



Knowledge, Attitudes, Practices, and Implementation of Nigeria's Chloroquine Withdrawal Policy in a Federal University Community

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Abstract

Chloroquine was withdrawn from first-line malaria treatment in Nigeria because of widespread *Plasmodium falciparum* resistance and was replaced by artemisinin-based combination therapies (ACTs). Nevertheless, continued access to and use of chloroquine may weaken implementation of the withdrawal policy. This study assessed implementation of the policy by examining knowledge, attitudes, practices, barriers, and predictors of compliant malaria treatment. A convergent mixed-methods cross-sectional survey was conducted among 456 students and staff of David Umahi Federal University of Health Sciences, Ebonyi State, Nigeria. Quantitative data were analysed in Stata version 17 using descriptive statistics, Pearson's chi-square test, and multivariable logistic regression, with statistical significance set at $p < 0.05$. Open-ended responses were analysed thematically. Policy implementation was incomplete: 44.1% of respondents had low compliance, 47.1% moderate compliance, and 8.8% high compliance. Occupation was associated with knowledge ($p < 0.001$), while attitude was associated with treatment practice ($p < 0.001$). Higher knowledge predicted positive attitudes (AOR = 1.74, 95% CI: 1.56–1.94) and compliant practices (AOR = 1.18, 95% CI: 1.08–1.29). Major barriers were inadequate public awareness, continued chloroquine availability, weak enforcement, and limited affordability of ACTs. Nigeria's chloroquine withdrawal policy remains only partially implemented in the study setting. Coordinated public education, regulatory enforcement, affordable access to ACTs, and training of healthcare providers and medicine vendors are required to improve compliance.

Keywords: Artemisinin-based combination therapies, chloroquine, drug resistance, malaria, Nigeria, policy compliance

Introduction

Malaria remains a major public health burden in Nigeria and contributes substantially to outpatient attendance, hospital admissions, treatment costs, and loss of productive time [1–4]. In Ebonyi State, reported prevalence was 56.8% by rapid diagnostic test and 38.6% by microscopy [3]. Effective malaria case management requires prompt diagnosis and treatment with medicines that remain effective against circulating *Plasmodium falciparum* parasites [4,5].

Chloroquine was historically favoured because it was affordable, accessible, and easy to administer [6]. Widespread *P. falciparum* resistance, however, led Nigeria to withdraw chloroquine as first-line treatment for uncomplicated malaria in

2005 and adopt artemisinin-based combination therapies (ACTs) [4,7,8]. Although reduced chloroquine use has been associated with the return of chloroquine-sensitive parasite strains in some African settings, reintroduction would require current evidence of therapeutic efficacy and strong safeguards against renewed resistance [9–12].

Implementation of a medicine-withdrawal policy depends on more than publication of treatment guidelines. Public understanding, medicine affordability, provider adherence, enforcement, and control of formal and informal drug markets influence whether recommended therapies are used [13–16]. Continued chloroquine availability, self-medication, and uncertainty about treatment guidance may therefore sustain a gap between national policy and community practice. Evidence on this implementation gap remains limited in Ebonyi State.

This study aimed to assess implementation of Nigeria's chloroquine withdrawal policy among students and staff of David Umahi Federal University of Health Sciences by evaluating their knowledge, attitudes, malaria treatment practices, implementation barriers, and factors associated with compliant practice.

Materials and Methods

Study design

A convergent mixed-methods cross-sectional Knowledge, Attitude, and Practice study was conducted. Quantitative and qualitative data were collected concurrently through closed-ended and open-ended questionnaire items, analysed separately, and integrated during interpretation to explain the measured patterns of policy knowledge, attitudes, practices, and implementation barriers.

