









## RESEARCH ARTICLE

# A survey on knowledge, attitude, and practice about antibiotic prescribing and resistance among medical practitioners in Kenya [version 1; peer review: 3 approved with reservations, 1 not approved]

Moses Kamita <sup>1</sup>, Joe Kimanathi Mutungi <sup>1,2</sup>, Samuel Mungai<sup>1</sup>, Dominic Mureithi <sup>3</sup>, Caroline Kijogi <sup>1</sup>, Racheal Kimani<sup>1</sup>, Davies Ndegwa <sup>4</sup>, Jeremiah Maina<sup>1</sup>, Jesse Gitaka <sup>1</sup>

<sup>1</sup>Directorate of Research and Innovation, Mount Kenya University, P.O. Box 342, Thika, 01000, Kenya

<sup>2</sup>College of Basic and Applied Sciences, University of Ghana, P.O. Box LG 25, Legon, Accra, Ghana

<sup>3</sup>Department of Animal Sciences, Chuka University, P.O. Box 109, Chuka, 60400, Kenya

<sup>4</sup>Department of Medical Laboratory Sciences, Kenya Medical Training College, P.O. Box 30195, Nairobi, 00100, Kenya

**V1** First published: 04 Feb 2022, 5:3  
<https://doi.org/10.12688/aasopenres.13328.1>

Latest published: 04 Feb 2022, 5:3  
<https://doi.org/10.12688/aasopenres.13328.1>

## Abstract

### Background

Antibiotic resistance is a growing global health threat worldwide and especially in developing countries. Irrational antibiotic prescription as well as lack of the requisite knowledge and awareness of proper antibiotic use are major drivers of antibiotic resistance. In Kenya, although the Ministry of Health has developed antibiotic use guidelines, these guidelines are not widely followed. Antibiotic prescription is, therefore, hugely at the discretion of the clinician. It is thus necessary to understand the knowledge, attitude, and practices (KAP) of antibiotic prescription among medical practitioners in the country. This study aimed to evaluate the knowledge, attitude, and practices (KAP) among antibiotic prescribers in three counties (Kiambu, Nakuru, and Bungoma) in Kenya.

### Methods

This was a cross-sectional study using a self-administered questionnaire. Simple descriptive statistics were used to generate frequencies, percentages, and proportions. Where necessary, univariate analyses such as Pearson's chi-square were performed to compare proportions for statistical significance.



### Results

From the three counties, 240 respondents recorded their responses: 30% from Kiambu, 34.6% from Nakuru, and 35.4% from Bungoma. The respondents included 19 (7.9%) consultants, 66 (27.4%) medical officers, 135 (56.3%) clinical officers and 20 (8.3%) pharmacists. Of all

## Open Peer Review

Approval Status

	1	2	3	4
version 1				
04 Feb 2022	<a href="#">view</a>	<a href="#">view</a>	<a href="#">view</a>	<a href="#">view</a>

1. **Veranja Liyanapathirana** , University of Peradeniya, Peradeniya, Sri Lanka
2. **Attila Sárváry**, University of Debrecen, Nyíregyháza, Hungary
3. **Atsadaporn Niyomyart**, Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
4. **Ebelechuku Francesca Ugochukwu** , Nnamdi Azikiwe University Awka Nigeria, Nnewi Campus, Nigeria  
Nnamdi Azikiwe University Awka Nigeria, Anambra, Nigeria

respondents, more than 90% agreed or strongly agreed that antibiotic resistance (ABR) is a catastrophe worldwide and in Kenya. However, the proportion of the respondents who either agreed or strongly agreed (71.6%) that antibiotic resistance is a problem in their respective health facilities was significantly lower ( $p=0.013$ ).

### Conclusion

This study revealed that most medical practitioners were aware and knowledgeable about antibiotic resistance. However, there was a disconnect with mitigation measures such as active antibiotic stewardship and laboratory analyses to support judicious prescription. There is, therefore, a need for continuous education and stewardship interventions.

### Keywords

antimicrobials, antimicrobial resistance, KAP-survey, Kenya, antibiotics, antibiotic prescription, medical practitioners

Any reports and responses or comments on the article can be found at the end of the article.

**Corresponding author:** Jesse Gitaka ([jgitaka@mku.ac.ke](mailto:jgitaka@mku.ac.ke))

**Author roles:** **Kamita M:** Data Curation, Formal Analysis, Investigation, Writing – Original Draft Preparation, Writing – Review & Editing; **Mutungi JK:** Data Curation, Methodology, Writing – Review & Editing; **Mungai S:** Data Curation, Methodology, Writing – Review & Editing; **Mureithi D:** Data Curation, Investigation, Writing – Review & Editing; **Kijogi C:** Data Curation, Methodology, Writing – Review & Editing; **Kimani R:** Data Curation, Investigation, Writing – Review & Editing; **Ndegwa D:** Data Curation, Methodology, Writing – Review & Editing; **Maina J:** Data Curation, Methodology, Writing – Review & Editing; **Gitaka J:** Conceptualization, Funding Acquisition, Methodology, Project Administration, Supervision

**Competing interests:** No competing interests were disclosed.

**Grant information:** This work was supported by The Kenya National Research Fund (grant number NRF/MKU/2017/007). Dr Jesse Gitaka is an Affiliate of the African Academy of Sciences.

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

**Copyright:** © 2022 Kamita M *et al.* This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Kamita M, Mutungi JK, Mungai S *et al.* **A survey on knowledge, attitude, and practice about antibiotic prescribing and resistance among medical practitioners in Kenya [version 1; peer review: 3 approved with reservations, 1 not approved]** AAS Open Research 2022, 5:3 <https://doi.org/10.12688/aasopenres.13328.1>

**First published:** 04 Feb 2022, 5:3 <https://doi.org/10.12688/aasopenres.13328.1>

## Introduction

Antimicrobial resistance (AMR) happens when human, animal, or plant pathogens (viruses, bacteria, parasites, and fungi) are no longer responsive to treatment (antivirals, antibiotics, antiparasitic, and antifungals) that had been effective against them before<sup>1</sup>. In humans, this makes treatment of common diseases difficult, increases the risk of disease severity, morbidity, and fatality. Indeed, antibiotic resistance (ABR) is a product of evolutionary dynamics driven by selection pressure and genetic mutations that confer a survival advantage to the bacteria<sup>2</sup>.

In low- and middle-income countries where the disease burden is already high and health systems are not well developed, antibiotic resistance and the resultant consequences are more pronounced. There is a problem of access to quality antibiotics on one hand and the problem of injudicious use of antibiotics on the other.

