. World Health Organization (2001): Global strategy for the containment of antimicrobial resistance. Geneva.

13. Guerra CM, Perreira CA, Neves Neto AR, et al (2007). Physicians' perceptions, beliefs, attitudes and knowledge concerning antimicrobial resistance in a Brazilian teaching hospital. *Infect Control Hosp Epidemiol* 28:1411–1414.
14. Thriemer K, Katuala Y, Batoko B, et al (2013). Antibiotic Prescribing in DR Congo: A Knowledge, Attitude and Practice Survey among Medical Doctors and Students. *PLoS One* 8:e55495 doi:10.1371/journal.pone.0055495.
15. Qavi A, Segal-Maurer S, Mariano N, et al (2010). A survey of physicians' knowledge and attitudes regarding antimicrobial resistance and antibiotic prescribing practices at the University Hospital of the West Indies. *West Indian Med J.* 59: 165-170.
16. Garcia C, Llamocca LP, Garcia K, et al (2011). Knowledge, attitudes and practice survey about antimicrobial resistance and prescribing among physicians in a hospital setting in Lima, Peru. *BMC Clin Pharmacol* 11:18.
17. San Francisco CN, Toro MD, Cobo J, et al (2013). Knowledge and perceptions of junior and senior Spanish resident doctors about antibiotic use and resistance: Results of a multicenter survey. *Enferm infec Microbiol Clin* 31:199-204.
18. Pulcini C, Williams F, Molinar N, et al (2010). Junior doctors' knowledge and perceptions of antibiotic resistance and prescribing: a survey in France and Scotland. *Clin Microbiol Infect* 17:80–87.
19. Kheder SI (2013). Physicians knowledge and perception of antimicrobial resistance. A survey in Khartoum State Hospital settings. *Br J Pharmaceut Res* 3:347-362.
20. Wester CW, Durairaj L, Evans AT, et al (2002). Antibiotic resistance. A survey of physician perceptions. *Arch Intern Med.* 162:2210–2216.

Table 1 Nurses profiles

Characteristics	Number (%)
<b>Hospital of practice</b>	
UDUTH	132 (59.2)
Specialist Hospital Sokoto	73 (32.7)
Others	15 (8.1)
<b>Highest qualifications</b>	
MSc	1 (0.4)
BSc/BNSC	2 (0.9)
RN/RM CERTIFICATE	2 (0.9)
RN CERTIFICATE	13 (5.8)
<b>Departments/subspecialty</b>	
Surgery	30 (13.48)
Medicine	44 (19.78)
Pediatrics	61(27.38)
Obstetrics and gynecology	49 (21.98)
Nursing and Midwifery education	39 (17.48)
<b>Years of service</b>	
Mean (SD) years	8.4 (7.8)
<b>Training attended on AMR</b>	

Yes	19(8.6)
No	204(91.4)

**Using AST results**

Yes	59(26.5)
No	164(73.5)

**Source of information**

Books	68(30.5)
Internet	25(11.2)
School course/workshops	55(24.7)
Lack of up to-date information	175(78.5)

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UsmanuDanfodiyo University Teaching Hospital (UDUTH), Antimicrobial Susceptibility Test (AST), Master of Science (MSc), Bachelor of Science/Bachelor of Nursing Science (BSc/BNSC), Registered Nurse (RN), Registered Midwife (RM)

Table 2 percentage of nurses rating of the scope of AMR problem

Scope of AMR	Strongly agree	Agree	Disagree	Strongly disagree	Don't know
AMR is a worldwide problem	34(15.2)	120(53.8)	22(9.9)	3(1.3)	44 (19.7)
AMR is a problem in Nigeria	61(27.4)	99(44.4)	22(9.9)	3(1.3)	38 (17.0)
AMR is a problem in your hospital	23(10.3)	90(40.4)	51(22.9)	11(4.9)	48(21.5)

AMR: antimicrobial resistance

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Table 3 Knowledge of AMR and its perceived causes

Variable	Response		
	Yes N (%)	No N (%)	Don't know N (%)
<b>Cause of AMR</b>			
Widespread/overuse of Antibiotics	148(66.4)	42(18.8)	33(14.8)
Usage of broad spectrum antibiotics	102(45.7)	82(36.8)	39(17.5)
Bacterial mutations	95(42.6)	54(24.2)	74(33.2)
Poor hand washing practice	125(56.1)	75(33.6)	23(10.3)
Poor infection control in hospitals	156(70.0)	47(21.1)	20(9.0)
Patient Poor adherence to antibiotics	165(74.0)	30(13.5)	28(12.6)
Substandard quality of antibiotics	152(68.2)	29(13.0)	42(18.8)

### Example of AMR bacteria

MRSA	69(30.9)	39(17.5)	115(51.6)
VRSA	78(35.0)	36(16.1)	109(48.9)
<i>Pseudomonas aeruginosa</i>	49(22.0)	57(25.6)	117(52.5)
MDR-TB	75(33.6)	46(20.6)	102(45.7)

### Local factors for development of AMR

Self-prescription by patients	167(74.9)	22(9.9)	34(15.2)
Lack of access to local anti-biogram data	124(55.6)	40(17.9)	59(26.5)
Prescribers poor awareness on AMR	163(73.1)	27(12.1)	33(14.8)

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Methicilin Resistant *Staphylococcus aureus* (MRSA), Vancomycin Resistant *Staphylococcus aureus* (VRSA),  
Multidrug Resistant Tuberculosis (MDR-TB), Anti-microbial Resistance (AMR)

Table 4 Nurses beliefs on causes of avoidable widespread/overuse of antibiotics

Variable	Yes N (%)	No N (%)	I don't know N (%)
<b>Reasons for avoidable use of antibiotics</b>			
Patients push	87(39.0)	73(32.7)	63(28.3)
Treatment failure	151(67.7)	42(18.8)	30(13.5)
Critical ill or immune compromise patients	139(62.3)	52(23.3)	32(14.3)
Hospital profit	69(30.9)	99(44.4)	55(24.7)
<b>Examples of diseases/infectious where avoidable use of antibiotics is common</b>			
URTI	86(38.6)	109(48.9)	28(12.6)
Febrile illness (unknown origin/cause)	127(57.0)	76(34.1)	20(9.0)
UTI	95(42.6)	107(48.0)	21(9.4)
Diarrheal diseases	106(47.5)	99(44.4)	18(8.1)

Upper Respiratory Tract Infection (URTI), Urinary Tract Infection (UTI)



Table 5 Beliefs on potential interventions to combat AMR resistance

Variables	Strongly agree(%)	Agree (%)	Disagree (%)	Strongly disagree	Don't know
Antimicrobial usage policy	91(40.8)	81(36.3)	13(5.8)	-	38(17.0)
Reduction of antibiotic use for outpatient setting	30(13.5)	118(52.9)	61(27.4)	7(3.1)	7(3.1)
Established NAMR surveillance	68(30.5)	123(55.2)	18(8.1)	4(1.8)	10(4.5)
Established HICC	94(42.2)	97(43.5)	21(9.4)	3(1.3)	8(3.6)
Institutional guidelines for anti-microbial use	91(40.8)	102(45.7)	22(9.9)	3(1.3)	5(2.2)
Education on Antimicrobial therapy for prescribers	104(46.6)	91(40.8)	17(7.6)	6(2.7)	5(2.2)
Established microbiology diagnostic services	87(39.0)	102(45.7)	22(9.9)	6(2.7)	6(2.7)

National Anti-Microbial Resistance (NAMR), Hospital Infection Control Committee (HICC)

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