Study setting

The study was conducted within the David Umahi Federal University of Health Sciences (DUFUHS) community, located in Ohaozara Local Government Area (LGA), Ebonyi State, Nigeria. Ebonyi State lies in the South-East geopolitical zone of Nigeria and is bordered by Benue State to the north and North-East, Enugu State to the west, Cross River State to the east and South-East, and Abia State to the South-West. The state has an estimated population of approximately 2.9 million people and is predominantly agrarian, with farming as the major occupation. Ebonyi State is one of Nigeria's leading rice-producing regions due to its swampy and water-logged lowlands, which also favour mosquito breeding and sustained malaria transmission [17].

Study population

The study population comprised students and academic and non-academic staff of David Umahi Federal University of Health Sciences, including participants from health-related and non-health-related disciplines. This population provided a diverse university community with differing exposure to health information, malaria treatment, and medicine-use practices, allowing comparison of policy knowledge, attitudes, and practices across occupational groups.

Study period and data collection

Data were collected between October and December 2025 using a self-administered online questionnaire developed on Google Forms. The survey link was distributed electronically through student and staff communication channels, including WhatsApp groups and individual messages to eligible participants within the DUFUHS community.

Sample size determination

The minimum sample size was estimated using Cochran's formula for cross-sectional studies, as shown in Equation 1:

$$n = \frac{Z^2 p(1-p)}{d^2} \dots \text{Equation 1}$$

where n is the minimum required sample size, Z is the standard normal deviate at a 95% confidence level (1.96), p is the estimated prevalence of adequate knowledge or compliance with the chloroquine withdrawal policy, and d is the margin of error [18]. In the absence of a prior population estimate, a

conservative prevalence of 50% ($p = 0.50$) and a margin of error of 5% ($d = 0.05$) were used. Substitution of these values into Equation 1 gave Equation 2:

$$n = \frac{(1.96)^2 (0.50)(1-0.50)}{(0.05)^2} = 384 \dots \text{Equation 2}$$

To account for potential non-response and incomplete questionnaires, a 20% adjustment was applied, resulting in a target sample size of 461 participants. Google Form settings required completion of core questionnaire items before submission, and responses were checked for completeness before analysis. A total of 456 completed responses were included in the final analysis.

Data collection instrument

Data were collected using a structured, researcher-developed questionnaire comprising six sections.

Section A (Socio-demographic characteristics) contained 5 items assessing participants' age, sex, marital status, educational level, and occupation.

Section B (Knowledge of chloroquine withdrawal policy and malaria treatment) contained 10 items with three response options (True, False, and Not Sure). Correct responses were scored as 1, while incorrect and "Not Sure" responses were scored as 0, giving a total score ranging from 0 to 10. Knowledge was categorised as poor (0–4), moderate (5–7), or good (8–10).

Section C (Attitudes toward the malaria treatment policy) contained 4 items assessing participants' perceptions of the effectiveness of the chloroquine withdrawal policy, policy enforcement, preference for artemisinin-based combination therapies (ACTs), and opinions on the continued sale of chloroquine. The section included closed-ended and open-ended questions.

Section D (Malaria treatment practices) contained 5 items assessing the antimalarial drugs used, sources of treatment, consultation with healthcare professionals, continued prescription of chloroquine, and awareness of the risks associated with chloroquine use.

Section E (Challenges in policy implementation) contained 3 items assessing perceived barriers to implementation, accessibility of ACTs, and cultural or traditional factors influencing the adoption of recommended malaria treatment.

Section F (Recommendations) contained 2 items: one multiple-response item and one open-ended question, to obtain participants' suggestions for improving the implementation of the chloroquine withdrawal policy.

Questionnaire development and validation

The questionnaire was developed from Nigeria's National Malaria Treatment Guidelines, World Health Organisation malaria policy recommendations, and relevant literature [19,20]. Face and content validity were established through expert review by malaria researchers, public health specialists, and pharmacology academics, and the questionnaire was revised based on their feedback.

The revised questionnaire was pilot tested among 20 respondents from a similar population to assess clarity and comprehension. Ambiguous items were reworded, response options refined, and the questionnaire sequence improved.