Studies have shown that in Africa, there are a lot of patients who do not receive antibiotics through the usual health care systems. More than 30% of antibiotic prescriptions received in most parts of Africa do not have a prescription from a clinician while more than 26% get antibiotics from informal sources<sup>3</sup>. Another study in South Africa established that

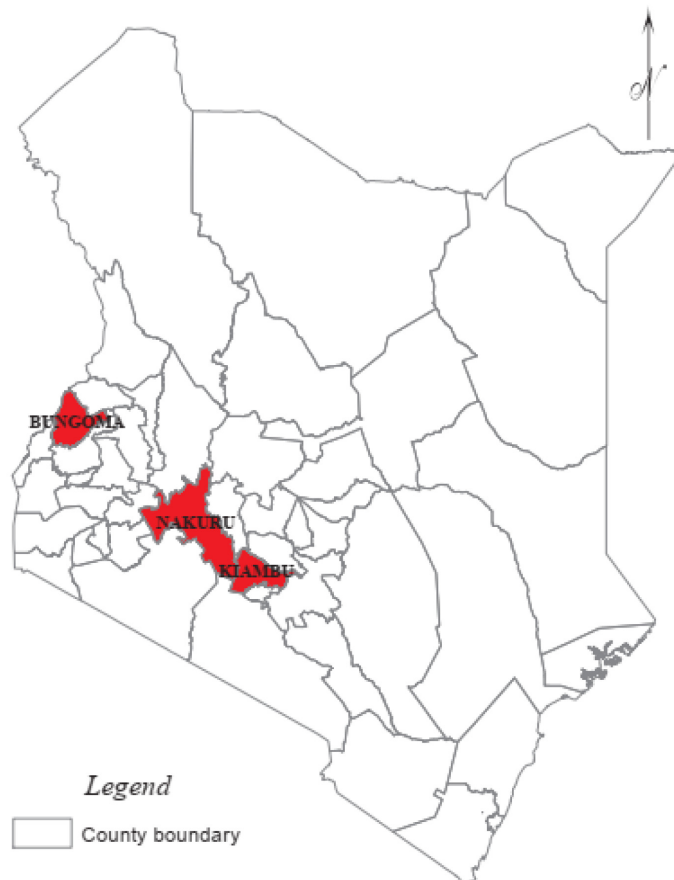
54.9% of antibiotics prescribed, especially in intensive care units, were inappropriate<sup>4</sup>. Similar findings have been reported in Australia<sup>5</sup> and in the USA<sup>6</sup> indicating that inappropriate use of antibiotics is more of a global issue rather than regional.

Clinicians' and pharmacists' antibiotic prescribing behaviors determine how well the drugs are utilized in hospital settings. Changing prescribers' behaviors is one of the strategies that can reduce misuse and/or overuse of antibiotics in hospital settings. However, sufficient data on this aspect is lacking especially in low- and middle-income countries. This study sought to address this gap by conducting a survey aimed at evaluating the knowledge, attitude, and practices of antibiotic prescription among clinicians in outpatient departments and pharmacies in three counties in Kenya.

## Methods

### Study design

The study consisted of a cross-sectional survey of clinicians and pharmacists from public hospitals in three counties in Kenya – Kiambu, Nakuru, and Bungoma (Figure 1). Quantitative data on knowledge, attitude, and practice of antibiotics use/prescription were collected using self-administered questionnaires in six participating facilities. The study is part of a



**Figure 1.** Map of Kenya showing the three counties (Kiambu, Nakuru, and Bungoma) where respondents were surveyed.

larger project which is ongoing and aims at building stewardship capacity in different hospitals within the three counties<sup>7</sup>.

### Study population

The study targeted medical officers (MOs), medical officer interns (MOIs), clinical officers (COs), clinical officer interns (COIs), and pharmacists who are the medical professional cadres authorized to prescribe antibiotics in hospitals. All the departments with outpatient services in the hospitals were considered eligible for the study. In every hospital, a total of 40 questionnaires were administered and the numbers for each cadre were determined by calculating the proportionate number of staff in each cadre against the total number of staff. This was done by dividing the number of staff in each cadre by the total number of the targeted population in the hospital multiplied by 40.

### Survey instrument

The study used a structured self-administered questionnaire<sup>7</sup>, which was developed in consultation with experts on antimicrobial resistance as well as previous studies<sup>8-10</sup>. For validation, the questionnaire was first subjected to a pre-testing at Gatundu Level 5 hospital, in Kiambu County, which was not one of the targeted hospitals. The survey instrument was a seven-part series questionnaire, with each series containing a set of questions intended to capture standardized responses. The questions ranged from those targeting general information responses to those that assessed knowledge, attitude, and practice in using antimicrobials. The first part entailed general questions on the number of years the respondent had worked since graduation from medical school, their current department, and designation. The second part comprised of the prescription pattern and the questions included frequency of prescribing antibiotics and use of antibiotic prescription guidelines when prescribing. The third part focused on the awareness and attitude on the current scope of antibiotic resistance while part four required the respondents to describe their confidence in antibiotic knowledge in prescribing and whether they consult their colleagues when prescribing. In part five, the source of information on antibiotic prescription and resistance was sought and part six aimed to know what guides their judgment when prescribing antibiotics. The last part included questions on the knowledge of antibiotic-resistant bacteria and the management of their infections.

### Survey administration

The survey was conducted between 30<sup>th</sup> April and 11<sup>th</sup> October 2019. The study team visited each hospital and handed

over the questionnaires to the respondents in their workstations after attaining written informed consent from each participant. The completed questionnaires were handed back to the study team with no incentives being offered for participation. To ensure the anonymity of respondents, identifiers were omitted from the questionnaires.

### Statistical analysis

All the filled questionnaires were checked for completeness. Although no questionnaire was excluded entirely due to incompleteness, entries that were incomplete in any questionnaire were excluded from those specific analyses where such entries were needed. Data entry and analysis were carried out using SPSS Statistics version 26.0 (IBM SPSS Statistics, RRID:SCR\_019096) (An open-access alternative is R Stats (R Project for Statistical Computing, RRID:SCR\_001905)) (The data set is available as underlying data<sup>11</sup>). Simple descriptive statistics were used to generate frequencies, percentages, and proportions. Where necessary, univariate analyses such as Pearson's chi-square were performed to compare proportions for statistical significance.

### Ethics statement

Ethical clearance was obtained from Mount Kenya University Ethics Review Committee (MKU/ERC/0764) and approval to carry out the study was obtained from the National Commission for Science, Technology, and Innovation (NACOSTI) (NACOSTI/P/18/33304/25986). In addition, written permissions were obtained from each of the participating hospitals' administration.

### Results

Two hundred and forty (240) participants from the three counties recorded their responses. By county, there were 72 (30%) from Kiambu, 81 (34.6%) from Nakuru, and 85 (35.4%) from Bungoma. The respondents included 135 (56.3%) clinical officers, 19 (7.9%) consultants, 66 (27.4%) medical officers and 20 (8.3%) pharmacists. Among the clinical officers, 76 (56.3%) were on internship, 10 (7.4%) had one to three years of experience, 8 (5.9%) had between four and six years of experience and 41 (30.4%) had seven years and above of work experience. Among the medical officers, most of the respondents were interns at 28 (42.4%) and the least were those with one to three years of experience. All the consultants (n = 19) who responded had seven or more years of experience while the majority of the pharmacists at 8 (40.0%) had four to six years of work experience (Table 1).

**Table 1. Work experience of the respondents classified by the different cadres.**

Work Experience	Clinical Officer	Consultants	Medical Officer	Pharmacist
Internship	76 (56.3%)	0 (0.0%)	28 (42.4%)	1 (5.0%)
1-3 years	10 (7.4%)	0 (0.0%)	11 (16.7%)	6 (30.0%)
4-6 years	8 (5.9%)	0 (0.0%)	14 (21.2%)	8 (40.0%)
7 years and above	41 (30.4%)	19 (100.0%)	13 (19.7%)	5 (25.0%)

The majority of the respondents (55.7%) indicated that they prescribe to both in- and outpatients while 25.5% and 18.7% indicated that they prescribe only to inpatients and outpatients, respectively. More than 70% of the respondents in each cadre indicated that they prescribed to 50% (5 out of 10) of patients that visited. Among the cadres, only consultants indicated that they do not prescribe antibiotics to all the (10 of 10) patients reviewed (Table 2). Overall, the survey showed that the highest percentage of medical practitioners (41.8%) prescribe antibiotics to most (6–9 out of 10) patients while 29.5% of respondents prescribe antibiotics to at least 50% of patients (5 out of 10 patients) (Table 2).

