

Assessment of antimicrobial stewardship and perspectives of healthcare professionals on antimicrobial resistance in primary health centres in Cross River State, Nigeria

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Abstract

Background

Antimicrobial resistance (AMR) is a major global public health threat, driven in part by inappropriate antibiotic use in primary care. In Nigeria, primary healthcare (PHC) providers, particularly Community Health Extension Workers (CHEWs), make many frontline prescribing decisions, yet little is known about their experiences and perspectives regarding antimicrobial stewardship (AMS). This study explored knowledge of AMR, antibiotic prescribing practices, barriers to appropriate prescribing, and opportunities for strengthening AMS among PHC providers in Cross River State, Nigeria.

Methods

A qualitative phenomenological study was conducted between July and August 2024 using key informant interviews with frontline healthcare workers from purposively selected PHC facilities across Cross River State. Eleven local government areas were included. Participants were selected based on their direct involvement in antibiotic prescribing, dispensing, laboratory services, or facility leadership. Interviews were audio-recorded, transcribed verbatim, and analysed using thematic analysis supported by NVivo software. Coding was conducted iteratively, and findings were organised into themes and subthemes reflecting participants' experiences and perceptions.

Results

Twenty-nine healthcare workers participated. Six major themes emerged: knowledge of AMR; prescribing practices and decision-making; training and guidelines; barriers to appropriate prescribing; interventions for improvement; and policy and system-level recommendations. Participants generally understood AMR because of antibiotic misuse, overuse, incomplete treatment courses, self-medication, and widespread antibiotic access through patent medicine vendors. Although prescribing was largely guided by standing orders and standard treatment protocols, routine practice was constrained by limited diagnostic capacity, medicine stock-outs, workforce shortages, patient expectations, and financial barriers. Formal AMR and AMS training was infrequent, with many participants relying primarily on standing orders and personal experience. Suggested improvements included regular AMS training, strengthened supervision, reliable availability of essential medicines, improved laboratory services, community education on antibiotic use, stricter regulation of antibiotic sales, updating prescribing guidelines, and deployment of additional skilled personnel to PHC facilities.

Conclusions

PHC providers in Cross River State recognise the importance of responsible antibiotic use but face significant system-level barriers that limit effective AMS. Strengthening training, diagnostics, medicine supply systems, regulatory enforcement, and community engagement could improve prescribing practices and support national efforts to mitigate AMR in Nigeria.

Introduction

Antimicrobial resistance (AMR) has been declared by the World Health Organisation (WHO) as one of the top global public health threats facing humanity [1]. AMR is estimated to have already claimed more than 36 million lives since 1990 [2]. The death toll from AMR is set to rise dramatically as it is projected to result in 10 million deaths per year by 2050, costing the global economy a cumulative US \$100 trillion [3, 4]. Optimising the use of antimicrobial medicines, one of the five strategic objectives of the WHO Global Action Plan on AMR, is an essential approach for preventing and minimising AMR [5, 6]. A strong and robust antimicrobial stewardship (AMS) programme is a key component of tackling AMR, reducing cost, and improving patient safety and outcomes [7]. AMR refers to the biological outcome of microorganisms developing resistance to antimicrobial agents, whereas AMS comprises the coordinated application of policies, practices, and systems designed to optimise antimicrobial use and slow the emergence of resistance.

High rates of antimicrobial consumption are often associated with high rates of inappropriate use in both agriculture and human medicine [8]. Community use of antimicrobials is projected to account for around 80% of overall human antimicrobial consumption, which is dispensed at the grassroots level by frontline healthcare providers [9]. The misuse and overuse of antibiotics in primary care are major contributors to AMR [10]. An effective response to AMR requires integrated health services where primary care is linked to systems that monitor antibiotic use and resistance at the community level [11]. Implementing effective AMS interventions in primary care can be challenging, and the perspectives of primary healthcare professionals are often not fully explored in the design of these programmes.

The over-consumption and misuse of antibiotics in Nigeria have been attributed to factors such as insufficient regulatory controls, poor diagnostic capabilities, and a lack of knowledge among healthcare professionals, particularly at the primary healthcare level [12]. Despite Nigeria's National Action Plan on Antimicrobial Resistance providing a strategic framework for stewardship, surveillance, and awareness, its operationalization at the primary healthcare (PHC) level remains weak, where frontline providers make most antibiotic-related decisions.