Internal consistency was assessed for the 10-item knowledge scale using Cronbach's alpha ($\alpha = 0.669$). A single reliability

coefficient was not calculated for the attitude, practice, barrier, and recommendation sections because they contained heterogeneous indicators or stand-alone categorical and open-ended items rather than unidimensional multi-item scales. The final questionnaire incorporated revisions arising from expert review and pilot testing.

Sampling and data collection procedure

Eligible students and staff (academic and non-academic) of the David Umahi Federal University of Health Sciences (DUFUHS) were recruited using convenience sampling. A self-administered questionnaire was developed using Google Forms and distributed electronically through institutional communication platforms between October and December 2025. Before completing the questionnaire, participants were informed about the purpose of the study, and electronic informed consent was obtained. Participation was voluntary, anonymous, and restricted to one response per participant. Completed questionnaires were checked for completeness before analysis.

Variables, definitions, and scoring

Outcome measures

The primary outcome measures were knowledge of the chloroquine withdrawal policy, attitudes toward malaria treatment policy, and malaria treatment practices. Although these constructs were interrelated, each outcome was analysed independently. Accordingly, separate multivariable logistic regression models were fitted for each outcome variable, with socio-demographic characteristics, healthcare-seeking behaviour, malaria prevention practices, and other relevant explanatory variables included as predictors, as appropriate.

Independent variables

Explanatory variables included socio-demographic characteristics (age, sex, marital status, educational level, and occupation), knowledge of chloroquine withdrawal and malaria treatment policy, attitudes toward malaria treatment, malaria treatment practices, healthcare-seeking behaviour, accessibility of artemisinin-based combination therapies (ACTs), awareness of chloroquine-related risks, use of malaria prevention measures, and perceived barriers to policy implementation. All variables were derived from responses to the structured questionnaire and analysed in categorical or binary form as appropriate.

Knowledge score

Knowledge of chloroquine withdrawal and malaria treatment policy was assessed using 10 items. Correct responses were scored as 1, while incorrect or “not sure” responses were scored as 0, yielding a total score ranging from 0 to 10. Knowledge scores were categorised as poor (0–4), moderate (5–7), or good (8–10).

Attitude score

Attitudes toward malaria treatment policy were assessed using items measuring perceived effectiveness of the chloroquine withdrawal policy and preference for ACTs over chloroquine. Responses were aggregated into a composite score and categorised as negative, neutral, or positive attitude.

Practice indicators

Malaria treatment practice was evaluated from reported drug choice, consultation with a healthcare professional, and chloroquine avoidance. Compliant practice was defined as use of an ACT for malaria treatment, consultation with a healthcare professional, and avoidance of chloroquine. Participants who did not meet all three criteria were classified as having non-compliant practice.

Policy compliance index (PCI)

A Policy Compliance Index (PCI) was constructed by integrating standardised knowledge, attitude, and practice scores and accounting for reported implementation barriers. Scores ranged from 0 to 100 and were categorised as low (<40), moderate (40–69), or high (≥ 70) compliance. Because the PCI was developed for this study, it was interpreted as an exploratory implementation measure.

Data analysis

All completed questionnaires were checked for completeness and internal consistency before analysis. Variables were retained in their original categorical form or recoded where necessary to meet the assumptions of the statistical tests.

Quantitative data were analysed using Stata version 17 (StataCorp, College Station, TX, USA). Descriptive statistics were summarised using frequencies and percentages. Associations between categorical variables were assessed using Pearson's chi-square test. Multivariable logistic regression models were used to identify predictors of adequate knowledge, positive attitude, and compliant practice. Results are presented as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$.

Qualitative responses to the open-ended items were analysed manually in Microsoft Excel using an inductive thematic approach. Responses were read repeatedly, meaningful text segments were assigned initial codes, related codes were grouped into themes and subthemes, and the themes were checked against the original responses. Anonymised quotations were selected to illustrate the principal themes. Quantitative and qualitative findings were integrated during interpretation. Statistical significance for quantitative analyses was set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from the David Umahi Federal University of Health Sciences Research Ethics Committee (Approval No. DUFUHS/UREC/2025/019). All procedures involving human participants were conducted in accordance with the Declaration of Helsinki and applicable institutional ethical standards.

