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Seasonal Malaria Chemo-Prevention Strategy: A Cross-Sectional Study of Healthcare Workers in Public Primary Healthcare Facilities in Edo State, Nigeria

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Abstract

Malaria infection is one of the most significant public health problems and the leading cause of global morbidity and mortality. Pregnant women and under-five (U5) children are particularly at risk in areas where malaria is endemic. The U5 children account for about 80% of all malaria-related deaths. This study aims to assess the adherence to the national guidelines for administering seasonal malaria chemoprevention (SMC) in U5 children by healthcare workers (HCWs) working in public Primary Health Care (PHC) facilities in Edo State, Nigeria. A cross-sectional study design was employed to assess the sociodemographic characteristics, awareness, and prescription of chemo-preventive therapy for the U5 by 200 HCWs in public PHC facilities in Edo State, with the aid of the researcher-designed pretested, self-administered, semi-structured questionnaire. Descriptive and inferential data analyses were carried out using the IBM SPSS version 20 software. All p-values had two tails and were deemed statistically significant if < 0.05. The majority of HCWs (71.5%) did not adhere to the national guideline for using chemo-preventive treatment for malaria in children, and there was a statistically significant relationship between many sociodemographic factors and compliance. The length of the HCW's work (in years) was a critical indicator of compliance with the recommendation. In conclusion, the use of malaria chemo-preventive treatment in accordance with the Nigerian malaria diagnosis and treatment guidelines is being practiced ineffectively by HCWs in public PHCs in Edo State. A longer period of employment (in years) predicts a better practice.

Keywords: *Implementation, Nigeria, Primary healthcare (PHC), Seasonal malaria chemoprevention (SMC), Under-five children.*

Introduction

Malaria remains a major public health problem, especially in sub-Saharan Africa. According to the World Malaria Report 2021, almost one-half of the world's population lives in locations at risk of malaria transmission in 87 countries and territories [1]. Amongst the 15 countries with a high burden of malaria in sub-Saharan Africa (SSA), Nigeria and the Democratic Republic of Congo (DRC) account for over 35% of the global estimated malaria deaths [2]. Morbidities and mortalities resulting from malaria affect many developing countries where pregnant women and young children are

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the most affected [3]. In 2020, malaria caused about 241 million clinical episodes and 627,000 deaths [3]. The WHO estimated that about 95% of all cases and 96% of all mortalities from malaria were from the African region [2]. Children under five years and pregnant women are the most vulnerable in endemic countries, while all age groups are equally affected in non-endemic countries. About 80% of the deaths due to malaria in sub-Saharan Africa (SSA) are among children aged below five years [2].

Many organizations, agencies, and countries worldwide have been involved in malaria eradication. Although the prevalence of the disease seems to be declining, problems of implementation of the various guidelines for malaria control still need significant sustenance and improvement if the already achieved gained would be sustained or not reversed as the case may be [4]. The strategic role of the primary healthcare (PHC) facilities as the first point of call for persons seeking medical care has been established [4]. PHCs is central to implementing different strategies to control, eliminate, or eradicate malaria [5]. The health care workers (HCWs) in these public PHC facilities treat patients in compliance with the regulations for the various disease conditions prevalent in their localities. The WHO has recommended chemoprevention as one of the strategies for malaria control, and the strategy has been adopted by Nigeria. Chemoprevention is a preventive therapy that entails administering a full course of antimalarial medications to susceptible groups, especially pregnant women and children under five, at specific time points during maximal risk [6]. Regardless of whether the Individual has malaria, the prescribed course of therapy is given to them.

The benefit of this strategy has been demonstrated in some studies. For instance, a study that involved community screening and targeted treatment of P. falciparum malaria asymptomatic carriers demonstrated a significant impact on 28 days (short-term) haemoglobin (blood) levels in these asymptomatic carriers, significantly improving haemoglobin (blood) levels in all asymptomatic carriers >6 months, and significantly lowering the incidence of anaemia in asymptomatic carriers aged >6 months to 5 years by over 30% [7].

Nigeria has adopted the prevention of malaria in children under the age of five (U5) with the use of Seasonal malaria chemoprevention (SMC) strategy which has shown a varying degrees of implementation throughout several States. During the peak malaria transmission season, the U5 children receive intermittent preventive therapy for malaria with a dispersible tablet of amodiaquine based given once daily for 3 days, and single dose of dispersible tablet of sulfadoxine-pyrimethamine [8]. However, several barriers have been identified as a bottleneck to eliminating Nigeria's malaria scourge. These barriers include poor funding of healthcare by the government, non-availability of malaria commodities, poor implementation of control strategies, policy issues, and health care personnel attitudes [9, 10]. It is important that an evidence-based evaluation of the malaria intervention strategies be conducted at the PHC level to identify the level of implementation of this U5 SMC strategy by HCWs.