The PHC workers are largely ignored in efforts to combat AMR in Nigeria. However, most patent medicine stores, and PHC services in Nigeria are run by community health extension workers (CHEWs) who are also first-line antibiotic prescribers [13]. The CHEWs receive only minimal training on antimicrobial use and prescription practices and are allowed to manage few commonly encountered clinical conditions based on the National Standing Orders for Community Health Officers/CHEWs [14]. Standing Orders are the instrument that outlines operational processes with which the CHEWs were trained and are expected to apply when attending to patients at PHC facilities in Nigeria.

While AMR knowledge and prescribing practices have been studied in tertiary and secondary care in Nigeria, there is limited qualitative evidence on how PHC providers, particularly CHEWs, understand and operationalize antimicrobial stewardship in routine care. To this end, in this study, we conducted key informant interviews (KIIs) with PHC providers in Cross River State to explore antibiotic prescribing behaviours, knowledge of AMR, influencing factors, and recommendations for AMS. The interview guides used in this study (see Appendix) were developed by the research team specifically for the purposes of this study and have not been previously published elsewhere. Following these interviews, we provide suggestions on how to approach the problem of AMR in Cross River State and beyond.

Methodology

Study setting

Cross River State has a population of 3,866,300 people [15] who are served by 1,028 publicly owned health facilities made up of 3 tertiary level facilities (or 0.3% of public facilities), 16 secondary level facilities (or 1.6% of public facilities) and 909 primary level facilities (or 88.4% of public facilities) comprising 722 health posts, 269 PHCs and 18 comprehensive health centres (CHCs). Approximately 70% of clients in CRS access care from public facilities, and most of antibiotics are prescribed by health professionals. Cross River State is divided into three zones, North, South and Central, with each zone having six local government areas (LGAs).

Study design

A phenomenological study using Key Informant Interviews (KIIs) was conducted between July to August 2024 in Cross River State. Frontline healthcare workers from the PHCs (comprising 26.2% of public facilities) across the state were selected using purposive sampling.

Sampling procedure

Eleven LGAs were randomly selected from the eighteen LGAs in Cross River State. In selected LGAs, the more functional PHCs were purposively selected to capture variation in service delivery contexts, health system functionality, urban vs rural population coverage, rather than to achieve geographic representativeness by district. In this study, functional PHCs were defined as facilities that had at least one qualified health worker on duty, provided routine outpatient services, maintained basic drug supplies, and recorded regular patient attendance at the time of data collection.

Selection of respondents

Participants were selected based on their roles within the PHC that directly relate to AMS including prescribing, laboratory services, dispensing, and supervisory responsibilities.

Most interviews were conducted with frontline providers who had direct responsibility for antibiotic prescribing, primarily CHEWs, while the other participants occupied supervisory or support roles and did not routinely prescribe antimicrobials.

Data collection

Data were collected through face-to-face KIIs. KIIs lasted approximately 15–60 minutes using a pre-tested KII guide developed by the research team. Probing techniques were used to deepen understanding of participants' experiences regarding prescribing behaviors, knowledge of AMR, influencing factors prescription practice (facilitators and barriers) within their facilities. The research team comprised public health researchers with prior training and experience in qualitative research methods. The researchers reflected on their professional backgrounds and assumptions throughout data collection and analysis to minimise potential bias and enhance analytical reflexivity. To minimise power imbalances within primary healthcare settings, interviews were conducted in private spaces in PHC facilities, participants were assured of confidentiality, interviewers emphasised that there were no right or wrong answers, that participants were free to decline to answer questions that they were not comfortable with, and that participation would not affect employment or supervision.

Interviewers had no supervisory or managerial relationship with research participants, and reflexive discussions were held within the research team to consider how professional positioning might influence data generation and interpretation.

Data analysis

All interviews were audio-recorded, transcribed manually and verbatim, and cross-checked for accuracy. A thematic analysis approach was applied, and NVivo software was used to organize, manage, and code the data. Through iterative review, the analysis produced six major themes and sixteen subthemes. Verbatim quotations were used to illustrate each theme and ensure that findings remained grounded in participants' actual experiences. This study was reported in alignment with the Standards for Reporting Qualitative Research (SRQR).

Ethical Approval

This study was conducted in compliance with the Declaration of Helsinki. Ethical approval was obtained for this study from the CRS Health Research Ethics Committee. The approval certificate identifier was CRS/MH/HREC/023/Vol.V1/255.

All participants were informed about the objectives, procedures, potential risks, and benefits of the study before enrolment. Participation was entirely voluntary, and participants were assured that refusal to participate or withdrawal from the study at any stage would not affect their employment, professional responsibilities, or access to any benefits. Written informed consent was obtained from all participants prior to data collection, including consent for audio recording of interviews. All interviews were conducted in private settings, and participants' confidentiality and anonymity were maintained throughout the study by removing personal identifiers from transcripts and reports.

