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Research Article

Assessment of Community Pharmacists' Knowledge, Perception and Practice Regarding Antimicrobial Stewardship in Ebonyi State, Southeastern Nigeria

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ABSTRACT

Antimicrobial stewardship (AMS) is vital for promoting the appropriate use of antimicrobials. This study evaluated the knowledge, perception, and practice of community pharmacists regarding AMS in a Nigerian state. The cross-sectional study was conducted among community pharmacists using a 33-item structured questionnaire. Data collected were analyzed with the significance level set as $P < 0.05$. Out of 79 distributed questionnaires, 70 were completed (participation rate: 88.6%). Majority of the respondents were males (n = 48, 68.6%), aged 26 – 45 years (n = 51, 72.9%), and had ≤ 10 years of community pharmacy experience (n = 54, 77.1%). Overall, more than half of the respondents possessed good AMS knowledge (n = 51, 72.9%), while approximately half had a positive perception (n = 38, 54.3%) and practiced AMS effectively (n = 36, 51.4%). Male pharmacists showed higher awareness of AMS compared to females (89.6% vs. 63.6%; $\chi2 = 6.716$, $p = 0.010$). Respondents who were Fellows of the West African Postgraduate College of Pharmacists (FPCPharm) had better AMS knowledge (100.0% vs. 67.8%; $\chi2 = 4.862$, $p = 0.027$) and a more positive perception (81.8% vs. 49.2%; $\chi2 = 3.986$, $p = 0.046$). While community pharmacists displayed good AMS knowledge, their perception and practice were average. Participation in the West African Postgraduate College of Pharmacists programme was associated with improved knowledge and perception of AMS. Strengthening inter-professional collaborations can optimize health outcomes. Enhancing antibiotic stewardship among Nigerian community pharmacists is imperative.

Keywords: *Antimicrobial Stewardship, Community Pharmacists, Knowledge, Perception, Practice*

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INTRODUCTION

Antimicrobials are used to prevent and treat various infections, making them the cornerstone of modern medicine (Padiyara *et al*., 2018). However, the misuse and overuse of antimicrobials in human and animal health have encouraged the emergence and spread of antimicrobial resistance (AMR) (Padiyara *et al*., 2018; Gajdács & Albericio, 2019). This necessitates an antimicrobial stewardship (AMS) programme. The aim of an AMS programme is "to optimize the use of antibiotics; promote behaviour change in antibiotic prescribing and dispensing practices; improve quality of care and patient outcomes; save on unnecessary health-care costs; reduce further emergence, selection and spread of AMR; prolong the lifespan of existing antibiotics; limit the adverse economic impact of AMR; build the best-practices capacity of health-care professionals regarding the rational use of antibiotics" (World Health Organization, 2019). It has proven effective in reducing the rate of antimicrobial misuse and AMR after implementation (Peragine *et al*., 2019; Al-Omari *et al*., 2020; Pallares *et al*., 2022).

In Nigeria, self-medication and inappropriate use of antibiotics are major threats to the future of antibiotics (World Health Organization, 2021a). Although there is limited data on the global AMR surveillance system in the country, a situation analysis from the Nigeria Centre for Disease Control (NCDC) discovered a high rate of antimicrobial-resistant organisms

(Egwuenu *et al*., 2018; World Health Organization, 2021b). A major contributor to this resistance and misuse of antimicrobials is the non-prescription sale and inappropriate dispensing of antimicrobials from community pharmacies in the country (Sakeena *et al*., 2018; Abubakar & Tangiisuran, 2020; Akpan *et al*., 2021; Isabel *et al*., 2021). Thus, community pharmacists have a vital role to play in promoting AMS practices among the general population. Their knowledge, attitude, and practice regarding antimicrobial use can significantly influence patient outcomes and the overall effectiveness of AMS initiatives.

Studies assessing the knowledge and practice of AMS among community pharmacists in Nigeria are very limited (Abubakar, 2020; Ugwu *et al*., 2023). This study aims to contribute to that body of literature by evaluating community pharmacists' knowledge, perception, and practice regarding antimicrobial stewardship (AMS) in a Nigerian State. It will also provide evidence-based recommendations for enhancing AMS practices in community pharmacy settings.

