

Original Article

Knowledge, Risk Perception and Practices Related to Antibiotic Resistance among Patent Medicine Vendors in Sokoto Metropolis, Nigeria

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ABSTRACT

Background: Resistance to antibiotics is now a serious threat to global health, and inappropriate use of drugs has been identified as a major contributing factor in the developing countries. Objectives: The aim of this study is to assess the knowledge, risk perception, and practices related to antibiotic resistance among patent medicine vendors (PMVs) in Sokoto metropolis, Nigeria.

Materials and Methods: A cross-sectional study was conducted among 200 PMVs selected by multi-stage sampling technique. Data were collected with a set of pretested, self administered, semi structured questionnaire. **Results:** A larger proportion (83, 42.1%) of the 197 respondents who completed the questionnaire were aged 20-29 years. Most of them were males (80.2%) and had tertiary education (80.7%). Most of the respondents had adequate knowledge of the causes of antibiotic resistance (94.9%), and its prevention (98.0%). Most of the respondents also perceived antibiotic resistance as a serious threat to their own health (95.4%), and the health of their clients (89.4%). Practices favorable to the development of antibiotic resistance were very prevalent among the respondents. Majority of respondents (59.9%) consistently sell antibiotics to clients without doctor's prescription, and close to half of them (49.2%) consistently practice self-medication.

Conclusion: Despite high levels of knowledge of the causes, prevention, and perception of the risks associated with antibiotics resistance, practices favorable to its development were very prevalent among PMVs in Sokoto, Nigeria. Government should regulate and closely monitor PMVs' practices in order to avert the looming crisis in medical practice that will become inevitable if there are no potent antibiotics.

KEYWORDS: Antibiotic resistance, knowledge, patent medicine vendors, practices, risk perception

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INTRODUCTION

Antibiotic resistance is rising to dangerously high levels in all parts of the world and now constitutes one of the biggest threats to global health, food security, and development.^[1] A growing number of infections such as pneumonia, tuberculosis (TB), gonorrhoea, and salmonellosis are becoming harder to treat as the antibiotics used in their treatment are becoming less effective, thus resulting in longer hospital stays, higher medical costs, and increased mortality.^[1]

At the turn of this century, the World Health Organization estimated that infections accounted for 45% of deaths in Africa and cause 48% of premature deaths worldwide.

It was also reported that bacteria cause a significant proportion of the infections in Africa. Currently, there are new emerging antibiotic-resistant bacteria trend, with about 70% resistant to at least one of the drugs most commonly used in treating infections.^[2] Between 2008 and 2009, of the 451 isolates of the *Shigella* bacterium responsible for diarrhea with blood identified in 18 countries across the continent, 78% were resistant to the

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primary drug used to treat it, and this has led to the use of new medicines that are expensive.^[3]

Recent findings around the globe are equally worrisome; the Centers for Disease Control and Prevention estimates that in the United States about 2 million people become infected and about 23,000 people die each year following infections with bacteria that are resistant to antibiotics.^[4] Also, there were an estimated 490,000 new cases of multi-drug-resistant TB in 2016 globally, thus necessitating longer and less effective treatment courses compared to those used for non-resistant TB.^[5] Worse of all, extensively drug-resistant TB has been identified in 121 countries.^[5] The most disturbing aspect is the fact that antibiotic resistance is putting the achievements of modern medicine at risk. Organ transplantations, chemotherapy, and surgeries such as cesarean sections become more dangerous without effective antibiotics for prevention and treatment of infections.^[1]

The rising prevalence of antibiotic resistance worldwide has been attributed to inappropriate use including failure to complete treatment, skipping of doses, re-use of leftover medicines, and overuse of antibiotics.^[6] In Nigeria, indiscriminate use of drugs and self-medication have resulted in the emergence of antibiotic-resistant strains.^[7] Reports from different parts of Nigeria showed high prevalence of resistant strains of enteric organisms such as *Escherichia coli* and *Shigella* species that were resistant to antibiotics such as cotrimoxazole, tetracycline, chloramphenicol, and ampicillin.^[8,9]

It has been noted that where antibiotics can be bought for human or animal use without a prescription, the emergence and spread of antibiotic resistance is made worse; and in countries without standard treatment guidelines, antibiotics are often over-prescribed by health workers and veterinarians, and over used by the public.^[1] In sub-Saharan Africa, people often seek care from patent medicine vendors (PMVs) for common but potentially deadly illnesses such as malaria and diarrhea.^[10] A systematic review of the characteristics, knowledge, and regulatory practices of PMVs in sub-Saharan Africa by Wafula *et al.*^[11] found high prevalence of inappropriate drug dispensing practices. A vast majority of them sold whatever medicines clients requested with little history taking and counseling, and most PMV shops stocked popular medicines at the expense of policy recommended treatments.