To determine the level of knowledge in antibiotics use, eight questions were administered. The respondents earned a single point for every question they answered correctly. From a total score of 8, the mean score was 4.63 with 78.8% of the respondents scoring between 4 and 6. The respondents scored poorest in the questions where no antibiotics were to be used irrespective of the cadre but showed good knowledge on the mode of action of the antibiotics (Table 3). Scores obtained did not significantly differ ( $p = 0.169$ ) depending on the years of work experience of the respondents. Generally, the correct responses were highest among consultants, followed by the medical officers then clinical officers.

Most of the respondents agreed or strongly agreed that antibiotic resistance is a problem worldwide (96.3%) and in Kenya (92.1%). However, the proportion of the respondents who either agreed or strongly agreed (71.6%) that antibiotic resistance is a problem in their respective health facilities was significantly lower ( $p = 0.013$ ) with about 23.8% of the respondents being neutral about their awareness of an antibiotic resistance problem in their facility (Table 4).

On the issue of the reasons fueling antibiotic resistance in the country, most respondents strongly agreed (31.3%,  $n=75$ ) or agreed (49.2%,  $n=118$ ) that overuse of antibiotics in hospitals was one of the reasons for increased antibiotic resistance. The other reason was the demand for antibiotics by patients where 25.4% ( $n=61$ ) of the respondents strongly agreed and

42.1% ( $n=101$ ) agreed. Increased use of over-the-counter medicine was the other reason with 65% ( $n=156$ ) of the respondents strongly agreeing and 29.6% ( $n=71$ ) agreeing (Figure 2).

More than 50% of the respondents had awareness of local patterns of antibiotic resistance ranging from good to excellent. The rest, 40.4%, 6.3%, and 1.7%, indicated that they had an average, very little, and no awareness of local antibiotic patterns, respectively (Figure 3).

On the level of confidence about knowledge on antibiotics and antibiotic prescribing, 20% of the respondents indicated they were very confident in their antibiotics knowledge and 25.4% were very confident on antibiotic prescribing. The proportions of those who indicated that they are generally confident, a bit confident, or had no idea about their confidence on either knowledge on antibiotics or antibiotic prescribing are shown in Table 5.

The scores on knowledge about the use of antibiotics were classified as poor (1–4), average (5–6), or excellent (7–8). Although there was a high number of those who scored poorly and indicated that they were confident about their knowledge and in prescribing antibiotics (Table 6), there was no significant correlation between the two ( $p > 0.05$ ). In all cadres surveyed, most of the respondents (> 70%) had an average score level with the clinical officers and pharmacists recording higher numbers of those who performed poorly in the knowledge score (Table 7).

Medical practitioners have a bigger say in ensuring that antibiotics are used judiciously. This can only happen if the medical practitioners are well informed and are up to date with the status of antimicrobial resistance in their facilities and the geographical area covered. To evaluate this aspect, the respondents were asked how they obtained information on antibiotic use. All the listed sources were reported to have been used by more than 50% of the respondents with the Internet being used by close to 90% of the respondents (Table 8). In terms of usefulness, all the listed sources were cited as either useful or very useful by more than 80% of the respondents (Table 9).

**Table 2. The average number of patients prescribed antibiotics in every 10 patients reviewed by the medical practitioners.**

Average patients prescribed AB out of 10	Clinical Officers	Consultant	Medical Officers	Pharmacist	Total
All 10 patients	12 (9.0%)	0 (0.0%)	2 (3.0%)	3 (15.8%)	17 (7.2%)
6–9 patients	53 (39.8%)	7 (36.8%)	33 (50.0%)	6 (31.6%)	99 (41.8%)
5 patients	40 (30.1%)	7 (36.8%)	16 (24.2%)	7 (36.8%)	70 (29.5%)
1–4 patients	27 (20.3%)	5 (26.3%)	15 (22.7%)	2 (10.5%)	49 (20.7%)
None	1 (0.8%)	0 (0.0%)	0 (0.0%)	1 (5.3%)	2 (0.8%)

AB: antibiotic

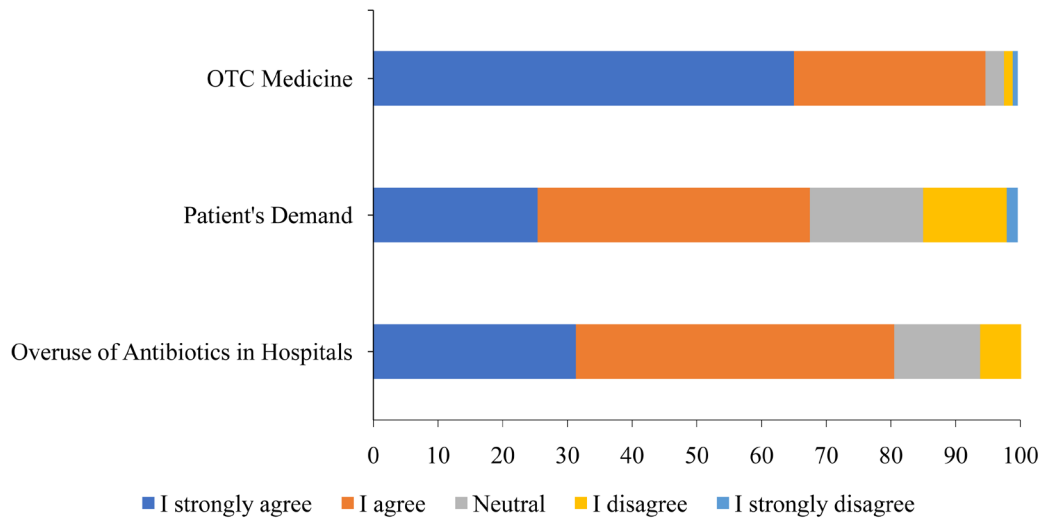
**Table 3. Questions on antibiotic knowledge and their results.**