Results

Numerical references are used to reflect thematic salience rather than prevalence. An in-depth thematic analysis of 29 semi-structured key informant interviews with frontline healthcare workers in PHC facilities across Cross River State was conducted. Themes were examined across cadres to explore similarities and differences in antibiotic prescribing behaviours, knowledge of antimicrobial resistance (AMR), influencing factors, perceived barriers, and recommendations for antimicrobial stewardship (AMS). Where relevant, variations in perspectives by cadre are highlighted to inform targeted interventions.

Profile of participants

Table 1 provides profiles of the 29 respondents. Interviews spanned 11 LGAs. Experience ranged from 6 months to 32 years (median ~5 years). Interviews (lasting 15–60 minutes) were audio-recorded with consent, transcribed verbatim, and anonymised. The respondents were all involved in prescribing antimicrobials.

Table 1: Profile of participants

Code number	Facility / LGA	Experience	Key Responsibilities (in addition to prescribing antimicrobials by some)
P1	Facility A, Biase	6 months	Oversight of facility, education
P2	Facility B Biase	2 years	Prescribing, operations
P3	Facility A, Akpabuyo	>4 years	Clinical supervision of CHEWs
P4	Facility B, Akpabuyo	4 years	Facility management
P5	Facility A, Abi	8 months	Family planning
P6	Facility B, Abi	9 years	Prescribing
P7	Facility B, Akpabuyo	11 years	Antenatal, delivery
P8	Facility C, Abi	~28 years	Training, oversight of facility
P9	Facility A, Yakurr	2 years	Patient management
P10	Facility B, Yakurr	~4 years	Administration
P11	Facility C, Yakurr	>12 years	Prescribing
P12	Facility D, Yakurr	2 years	Immunization, delivery/midwifery?
P13	Facility D, Yakurr	3 years	Prescribing
P14	Facility E, Yakurr	12 years	Case management
P15	Facility F, Yakurr	10 years	LGA coordination
P16	Facility G, Yakurr	6 years	Dispensing drugs
P17	Facility A, Ogoja	>5 years	Case management
P18	Facility B, Ogoja	Not stated	Midwifery
P19	Facility C, Ogoja	1 year	Facility oversight
P20	Facility D, Ogoja	2 years	Facility Oversight
P21	Facility A, Obubra	4 years	Prescribing
P22	Facility A, Biase	32 years	Supervision of CHEWs
P23	Facility B, Obubra	2 years	Dispensing of drugs
P24	Facility A, Boki	Not stated	Prescribing
P25	Facility A, Akampka	2 years	ANC, delivery/midwifery
P27	Facility B, Akampka	8 years	PHC oversight
P27	Facility A, Odukpani	14 years	Diagnosis
P28	Facility A, Odukpani	>5 years	Clinic activities
P29	Facility A, Yala	>10 years	Labour, ANC

OIC: officer-in-charge, FP: Focal Person, CHO: Community Health Officer, ANC: Antenatal care, M&E: Monitoring and evaluation, RNM: Registered Nurse Midwife

Thematic Findings

The iterative coding process yielded 170 open codes, 34 axial categories, 16 sub-themes, and six main themes. The iterative process is a, non-linear, and, reflexive process that allows for continuous cycling back through data, coding, and analysis to deepen understanding and refine themes [16]. Figure 1 illustrates the thematic findings. Saturation occurred by transcript 24. Trustworthiness was enhanced through thick description, audit trails, and member-checking.

Figure 1: Themes identified

The six main themes identified were: i) Knowledge of AMR, ii) Prescribing Practices and Decision-Making, iii) Training and Guidelines, iv) Barriers to appropriate prescribing, v) interventions for improvement, and vi) Policy and System-level recommendations. These are described next:

Theme 1: Knowledge of AMR

Participants exhibited some level of conceptual understanding, defining AMR as diminished drug efficacy due to behavioral misuse of antibiotics or biological adaptation of the organism to prescribed antibiotics. Knowledge was practical but often lacked microbiological depth except among laboratory

staff.