The de-identified dataset, study questionnaire, scoring guide, and qualitative coding framework are available from the corresponding author upon reasonable request to support the reproducibility of the study.

Results

A total of 456 respondents were included. For items with missing responses, valid denominators are reported and percentages are based on valid responses unless otherwise stated.

Participant characteristics

Most respondents were aged 18–25 years (62.7%), female (64.9%), single (61.6%), tertiary educated (82.9%), and students (64.9%) (Table 1).

Knowledge of the chloroquine withdrawal policy

Knowledge was suboptimal: 43.4% had poor, 37.9% moderate, and 18.6% good knowledge. Although 82.0% identified ACTs as the recommended treatment, uncertainty remained about policy enforcement and chloroquine-related treatment failure (Tables 2 and 3).

Knowledge differed by occupation ($p < 0.001$), but not educational status ($p = 0.085$). Compared with students, academic staff (AOR = 17.89) and health-related respondents (AOR = 67.39) had higher odds of good knowledge, whereas respondents aged ≥ 46 years had lower odds (AOR = 0.06) (Table 4).

Attitudes toward the malaria treatment policy

Overall, 47.4% had a negative attitude, 15.8% a neutral attitude, and 36.8% a positive attitude. Most considered ACTs superior to chloroquine, and attitude was associated with knowledge ($p < 0.001$) (Tables 5 and 6).

Malaria treatment practices

ACTs were the most commonly reported treatment (63.2%), and pharmacies were the main treatment source (61.3%). Nearly half reported continued chloroquine prescribing or recommendation (49.9%), while only 16.8% were aware of its risks. Attitude was associated with treatment practice ($p < 0.001$) (Tables 7 and 8).

Relationships among knowledge, attitudes, and practices

Higher knowledge predicted positive attitude (AOR = 1.74) and compliant practice (AOR = 1.18). Positive attitude also predicted compliant practice (AOR = 1.86) (Table 9).

Policy compliance

The mean Policy Compliance Index was 40.1 (SD = 23.4); 44.1% had low, 47.1% moderate, and 8.8% high compliance. Health-related respondents had the highest mean PCI, whereas non-academic staff had the lowest. Barrier count, knowledge, and positive attitude independently predicted compliant practice (Tables 10 and 11).

Qualitative findings

Three themes explained policy implementation: barriers to enforcement, factors sustaining chloroquine use, and recommended strategies for improvement (Table 12).

Implementation barriers

Participants described weak enforcement, continued chloroquine availability, inadequate sensitisation, ACT cost and access, and cultural or behavioural influences as key barriers. One participant stated, “There is no serious monitoring by authorities” (Participant 41). These findings are summarised in Table 13.

Factors sustaining chloroquine use

Participants linked continued chloroquine use to vendor profit, weak oversight, treatment familiarity, and habitual use. They generally favoured tighter regulation of chloroquine use for malaria rather than complete removal of the medicine from the market (Table 13).

Recommendations

Participants recommended public education, stronger regulation of medicine sales, affordable ACTs, healthcare-worker training, and improved malaria prevention. Frequencies are presented in Table 12, and the corresponding qualitative themes are summarised in Table 13.

Table 1. Socio-demographic characteristics of respondents (total population N = 456)

Variable	Category	N	%
Age (years)	18–25	286	62.7
	26–45	55	12.1
	≥ 46	48	10.5
Sex	Male	160	35.1
	Female	296	64.9
Marital status	Single	281	61.6
	Married	81	17.8
	Prefer not to say	16	3.5
	Widowed	1	0.2
	Separated	1	0.2
Educational level	Tertiary	378	82.9
	Secondary	14	3.1
	Primary	1	0.2
	No formal education	3	0.7
Occupation	Student	296	64.9
	Academic staff	40	8.8
	Health professional	26	5.7
	Non-academic staff	20	4.4
	Health worker	11	2.4
	Trader	3	0.7

Note: Percentages are based on the total population (N = 456). Totals may be below 100% because missing responses are not displayed.