In Nigeria, due to the grossly inadequate number of healthcare personnel and facilities across the country, PMVs are a main source of medicine for acute conditions^[12] and also the first source of care of between 8% and 55% of illnesses occurring among children under 5 years old.^[13,14] PMVs are not required to have

formal training in medicine or pharmacy in Nigeria^[15] and they are only permitted to sell a limited number of pre-packaged, over-the-counter medicines and medical products; the law prohibits them from selling prescription medications (including antibiotics) or conducting invasive medical procedures (such as giving injections).^[16]

Of serious concern is the fact that PMV practices are largely unsupervised and unregulated in Nigeria; thus, they often engage in appropriate drug dispensing practices and perform illegal invasive medical procedures. Rather than complement the services provided at the health facility, a study conducted in Ibadan, Nigeria^[17] reported that PMVs promote self-medication by members of the community by providing uncontrolled access to drugs without consultation and prescription by doctors, and this poses a serious threat to rational utilization of medications.

A systematic review of self-medication practices among adolescents aged 13-18 years showed self-medication prevalence ranging from 2% to 92% in different countries, with the most frequently self-medicated over-the-counter and prescription-only medicines being analgesics and antibiotics respectively.^[18] Another systematic review of household antimicrobial self-medication in developing countries reported high prevalence of self-medication (38.8%) with PMV shops being one of the major sources of the antimicrobials used.^[19]

Alarming, a systematic review of the role of PMVs in healthcare provision in Nigeria reported generally low health knowledge and poor health treatment practices.^[20] Another study among PMVs in Jos, Nigeria reported poor medicine knowledge (34.3%) and high prevalence of self-medication (75.4%); this is of serious concern in view of the hazards of this practice, particularly development of antibiotic resistance.^[21]

Although not surprising, but very disturbing, is the high prevalence of self-medication reported in studies conducted in different populations across Nigeria, and the fact that the two most commonly self-medicated drugs were analgesics and antibiotics. A study conducted in a rural community of South West Nigeria^[22] reported that 96.5% of mothers practiced antibiotic self-medication for their children under 5 years of age, and only 28.1% of mothers were knowledgeable about the risks and side effects of antibiotic self-medication. Similarly, another study among undergraduate pharmacy students in Jos, Nigeria^[23] found high prevalence of self-medication (53.2%). The Health Belief Model posits that risk perception which encompasses perceived susceptibility and perceived severity of a particular

health problem influences adoption of health behaviors that prevent them from occurring or reduce their severity.^[24] Although there is a dearth of literature on the risk perception of self-medication and antibiotic resistance, perception of severity and susceptibility to a given health condition is believed to depend on the knowledge of the condition.^[25] This is supported by the finding of high prevalence of self-medication but poor knowledge of its hazards including antibiotic resistance in several studies.^[22,26,27]

The prevalent poor knowledge of medicine/hazards of self-medication among PMVs in Nigeria, and the concomitant high prevalence of inappropriate drug dispensing practices among them underscore the need to critically examine the knowledge, risk perception, and practices related to antibiotic resistance among this indispensable sub-group of healthcare providers in the populations across the country, and this necessitated the conduct of this study.

MATERIALS AND METHODS

A cross-sectional study was conducted among PMVs in Sokoto metropolis, Nigeria, in August and September 2014. Sokoto metropolis is both the capital and center of economic activities in the state. It comprises four local government areas with a combined population of 809,387 based on the 2006 census, and covers an area of 60.33 km².^[28] PMVs who were aged 18 years and above, and have worked for at least 6 months in the respective patent medicine stores were considered eligible for this study.