"Antibiotic resistance is the inability of the body or the antibiotic to treat a particular ailment... due to overuse or underuse or misuse of an antibiotic." - Participant 21

"Antibiotic resistance scientifically is a condition whereby some clients or patients have taken some of these drugs... and these drugs are taken and at a point in time, the drugs do not effectively act on the individuals to give them results." - Participant 24

"Antibiotic resistance... you prescribe antibiotics to a patient and discover that... that very one is not working on that patient's body." - Participant 11

"The organism develops resistance... through mutation or gene transfer." - Participant 27

Definitions and mechanisms: Overwhelmingly attributed to overuse/misuse incomplete doses, or microbial evolution.

"When the drug is abused especially by the doses... and the time limits." - Participant 2

"When a patient or somebody abuses the drug... at a point that you supposed to take it, it doesn't work." - Participant 27

"Anti-biotic resistance... when anti-biotic is not properly taken, it does not have effect... when it is over taken, it may cause anaemia." - Participant 17

Perceived causes of self-medication

"The high rate of antibiotics resistance is from patent medicine... no trained health worker will under prescribe or over prescribe." - Participant 21

"Some companies manufacture a lot of fake drugs... patient comes back, 'I'm feeling worse.'" - Participant 5.

"Patent medicine dealers... they are doing more harm than good." – Participant 23

Theme 2: Prescribing practices and decision-making

Prescribing was protocol-based with workers prioritising diagnostic modalities but providing treatment when diagnostic tests were not possible. This reveals a clear tension between health providers' commitment to cautious antibiotic use and their reliance on routine empirical prescribing under everyday service constraints.

"We start from the minor antibiotics... according to the age and the weight." - Participant 11

Diagnostic approach: Standing orders guided all prescriptions; laboratory investigations remained aspirational at times.

"You can't start running a health facility without the use of antibiotics, so I do prescribe [antibiotics]... their correct dosage [based on the standing order] form and in the correct amount." - Participant 21

"If a child comes with difficulty in breathing and cough... this type of antibiotic, the dosage according to the age and weight... it is written and pasted [in the standing order]." – Participant 23

"Before you prescribe any drug, you must have gone through some analysis... laboratory... culture and sensitivity." – Participant 24

"Swab test... that they use to know the drug that they will use to treat that particular infection." - Participant 27

Cautious attitudes

"As a professional you must not follow their wish, you must go through the guidelines." - Participant 21

"I hardly prescribe anti-biotic for patients... only when necessary." - Participant 1

"We follow standing order... except there's need, do not give." - Participant 28

Influencing Factors: Patient misconceptions and drug availability shaped decisions.

"Patients believe that any ailment... must be added antibiotics... you must add amoxicillin." -Participant 21

"We buy drugs by ourselves... when drugs are not provided." - Participant 13

"Considering the distance... you ask the patient to go and buy drugs." - Participant 25

Theme 3: Training and guidelines

Standing orders, standard operating procedures (SOPs) and personal resources anchored practice; formal AMR training was sparse.

"I use my standing order." - Participant 27

Sources

- Standing orders/SOPs
- Workshops

"We have SOPs... and also research, online research." - Participant 14

"Through trainings... if there's any new antibiotics online that's when we will know." - Participant 1

Infrequency of trainings and lack of specificity.

"I don't remember when last the training was done... I don't know if I'm up to date." -Participant 28

"We have workshops, conferences... but it could be outside Okundi." - Participant 24

Theme 4: Barriers to appropriate prescribing

Participants identified multiple barriers that constrained appropriate antibiotic prescribing within primary health care settings. These barriers operated at structural, community, and clinical levels and often interacted to undermine adherence to recommended prescribing guidelines.

Structural barriers

Structural constraints such as drug stockouts, inadequate staffing, and patients' inability to afford care were frequently described as major challenges. Participants explained that inconsistent availability of essential medicines disrupted prescribing practices and forced patients to seek drugs outside the formal health system.

"They need to find the drugs from the chemist before they come, because most times the drugs are not available in the facility." -Participant 27

Financial hardship among patients was also reported to limit access to appropriate investigations and treatments, leading to compromised clinical decisions.

"Somebody will be coming without money, and some cases are supposed to be handled properly, but because of finances we cannot do everything that is required." -Participant 9

External influences: patent medicine vendors and herbal practitioners

Beyond facility-level constraints, participants expressed concern about the widespread activities of patent medicine vendors and unqualified individuals promoting herbal remedies within communities. These actors were perceived to undermine appropriate prescribing practices by providing antibiotics and injections without proper training or regulation.

"Patent medicine stores are not supposed to be administering injections, but they do, and it has caused untimely deaths." -Participant 24

Another participant emphasised that community members often relied on untrained individuals for treatment, further complicating efforts to promote rational antibiotic use.