MATERIALS AND METHODS

Study Design and Sample Population: This cross-sectional study (May 2022 to June 2022) was conducted among community pharmacists in one of the States in the south-eastern geopolitical zone of Nigeria. This State had a population of not less than 2.9 million people, with less than 100 community pharmacists registered with the Pharmacy Council of Nigeria (PCN). Nigeria has 36 States and a Federal Capital Territory, Abuja.

Eligibility Criteria: All community pharmacists practicing in the State who provided consent and were willing to participate were included in the study.

Sample Size and Selection: The total population of community pharmacists in the State was obtained from the State Branch of the Association of Community Pharmacists of Nigeria (ACPN). The required sample size was calculated using the Raosoft® sample size calculator, with a 5% margin of error, at a 95% confidence interval, assuming a 50% response rate. Community pharmacists who fell within the eligibility criteria and were willing to participate in the study were included. Convenience sampling was employed.

Data Collection: The aim of the study was explained to the intending respondents with verbal and written consent obtained from those who agreed to participate. To maintain confidentiality, the names of the respondents were not requested. The study instrument was a 33-item structured, self-administered questionnaire in five domains. The first domain focused on demographic details. The second domain assessed awareness of AMS. The third domain explored the community pharmacists' knowledge of AMS. The fourth domain focused on community pharmacists' perceptions about AMS while the fifth domain assessed their practices regarding AMS.

Data Analysis: Data was analyzed using the IBM SPSS Version 25.0. Descriptive statistics, such as frequency, percentages, mean, and standard deviation were used to summarize data. Inferential statistics such as Pearson's Chi-Square test was used to test the association between variables, with statistical significance set as $P < 0.05$.

The total knowledge score was the sum of the correct options for the items testing knowledge of antimicrobial stewardship. There were 10 items testing knowledge of AMS. Each correct option had a score of one point while incorrect options had zero points. Thus, the maximum total knowledge score per respondent was 10. Knowledge was categorized as good or poor such that good knowledge of AMS referred to those with total knowledge score ≥ 9 (the median score).

The domain on perception of AMS was a 4-point Likert scale. There were nine items. The total perception score was the sum of the scores for the different items. The maximum total perception score was 36. The responses were coded as Strongly Disagree (coded as '1'); Disagree (coded as '2'); Agree (coded as '3') and Strongly Agree (coded as '4'). Statements that were negatively-phrased had their codes reversed to Strongly Disagree (coded as '4'); Disagree (coded as '3'); Agree (coded as '2') and Strongly Agree (coded as '1'). The perception was categorized as positive or negative such that positive perception about AMS referred to those with total perception score ≥ 32 (the median score).

The domain on practices regarding AMS was a 4-point Likert scale. There were seven items. The total practice score was the sum of the scores for the different items. The maximum total practice score was 28. The responses were coded as: Never (coded as '1'); Rarely (coded as '2'); Often (coded as '3'); Always (coded as '4'). Statements that were negatively-phrased had their codes reversed to: Never (coded as '4'); Rarely (coded as '3'); Often (coded as '2'); Always (coded as '1'). Practice was categorized as good or poor such that good practice regarding AMS referred to those with total practice scores ≥ 21 (the median score).

Ethical Consideration: Ethical clearance was received from the Health Research and Ethics Committee (HREC) of the University of Nigeria Teaching Hospital (UNTH), Ituku-Ozalla, Enugu State, before the commencement of the study (NHREC/05/01/2008B-FWA00002458-1RB00002323 on 20th May, 2022).

RESULTS

Seventy community pharmacists practicing in the State completed the questionnaire (participation rate: 70/79 = 88.6%). The majority of the respondents were between 26 and 45 years old (n = 51, 72.9%), males (n = 48, 68.6%) and had ≤ 10 years of community pharmacy experience (n = 54, 77.1%). Less than half of the respondents owned the community pharmacy where they practiced (n = 23, 32.9%), Table 1.

More than half of the respondents were aware of (n = 57, 81.4%) and had good knowledge of antimicrobial stewardship (n = 51, 72.9%). Most of the respondents knew the meaning of antimicrobial resistance (n = 69, 98.6%) and understood it is a global threat to public health (n = 69, 98.6%). The question on the possibility of antibiotic-resistant bacteria being communicable had the lowest number of correct responses (n = 48, 68.6%), Table 2.