This study was conducted to assess compliance with the Nigeria National Malaria Diagnosis and Treatment Guideline 2020, for the practice of SMC in the U5 by HCWs in PHC facilities in a State Southern Nigeria that would serve as a basis for strategic policy development and future assessment.

Methods

Study Area

This study was conducted in Edo State in the South-South geo-political zone of Nigeria. The State lies between longitudes 5^0 and 6^045" East and latitudes 6^01" and 7^030" North, with a total land area of 19,281.93 square kilometers [11]. The administrative headquarters of Edo State is Benin City, located in the southern part of the State. According to a report by the Edo State

Ministry of Health and WHO, Edo State, in 2011, there were 924 healthcare facilities across all 18 LGAs in Edo State, Nigeria. There are about 871 PHC facilities in Edo State; 37% (322) are government-owned, and the remaining 63% (549) are private providers [12].

There has been some improvement in these numbers over the last decade. According to the Edo State Primary Healthcare Development Agency (Eds PHCDA) implementation committee report carried out in 2021, there is a total of 18 medical doctors, 674 Community Health Officers (CHOs), and 368 nurses and midwives working in the various 496 public PHC facilities in Edo State now under the Eds PHCDA [13]. There are 497 health facilities designated as PHC Centers, 251 as health centres, and 48 as health posts, respectively.

Study Design

This study used a descriptive cross-sectional study design.

Study Population

The study population comprised 1,264 HCWs in public PHC facilities directly involved in antimalarial drug prescription or through a standing order (medical doctors – 18, Community Health Officers (CHOs) and Community Health Extension Workers(CHEWs) – 672, Junior CHEWs – 144, and nurses/midwives – 368) [14]..

Inclusion Criteria

All consenting HCWs involved in drug prescription as part of their work schedules in any of the public PHC facilities in Edo State, who have worked for at least one year.

Exclusion Criteria

Any health worker in Edo State involved in drug prescription at the PHC that was recently transferred from outside the study area within the last 12 months or working in a newly built PHC facility (less than 12 months).

Study Duration

The study was carried out within six months of obtaining institutional ethical in December 2022.

Sample Size Determination

The minimum sample size for the study, irrespective of the categories involved, was determined using the formula for cross-sectional studies [15]. The study measures the desired precision/degree of accuracy or deviation, usually at *5%*. The minimum sample size is for the number of HCWs involved in prescribing medicines working in public PHCs in Edo State.

$$n = \frac{Z^2 1-\alpha/2P(1-P)}{d^2} \ldots\ldots\ldots [15]$$

Using the result of a study carried out among HCWs in the Busoga sub-region, eastern Uganda, on the adherence to malaria management guidelines, it was reported that 86.9% of all confirmed malaria cases received appropriate malaria treatment in accordance with their national guideline [16].

$P = 0.869$, while $q = 1 - 0.869 = 0.131$.

Using the above formula to compute the sample size (n); where:

Z is the standard normal deviate at a 95% confidence interval (CI) of 1.96, P is the proportion of respondents that have overall good practice of malaria guidelines recommendations.

q is the complementary probability of P $(1-p)$, that is, the proportion of respondents that did not have good practice of the guideline; and d is the precision level 5% =0.05. Therefore, using p = 86.9% (0.869)[16] and d = 5%, q = 13.1% (0.131).

By substitution,

$$n = \frac{1.96 * 1.96 * (0.869\text{x}0.131)}{0.05 * 0.05}$$

$$n = \frac{3.8416 * (0.1138)}{0.0025}$$

$$n = \frac{0.4372}{0.0025} = 174.88$$

Consideration for Non-Response Rate

Allowing a non-response rate of 10% of the calculated minimum sample size = 175/90% = 194.44. Approximately a minimum of 194 participants would be needed for this study. Therefore, the minimum sample size required for the study is 194 healthcare workers involved in drug prescription.

Sampling Technique

The participants for this study were chosen using a simple random sampling technique[17]. Edo State like all other States in Nigeria have three senatorial (political) districts (demarcations). In Edo State, these three districts are, Edo South, Central, and North senatorial districts. The State has 18 Local Government Areas (LGAs) distributed across the three senatorial districts. One LGA was randomly selected through a simple random sampling technique (balloting) for in each of the senatorial districts for one LGA to give a total of 3 LGAs. HCWs who met the inclusion criteria in each LGA were sampled until the desired minimum sample size was achieved.