"A lot is happening in the communities, and that person is not a medical doctor, he's not trained." -Participant 22

Clinical and diagnostic gaps

Limited diagnostic capacity was also identified as a significant clinical barrier. Participants reported that the absence of laboratory support increased diagnostic uncertainty and encouraged empirical antibiotic prescribing.

"When diagnosis is not done, you find it difficult to know what exactly to prescribe." -Participant 15

Theme 5: Interventions for improving prescribing practices

Participants suggested a range of interventions aimed at addressing the identified barriers and improving antibiotic prescribing practices. These interventions targeted health worker capacity, availability of resources, and community engagement.

Capacity building and routine training

Regular training and continuing professional development were frequently proposed as essential strategies for improving knowledge and practice related to antimicrobial stewardship. Participants emphasised that training should involve all cadres of health workers and be conducted routinely.

"There should be workshops and seminars for health workers, so that everybody will understand how antibiotics should be used." - Participant 8

Another participant highlighted the need for structured and periodic training programmes.

"Quarterly training of all cadres of health workers will really help." -Participant 25

Resource provision: drugs and laboratory services

Ensuring consistent availability of essential medicines and basic laboratory services was also identified as critical. Participants noted that improved access to drugs and diagnostics would support rational prescribing and reduce dependence on informal drug sources.

"Government should assist the PHCs by providing essential drugs, so that patients don't have to go outside to buy them."-Participant 27

Community engagement and sensitisation

Participants emphasised the importance of engaging communities to improve understanding of appropriate antibiotic use. Public awareness campaigns were seen as a way to reduce misconceptions and patient-driven pressure on health workers.

"Campaigns should be done for sensitisation and mobilisation, so the community will understand how antibiotics should be used."-Participant 21

Theme 6: Policy and system-level recommendations

Participants proposed several policy- and system-level actions to strengthen antimicrobial stewardship and improve prescribing practices within primary health care.

Regulatory enforcement

Weak enforcement of existing regulations governing the sale and distribution of antibiotics was a major concern. Participants called for stricter monitoring and regulation of patent medicine vendors to curb inappropriate access to antibiotics.

"There should be policies that restrict patent medicine dealers from selling antibiotics freely, and those policies should be enforced."-Participant 21

Strengthening primary health care through human resources

Participants highlighted the shortage of skilled personnel, particularly medical doctors, in primary health care facilities. They suggested that strengthening human resources would improve clinical oversight and prescribing decisions.

"Give us a medical doctor in the primary health care, because it will help in decision-making."- Participant 21

Ensuring drug quality

Concerns were also raised about the quality of medicines in circulation. Participants recommended stronger regulatory oversight to ensure that only safe and authentic drugs reach health facilities and communities.

"There should be policies to ensure that only registered and authentic drugs are distributed."-Participant 27

Discussion

Knowledge of AMR

The healthcare workers in this present study exhibited a behavioural and experiential understanding of AMR predominantly, defining it as a loss of drug effectiveness caused by overuse, under-use, incomplete courses/regimen, self-medication, patent medicine vendors, and substandard drugs. This is also consistent with studies by Engler et al [17] and Weier et al. [18], where participants similarly emphasized misuse and external factors shaping AMR. A recent multi-country survey across 28 African nations further corroborates this, revealing that while 68% of pharmacy workers recognized AMR as a growing threat, only 22% could accurately describe mechanisms like selective pressure, with attributions to patient behaviors dominating [19]. In the West and East African contexts, only fewer than 15% of non-laboratory staff could describe microbiological mechanisms such as selective pressure, mutation, or horizontal gene transfer [19], a figure echoed in a systematic review of 64 studies from 12 WHO African Region countries, which documented widespread suboptimal knowledge among healthcare workers, with self-medication and vendor sales cited several cases [20]. This superficial grasp/knowledge of AMR persists despite increasing national awareness campaigns, likely due to the heavy reliance on short-term workshops rather than integrated curricula, as highlighted in a meta-analysis of 39 African studies showing pooled knowledge prevalence at just 55% among healthcare providers [21].

In contrast, a well-resourced systematic training-based intervention in South Africa has changed the knowledge of hospital nurses, and similar could be relevant to Nigerian PHCs in CRS. South Africa's "Best Care Always" initiative, backed by annual allocations exceeding 1% of the health budget, has embedded AMR modules into routine in-service training, resulting in 62% of nurses demonstrating improved mechanistic understanding in post-intervention audits [22]. Similarly, Kenya's national AMR surveillance curriculum, rolled out since 2017 with Fleming Fund support totalling over \$10 million, has trained over 500 healthcare workers yielding a 40% increase in microbiological knowledge scores [23]. In Botswana, integration of AMR education into the Medical Education Partnership Initiative (MEPI) has leveraged \$150 million in U.S. funding to enhance postgraduate training, contrasting sharply with Nigeria's fragmented approach [24].