Table 1:
Demographic details, N = 70

Variables		n (%)
Age (in years)	≤ 25	2 (2.9)
	26 – 35	30 (42.9)
	36 – 45	21 (30.0)
	46 – 55	9 (12.9)
	56 – 65	6 (8.6)
	>65	2 (2.9)
Gender	Male	48 (68.6)
	Female	22 (31.4)
Number of years after graduation	< 5	17 (24.3)
	5 – 10	28 (40.0)
	11 – 20	13 (18.6)
	> 20	12 (17.1)
Community pharmacy experience (in years)	< 5	29 (41.4)
	5 – 10	25 (35.7)
	11 – 20	10 (14.3)
	> 20	6 (8.6)
Additional qualification (Yes)	PharmD	2 (2.9)
	MSc/MPharm	15 (21.4)
	MPH	8 (11.4)
	MBA	2 (2.9)
	FPCPharm	11 (15.7)
	PhD	2 (2.9)
Job status (Yes)	Pharmacy owner	23 (32.9)
	Superintendent pharmacist	26 (37.1)
	Staff pharmacist	24 (34.3)

PharmD = Doctor of Pharmacy; MSc = Master of Science; MPharm = Master of Pharmacy; MPH = Master of Public Health; MBA = Master of Business Administration; FPCPharm = Fellow of West African Postgraduate College of Pharmacists; PhD = Doctor of Philosophy

About half of the respondents had a positive perception of antimicrobial stewardship (n = 38, 54.3%). All the respondents (n = 70, 100.0%) agreed that adequate training on antimicrobial use should be provided to community pharmacists. Majority of the respondents disagreed (n = 66, 94.2%) that prescribing physicians are the only health professionals who need to understand antimicrobial stewardship, Table 3.

Two-fifths of the respondents (n = 28, 40.0%) reported that they dispense antibiotics without prescription often/always. Close to three-quarters of them (n = 50, 71.4%) often/always advise patients to use over-the-counter medications when they present with symptoms of infections that do not need antibiotics. Majority of the respondents (n = 54, 77.2%) claimed that they often/always contact the prescriber if the choice of antibiotics is inappropriate. Overall, about half of the respondents had good AMS practices (n = 36, 51.4%), Table 4.

Both age and gender were significantly associated with awareness about AMS. A larger proportion of respondents between 26 – 35 years old (96.7%) were aware of the term 'antimicrobial stewardship' compared to other age brackets: 56 – 65 years (83.3%), 36 – 45 years (76.2%), 46 – 55 years (66.7%), > 65 years (50.0%), ≤ 25 years (0.0%) ($\chi2$ = 16.374, P = 0.006). In addition, a larger proportion of males were aware of AMS compared to females (89.6% Vs. 63.6%, $\chi2$ = 6.716, P = 0.010), Table 5a.

There was a significant association between being a Fellow of the West African Postgraduate College of Pharmacists (FPCPharm) and perception about/knowledge of AMS. More respondents who had FPCPharm had good knowledge of AMS (100.0% Vs. 67.8%; $\chi2$ = 4.862, P = 0.027) and positive perception of AMS (81.8% Vs. 49.2%; $\chi2$ = 3.986, P = 0.046), compared to those who had not, Table 5b.

Table 2:
Awareness and knowledge of antimicrobial stewardship (AMS), N = 70

Variables	n (%)
Awareness about AMS	
I have heard of the term 'antimicrobial stewardship' (Yes)	57 (81.4)
	Correct (%)
Knowledge of AMS	
1. Antimicrobial stewardship promotes the responsible use of antimicrobials	66 (94.3)
2. All antibiotics are antimicrobials but not all antimicrobials are antibiotics	57 (81.4)
3. Antimicrobial resistance is the ability of microbes to grow in the presence of a drug that would normally kill them or limit their growth	69 (98.6)
4.† Antimicrobial resistance affects only adults	65 (92.9)
5.† Antibiotics will improve the outcome of the treatment of the common cold	49 (70.0)
6. Antimicrobial resistance is a global threat to public health	69 (98.6)
7. Antimicrobial resistance makes it harder to eliminate infections from the body as existing drugs become less effective	65 (92.9)
8.†Antibiotic-resistant bacteria cannot spread from person-to-person in the community	48 (68.6)
9.† Antimicrobial resistance cannot cause deaths	65 (92.9)
10. Improper self-medication with antimicrobials can cause antimicrobial resistance	68 (97.1)