Question	Overall N (%) answered correctly.	N (%) of COs answered correctly	N (%) of Consultants answered correctly	N (%) of MO answered correctly	N (%) of pharmacists answered correctly	p
1. A 4-year-old child had diarrhoea in the last 4 days (3 stools daily). She had no fever during the past days nor at consultation. What is your treatment choice? a) Amoxicillin orally b) Trimethoprim/sulphamethoxazole orally c) Amoxicillin/clavulanic acid orally d) <b>Oral rehydration salts with no antibiotic</b>	228/236 (96.6%)	127/132 (96.2%)	19/19 (100.0%)	64/65 (98.5%)	18/20 (90.0%)	0.253
2. A 6-year-old child has a fever (38°C), nasal discharge, and a painful throat for two days. At visual inspection, the throat is reddish. What is your treatment choice? a) Trimethoprim/sulphamethoxazole orally b) Amoxicillin orally c) Amoxicillin/clavulanic acid orally d) <b>No antibiotic</b>	23/230 (10.0%)	10/128 (7.8%)	04/19 (21.1%)	8/64 (12.5%)	1/19 (5.3%)	0.243
3. During ward round, you have seen two patients with impaired renal function. - Patient A is a 68-year-old male with cellulitis in the lower limb. He is administered clindamycin. - Patient B is a 64-year-old woman with diabetes who received treatment for sepsis with ceftriaxone empirically. In which case will you need to adjust the antibiotic dose? a) Patient A b) Patient B c) Patient A & B d) <b>Neither patient A nor patient B</b>	26/232 (11.2%)	21/131 (16.0%)	1/19 (5.6%)	4/66 (6.3%)	0/20 (0.0%)	0.055
4. Which one of the following antibiotics may be safely given during the first trimester of pregnancy? a) <b>Amoxicillin</b> b) Ciprofloxacin c) Gentamicin	220/233 (94.4%)	121/130 (93.1%)	18/19 (94.7%)	62/66 (96.9%)	19/20 (95.0%)	0.755
5. Which of the following antibiotics has the best activity against anaerobes? a) Ciprofloxacin b) <b>Metronidazole</b> c) Trimethoprim/sulphamethoxazole	219/234 (93.5%)	124/131 (94.7%)	19/19 (100.0%)	61/66 (95.3%)	15/20 (75.0%)	0.004
6. Methicillin-resistant - <i>Staphylococcus aureus</i> is susceptible to: a) Amoxicillin clavulanic acid b) Cefotaxime c) Ceftriaxone d) <b>None of these antibiotics</b>	83/222 (37.3%)	21/135 (16.9%)	12/19 (70.6%)	42/62 (67.7%)	8/19 (42.1%)	0.0001
7. Which of the following antibiotics most effectively crosses the blood-brain barrier? a) Clindamycin b) <b>Ceftriaxone</b> c) Vancomycin	151/226 (66.8%)	75/124 (60.5%)	16/19 (84.2%)	45/64 (70.3%)	15/19 (78.9%)	0.092
8. Aminoglycoside antibiotics such as gentamicin are most active when they are administered as follows: a) Orally, three times daily b) <b>Parenterally, once daily</b> c) Parenterally, three times daily	162/231 (70.1%)	90/129 (69.8%)	13/19 (68.4%)	49/63 (77.8%)	10/20 (50.0%)	0.129

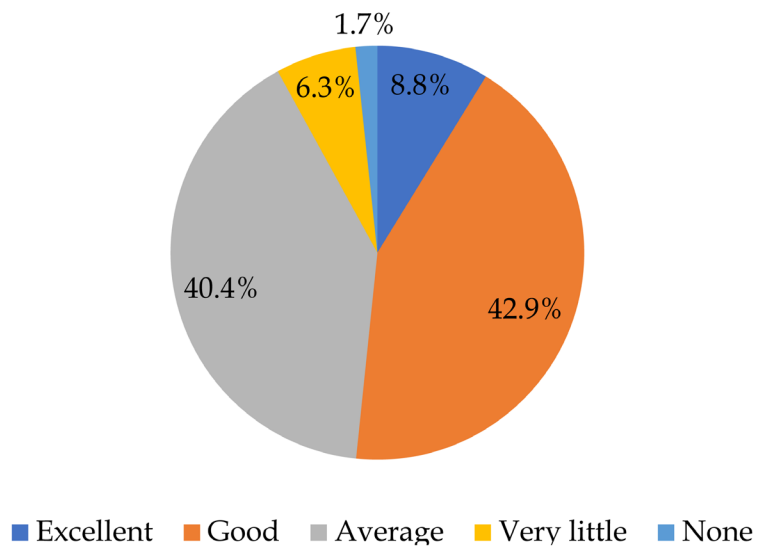
N: number; COs: Clinical Officers; MO: Medical Officers

**Table 4. Perception of antibiotic resistance as a problem.**

Antibiotic resistance problem	Worldwide	Kenya	Health facilities
I strongly agree	135 (56.3%)	126 (52.5%)	56 (23.3%)
I agree	96 (40%)	95 (39.6%)	116 (48.3%)
Neutral	8 (3.3%)	16 (6.7%)	57 (23.8%)
I disagree	1 (0.4%)	3 (1.3%)	11 (4.6%)



**Figure 2. Reasons for the antibiotic resistance problem in Kenya.**



**Figure 3. Awareness of local antibiotic resistance patterns.**

**Table 5. Level of confidence on antibiotic knowledge or prescribing antibiotics by the respondents.**

Confidence level	Confidence on	
	Antibiotic knowledge	Prescribing antibiotics
Very confident	48 (20%)	61 (25.4%)
Confident	166 (69.2%)	157 (65.4%)
A bit confident	25 (10.4%)	19 (7.9%)
Neutral/I have no idea	1 (0.4%)	3 (1.3%)

**Table 6. Level of confidence on knowledge and prescribing antibiotics and the score levels.**

Score Level	How confident are you about your knowledge of antibiotics?				What is your confidence level in prescribing antibiotics?			
	Very confident	Confident	A bit confident	I have no idea	Very confident	Confident	A bit confident	I have no idea
Poor	7 (19.4%)	23 (63.9%)	5 (13.9%)	1 (2.8%)	8 (22.2%)	20 (55.6%)	8 (22.2%)	0 (0%)
Average	41 (21.7%)	128 (67.7%)	20 (10.6%)	0 (0%)	49 (25.9%)	127 (67.2%)	10 (5.3%)	3 (1.6%)
Excellent	0 (0%)	15 (100%)	0 (0%)	0 (0%)	4 (26.7%)	10 (66.7%)	1 (6.7%)	0 (0%)

**Table 7. Knowledge score on antibiotics use among the different cadres based on the answers given in knowledge questions.**

Score Level	CO	Consultant	MO	Pharmacist	P
Poor	23 (17.0%)	1 (5.3%)	6 (9.1%)	6 (30.0%)	0.033
Average	107 (79.3%)	15 (78.9%)	53 (80.3%)	14 (70.0%)	
Excellent	5 (3.7%)	3 (15.8%)	7 (10.6%)	0 (0.0%)	

CO: Clinical Officer; MO: Medical Officer. The scores were classified as poor (1–4), average (5–6), or excellent (7–8).

**Table 8. Sources of information on antibiotic use consulted in the last month.**

Source of information consulted in the last month	N (%)
Information supplied by pharmaceutical companies	123 (51.2%)
Knowledge from training institutions	156 (65%)
Internet	214 (89.2%)
National guideline for empiric antimicrobial therapy	161 (67.1%)
The World Health Organization's (WHO) guidelines for the treatment of bacterial diseases	168 (70%)

We aimed to find out at which level the respondents agreed to the fact that patient demand for antibiotics and medicine sold over-the-counter contributes to antibiotic resistance. The

results showed that more than 67 % agreed or strongly agreed that patient demand is a major contributor to antibiotic resistance while more than 95% agreed or strongly agreed that

**Table 9. Usefulness of the different sources of information on antibiotic use.**

Source of information		Frequency
Information supplied by pharmaceutical companies	Very useful	48 (20%)
	Useful	161 (67.1%)
	Not at all useful	15 (6.3%)
	I do not know	9 (3.8%)
	No Answer	7 (2.9%)
Knowledge from training institution	Very useful	123 (51.2%)
	Useful	94 (39.2%)
	Not at all useful	1 (0.4%)
	I do not know	14 (5.8%)
	No Answer	8 (3.3%)
Internet	Very useful	90 (37.5%)
	Useful	136 (56.7%)
	Not at all useful	7 (2.9%)
	I do not know	4 (1.7%)
	No Answer	3 (1.3%)
National guideline for empiric antimicrobial therapy	Very useful	131 (54.6%)
	Useful	78 (32.5%)
	Not at all useful	1 (0.4%)
	I do not know	24 (10%)
	No answer	6 (2.5%)
The World Health Organization's guidelines for the treatment of bacterial diseases	Very useful	140 (58.3%)
	Useful	72 (30%)
	Not at all useful	2 (0.8%)
	I do not know	17 (7.1%)
	No answer	9 (3.8%)

over-the-counter medicine is a huge contributor to antibiotic resistance (Table 10).