Table 2. Item-level knowledge of chloroquine withdrawal and malaria treatment (total population N = 456)

Knowledge item	Yes N (%)	No N (%)	Not sure N (%)	Valid Number
Chloroquine officially withdrawn	246 (62.3)	40 (10.1)	109 (27.6)	395
Withdrawal due to parasite resistance	228 (58.5)	39 (10.0)	123 (31.5)	390
ACTs are recommended treatment	319 (82.0)	4 (1.0)	66 (17.0)	389
Chloroquine still effective in some cases	12 (3.1)	268 (69.1)	108 (27.8)	388
Chloroquine use may cause treatment failure	135 (34.7)	71 (18.3)	183 (47.0)	389
Withdrawal adequately communicated	161 (41.4)	115 (29.6)	113 (29.0)	389
Policies exist to enforce withdrawal	149 (38.7)	40 (10.4)	196 (50.9)	385
Self-medication with chloroquine still occurs	305 (79.2)	2 (0.5)	78 (20.3)	385
Resistance increased malaria complications	232 (60.7)	20 (5.2)	130 (34.0)	382
Non-compliance limits implementation	259 (67.8)	10 (2.6)	113 (29.6)	382

Note: Percentages are based on the valid responses shown for each item; denominators vary because of item non-response.

Table 3. Overall knowledge category (N = 456)

Knowledge category	N	%
Poor (0–4)	198	43.4
Moderate (5–7)	173	37.9
Good (8–10)	85	18.6

Note: Knowledge scores ranged from 0 to 10 and were categorised as poor (0–4), moderate (5–7), or good (8–10).

Table 4. Multivariable predictors of good knowledge (total population N = 456)

Predictor	AOR	95% CI	p-value
Male vs female	0.65	0.41–1.04	0.072
Age 26–45 vs 18–25	0.49	0.13–1.80	0.284
Age ≥46 vs 18–25	0.06	0.01–0.43	0.005
Non-tertiary vs tertiary education	1.55	0.40–6.07	0.528
Academic staff vs student	17.89	2.54–125.83	0.004
Health-related occupation vs student	67.39	7.26–625.33	<0.001
Other staff vs student	0.45	0.10–1.99	0.296

Note: AOR, adjusted odds ratio; CI, confidence interval. Statistical significance was set at $p < 0.05$; analysis denominators may vary because of item non-response.

Table 5. Attitudes and perceptions regarding malaria treatment policy (total population N = 456)

Measure	Category	N	%	Valid Number
Perceived policy effectiveness	Very effective	40	10.5	382
	Moderately effective	168	44.0	382
	Not effective	51	13.4	382
	Not sure	123	32.2	382
ACTs better than chloroquine	Yes	247	65.0	380
	No	13	3.4	380
	Not sure	120	31.6	380
Overall attitude	Negative	216	47.4	456
	Neutral	72	15.8	456
	Positive	168	36.8	456

Note: Percentages are based on the valid responses shown for each measure; denominators vary because of item non-response.

Table 6. Association between knowledge and attitude (N = 456)

Knowledge level	Negative n (%)	Neutral n (%)	Positive n (%)	Total
Poor	159 (80.3)	22 (11.1)	17 (8.6)	198
Moderate	48 (27.7)	33 (19.1)	92 (53.2)	173
Good	9 (10.6)	17 (20.0)	59 (69.4)	85

Note: Pearson's $\chi^2 = 155.4$; $p < 0.001$. Percentages are calculated within each knowledge category.