The sample size was estimated at 193 using the Fisher's formula for calculating the sample size for cross-sectional descriptive studies,^[29] a 75.4% prevalence of practice related to the development of antibiotic resistance from a previous study,^[21] a precision level of 5%, an anticipated participant response rate of 95%, and an adjustment for a finite population of 507 PMVs in Sokoto metropolis (obtained from the PMVs' association records). The eligible participants were selected by a multi-stage sampling technique. At the first stage, Sokoto metropolis was divided into 12 business districts and 8 of them were selected by simple random sampling using the ballot option. At the second stage, the selection of patent medicine stores in each of the selected districts was done by systematic sampling technique using the list of patent medicine stores in the respective districts to constitute the sampling frame. One of every 3 patent medicine stores was selected in the selected districts, at the end of which 55 patent medicine stores were selected. At the third stage, the selection of participants in the selected patent medicine stores was

done by systematic sampling technique using the staff list in the respective patent medicine stores to constitute the sampling frame. One of every 3 eligible participants was selected in the selected patent medicine stores, at the end of which 200 participants were selected.

A standardized, semi-structured, self-administered questionnaire was developed after a thorough review of relevant literature, and used to obtain information on participants' sociodemographic characteristics, knowledge of indications for use of antibiotics, causes, consequences, attitude to, and prevention of antibiotic resistance. It was reviewed by researchers in the Department of Community Health, Usmanu Danfodiyo University, Sokoto, Nigeria. Corrections were made based on their inputs on content validity. Evaluation of content validity of the questionnaire was done by a team of experts that comprised of four senior lecturers and two professors from the College of Health Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria. The relevance of each of the items on the questionnaire was rated on a 4-point Likert scale (1 = not relevant; 2 = somewhat relevant; 3 = quite relevant; 4 = highly relevant). The Content Validity Index for items (I-CVI) was computed as the proportion of experts giving a rating of either 3 or 4.^[30] Items on the questionnaire with I-CVI of 0.83 were retained. Content Validity Index for scales (S-CVI) was computed as the proportion of items on the questionnaire that achieved a rating of 3 or 4 by the content experts.^[31] An S-CVI of 0.94 was obtained.

The questionnaire was pretested on 15 PMVs in one of the business districts not selected for the study; some questions were rephrased for clarity based on the observations made during the pretest. The questionnaire instrument shows good internal consistency (Cronbach's alpha = 0.85) and reliability (2 weeks test/retest correlation coefficient was 0.74). Four resident doctors assisted in questionnaire administration after being trained on the conduct of survey research, the objectives of the study, and questionnaire administration. Institutional ethical clearance was obtained from the Ethical Committee of Ministry of Health, Sokoto state, Nigeria. Permission to conduct the study in the patent medicine stores was obtained from the PMVs' union leaders and the owners of the patent medicine stores selected. The study objectives were explained to the participants and informed written consent was obtained from them before data collection.

Data were analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 20.0 software (SPSS, IBM Corp, Armonk, NY). Respondents' knowledge of the causes of antibiotic resistance as well as their knowledge of the prevention of antibiotic resistance

was scored and graded on a 10-point scale. One point was awarded for a correct response, while a wrong response or a non-response received no points. This gives a minimum score of “0” and a maximum score of “10” points. Those that scored >6 of 10 points were considered as having “adequate” knowledge, while those that scored <6 of 10 points were graded as having “inadequate” knowledge. Frequency distribution tables were constructed, and cross tabulations were done to examine the relationship between categorical variables. The Chi-square test was used for bivariate analysis involving categorical variables. All levels of significance were set at $P < 0.05$.

RESULTS

Of the 200 questionnaires administered, 197 were adequately completed and found suitable for analysis, giving a response rate of 98.5%. The ages of the respondents ranged from 20 to 59 years (mean = 33.82 ± 9.46) and a larger proportion (83, 42.1%) of them were aged 20-29 years. Males constituted 80.2% of respondents, and majority of them were married (52.3%) and practiced Islam as religion (59.4%). Most of the respondents (159, 80.7%) had tertiary education, and majority of them (121, 61.4%) have spent less than 10 years in practice [Table 1].

Awareness of antibiotics and antibiotic resistance by respondents

Almost all (192, 97.5%) of the 197 respondents were aware of antibiotics, and majority of them (141, 71.6%) knew that antibiotics are used in treating bacterial infections. Most (172, 87.3%) of the 197 respondents were aware of antibiotic resistance, and also knew that antibiotic resistance has occurred when the antibiotic is no longer effective in treating the disease it used to treat.