Even though most of the respondents agreed that patient demand and over-the-counter medications are the main contributors to antibiotic resistance, there was a high number who indicated that they do not depend on antibiotic sensitivity data to vary their prescription. In all the six facilities, more than 20% of the respondents stated they never use antibiotic sensitivity data while 51.5% stated that they only do so sometimes (Table 11).

## Discussion

The present study describes the results of a survey on knowledge, attitude, and practice on the prescription of antibiotics among medical practitioners in three counties in Kenya. The study targeted the clinicians and pharmacists, who are the primary antibiotics prescribers in hospitals. Most of the respondents were aware that antibiotic resistance is a global and national problem, although few admitted that it is a problem in their local facilities. These results mirror previously reported studies where the respondents rated lower existence of antibiotic resistance in their facilities compared with either nationally

**Table 10. Contributors of antimicrobial resistance.**

Response	Contributors of antibiotic resistance	
	Patient's demand	OTC medicine
I strongly agree	61 (25.5%)	156 (65.3%)
I agree	101 (42.3%)	71 (29.7%)
Neutral	42 (17.5%)	7 (2.9%)
I disagree	31 (13%)	3 (1.3%)
I strongly disagree	4 (1.7%)	2 (0.8%)

OTC: over-the-counter

**Table 11. How often do you depend on antibiotic sensitivity data from the laboratory to vary your prescription?**

	Hospital						Total
	Kiambu	Thika	Nakuru	Naivasha	Bungoma	Webuye	
Never	17 (40.5%)	6 (22.2%)	10 (22.7%)	8 (20.5%)	8 (20.0%)	11 (24.4%)	60 (25.3%)
Sometimes	19 (45.2%)	16 (59.3%)	22 (50.0%)	21 (53.8)	22 (55.0%)	22 (48.9%)	122 (51.5%)
Half of the times	3 (7.1%)	0 (0.0%)	3 (6.8%)	4 (10.3%)	2 (5.0%)	4 (8.9%)	16 (6.8%)
Mostly	3 (7.1%)	5 (18.5%)	5 (11.4%)	4 (10.3%)	5 (12.5%)	8 (17.8%)	30 (12.7%)
Always	0 (0.0%)	0 (0.0%)	4 (9.1%)	2 (5.1%)	3 (7.5%)	0 (0.0%)	9 (3.8%)

or globally<sup>12-14</sup>. This signals a dangerous trend given that these are the primary levels from where antibiotic resistance begins. Overall, the survey showed that the highest percentage of medical practitioners (41.8%) prescribe antibiotics to most (6–9 out of 10) of their patients. This is an alarming number considering that most of these hospitals do not perform culture and sensitivity tests for most of these cases, and most of them state that they rarely depend on antibiotic sensitivity data when prescribing antibiotics.

There was a high level of self-confidence reported among the respondents both in their knowledge and in prescribing antibiotics. Although a high number of respondents scored poorly in the knowledge score, they at the same time indicated to be confident about their knowledge and in prescribing antibiotics. In addition, the respondents who were either medical officers or consultants scored higher in the knowledge score than either clinical officers or pharmacists. This could be due to the advanced training that medical officers and consultants undergo. This also highlights the importance of targeting the clinical officers for future educational interventions on antibiotic use. Similar findings have been reported in Ghana where senior physicians had better knowledge on those bacteria that have developed resistance in their setting compared with junior physicians<sup>12</sup>.

On average, the respondents scored 4.63 out of the possible 8 points in the knowledge questions. This was slightly lower than the results reported in the Democratic Republic of Congo (DRC) targeting medical doctors and students where the respondents scored 4.9/8<sup>15</sup> and in Peru with a score of 6.0/7<sup>16</sup>. The low score was contributed to by the poor performance in three of the eight questions that were on the use of antibiotics in upper respiratory tract infection, antibiotics that are effective in treating methicillin-resistant, for example, *Staphylococcus aureus*, and antibiotic reduction in renal failure conditions. Interestingly, responses to these same questions performed poorly in a study conducted in DRC<sup>15</sup>, suggesting that this challenge goes beyond local or national boundaries.

The antibiotic resistance profile is dynamic, with novel resistant strains emerging often and making common infections either difficult or impossible to treat<sup>17</sup>. To curtail the misuse and overuse of antibiotics, there is a need for the prescribers to be well updated on the appropriate use of antibiotics. Most respondents in our study indicated that the knowledge they have on antibiotics and antibiotic resistance is from either the Internet, knowledge attained in training institutions, pharmaceutical companies, or the World Health Organization (WHO) guidelines. Generally, most respondents indicated that they sourced their information from the Internet because almost

all documents are posted as soft copies online. In agreement with previous studies<sup>16,18</sup>, our findings also highlight the role played by the Internet in health service delivery. However, Internet access has also been cited as one of the factors that have enhanced the self-medication of antibiotics in the recent past<sup>19</sup>.

In terms of the value of the acquired information, the WHO guidelines ranked top, followed by national guidelines, and then training institutions. Most respondents, however, affirmed that local guidelines were more important than the global guidelines because they are contextualized to the local needs and antimicrobial resistance profile. Indeed, previous studies have reported commendable compliance with the Kenya Essential Medicines List in antibiotic prescribing in some of the public hospitals<sup>20</sup>. Even though the value of the knowledge attained from training institutions was graded lowest, it was still useful because any gaps in knowledge could be addressed at the training stages.

Previous studies have pointed out that pressure from patients to prescribe antibiotics plays a crucial role in inappropriate use leading to antibiotic resistance<sup>16,21,22</sup>. In this study, the majority of the respondents agreed or strongly agreed that patients' demand for antibiotics and the over-the-counter acquisition are huge contributors to antibiotic resistance.

## Conclusion

The present study revealed that most medical practitioners in Kenya are aware and knowledgeable about antibiotic resistance. There is, however, a need for educational interventions to sensitize medical practitioners on their attitude and excessive or unnecessary prescription of antibiotics. Although the study targeted antibiotic prescribers in different cadres and geographical locations in Kenya, there is still the need to expand the study to vast parts of the country as our study focused on just three out of 47 counties.

## Data availability

### Underlying data

Mendeley data: Underlying data for 'A survey on knowledge, attitudes, and practice about antibiotic prescribing and resistance among medical practitioners in Kenya'. <https://doi.org/10.17632/fmw97xwvdt.2<sup>11</sup>>.

This project contains the following underlying data:

- Data file: Knowledge, Attitude and Practice Survey in Kenya – Baseline Data 1.xlsx

### Extended data

Mendeley data: Extended data for 'A survey on knowledge, attitudes, and practice about antibiotic prescribing and resistance among medical practitioners in Kenya'. <https://doi.org/10.17632/fmw97xwvdt.2<sup>11</sup>>

This project contains the following extended data:

- Questionnaire: KAP data collection tool.pdf

Data are available under the terms of the [Creative Commons Attribution 4.0 International license \(CC-BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).

## Consent

Written informed consent for publication of the participants' details was obtained from the participants.