Table 7. Malaria treatment practices and access indicators (total population N = 456)

Measure	Category	N	%	Valid N
Drug used	ACT	199	63.2	315
	Chloroquine	7	2.2	315
	Other/not sure	109	34.6	315
Source of treatment	Pharmacy	231	61.3	377
	Hospital clinic	112	29.7	377
	Patent medicine dealer	27	7.2	377
	Family/other	7	1.9	377
Consulted a healthcare professional	Yes	274	72.7	377
	No	103	27.3	377
Chloroquine still prescribed/recommended	Yes	184	49.9	369
	No	185	50.1	369
Aware of chloroquine-related risks	Yes	63	16.8	375
	No	312	83.2	375
Accessibility of ACTs	Easily accessible	219	58.4	375
	Moderately accessible	137	36.5	375
	Not accessible	19	5.1	375
Cultural/traditional barriers to ACT use	Yes	40	10.7	375
	No	335	89.3	375

Note: Percentages are based on valid responses; minor deviations from 100% are due to rounding and denominators vary because of item non-response.

Table 8. Association between attitude and treatment practice (N = 456)

Attitude	Poor practice n (%)	Fair compliant practice n (%)	Total
Negative	134 (62.0)	82 (38.0)	216
Neutral	32 (44.4)	40 (55.6)	72
Positive	57 (33.9)	111 (66.1)	168

Note: Pearson's $\chi^2 = 68.92$; $p < 0.001$. Percentages are calculated within each attitude category.

Table 9. Multivariable models for positive attitude and compliant practice (total population N = 456)

Outcome	Predictor	AOR	95% CI	p-value
Positive attitude	Knowledge score	1.74	1.56–1.94	<0.001
Compliant practice	Knowledge score	1.18	1.08–1.29	<0.001
Compliant practice	Positive vs negative attitude	1.86	1.07–3.22	0.027

Note: AOR, adjusted odds ratio; CI, confidence interval. Statistical significance was set at $p < 0.05$; analysis denominators may vary because of item non-response.

Table 10. Policy Compliance Index distribution and occupational differences (N = 456)

Domain	Category	n	% or mean (SD)	Valid N
PCI level	Low (<40)	201	44.1	456
	Moderate (40–69)	215	47.1	456
	High (≥ 70)	40	8.8	456
Mean PCI by occupation	Health-related	37	53.33 (14.71)	37
	Students	296	47.26 (18.86)	296
	Academic staff	40	41.16 (15.68)	40
	Non-academic staff	20	29.97 (17.82)	20

Note: PCI, Policy Compliance Index; SD, standard deviation. Overall mean PCI = 40.1 (SD = 23.4).

Table 11. Predictors of compliant malaria treatment practice (total population N = 456)

Predictor	AOR	95% CI	p-value
Barrier count	2.58	1.69–3.95	<0.001
Knowledge score	1.12	1.02–1.23	0.022
Positive attitude	1.77	1.03–3.04	0.038

Note: AOR, adjusted odds ratio; CI, confidence interval. Statistical significance was set at $p < 0.05$; analysis denominators may vary because of item non-response.

Table 12. Recommended strategies for improving implementation of the chloroquine withdrawal policy (valid responses N = 370)

Recommended strategy	Frequency (n)	Percentage (%)
Increasing public awareness campaigns	195	52.7
Training healthcare professionals	63	17.0
Monitoring and regulation of drug sales	58	15.7
Reducing the cost of ACTs	56	15.1
Strengthening policy enforcement	49	13.2
Other specified recommendations	8	2.2

Note: Multiple responses were permitted; therefore, percentages do not sum to 100%. ACTs, artemisinin-based combination therapies.

Table 13. Summary of qualitative themes and subthemes

Main theme	Sub-themes
Barriers to implementation	Weak regulatory enforcement; continued availability of chloroquine; inadequate public sensitization; cost and accessibility of ACTs; cultural and behavioural influences.
Factors sustaining continued chloroquine use	Profit-driven practices; weak regulatory oversight; cultural attachment and habitual use; views on continued sales.
Recommendations for improving policy implementation	Public awareness and health education; enforcement and regulation of drug sales; affordability and accessibility of ACTs; training of healthcare workers; vector control and malaria prevention.