However, the majority of the respondents misunderstood conditions that signify antibiotic resistance to include when a new antibiotic with similar efficacy becomes available in the market (76.1%), when the cost of antibiotic increases in the market (70.1%), and when the packaging of the antibiotic is changed (70.1%) [Table 2].

Respondents' knowledge of the causes of antibiotic resistance

Most (187, 94.9%) of the 197 respondents had adequate knowledge of the causes of antibiotic resistance, with the most commonly known causes of antibiotic resistance being inappropriate use of antibiotics (91.9%), selling antibiotics without doctor's prescription (90.9%), and over-use of antibiotics particularly for disease conditions in which use of antibiotics is not necessary (89.8%). The other causes of antibiotic resistance known to the respondents are shown in Table 3. There was no

Table 1: Sociodemographic characteristics of respondents

Variables	Frequency (%) (n=197)
Age group (years)	
20-29	83 (42.1)
30-39	58 (29.4)
40-49	38 (19.3)
50-59	18 (9.1)
Sex	
Male	158 (80.2)
Female	39 (19.8)
Marital status	
Single	94 (47.7)
Married	103 (52.3)
Religion	
Islam	117 (59.4)
Christianity	80 (40.6)
Highest education level	
None/Quranic only	4 (2.0)
Secondary	34 (17.3)
Tertiary	159 (80.7)
Status	
Store owner	102 (51.8)
Sales attendant/apprentice	95 (48.2)
Length of practice (years)	
1-9	121 (61.4)
10-19	57 (28.9)
20-29	19 (9.6)

association ($P > 0.05$) between adequate knowledge of the causes of antibiotic resistance and any of the respondents' sociodemographic variables.

Respondents' knowledge of the prevention of antibiotic resistance

Almost all (193, 98.0%) of the 197 respondents had adequate knowledge of the prevention of antibiotic resistance, with the most commonly known preventive measures for antibiotic resistance being treating patients with a combination of antibiotics rather than a single antibiotic when necessary (96.4%), regular hand washing by clients/patients and care givers (93.9%), and good infection prevention and control practices in the health facilities (93.9%). The other preventive measures for antibiotic resistance known to the respondents are shown in Table 4. There was no association ($P > 0.05$) between adequate knowledge of the prevention of antibiotic resistance and any of the respondents' sociodemographic variables.

Respondents' perception of the risk of antibiotic resistance

Almost all (188, 95.4%) of the 197 respondents perceived antibiotic resistance as a serious threat to their own health, while majority of them (176, 89.4%) also

Table 2: Awareness of antibiotics and antibiotic resistance by respondents

Variables	Frequency (%) (n=197)
Ever heard of antibiotics	
Yes	192 (97.5)
No	5 (2.5)
Group of diseases curable with antibiotics	
All diseases	39 (19.8)
Viral infections	5 (7.6)
Bacterial infections	141 (71.6)
Parasitic infections	2 (1.0)
Ever heard of antibiotic resistance	
Yes	172 (87.3)
No	25 (12.7)
Conditions that signify antibiotic resistance	
When the packaging of the antibiotic is changed	138 (70.1)
When the cost of the antibiotic increases in the market	138 (70.1)
When a new (or more costly antibiotic) with similar efficacy becomes available in the market	150 (76.1)
When the antibiotic is no longer effective in treating the diseases it used to treat	172 (87.3)

Table 3: Respondents' knowledge of the causes of antibiotic resistance

Variables	Correct response frequency (%) (n=197)
Causes of antibiotic resistance	
Inappropriate use of antibiotics (with respect to the indication, dose, and duration of treatment)	181 (91.9)
Treating patients with a single antibiotic for diseases that require combination of antibiotics	172 (87.3)
Over-use of antibiotics especially for disease conditions where antibiotic use is not necessary	177 (89.8)
Selling antibiotics to clients without doctor's prescription	179 (90.9)
Self-medication (use of antibiotics without doctor's prescription)	175 (88.8)
Poor adherence to drugs by patients (e.g., not completing the full course of treatment)	176 (89.3)
Sharing antibiotics with others or using left over prescriptions	164 (83.2)
Poor hand washing practices by clients/patients and care givers	170 (86.3)
Poor infection prevention and control practices in the health facilities	175 (88.8)
Fake/substandard quality of antibiotics	169 (85.5)
Knowledge grade	
Adequate	187 (94.9)
Inadequate	10 (5.1)