## Acknowledgements

We thank all medical workers who participated in responding to the questionnaires. We would also like to thank the administrations in all the six hospitals for their cooperation and support during data collection.

## References

1. Prestinaci F, Pezzotti P, Pantosti A: **Antimicrobial resistance: A global multifaceted phenomenon**. *Pathog Glob Health*. Maney Publishing, 2015; **109**(7): 309–318. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
2. Hoffman SB: **Mechanisms of Antibiotic Resistance**. *Compend Contin Educ Pract Vet*. 2001; **23**(5): 464–472. [Reference Source](#)
3. Vialle-Valentin CE, Lecates RF, Zhang F, *et al.*: **Predictors of antibiotic use in African communities: Evidence from medicines household surveys in five countries**. *Trop Med Int Health*. 2012; **17**(2): 211–222. [PubMed Abstract](#) | [Publisher Full Text](#)
4. Paruk F, Richards G, Scribante J, *et al.*: **Antibiotic prescription practices and their relationship to outcome in South Africa: findings of the prevalence of infection in South African intensive care units (PISA) study**. *S Afr Med J*. 2012; **102**(7): 613–6. [PubMed Abstract](#) | [Publisher Full Text](#)
5. Ingram PR, Seet JM, Budgeon CA, *et al.*: **Point-prevalence study of inappropriate antibiotic use at a tertiary Australian hospital**. *Intern Med J*. 2012; **42**(6): 719–721. [PubMed Abstract](#) | [Publisher Full Text](#)
6. Fridkin SK, Baggs J, Fagan R, *et al.*: **Vital Signs: Improving Antibiotic Use Among Hospitalized Patients**. *MMWR Morb Mortal Wkly Rep*. 2014; **63**(9): 194–200. [PubMed Abstract](#) | [Free Full Text](#)
7. Gitaka J, Kamita M, Mureithi D, *et al.*: **Combating antibiotic resistance using guidelines and enhanced stewardship in Kenya: A protocol for an implementation science approach**. *BMJ Open*. 2020; **10**(3): e030823. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
8. Teixeira Rodrigues A, Roque F, Falcão A, *et al.*: **Understanding physician antibiotic prescribing behaviour: A systematic review of qualitative studies**. *Int J Antimicrob Agents*. Elsevier B.V., 2013; **41**(3): 203–212. [PubMed Abstract](#) | [Publisher Full Text](#)
9. Teixeira Rodrigues A, Ferreira M, Roque F, *et al.*: **Physicians' attitudes and knowledge concerning antibiotic prescription and resistance: Questionnaire development and reliability**. *BMC Infect Dis*. 2016; **16**: 7. [PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

10. Fathi I, Sameh O, Abu-Ollo M, *et al.*: **Knowledge, Attitudes, and Beliefs Regarding Antimicrobial Therapy and Resistance among Physicians in Alexandria University Teaching Hospitals and the Associated Prescription Habits.** *Microb Drug Resist.* 2017; **23**(1): 71–78.  
[PubMed Abstract](#) | [Publisher Full Text](#)
11. Kamita M, *et al.*: **A Survey on Knowledge, Attitudes, and Practice About Antibiotic Prescribing and Resistance Among Medical Practitioners in Kenya - Mendeley Data.** (accessed Nov. 22, 2021).  
<https://data.mendeley.com/drafts/fmw97xwvdt>
12. Nicholson A, Tennant I, White L, *et al.*: **Correction to: The knowledge, attitudes and practices of doctors regarding antibiotic resistance at a tertiary care institution in the Caribbean.** *Antimicrob Resist Infect Control.* 2018; **7**: 77.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
13. Sellman JS, Decarolis D, Schullo-Feulner A, *et al.*: **Information resources used in antimicrobial prescribing.** *J Am Med Inform Assoc.* 2004; **11**(4): 281–284.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
14. Wester CW, Durairaj L, Evans AT, *et al.*: **Antibiotic resistance: A survey of physician perceptions.** *Arch Intern Med.* 2002; **162**(19): 2210–2216.  
[PubMed Abstract](#) | [Publisher Full Text](#)
15. Thriemer K, Katuala Y, Batoko B, *et al.*: **Antibiotic Prescribing in DR Congo: A Knowledge, Attitude and Practice Survey among Medical Doctors and Students.** *PLoS One.* 2013; **8**(2): e55495.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
16. García C, Llamocca LP, García K, *et al.*: **Knowledge, attitudes and practice survey about antimicrobial resistance and prescribing among physicians in a hospital setting in Lima, Peru.** *BMC Clin Pharmacol.* 2011; **11**: 18.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
17. Neely AN, Holder IA: **Antimicrobial resistance.** *Burns.* 1999; **25**(1): 17–24.  
[PubMed Abstract](#) | [Publisher Full Text](#)
18. Khan AKA, Banu G, Reshma KK: **Antibiotic resistance and usage-a survey on the knowledge, attitude, perceptions and practices among the medical students of a southern Indian teaching hospital.** *J Clin Diagn Res.* 2013; **7**(8): 1613–1616.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
19. Sundararajan A, Thangappan AK: **Knowledge, attitude and practice of self medication among undergraduate medical students in a teaching institution.** *Int J Basic Clin Pharmacol.* 2018; **7**(12): 2414.  
[Publisher Full Text](#)
20. Mulwa NC, Osanjo GO, Ndwigah SN, *et al.*: **Patterns of Prescribing Practices in Makueni County Referral Hospital, Kenya.** 2015; **4**(4): 161–168.  
[Reference Source](#)
21. Saliba-Gustafsson EA, Dunberger Hampton A, Zarb P, *et al.*: **Factors associated with antibiotic prescribing in patients with acute respiratory tract complaints in Malta: A 1-year repeated cross-sectional surveillance study.** *BMJ Open.* 2019; **9**(12): e032704.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
22. Lin L, Sun R, Yao T, *et al.*: **Factors influencing inappropriate use of antibiotics in outpatient and community settings in China: A mixed-methods systematic review.** *BMJ Glob Health.* BMJ Publishing Group, 2020; **5**(11): e003599.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

# Open Peer Review

Current Peer Review Status: ? ? X ?

## Version 1

Reviewer Report 19 March 2024

<https://doi.org/10.21956/aasopenres.14463.r30756>

© 2024 Ugochukwu E. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

? **Ebelechuku Francesca Ugochukwu** 

<sup>1</sup> Nnamdi Azikiwe University Awka Nigeria, Nnewi Campus, Nigeria

<sup>2</sup> Paediatrics, Nnamdi Azikiwe University Awka Nigeria, Anambra, Anambra, Nigeria

### **A Survey on knowledge, attitude, and practice about antibiotic prescribing and resistance among medical practitioners in Kenya.**

This is a research article conducted in Kenya.

1. **Title:** I would suggest the title be modified to read, "A survey on knowledge, attitude and practice about antibiotic prescribing and resistance among **health workers** in Kenya".

The term "medical practitioner" by definition connotes "a physician or surgeon" (Oxford Dictionary), or "a person who is skilled in the science of medicine: a doctor" (Merriam-Webster Dictionary).

This is suggested because the subjects used in the research constitute other professionals, in addition to medical doctors.

2. **Is the work clearly and accurately presented and does it cite the current literature?**

The work is clearly presented and more than 70% of cited literature fall within the past ten years. Reference number 20 is incomplete.

3. **Is the study design appropriate and does the work have academic merit?**

The authors need to throw more light on how the attitudes of the prescribers were assessed. The work, indeed has academic merit.