Discussion

Principal findings and contribution

This study shows that the formal withdrawal of chloroquine has not led to complete implementation in the study setting. The central inference is that awareness of artemisinin-based combination therapies (ACTs) can coexist with weak understanding of the reasons for policy change, limited confidence in enforcement, and continued use of withdrawn medicines. This gap suggests that policy effectiveness depends not only on issuing treatment guidelines but also on sustained communication, market regulation, provider and vendor compliance, and public trust in enforcement mechanisms [13].

Knowledge of the chloroquine withdrawal policy

The observed knowledge gaps suggest that malaria communication has been more successful in promoting ACTs as the recommended treatment than in explaining why chloroquine was withdrawn and the consequences of continued use. Similar evidence from Nigeria has shown that awareness of revised treatment recommendations does not always result in adequate understanding or adherence, particularly where outdated antimalarials remain available through retail medicine outlets [14]. In contrast, evidence from Kenya indicates that guideline adherence improves when policy changes are supported by structured training, supervision, diagnostic capacity, and sustained health-system oversight [21,22]. These comparisons imply that repeated and explanatory

communication, rather than one-time policy announcements, is essential for translating national guidance into routine practice. The stronger knowledge observed among health-related respondents and academic staff likely reflects greater exposure to professional information, treatment guidelines, and health education. This supports evidence that proximity to the health system improves understanding of malaria policy and appropriate treatment practices [15,16]. The implication is that communication strategies should be tailored to groups with limited professional exposure rather than assuming that general educational attainment alone ensures adequate policy knowledge.

Attitudes toward the malaria treatment policy

Uncertainty and unfavourable attitudes toward the withdrawal policy appear to reflect limited confidence in how the policy is implemented rather than rejection of ACTs themselves. Where withdrawn medicines remain visible in pharmacies and informal markets, the public may reasonably question whether the policy is active or effective. Evidence from Ghana and other African settings shows that acceptance of malaria treatment changes improves when communities receive clear explanations, observe consistent enforcement, and have reliable access to recommended alternatives [23]. Therefore, positive attitudes are likely to depend on visible consistency between official policy, medicine availability, and provider behaviour.

The qualitative findings further suggest that weak monitoring, continued chloroquine availability, and limited public

sensitization undermine confidence in the policy. This indicates that attitude change requires more than health messages; it also requires practical evidence that regulators, healthcare providers, and medicine vendors are acting in line with national treatment recommendations.

Malaria treatment practices and continued chloroquine use

The continued circulation of chloroquine points to a persistent gap between policy and practice. Similar Nigerian studies have linked ongoing use of non-recommended antimalarials to weak regulation, profit-driven retail practices, self-medication, and easy access through proprietary and patent medicine vendors [13,14]. Evidence from wider African settings also shows that withdrawn medicines may remain in use when drug markets are poorly regulated and recommended alternatives are not consistently affordable or accessible [24].

This pattern suggests that continued chloroquine use should not be viewed solely as an individual behavior problem. It is also a market and health-system problem shaped by medicine availability, vendor incentives, treatment familiarity, and weak enforcement. Interventions directed only at patients are therefore unlikely to achieve full compliance unless accompanied by stronger regulation of medicine sales and improved access to appropriate treatment.

Policy compliance and implementation gaps

The Policy Compliance Index provides an integrated view of how knowledge, attitudes, practices, and implementation barriers interact. The predominance of low-to-moderate compliance suggests that the withdrawal policy remains only partially implemented. Similar evidence from Nigeria has documented persistent chloroquine use years after the national transition to ACTs [15,25]. The association between implementation barriers and compliance further supports the interpretation that policy failure is cumulative: weaknesses in communication, regulation, affordability, and service delivery reinforce one another.

The value of the index lies in its ability to identify where implementation breaks down and which groups may require targeted intervention. However, its usefulness depends on external validation in other populations and settings. It should therefore be regarded as a potentially useful monitoring approach rather than a definitive measure of national policy performance.

Health and resistance implications

Weak enforcement of malaria treatment policy may expose patients to delayed recovery, treatment failure, avoidable complications, and inappropriate self-medication, particularly when treatment begins without diagnostic confirmation [5,13,14]. At population level, continued inappropriate drug pressure may sustain resistant parasite strains and complicate future treatment policy [10,26].