Table 4: Respondents' knowledge of the prevention of antibiotic resistance

Variables	Correct response frequency (%) (n=197)
Prevention of antibiotic resistance	
Use the appropriate antibiotic in the right dose and duration of treatment	182 (92.4)
Treat the patients with a combination of antibiotics rather than a single antibiotic when necessary	190 (96.4)
Use of antibiotics only for diseases that require treatment with it	181 (91.9)
Do not sell antibiotics to the clients without doctor's prescription	172 (87.3)
Avoid self-medication	183 (92.7)
Adherence to drug treatment	178 (90.4)
Avoid sharing antibiotic with others or using left over prescription	180 (91.4)
Regular hand washing by clients/patients and care givers	185 (93.9)
Good infection prevention and control practices in the health facilities	185 (93.9)
Vigilance by clients, medicine vendors, and government agencies in preventing sale and distribution of fake antibiotic and those with substandard quality	170 (86.3)
Knowledge grade	
Adequate	193 (98.0)
Inadequate	4 (2.0)

Table 5: Respondents' practices regarding antibiotic resistance

Practices regarding antibiotic resistance	How often			
	Always, <i>n</i> (%)	Very often, <i>n</i> (%)	Occasionally, <i>n</i> (%)	Never, <i>n</i> (%)
Sell antibiotics to clients without doctor's prescription	118 (59.9)	43 (21.8)	20 (10.2)	16 (8.1)
Practice self-medication	97 (49.2)	61 (31.0)	19 (9.6)	19 (9.6)
Wash hands before dispensing antibiotics to patients	48 (24.4)	59 (29.9)	22 (11.2)	67 (34.0)
Counsel clients on the need to complete the recommended dose of antibiotics even if there is relief of symptoms	50 (25.4)	31 (15.7)	36 (18.3)	80 (40.6)
Complete the recommended dose of antibiotics if sick	32 (16.2)	34 (17.3)	30 (15.2)	101 (51.3)
Check the expiry date of drug before selling it to clients	30 (15.2)	31 (15.7)	29 (14.7)	107 (54.3)
Check the expiry date of drug before taking it if sick	38 (19.3)	36 (18.3)	33 (16.8)	90 (45.7)
Purchase drugs in bulk from the open market instead of the pharmaceutical companies	48 (24.4)	40 (20.3)	30 (15.2)	79 (40.1)
Screen drugs purchased for fake ones or with substandard quality	29 (14.7)	46 (23.4)	31 (15.7)	90 (45.7)

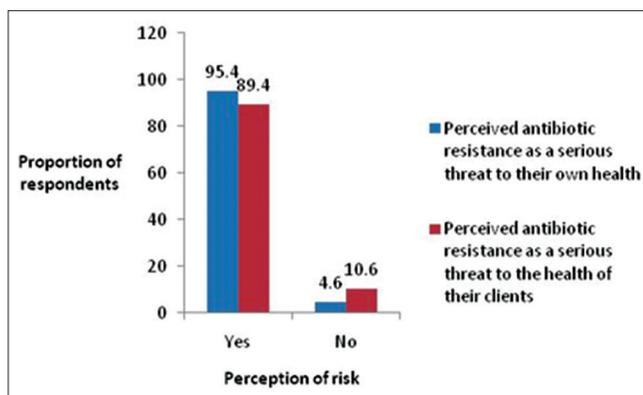


Figure 1: Respondents' perception of the risk of antibiotic resistance

perceived antibiotic resistance as a serious threat to the health of their clients [Figure 1].

Respondents' practices regarding antibiotic resistance

Practices favorable to the development of antibiotic resistance were very prevalent among the respondents. Majority (118, 59.9%) of the 197 respondents consistently sell antibiotics to clients without doctor's prescription. Close to half (49.2%) of the respondents consistently practice self-medication, and a larger proportion (44.7%) of respondents either consistently or often purchase drugs from the open market. Other practices favorable to the development of antibiotic resistance among the respondents are shown in Table 5.