4. **Are sufficient details of methods and analysis provided to allow replication by others?**

There is a need to be categorical on the criteria for selection of the facilities in the three chosen counties. How many hospitals/health facilities are sited in the chosen counties? What made the researchers choose the six facilities used? What determined the sample size of 240? What levels (primary care, secondary care or tertiary care) of facilities were used? How was bias eliminated?

5. **If applicable, is the statistical analysis and its interpretation appropriate?**

A statistician's input may be required. It may not just be simply a Chi-Square analysis as the responses are given following a Likert scale model, and also there are sections with multiple responses.

6. **Results:** In the tables and figures depicting the various characteristics of prescribers, it would have been more appropriate to have them categorized according to the various professional

groups studied (consultants, MOs, etc.). This will help to focus on the actual areas that need intervention for improvement. Table 4, Figure 3, Table 5, Table 6, Table 8 and Table 9 may need to have such modification.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Paediatric Infectious Diseases (Paediatrician)

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Reviewer Report 29 February 2024

<https://doi.org/10.21956/aasopenres.14463.r30761>

© 2024 Niyomyart A. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



**Atsadaporn Niyomyart**

Ramathibodi School of Nursing, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Thank you for granting me the chance to review your paper. Your study is intriguing and holds relevance for other researchers endeavoring to combat antibiotic resistance in their regions. However, there are areas where improvements could strengthen your paper. Below, I provide feedback and recommendations for enhancement.

**Abstract:**

Please provide specific details regarding participants, study tools, the platform for delivering the questionnaire, and the study setting.

Findings: (1) Could you clarify the terms "consultants," "medical officer," and "clinical officers"?

These terms refer to physicians.

(2) Please present results in alignment with the study's objectives, focusing on knowledge, attitude, and practices.

**Introduction:**

Page 3: When mentioning "26% obtain antibiotics from informal sources," discuss the nature of "informal sources" in South Africa to make the reader understand more about how people in Africa access antibiotics.

I suggested that the authors provide an overview of the present state of antimicrobial resistance (AMR) in Kenya. This would encompass details on various global efforts involving Kenya, such as partnerships with the World Health Organization (WHO) and other international organizations, accessibility of antibiotics over the counter without a prescription, the pricing of antibiotics, and related factors. This can help the readers with a comprehensive understanding of the antibiotic resistance issue in Kenya and its impact on public health, healthcare expenses, and the healthcare system in its entirety.

Please consider adding some statistical data (i.e., mortality rate and medical costs as a result of AMR in Kenya) to support your introduction.

Please briefly explain what the authors by "consultants," "medical officer," and "clinical officers"? Do these terms refer to physicians? Otherwise, the readers are confused about who they are and their role in prescribing antibiotics.

**Method:**

Briefly provide information about public hospitals (i.e., community and tertiary hospitals) for data collection.

Specify when recruitment commenced and the duration to recruit participants.

Explain the rationale for selecting three counties.

Please add inclusion and exclusion criteria.

According to the calculation of the number staff in each unit and the total number of staff, how the author came up with the sample size. Please elaborate on how the team determined the sample size.

Describe the platform used for delivering questionnaires.

Provide details about the questionnaires, including their development, the number of sections, and whether a Likert scale was employed.

As the author mentioned the questionnaire was developed, and the team examined content and face validity. Did the pilot study test confirm the reliability of the instrument? What is the internal consistency of the total scale and subscale (knowledge, attitude, practice)?

How the team handled the answered questionnaire (i.e., where to keep them, how long to keep them) and who could access them.

**Result:**

What do you mean by "local patterns of antibiotic resistance"?

I suggest the author include a citation of how the author classified antibiotic scores into poor, average, or excellent.

**Discussion:**

It would be interesting to discuss how the training of consultants, medical officers, and clinical offices may be associated with knowledge and prescribing antibiotics.

Paragraph 2: (a) As the authors noted that the majority of consultants are pharmacists, it remains ambiguous whether there are diverse clinical professions within this group that might exhibit varying levels of knowledge regarding antibiotic prescriptions. So, if the authors can provide clarification regarding the professions included in the group, it would help the reader to follow the discussion logically and understand the potential differences in knowledge related to antibiotic prescriptions among various clinical professions.

(b) According to "This could be...the advanced training", it would be beneficial to elaborate further on the duration of the training, as the author has only provided descriptions of the experiences within each profession.

(c) Giving both clinical officers and pharmacists have low scores in antibiotic knowledge, the need for educational intervention would focus on antibiotic knowledge rather than simply antibiotic use.

For the entirety of the discussion section, I recommend that the authors delve into the attitudes and practices among consultants, medical officers, and clinical officers, as these concepts represent the primary outcomes of the study.

Along with online sources, participants in the study also cited the World Health Organization (WHO), national guidelines, and institutional training as their sources for obtaining information about antibiotics. Therefore, it is important to consider discussing how Kenya can ensure that online sources are reliable and trustworthy, benefiting not only healthcare professionals but also the general public.

Furthermore, there are important aspects that have not yet been addressed, such as antibiotic sensitivity data and the over-the-counter availability of antibiotics, both of which contribute to antibiotic resistance. I suggest that the author provide more detailed explanations to help readers better understand how these factors compare to or differ from findings in previous studies.

**Is the work clearly and accurately presented and does it cite the current literature?**

Partly

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Self-management, antibiotic resistance, chronic illness

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.**

Reviewer Report 22 February 2024

<https://doi.org/10.21956/aasopenres.14463.r30758>

© 2024 Sárváry A. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



**Attila Sárváry**

University of Debrecen, Nyíregyháza, Hungary

This article investigated a hot and important topic that especially affects African countries. The findings harmonize with the previous results coming from other African countries and strengthen the role and importance development of antibiotic stewardship and improving the education of healthcare workers regarding antibiotic use.

Introduction:

You should mention the WHO action program entitled „Promoting antimicrobial stewardship to tackle antimicrobial resistance” aiming to help countries in reducing antibiotic resistant ( <https://www.who.int/europe/activities/promoting-antimicrobial-stewardship-to-tackle-antimicrobial-resistance>). The other connected WHO initiated program is the „Access, Watch, and Reserve (AWaRe) classification of antibiotics for evaluation and monitoring of use” which can help the countries to develop an antibiotic stewardship efforts. ( <https://www.who.int/publications/i/item/WHO-MHP-HPS-EML-2023.04>).

You should mention that several studies were conducted in African countries investigating the antibiotic use and knowledge of the health care workers. For example:

Abubakar U. 2020 (Ref 1)

Adegbite B. R, *et.al.*2022 (Ref 2)  
Akinyandenu O, *et.al.* 2014 (Ref 3).  
Asante K. P, *et.al.*2017 (Ref 4)  
Auta A, *et.al.*2016 (Ref 5)  
Abubakar B, *et.al.*2023 (Ref 6)

#### Methods:

In the Study population section you described the main groups of health care workers involved in the study. In my mind officers are those workers who are working in an office, therefore I suggest changing this term because this can lead to misunderstanding. These are clinicians (physicians) or medical students. On the other hand, you have mentioned consultants in the Result section. This group should also be indicated here.

In the Survey Instrument section, I suggest listing all questions and the belonging answer options or describing what type of questions were used and evaluated in the results.

#### Results:

Table 3. Please describe in the text where you found significant differences between the different groups of healthcare workers.

Figure 2. Please indicate the label of the X axis.