Evidence from southeastern Nigeria has shown a high prevalence of chloroquine-resistance-associated PfCRT mutations, indicating that resistance remains an important concern in the region [26]. By contrast, studies from Ethiopia and Kenya have reported partial return of chloroquine sensitivity after prolonged withdrawal and reduced drug pressure [9]. These contrasting patterns demonstrate that resistance trends are context-specific and should not be generalized across countries. Any consideration of chloroquine

reintroduction in Nigeria would require strong evidence from current therapeutic efficacy studies and molecular surveillance, alongside confidence that drug use can be effectively regulated.

Implications for policy and practice

The findings support three priorities. First, regulatory agencies should strengthen monitoring of pharmacies and proprietary and patent medicine vendors, with clear sanctions for continued stocking or recommendation of withdrawn antimalarials [14]. Second, public communication should explain not only that ACTs are recommended, but also why chloroquine was withdrawn and how continued use contributes to treatment failure and resistance. Third, healthcare providers and medicine vendors require regular training, supervision, and simple point-of-sale decision aids to promote consistent treatment advice.

Improving affordability and access to ACTs is equally important. Enforcement is unlikely to succeed where recommended medicines are perceived as costly or difficult to obtain. A coordinated strategy combining regulation, education, provider support, and access to affordable ACTs is therefore more likely to improve compliance than isolated awareness campaigns.

Strengths of the study

A major strength of this study is the integration of quantitative and qualitative evidence, which allowed statistical patterns to be examined alongside participants' explanations of implementation barriers. The consistency between the two components strengthens the interpretation that weak enforcement, continued medicine availability, affordability concerns, and limited sensitization contribute to incomplete policy implementation.

Limitations of the Study

The study also has limitations. Its cross-sectional design does not establish causality, and self-reported practices may be affected by recall and social desirability bias. Convenience sampling and online questionnaire distribution may have reduced representativeness, particularly for individuals with limited internet access or weaker links to the university communication network. In addition, the study was conducted in one university community, so the findings should not be generalized to the whole of Nigeria without caution. The Policy Compliance Index was developed for this study and requires validation in other settings before wider use. Future multicentre studies should validate the PCI and examine implementation using probability sampling and direct assessment of medicine availability and prescribing practices.

Conclusion

This study demonstrated that Nigeria's chloroquine withdrawal policy remains incompletely implemented at the community level, characterized by partial knowledge, mixed attitudes, persistent market-level availability, and limited high-level compliance. Closing the gap between policy intent and practice requires a coordinated package of enforcement, communication, vendor regulation, provider alignment, and access protection for ACTs. The PCI framework offers a practical monitoring tool to quantify implementation progress and identify groups at highest risk for non-compliance.

Declarations

Ethical approval

Ethical approval for this study was obtained from the David Umahi Federal University of Health Sciences Research Ethics Committee, with reference number DUFUHS/UREC/2025/019. Participation was voluntary, and all respondents gave electronic informed consent before completing the questionnaire.

Informed consent

Electronic informed consent was obtained from all participants before they completed the questionnaire.

Consent for publication

Not applicable.

Availability of data and materials

The de-identified dataset, questionnaire, scoring guide, and qualitative coding framework are available from the corresponding author upon reasonable request.

Competing interests / Conflict of interests

The authors declare that they have no competing interests.

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Authors' Contributions

BOO and DUE: conceptualization, methodology, data analysis, and writing the original draft. DUE and OEE: data collection. BOO, DUE, and OEE: writing the review and editing the manuscript. BOO: supervision and final review. All authors read and approved the final manuscript.

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Artificial Intelligence (AI) Disclosure

The authors used ChatGPT (OpenAI) for language editing, grammar improvement, readability, formatting, and assistance in organising responses to editorial and reviewer comments. The tool was not used to collect, generate, or analyse study data. All AI-assisted content, statistical results, interpretations, citations, and references were critically reviewed and manually verified by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

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