Study Instruments

Semi-structured and self-administered questionnaires for the prescribers.

Data Collection

The trained research assistants assisted in distributing the pretested semi-structured questionnaires to healthcare professionals working in public PHC facilities to collect information on their sociodemographic characteristics and compliance with the recommendation and use of malaria chemotherapy for children under five (U5).

Data Management

Variables were measured as nominal, ordinal, and numerical variables. Frequencies and percentages were derived from the categorical variables. The significance level – alpha (α) was set at 5%. All p-values will be two-tailed and considered statistically significant if < 0.05.

Statistical Analysis

Survey data were coded, inputted, and cleaned for analysis in the SPSS version 20.0 spreadsheet [18]. Alpha (α), the statistical significance level, was 5%. The univariate data's mean (standard deviation) was calculated and displayed in tables. The Chi-square test was used to evaluate the bivariate data (or Fisher's exact test when appropriate). Through the HCWs' use of seasonal malaria chemopreventive strategy at the PHC facilities, compliance with the practice of malaria prevention was evaluated. Responses to the practice included always, occasionally, and never. Those who consistently prescribe anti-malaria chemopreventive drugs for their under-five clients or patients were seen to have good compliance, whereas those who only occasionally or never did so were recognized as having poor compliance. The various justifications for the various actions (practice levels) and sociodemographic attributes of the HCWs were used to determine the factors affecting compliance with malaria chemopreventive practice. Both individually and in the adjusted form, these were analyzed.

Results

Data were obtained from 200 healthcare practitioners working in public PHC facilities in the selected LGAs in Edo State, Nigeria.

Table 1. Sociodemographic Characteristics of Healthcare Workers

Variables	Frequency (N=200)	Percentage (%)
Age (years)		
20 – 29	10	5.0
30 – 39	65	32.5
40 – 49	88	44.0
≥ 50	37	18.5
Mean ± SD of age (years) = 42.3 ± 7.3		-
Sex		
Female	189	94.5
Male	11	5.5
Marital status		
Married	183	91.5
Single	12	6.0
Widowed	5	2.5
Tribe		
Esan	55	27.5
Bini	49	24.5
Igara	44	22.0
Etsako	16	8.0
Owan	13	6.5
Urhobo	9	4.5
Okpameri	5	2.5
Ika	4	2.0
Igbo	4	2.0
Ijaw	1	0.5

Legend: SD – Standard deviation.

The mean (standard deviation) age of respondents was 42.3(±7.3) years, with over two-fifths of the respondents, 88(44.0%), belonging to the age group of 40-49 years. 65 (32.5%) were in the age group of 30-39 years, while 37 (18.5%) were aged 49 years and above, and only 10 (5.0%) were between the ages of 20 to 29 years. Majority of the respondents were females [189(94.5%)], also, majority were married [183(91.5%)]. All the major tribes in Edo State, Nigeria, were represented in this survey.

Table 2. Socioeconomic Characteristics Related to Healthcare Workers in PHC Facilities

Variables	Frequency (N=200)	Percentage (%)
Senatorial district		
Edo Central	40	20.0
Edo North	71	35.5
Edo South	89	44.5
PHC Category		
Health centre	6	3.0
Primary healthcare centre	194	97.0
Location		

Rural	140	70.0
Semi-urban	35	17.5
Urban	25	12.5
Job category		
Community Health Extension Worker	85	42.5
Community Health Officer	36	18.0
Medical Doctor	2	1.0
Nurse	77	38.5
Duration of work as healthcare worker (years)		
< 10.0	23	11.5
10.0 – 19.9	134	67.0
20.0 – 29.9	35	17.5
≥ 30.0	8	4.0
Mean ± SD of the duration of work (years) = 15.0 ± 7.2		-

Legend: SD – Standard deviation

Out of the 200 respondents, 89 (44.5%) were from Edo South Senatorial zone, 71 (35.5%) from Edo North, and 40(20.0%) were from Edo Central senatorial district. One hundred and ninety-four (97.0%) worked in the PHC center, and 6(3.0%) in the health center. The distribution of the HCWs according to their location practice was 140 (70.0%) in rural areas, 35 (17.5%) in semi-urban, and 25 (12.5%) in urban areas of the state.