† The correct option is reversed.
AMS = Antimicrobial Stewardship.
The total knowledge score was the sum of the correct options for the items testing knowledge of antimicrobial stewardship with maximum total knowledge score of 10.
Knowledge was categorized as *good* or *poor* such that good knowledge of antimicrobial stewardship referred to those with total knowledge scores ≥ 9 (the median score).
More than half of the respondents had good knowledge of antimicrobial stewardship (n = 51; 72.9%).

Table 3:
Perception of antimicrobial stewardship (AMS), N = 70

Items	n (%)			
	SD	D	A	SA
1. AMS improves patient care	4 (5.7)	0 (0.0)	13 (18.6)	53 (75.7)
2. Adequate training on antimicrobial use should be provided to community pharmacists	0 (0.0)	0 (0.0)	12 (17.1)	58 (82.9)
3.† It is not necessary for community pharmacists to attend conferences, workshops and other educational activities focused on AMS	48 (68.6)	11(15.7)	3 (4.3)	8 (11.4)
4. AMS prevents the development of new drug resistance	1 (1.4)	5 (7.1)	26 (37.1)	38 (54.3)
5. AMS gives the prescriber room for more treatment options	1 (1.4)	2 (2.9)	29 (41.4)	38 (54.3)
6. AMS should be incorporated at the community pharmacy level	0 (0.0)	2 (2.9)	25 (35.7)	43 (61.4)
7. AMS reduces the cost of treatment	1 (1.4)	4 (5.7)	24 (34.3)	41 (58.6)
8.† Individual efforts at antimicrobial stewardship have minimal impact on the antimicrobial-resistance problem	19 (27.1)	34(48.6)	17 (24.3)	0 (0.0)
9.† Prescribing physicians are the only health professionals who need to understand antimicrobial stewardship	54 (77.1)	12(17.1)	1 (1.4)	3 (4.3)

Strongly Disagree (coded as '1'); Disagree (coded as '2'); Agree (coded as '3'); Strongly agree (coded as '4').
[+] Reversed Items such that: Strongly Disagree (coded as '4'); Disagree (coded as '3'); Agree (coded as '2'); Strongly agree (coded as '1').
AMS = Antimicrobial Stewardship.
The total perception score was the sum of the scores for the different items with a maximum total perception score of 36.
Perception was categorized as positive or negative such that positive perception about AMS referred to those with total perception scores ≥ 32 (the median score).
About half of the respondents had a positive perception of antimicrobial stewardship (n = 38; 54.3%).

Table 4:
Practices regarding antimicrobial stewardship (AMS), N = 70

Items	n (%)			
	Never	Rarely	Often	Always
1.† I dispense antibiotics without a prescription	14 (20.0)	28 (40.0)	22 (31.4)	6 (8.6)
2. I advise patients to use over-the-counter medications when they present with symptoms of infections that do not need antibiotics	18 (25.7)	2 (2.9)	18 (25.7)	32 (45.7)
3. I refer patients to a physician when symptoms are suggestive of an infection	3 (4.3)	29 (41.4)	26 (37.1)	12 (17.1)
4. I ask patients about their history of allergies before I dispense antibiotics	0 (0.0)	5 (7.1)	21 (30.0)	44 (62.9)
5. I contact the prescriber if the patient is allergic to the prescribed antibiotics	9 (12.9)	17 (24.3)	24 (34.3)	20 (28.6)
6. I contact the prescriber if the choice of antibiotics is inappropriate	5 (7.1)	11 (15.7)	31 (44.3)	23 (32.9)
7.† I dispense another antibiotic, without contacting the prescriber, if the prescribed antibiotic is not appropriate	17 (24.3)	21 (30.0)	25 (35.7)	7 (10.0)

Never (coded as '1'); Rarely (coded as '2'); Often (coded as '3'); Always (coded as '4')
[+] Reversed Items such that: Never (coded as '4'); Rarely (coded as '3'); Often (coded as '2'); Always (coded as '1')
The total practice score was the sum of the scores for the different items with a maximum total perception score of 28.
Practice was categorized as good or poor such that good practice regarding AMS referred to those with total perception scores ≥ 21 (the median score).
About half of the respondents had good AMS practices (n = 36; 51.4%).