Prescribing practices and decision-making

Most participants in the CRS study reported initial adherence to the Nigerian Standard Treatment Guidelines [25] and CHEW standing orders for PHC, emphasizing symptom-based algorithms and weight/age-adjusted dosing (for infants) for common conditions like respiratory infections and diarrhea. However, nearly all participants candidly described frequent rational deviations from these protocols, driven by entrenched structural barriers such as chronic drug stock-outs. This duality- protocol-informed intent clashing with lack of knowledge, training and resource-driven initiatives (based on availability of

antibiotics) - is a hallmark of prescribing in Nigerian PHC settings, as evidenced by a study in Akwa Ibom State, where it was reported that antibiotic prescriptions did not align with WHO guidelines. That said, Access-group antibiotics comprised 58% of total prescriptions, close to the recommended 60% threshold. Similarly, a point-prevalence survey across urban secondary and tertiary facilities in Lagos, Nigeria revealed that most pediatric outpatients received antibiotics which were non-compliant with national guidelines, attributing deviations to unavailability of first-line options [26].

When taken together, the findings point to a reinforcing cycle in which limited training, inconsistent supervision, and weak regulation of medicine vendors shape routine antibiotic use at primary healthcare level. Rather than isolated deficits, these factors interact to normalise empirical prescribing practices and constrain the uptake of AMS principles.

Patient expectations are perceived by health workers as a key influencing factor with many participants citing demands for "strong" antibiotics or injectables. This is perceived to be rooted in misconceptions that all fevers require antibiotics, leading to reputational risks if demands are unmet (e.g. "if I don't give, they'll go to the chemist for injections"). This demand-side pressure concurs with West African studies, such as a 2023 mystery-client audit in Ghana where about two-thirds of simulated viral cases received antibiotics due to simulated parental insistence, mirroring Nigeria's high rate [27, 28]. These findings illuminate a prescribing ecosystem in Cross River PHCs where guideline adherence is aspirational yet routinely not followed. The consistency with broader Nigerian and West African evidence contrasts with East African successes, where diagnostic investments and vendor regulations have curbed deviations [29, 30]. Targeted interventions, such as subsidised rapid diagnostics and community education to temper expectations, are required to align practice with intent and mitigate AMR acceleration.

Training and guidelines

Standing orders pasted on clinic walls and decades-old pharmacology textbooks constituted the main knowledge backbone for most participants; fewer than one-third could recall any AMR-specific training in the past five years. This training gap is consistent with recent studies showing that irrational prescription of antibiotics among Nigerian PHC workers persisted due to little or no AMS trainings or lack of dedicated AMS education [14]. In contrast, Zambia's Primary Healthcare AMS programme, launched in 2019 with Global Fund support, has delivered quarterly on-site mentoring to more than 85 % of facilities and reduced inappropriate prescribing [31]. In Nigeria, AMR is still absent from the Minimum Standards for Primary Health Care, from the National Health Management Information System indicators, and from the PHC monitoring tools [32, 33].

Barriers to appropriate prescribing

Three interlocking barrier clusters emerged: structural (chronic stock-outs, under-staffing, user fees/poverty) and external (unregulated patent medicine vendors and people who administer injections). Drug stock-outs forcing patients into the informal market were mentioned by more than two-thirds of the participants. This figure is higher than in most other African studies, perhaps because Nigeria's Essential Medicines List procurement is devolved to several local governments, which have highly variable capacity and corruption risks [34]. The dominance of informal vendors, weak regulations and policy enforcements, inadequate diagnostic capacity, human resource funding shortage, and insufficient AMS programmes all contribute to limited AMS in Nigerian health facilities [12]. These findings are consistent with a study by Obasanya et al [32] who stated that the lack of functional AMS structures were barriers to appropriate prescribing. Similarly, a study in Nigeria [33] found inadequate stewardship programmes in Nigeria with poor regulation of antimicrobial agents, improper empirical prescriptions, inadequate infection prevention practices, arbitrary use of antibiotics in food-producing animals, and insufficient surveillance programmes contributed to the problem of AMR in Nigeria's healthcare system [33].