DISCUSSION

The relatively young age of the respondents in this study with a larger proportion (42.1%) in the 20-29 years age group, and the preponderance of males (80.2%) and respondents with secondary (17.3%) and tertiary education (80.7%) are in consonance with the findings in a study conducted among PMVs in Rivers State, Nigeria^[32] that reported a preponderance of males (68.1%), and respondents with secondary (56.3%)

and post-secondary education (38.4%). Similarly, another study conducted among PMVs in Jos,^[21] Nigeria reported a preponderance of respondents in the 21-30 years age group (62.0%), and those with secondary (31.8%) and tertiary education (65.7%). These findings could be due to the fact that even though the licensure of PMVs in Nigeria does not require formal training in medicine or pharmacy, PMVs are expected to have basic education to enable them identify the drugs requested by clients, read the instructions on the drug label and counsel their clients on the dosage regimen, the likely side effects, and what to do should they experience any adverse drug reaction. In addition, it is known that employers prefer to recruit young people compared to older people because of the lower cost of employing them, being more flexible in terms of the hours they work, being more willing to learn, and the important links they provide to the customer base.^[33]

Although the high level of awareness of antibiotic resistance (87.3%) and adequate level of causes of antibiotic resistance (94.9%) and its prevention (98.0%) shown by the respondents in this study are in agreement with the findings in a study conducted among PMVs in Tanzania^[34] that reported high level of knowledge of antibiotics (75.0%), they differ from the findings in a study conducted among PMVs in Jos, Nigeria^[21] that reported low level of knowledge of medicines (34.3%), and another systematic review by Beyeler *et al.*^[20] that reported generally low health knowledge among PMVs in Nigeria. The variations observed in these studies suggest the need to design education interventions on knowledge and practices related to prevention of antibiotic resistance among PMVs in line with the local peculiarities and pattern across the sub Saharan African countries.

It is a paradox that despite the high level of knowledge of causes and prevention of antibiotic resistance and the high risk perception of antibiotic resistance as a serious threat to their health (95.4%) and the health of their

clients (89.4%), practices favorable to the development of antibiotic resistance were very prevalent among the respondents in this study. These include dispensing drugs without doctor's prescription, not checking for fake and substandard drugs before dispensing to clients, and self-medication. Similar to the findings in this study, a study among PMVs in rural and urban communities of South West Nigeria^[35] reported poor dispensing practices with clients requesting for drugs by names (urban 75.4%, rural 62.2%), and drugs were mostly sold as requested without questions (urban 65.3%, rural 57.8%). Another study among PMVs in rural areas of Lagos, Nigeria^[36] also reported poor compliance with regulatory practices; only 1.1% of the PMVs who participated in the study had a valid annual practicing license, only 1.1% of the drug shops had specified sign post, and most drug shops stocked drugs that were no longer recommended. A cause for concern is the highly prevalent self-medication practices found among different populations in Nigeria including students (53.3%),^[23] mothers of children under 5 years of age (96.5%),^[22] PMVs (75.4%),^[21] and healthcare workers in government-owned health facilities (38.2%).^[37] It is also disturbing that studies conducted across sub-Saharan Africa reported high prevalence of inappropriate drug dispensing and other illegal practices (including performing invasive procedures) that are favorable to the development of antibiotic resistance among PMVs. This is corroborated by the findings in a systemic review of the characteristics, knowledge, and regulatory practices of specialized drug shops in sub-Saharan Africa,^[11] which showed that a vast majority of the shops across the continent simply sold whatever drugs clients requested, with little history taking and counseling. In addition, most shops also stocked popular medicines at the expense of policy recommended treatments. These findings are of serious concern as they highlight the irreconcilable differences between the high levels of knowledge and risk perception of antibiotic resistance among PMVs in sub-Saharan Africa, and the prevalent inappropriate practices favorable to the development of antibiotic resistance among them, and they underscore the need for governments of sub Saharan African countries to regulate and closely monitor their practices in order to avert the looming crisis of medical practice without potent antibiotics across the continent.

Study limitation

The main limitation of the study is deliberate misinformation by the participants, thus making an unbiased assessment of their self-reported practices difficult despite explaining the objectives of the study to them and assuring them of the confidentiality of the information given by them.

CONCLUSION

Despite high levels of knowledge of the causes, prevention, and perception of the risks associated with antibiotic resistance, practices favorable to its development were very prevalent among PMVs in Sokoto, Nigeria. Government should regulate and closely monitor PMVs' practices in order to avert the looming crisis of medical practice without potent antibiotics.

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Conflicts of interest

There are no conflicts of interest.

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