DISCUSSION

More than half of the respondents had good knowledge of antimicrobial stewardship (AMS). However, only about half of the respondents had a positive perception of AMS and good AMS practices. A significant association between gender and awareness about AMS revealed that a larger proportion of male pharmacists were aware about AMS compared to their female counterparts. Some postgraduate programmes, such as the West African Postgraduate College of Pharmacists could influence knowledge and perception of AMS.

The majority of the respondents were between 26 and 45 years old, males and had ≤ 10 years of community pharmacy experience. Less than half of the respondents owned the community pharmacy where they practiced. These findings are consistent with two similar studies in Northern Nigeria, which reported more male than female pharmacists with experience of less than or up to 5 years (Abubakar, 2020; Ugwu *et al*., 2023). This could be because there are more males than females in the pharmacy workforce in Nigeria (Ekpenyong *et al*., 2018). Another study in China also reported similar findings of more male pharmacists between 30 and 39 years and had less than five years of experience (Feng *et al*., 2020). In contrast, a study in Australia reported more female than male pharmacists with a high distribution of age and experience (Rizvi *et al*., 2018).

More than half of the respondents were aware of and had good knowledge of antimicrobial stewardship. Most of the respondents knew the meaning of antimicrobial resistance and understood it is a global threat to public health. This is not surprising as AMR and AMS are included in the undergraduate pharmacy curriculum. Thus, as graduates, it is expected that community pharmacists should have a good understanding of these terms. Other studies in Nigeria, China, Australia, and Zambia reported similar results with the majority of the participants agreeing that antimicrobial resistance is a serious health threat and AMS is important to prevent this threat (Rizvi *et al*., 2018; Abubakar, 2020; Feng *et al*., 2020; Mudenda *et al*., 2021; Ugwu *et al*., 2023).

Table 5a:

Association between demographic variables, awareness, knowledge, perception and practice regarding antimicrobial stewardship (AMS), N = 70

Variables	Awareness		χ^2	*P*	Knowledge		χ^2	*P*	Perception		χ^2	*P*	Practice		χ^2	*P*
	Yes	No			Poor	Good			Negative	Positive			Poor	Good		
Age (in years)			16.374	0.006*			10.290	0.067			3.761	0.584			3.285	0.656
≤ 25	0 (0.0)	2 (100.0)			2 (100.0)	0 (0.0)			2 (100.0)	0 (0.0)			2 (100.0)	0 (0.0)		
26 – 35	29 (96.7)	1 (3.3)			6 (20.0)	24 (80.0)			12 (40.0)	18 (60.0)			16 (53.3)	14 (46.7)		
36 – 45	16 (76.2)	5 (23.8)			8 (39.1)	13 (61.9)			11 (52.4)	10 (47.6)			9 (42.9)	12 (57.1)		
46 – 55	6 (66.7)	3 (33.3)			2 (22.2)	7 (77.8)			3 (33.3)	6 (66.7)			4 (44.4)	5 (55.6)		
56 – 65	5 (83.3)	1 (16.7)			0 (0.0)	6 (100.0)			3 (50.0)	3 (50.0)			2 (33.3)	4 (66.7)		
>65	1 (50.0)	1 (50.0)			1 (50.0)	1 (50.0)			1 (50.0)	1 (50.0)			1 (50.0)	1 (50.0)		
Gender			6.716	0.010*			3.075	0.080			1.130	0.288			2.915	0.088
Male	43 (89.6)	5 (10.4)			10 (20.8)	38 (79.2)			24 (50.0)	24 (50.0)			20 (41.7)	28 (58.3)		
Female	14 (63.6)	8 (36.4)			9 (40.9)	13 (59.1)			8 (36.4)	14 (63.6)			14 (63.6)	8 (36.4)		
Number of years after graduation			2.468	0.481			1.375	0.711			1.192	0.755			5.072	0.167
< 5	15 (88.2)	2 (11.8)			6 (35.3)	11 (64.7)			7 (41.2)	10 (58.8)			9 (52.9)	8 (47.1)		
5 – 10	24 (85.7)	4 (14.3)			8 (28.6)	20 (71.4)			15 (53.6)	13 (46.4)			13 (46.4)	15 (53.6)		
11 – 20	9 (69.2)	4 (30.8)			3 (23.1)	10 (76.9)			5 (38.5)	8 (61.5)			9 (69.2)	4 (30.8)		
> 20	9 (75.0)	3 (25.0)			2 (16.7)	10 (83.3)			5 (41.7)	7 (58.3)			3 (25.0)	9 (75.0)		
Community pharmacy experience (in years)			6.190	0.103			4.041	0.257			4.689	0.196			2.562	0.464
< 5	26 (89.7)	3 (10.3)			7.9 (24.1)	22 (75.9)			12 (41.4)	17 (58.6)			13 (44.8)	16 (55.2)		
5 – 10	21 (84.0)	4 (16.0)			10 (40.0)	15 (60.0)			12 (48.0)	13 (52.0)			12 (48.0)	13 (12.9)		
11 – 20	7 (70.0)	3 (30.0)			1 (10.0)	9 (90.0)			3 (30.0)	7 (70.0)			7 (70.0)	3 (30.0)		
> 20	3 (50.0)	3 (50.0)			1 (16.7)	5 (83.3)			5 (83.3)	1 (16.7)			2 (33.3)	4 (66.7)		