These findings reflect broader political economy dynamics within Nigeria's PHC system. Weak regulation of proprietary and patent medicine vendors persists in part due to fragmented oversight and reliance on informal medicine markets to meet unmet demand. At the same time, inconsistent PHC drug financing limits facilities' ability to ensure reliable antibiotic supply, reinforcing dependence on external vendors. Decentralisation further diffuses accountability across federal, state, and local levels, complicating stewardship implementation and enforcement.

Interventions for improvement

Participants' suggestions-regular hands-on training with per diems, uninterrupted drug supply, functional laboratories, point-of-care tests, and mass media/community sensitization are the same as packages that have succeeded elsewhere. Kenya's multi-component intervention (training plus audit/feedback plus SMS reminders plus patient leaflets) reduced antibiotic use in public facilities [35]. South Africa's "Best Care Always" campaign combined similar elements and achieved sustained declines in PHC antibiotic consumption [22]. Rwanda's community healthcare worker programme, which now incorporates AMR messaging, has contributed to low antibiotic consumption [36]. The fact that Nigerian frontline healthcare workers independently arrive at the same recipe underscores the transferability of these evidence-based models.

Several of the barriers identified could be addressed through existing financing mechanisms. The Basic Health Care Provision Fund offers an opportunity to embed antimicrobial stewardship within routine PHC operations, including training, supervision, and basic diagnostic capacity. Similarly, strengthening State Drug Revolving Funds could stabilise antibiotic supply chains, reducing reliance on informal vendors and supporting more rational prescribing practices.

Policy and system-level recommendations

The strongest policy demand was for decisive regulation of patent and proprietary medicine vendors (PPMVs), including outright bans on antibiotic sales-an idea that has been repeatedly proposed in Nigeria. Rwanda, by contrast, successfully implemented graduated regulation without major political backlash because the informal sector was smaller and less organised at the time of reform [29]. Calls for posting medical doctors to PHCs and upgrading standing orders reflect frustration with the current task-shifting model that leaves CHEWs bearing full prescribing responsibility with minimal support. The sentiment expressed by the study respondents - demanding the deployment of medical doctors to PHC facilities and the revision of outdated standing orders- captures

a significant frustration with Nigeria's long-standing task-shifting model. This model is a pragmatic response to chronic physician shortages, which delegates a disproportionate burden of clinical decision-making to non-physician cadres [37, 38]. While task-shifting has undeniably expanded access to basic services in a country where the doctor-to-patient ratio hovers at a dismal 1 to over 9,000-far below the WHO's recommended 1:1,000. However, it often leaves these mid-level workers operating as de facto prescribers without adequate supervision, diagnostic tools, poor training and re-training or updated protocols [39].

The frustration is not merely logistical but existential: these workers feel overburdened, under-resourced, and exposed to ethical risks, as they bear full responsibility for outcomes without the clinical acumen or support structures afforded to physicians [40]. Upgrading standing orders represents a call for evidence-based evolution, incorporating local AMR surveillance data, WHO AWaRe classification, and stewardship principles to mitigate misuse [41]. Without such reforms, the model perpetuates a cycle of irrational prescribing, eroding trust in PHC and driving patients to unregulated informal sectors.

Real-world studies underscore this frustration, revealing how task-shifting amplifies prescribing errors, knowledge gaps, and AMR risks while highlighting the urgent need for physician integration and protocol modernization. These recommendations find powerful national-level corroboration in a 2021 cross-sectional survey of 358 healthcare workers across all six geopolitical zones (including primary, secondary, and tertiary facilities), which documented only fair-to-moderate AMR knowledge overall that was significantly worse in primary health centres and among non-physician cadres [42]. Critically, this lower knowledge in PHC settings, where task-shifting forces CHEWs and nurses to prescribe in the absence of doctors, directly translated into higher rates of inappropriate practices: 76% prescribed antibiotics for sore throats, 38% for measles, and over 60% admitted defensive prescribing "just to be on the safe side," despite 71% claiming moderate-to-frequent guideline use [42]. The authors explicitly attributed these gaps to physician shortages in lower-tier facilities and outdated or inaccessible guidelines, recommending nationwide AMS programmes, improved PHC staffing and training, evidence-based guideline updates, and state-specific behaviour-change interventions. These recommendations align with the demands of participants from this present study.

Strengths and limitations

- This study has some strengths and limitations. The strengths include the wide geographic coverage achieved across a large state, inclusion of the cadres who perform more than 95% of prescribing in Nigerian PHCs, achievement of saturation, and adherence to qualitative methodology. An additional strength is the qualitative insight in the study that facilitates an understanding of behaviour and systems, particularly where routine data are weak.