I suggest removing the Figure 3. The information depicted in this figure is not so important, it is enough to describe it in the text.

Regarding the results of Table 6 I recommend merging the categories „very confident“ and „confident“ and merging the categories „A bit confident“ and „I have no idea“ and making an association analysis between the two variables.

I recommend removing Table 9, because it does not contain important information. Just briefly summarize the main findings in the text.

#### Discussion:

This part is concise and logical, contains and explains the results. You can use the references that I have mentioned in the Introduction part. The conclusions drawn from the results are logical.

#### References

1. Abubakar U: Antibiotic use among hospitalized patients in northern Nigeria: a multicenter point-prevalence survey. *BMC Infect Dis.* 2020; **20** (1): 86 [PubMed Abstract](#) | [Publisher Full Text](#)
2. Adegbite BR, Edoa JR, Schaumburg F, Alabi AS, et al.: Knowledge and perception on antimicrobial resistance and antibiotics prescribing attitude among physicians and nurses in Lambaréné region, Gabon: a call for setting-up an antimicrobial stewardship program. *Antimicrob Resist Infect Control.* 2022; **11** (1): 44 [PubMed Abstract](#) | [Publisher Full Text](#)
3. Faculty of Health, Sports and Science, University of South Wales, United Kingdom, Akinyandenu O, Akinyandenu A, Department of Pharmacology, College of Medicine, University of Lagos, Nigeria: Irrational use and non-prescription sale of antibiotics in Nigeria: A need for change. *Journal of Scientific and Innovative Research.* 2014; **3** (2): 251-257 [Publisher Full Text](#)
4. Asante KP, Boamah EA, Abdulai MA, Buabeng KO, et al.: Knowledge of antibiotic resistance and antibiotic prescription practices among prescribers in the Brong Ahafo Region of Ghana; a cross-sectional study. *BMC Health Serv Res.* 2017; **17** (1): 422 [PubMed Abstract](#) | [Publisher Full Text](#)
5. Auta A, Strickland-Hodge B, Maz J: Stakeholders' views on granting prescribing authority to pharmacists in Nigeria: a qualitative study. *Int J Clin Pharm.* 2016; **38** (4): 960-7 [PubMed Abstract](#) | [Publisher Full Text](#)
6. Abubakar B, Sárváry A: Knowledge, attitude, and practice on antibiotics use among healthcare workers: A cross-sectional study in Niger state, Nigeria. *J Infect Prev.* 2023; **24** (5): 206-215 [PubMed](#)

[Abstract](#) | [Publisher Full Text](#)

**Is the work clearly and accurately presented and does it cite the current literature?**

Partly

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** epidemiology of non-communicable diseases, antibiotic resistance, complementary medicine

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Reviewer Report 22 December 2023

<https://doi.org/10.21956/aasopenres.14463.r30423>

© 2023 Liyanapathirana V. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



**Veranja Liyanapathirana** 

University of Peradeniya, Peradeniya, Central Province, Sri Lanka

**A survey on knowledge, attitude, and practice about antibiotic prescribing and resistance among medical practitioners in Kenya**

This is a KAP study on antibiotics and AMR conducted in Kenya.

Abstract: The methods section need to include more details on the study type, study tool, administration of the study tool and time of administration, not so much the statistical methods. The results of the abstract need to represent all three domains on knowledge, attitude and

practice. Actual data needs to be presented. The conclusion of the abstract should be based on the data given in the results of the abstract only. The introduction section of the abstract can be considerably shortened to improve the other sections.

The study uses different terms such as medical practitioners, clinicians and prescribers. You have recruited consultants, medical officers and pharmacists. Are pharmacists authorized to prescribe antibiotics in Kenya? Since this is not the norm globally, if they are authorized to prescribe, please state so in the introduction. If they are not authorized to prescribe, then the term medical practitioners or prescribers is not appropriate. Just state as among "doctors and pharmacists" from the title, throughout the manuscript and remove the other words such as prescribers, clinicians or medical practitioners.

Who is a medical officer and who is a clinical officer? Again, this would not be known to non Kenyan readers, please elaborate a bit more in the introduction. Stating what their role is in relation to antibiotic prescribing and dispensing and their training (university, apprenticeship etc) "However, sufficient data on this aspect is lacking especially in low- and middle-income countries" This statement is incorrect as shown by any PubMed search. Please state a different justification, which is more specific to your situation.

Describe the study sites in brief, are they primary, secondary or tertiary care facilities? What are the bed strengths? Are these teaching units for or non teaching units?

What was the basis for distributing 40 questionnaires per study site? How was the total sample size calculated? What was the sampling method?

"Data entry and analysis were carried out using SPSS Statistics version 26.0 (IBM SPSS Statistics, RRID:SCR\_019096) (An open-access alternative is R Stats (R Project for Statistical Computing, RRID:SCR\_001905))" what is meant by this? It appears to be that a comment is included without being deleted.

Table 1 is almost fully described in the text. Reduce the text and direct to the table.

Table 2 description can be improved. "More than 70% of the respondents in each cadre indicated that they prescribed to 50% (5 out of 10)" – not a very clear statement. May be better to state as "More than 70% of the respondents in each cadre indicated that they prescribed to at least 50% (5 out of 10) of their patients". Rest of the description for Table 2 is also not very clear. Please go through the written section again and rephrase. Or, delete the text with a short introductory sentence and direct to the table, which is self-explanatory.

Along with the mean knowledge score, include the SD, minimum and maximum scores as well as the median and the IQR. Check if the knowledge scores were normally distributed or not.

"Generally, the correct responses were highest among consultants, followed by the medical officers then clinical officers." – this is not the pattern for all questions. Please give a more specific statement and direct towards the table.

"However, the proportion of the respondents who either agreed or strongly agreed (71.6%) that antibiotic resistance is a problem in their respective health facilities was significantly lower ( $p = 0.013$ ) with about 23.8% of the respondents being neutral about their awareness of an antibiotic resistance problem in their facility" – what exactly was this p value calculated for? Overall table 4? Overall number of participants identifying that antibiotic resistance is an issue for their practice compared to whom?

Figure 3: Remove the figure and keep as a description in the text only.

Table 5 – Can be described with no table

Table 7 – How was the p value calculated? For the overall table or for specific groups. Please clearly state. An overall p value would be of little use for a table like this without a post-hoc analysis.

What was the reason for keeping both figure 2 and table 10? Is it because there were very similar questions asking for overall contributors for AMR vs specific reasons for Kenya? It is best to

present both data close to each other and use only one table/figure combining both sets of data or if the data is the same, just present the data once.

The number of tables and figures are too high and the way they are placed makes it difficult to read the article. Authors are encouraged to re-visit the results section's formatting, collapse some of the categories (eg combining strongly agree to agree etc) to facilitate describing certain points than using multiple tables or combining certain tables. The questionnaire itself has a better flow, indicating how sections can be presented together.

Are references 15 and 16 based on the same questionnaire to directly compare marks?

Discussion should include all areas where results are presented. Many results are not discussed.

The presentation of results and discussion needs to follow to same order for easier reading.

Revisit the conclusion after all results are looked at, for example, currently it says that the population is knowledgeable on AMR, however findings are contrary to that.

The manuscript has been completed nearly two years ago, so an update is required including any subsequently published work in the introduction and discussion as appropriate

**Is the work clearly and accurately presented and does it cite the current literature?**

Partly

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

I cannot comment. A qualified statistician is required.

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Medical Microbiology

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

---