* P < 0.05 is statistically significant

Table 5b:
Association between demographic variables, awareness, knowledge, perception and practice regarding antimicrobial stewardship (AMS), N = 70

Variables		Awareness		χ^2	*P*	Knowledge		χ^2	*P*	Perception		χ^2	*P*	Practice		χ^2	*P*
		Yes	**No**			**Poor**	**Good**			**Negative**	**Positive**			**Poor**	**Good**		
Additional qualification	PharmD			0.470	0.493							2.445	0.118			0.002	0.967
	Yes	2 (100.0)	0 (0.0)			1 (50.0)	1 (50.0)			2 (100.0)	0 (0.0)			1 (50.0)	1 (50.0		
	No	55 (80.9)	13 (19.1)			18 (26.5)	50 (73.5)			30 (44.1)	38 (55.9)			33 (48.5)	35 (51.5)		
	MSc/MPharm			0.026	0.872			0.370	0.543			0.007	0.933			0.173	0.677
	Yes	12 (80.0)	3 (20.0)			5 (33.3)	10 (66.7)			7 (46.7)	8 (53.3)			8 (53.3)	7 (46.7)		
	No	45 (81.8)	10 (18.2)			14 (25.5)	41 (74.5)			25 (45.5)	30(54.5)			26 (47.3)	29 (52.7)		
	MPH			0.220	0.639			0.979	0.322			1.562	0.211			0.007	0.932
	Yes	7 (87.5)	1 (12.5)			1 (12.5)	7 (87.5)			2 (25.0)	6 (75.0)			4 (40.0)	4 (50.0)		
	No	50 (80.6)	12 (19.4)			18 (29.0)	44 (71.0)			30 (48.4)	32(51.6)			30 (48.4)	32 (51.6)		
	MBA			0.470	0.493			0.767	0.381			0.015	0.902			2.180	0.140
	Yes	2(100.0)	0 (0.0)			0 (0.0)	2 (100.0)			1 (50.0)	1 (50.0)			2 (100.0)	0 (0.0)		
	No	55 (80.9)	13 (19.1)			19 (27.9)	49 (72.1)			31 (45.6)	37(54.4)			32 (47.1)	36 (52.9)		
	FPCPharm			0.001	0.971			4.862	0.027*			3.986	0.046*			0.051	0.822
	Yes	9 (81.8)	2 (18.2)			0 (0.0)	11 (100.0)			2 (18.2)	9 (81.8)			5 (45.5)	6 (54.5)		
	No	48 (81.4)	11 (18.6)			19 (32.2)	40 (67.8)			30 (50.8)	29(49.2)			29 (49.2)	30 (50.8)		
	PhD			0.470	0.493			0.544	0.461			2.445	0.118			0.002	0.967
	Yes	2 (100.0)	0 (0.0)			1 (50.0)	1 (50.0)			2 (100.0)	30(44.1)			1 (50.0)	1 (50.0)		
	No	55 (80.9)	13 (19.1)			18 (26.5)	50 (73.5)			0 (0.0)	38(55.9)			33 (48.5)	35(51.5)		
Job status	Pharmacy owner			1.279	0.258			0.506	0.477			0.062	0.804			0.008	0.930
	Yes	17 (73.9)	6 (26.1)			5 (21.)	18 (78.3)			11 (47.8)	12(52.2)			11 (47.8)	12(52.2)		
	No	40 (85.1)	7 (14.9)			14 (12.8)	33 (70.2)			21 (44.7)	26(55.3)			23 (48.9)	24(51.1)		
	Superintendent pharmacist			0.012	0.931			0.001	0.975			0.193	0.660			1.378	0.241
	Yes	21 (80.8)	5 (19.2)			7 (26.9)	19 (73.1)			11 (42.3)	15(57.7)			15 (57.7)	11(42.3)		
	No	36 (81.8)	8 (18.2)			12 (27.3)	32 (72.7)			21 (47.7)	23(52.3)			19 (43.2)	25(56.8)		
	Staff pharmacist			0.890	0.345			0.076	0.783			0.241	0.623			0.030	0.863
	Yes	21 (87.5)	3 (12.5)			7 (29.2)	17 (70.8)			10 (41.7)	14(58.3)			12 (50.0)	12(50.0)		
	No	36 (78.3)	10 (21.7)			12 (26.1)	34 (73.9)			22 (47.8)	24(52.2)			22 (47.8)	24(52.2)		