The categories of HCWs surveyed in this study were CHEWs 85 (42.5%), Nurses 77(38.5%), CHOs 36(18.0%), and Medical Doctors 2(1.0%). Their mean (± SD) duration of working as an HCW was 15.0 (± 7.2) years; 23 (11.5%) of them have worked for less than 10 years, 134(67.0%) of them have a work duration of 10.0 to 19.9 years, 35(17.5%) for 20.0 to 29.9 years, and 8(4.0%) have a work duration of at least 30 years.

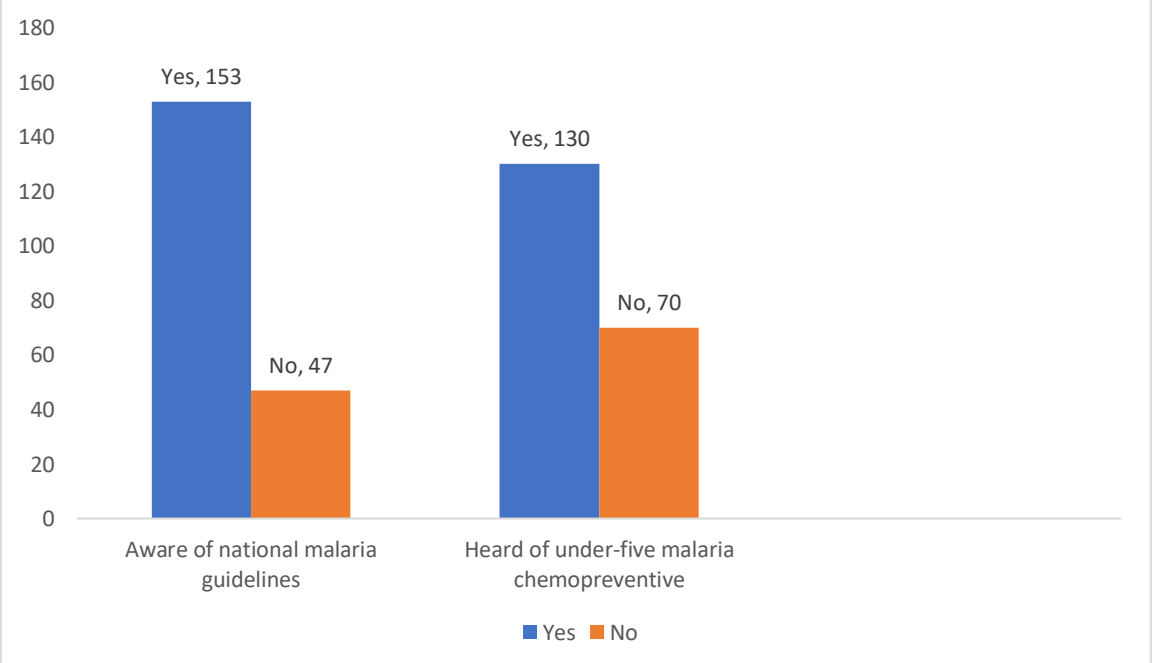

Figure 1. Awareness of the National Malaria Guideline and the U5 Chemo-Prevention Strategy

One hundred fifty-three healthcare workers (HCWs) were aware of the current (2020) national malaria diagnosis and treatment guidelines, and 130 (65%) were aware of the seasonal malaria chemopreventive treatment strategy for the under five children.

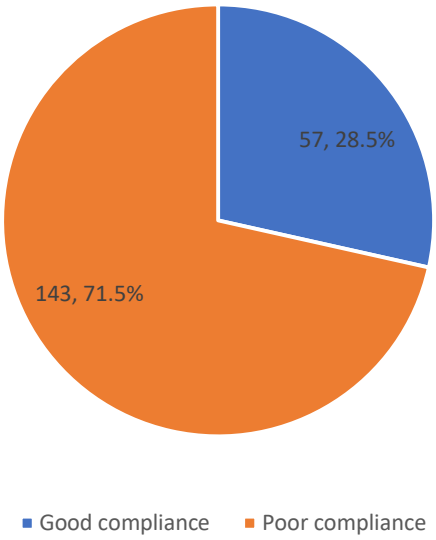

Figure 2. Compliance with under-Five malaria Chemo-prevention among Healthcare Workers in PHC Facilities

One hundred and forty-three (71.5%) respondents had poor compliance with the practice of the recommended under-five SMC strategy among HCWs in PHC facilities.