Limitations include the modest sample size, likely social desirability bias, and the inability of a single cross-sectional qualitative study to quantify actual prescribing volumes or to measure change over time.

Conclusion

This study showed that healthcare workers in Cross River State PHCs know the dangers of AMR and do want to prescribe antibiotics correctly. However, they face daily obstacles: medicines are often missing, diagnostic tests are unavailable, training is rare, and unregulated vendors sell any antibiotic. Recommendations from the participants include regular training, steady drug supply, functional laboratories, community education, deployment of doctors to PHCs, updating of the CHEW standing orders and other guidelines, and strict control of patent medicine vendors. These strategies are practical and have yielded benefits in other African countries such as Kenya and Rwanda. Greater political will and better funding for State Ministries of Health and AMR coordinating bodies are key ingredients to addressing the issue of AMR in Nigeria and similar contexts.

Abbreviations

AMR Antimicrobial resistance

AMS Antimicrobial stewardship

CHC Comprehensive Health Centre

CHEWs Community Health Extension Workers

KII Key Informant Interview

MEPI Medical Education Partnership Initiative

PHC Primary Health Centre

PPMV Patent and Proprietary Medicine Vendor

SRQR Standards for Reporting Qualitative Research

WHO World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Health Research Ethics Committee of the Cross River State Ministry of Health, Calabar. Verbal informed consent was obtained from all participants prior to data collection, and all processes in this study were performed in line with the Declaration of Helsinki.

Consent for publication

Not applicable (no individual person's data, images, or identifying details are reported).

Availability of data and materials

The datasets used will be available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Authors' contributions

AAO, OCO, and UAU conceived and designed the study. OCO, UMJU, JI, EEE, BE, FA and JW were responsible for data curation and formal analysis. OCO, AAO, UMJU, JI, and UAU prepared the original draft of the manuscript, while BE, EEE, FA, and JW contributed to reviewing and editing the manuscript. All authors contributed to the final revision, approved the final version for publication, and meet the ICMJE authorship criteria.

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Figures

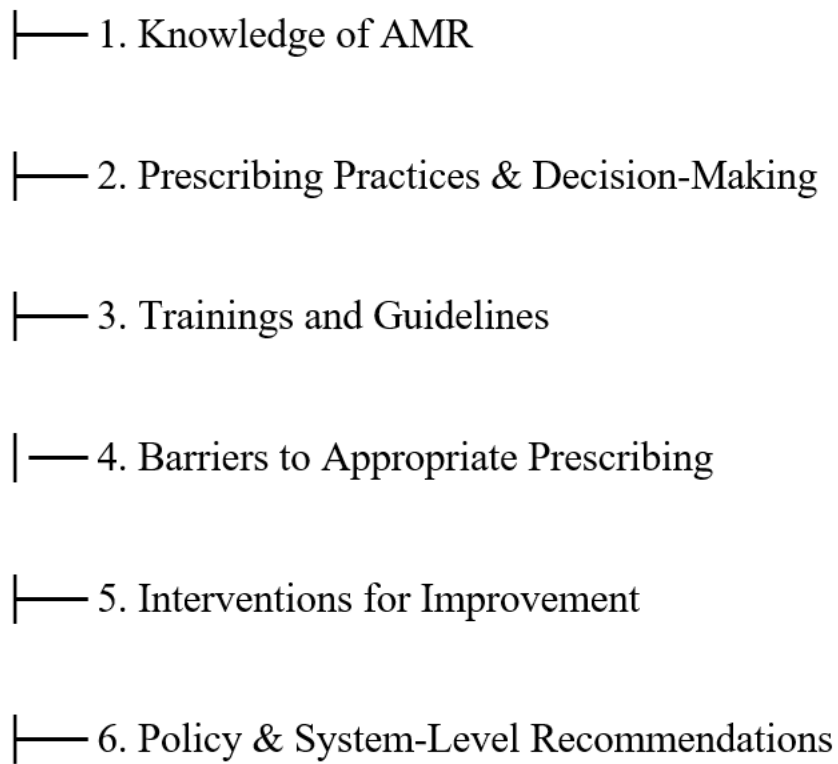
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1. Knowledge of AMR
 2. Prescribing Practices & Decision-Making
 3. Trainings and Guidelines
 4. Barriers to Appropriate Prescribing
 5. Interventions for Improvement
 6. Policy & System-Level Recommendations

Figure 1

Themes identified

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