* P < 0.05 is statistically significant
PharmD = Doctor of Pharmacy; MSc = Master of Science; MPharm = Master of Pharmacy; MPH = Master of Public Health; MBA = Master of Business Administration; FPCPharm = Fellow of West African Postgraduate College of Pharmacists; PhD = Doctor of Philosophy

About half of the respondents had positive perception of antimicrobial stewardship. This is consistent with findings from similar studies (Saha *et al*., 2019; Abubakar, 2020; Feng *et al*., 2020; Ugwu *et al*., 2023). All the respondents agreed that adequate training on antimicrobial use should be provided to community pharmacists. In contrast, a similar study in China reported that three-thirds (75.4%) of the participants agreed that "adequate training should be provided to community pharmacists on antimicrobial use" (Feng *et al*., 2020). In another study in Nigeria, the majority of the participants (93.3%) agreed that "adequate training should be provided to community pharmacists on antimicrobial use" (Ugwu *et al*., 2023). There might be need to train and re-train community pharmacists in Nigeria to be antimicrobial stewards.

The majority of the respondents disagreed that prescribing physicians are the only health professionals who need to understand antimicrobial stewardship. This corroborates with the findings of another Nigerian study (Ugwu *et al*., 2023). Furthermore, a scoping review reported that most community pharmacists agree that other health professionals, besides prescribers, need to understand antimicrobial stewardship (Saha *et al*., 2019). These demonstrate the awareness of the vital role all healthcare professionals can play in antimicrobial stewardship, and in preventing antimicrobial resistance.

Two-fifths of the respondents reported that they dispense antibiotics without prescription often/always. This finding is consistent with similar studies and other studies which evaluated the non-prescription sale of antibiotics in Nigeria (Sakeena *et al*., 2018; Abubakar, 2020; Abubakar & Tangiisuran, 2020; Akpan *et al*., 2021; Isabel *et al*., 2021; Ugwu *et al*., 2023). In Nigeria, antibiotics are prescription-only medicines, and it is illegal to dispense without a prescription (Isabel *et al*., 2021). However, community pharmacists still dispense antibiotics without prescription. Some of the reasons reported include pharmacists' confidence in the knowledge of antibiotic therapy and poor regulatory activities (Sakeena *et al*., 2018; Abubakar & Tangiisuran, 2020). The Pharmacy Council of Nigeria (PCN) regulates the pharmaceutical sector in Nigeria, ensuring the registration and licensing of pharmacists and their premises as well as regulating their operations (Pharmacy Council of Nigeria, 2023). To reduce the indiscriminate dispensing of prescription-only medications, like antibiotics, the Council needs to be stricter and more thorough in its regulatory activities.

Close to three-quarters of the respondents claimed to often/always advise patients to use over-the-counter (OTC) medications when they present with symptoms of infections that do not need antibiotics. This result is similar to the findings from an Australian study where the majority of the participants (95.8%) responded that they managed patients by recommending OTC medications where an infection was not suspected (Rizvi *et al*., 2018). The overuse and misuse of antibiotics contribute significantly to the development of antimicrobial resistance, which poses a serious threat to public health globally (Padiyara *et al*., 2018; Gajdács & Albericio, 2019). Therefore, the community pharmacists must play a pivotal role in promoting responsible antimicrobial use by counselling and educating their patients on the rational use of antibiotics.

Interprofessional collaboration between community pharmacists and other healthcare professionals is vital in strengthening AMS objectives at the community level (Saha *et al*., 2019). Good enough, most of the respondents in our study claimed that they often/always contact the prescriber if the choice of antibiotics is inappropriate. These findings are consistent with similar studies (Saha *et al*., 2019; Ugwu *et al*., 2023). However, unlike our findings, one study reported that most pharmacists rarely/never collaborated with other healthcare professionals over antibiotic use (Sarwar *et al*., 2018). Another study reported that pharmacists less commonly contacted prescribers for inappropriate antibiotic choices but more frequently for drug interactions, allergies, or dosing cases (Rizvi *et al*., 2018). Overall, about half of the respondents in our study had good AMS practices. This suggests the need for strategies to improve their practices. Rather than dispense antibiotics to patients without prescription, community pharmacists can make their suggestions to the prescribers. In addition, if community pharmacists perceive that the prescribed antibiotic is inappropriate, they should contact the prescriber before dispensing another.

Both age and gender were significantly associated with awareness about AMS. A larger proportion of respondents between 26 – 35 years old were aware of the term 'antimicrobial stewardship' compared to other age brackets: ≤ 25 years, 36 – 65 years, and > 65 years. In addition, a larger proportion of male pharmacists were aware of AMS compared to their female counterparts. This could be because, as earlier mentioned, a large proportion of the pharmacist workforce are males with less than ten years of experience. However, a similar study conducted in Nigeria found no association between pharmacists' demographic characteristics and overall perception of AMS (Abubakar, 2020). Whereas, a study in Pakistan reported that although male pharmacists between 20 - 29 years old had a higher perception of AMS, they were also associated with poor AMS practices (Sarwar *et al*., 2018).

There was a significant association between being a Fellow of the West African Postgraduate College of Pharmacists (FPCPharm) and perception about/knowledge of AMS. All the respondents who had FPCPharm had good knowledge of AMS compared to those who were not Fellows of the College. Furthermore, a larger proportion of respondents with FPCPharm had a positive perception of AMS compared to those who were not Fellows of the College. This postgraduate programme is only open to pharmacists with some years of practice experience. Some of the pharmacists who enroll in the programme already have postgraduate degrees such as Masters or Doctorate degrees. This suggests that pharmacists with higher educational qualifications and experience years might have better knowledge and perception of AMS than those with fewer educational qualifications and experience years. Similarly, other studies reported a positive association between higher educational qualifications and community pharmacists' perception of AMS; between higher years of experience and the perception of AMS; and between higher years of

experience and community pharmacists' practice of AMS (Sarwar *et al*., 2018; Saha *et al*., 2019; Abubakar, 2020).

The limitations of the study include small sample size due to the number of registered community pharmacists in the State. It also reveals the poor community pharmacist-to-patient ratio, in the State. Furthermore, the findings should not be generalized to community pharmacists in Nigeria. Further studies can consider extrapolation to other States. The results should be interpreted with caution because of the influence of social desirability bias on the responses provided by the community pharmacists.

In conclusion, while community pharmacists displayed good AMS knowledge, their perception and practice were average. Participation in the West African Postgraduate College of Pharmacists programme was associated with improved knowledge and perception of AMS. Strengthening inter-professional collaborations can optimize health outcomes. Enhancing antibiotic stewardship among Nigerian community pharmacists is imperative.

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