Table 3. Association between HCW's Sociodemographic Characteristics and Compliance with U5 SMC in PHC

Variables	**Compliance with under-five malaria chemo-preventive practice**		χ^2	**p-value**
	Good compliance n (%)	**Poor compliance n (%)**		
Age (years)				
20 – 29	3 (30.0)	7 (70.0)	5.301	0.151
30 – 39	22 (33.8)	43 (66.2)		
40 – 49	18 (20.5)	70 (79.5)		
≥ 50	14 (37.8)	23 (62.2)		
Sex				
Female	56 (29.6)	133 (70.4)	-	0.184#
Male	1 (9.1)	10 (90.9)		
Marital status				
Married	57 (31.2)	126 (68.8)	-	0.018#*
Single	0 (0.0)	12 (100.0)		
Widowed	0 (0.0)	5 (100.0)		
Senatorial district				
Edo Central	9 (22.5)	31 (77.5)	3.181	0.204
Edo North	17 (23.9)	54 (76.1)		
Edo South	31 (34.8)	58 (65.2)		
PHC Category				
HC/CHC	2 (33.3)	4 (66.7)	-	0.060#

PHC	140 (72.2)	54 (27.8)		
Location				
Rural	50 (35.7)	90 (64.3)	11.919	0.001*
Semiurban/urban	7 (11.7)	53 (88.3)		
Job category				
CHEW/CHO	36 (29.7)	85 (70.3)	0.236	0.627
MD/nurse/pharm	21 (26.6)	58 (73.4)		
Duration of work (years)				
< 10	1 (4.4)	22 (95.6)	30.622	<0.001*
10 – 19	30 (22.4)	104 (77.6)		
20 – 29	21 (60.0)	14 (40.0)		
≥ 30	5 (62.5)	3 (37.5)		

Legend# Fisher's Exact. *Statistically Significant

There was a statistically significant association between HCW's marital status (p=0.018), location of the place of practice (p=0.001), and their duration of work (years) (p<0.001) with their compliance with under-five SMC treatment practice in PHC facilities in Edo State, Nigeria. The majority of the semi-urban/urban practitioners [53 (88.3%)] had poor practice, while [90(64.3%)] of the rural healthcare practitioners had poor practice. There was a strong relationship between the HCW's duration of work (years) and the practice of chemopreventive use; the longer the duration of work seems to give rise to better practice, and the shorter their duration of work, the poorer the practices seen.

Table 4. Predictors of Compliance Level with under-Five Malaria Chemo-Preventive Practice

Predictors	**β-Coefficient**	**Odds ratio**	**95% CI**	**p-value**
Sex				
Female	Reference	-	-	-
Male	0.66	1.93	0.15 – 25.02	0.616
Senatorial district				
Edo Central	Reference	-	-	-
Edo North	-0.01	0.99	0.35 – 2.79	0.978
Edo South	-0.92	0.40	0.15 – 1.07	0.067
Location				
Semiurban/urban	Reference	-	-	-
Rural	-1.41	0.24	0.09 – 0.65	0.050
Location				
Rural	Reference	-	-	-
Semiurban/urban	1.14	3.14	1.00 – 9.86	0.050
Duration of work				
<10	Reference	-	-	-
10 – 19	-1.93	0.15	0.02 – 1.18	0.071
20 – 29	-3.30	0.04	0.01 – 0.32	0.003*
≥ 30	-4.11	0.02	0.00 – 0.25	0.003*

Legend*Statistically significant

Only the length or duration of work of the HCW, that was statistically significant for predicting the practice of good compliance level with under-five malaria chemopreventive in a binary multivariate logistic regression model analysis for the HCWs working in public PHC facilities in Edo State, Nigeria. For a work duration of 20–29 years (p=0.003 and 95% CI = 0.01–0.32) and at least 30 years (p=0.003 and 95% CI = 0.00–0.25), respectively, there are 0.04 odds and 0.02 chances of having good compliance with practice of seasonal malaria chemopreventive treatment in the PHC facilities.

Discussion

In this study, 200 healthcare professionals who were involved in prescription antimalarial drugs in the course of their duties were interviewed. The HCWs in these public PHC facilities treat patients in compliance with the regulations for the various disease conditions prevalent in their localities. About 72% of the respondents in this study demonstrated poor compliance with the recommended national guideline for SMC, in which, during the peak period of malaria transmission, under-five children receive seasonal, intermittent preventive therapy for malaria [8]. This proportion with poor compliance is ridiculously high considering the benefit that would have been derived from using the strategy if duly implemented for this age group despite 65.0% of the HCWs being aware of the use of chemopreventive strategy in controlling malaria in the under-five. Furthermore, this may result from a lack of policy directives on the implementation of the strategy in the region of the country where this was conducted [8].

In this study, over three-quarters of the HCWs knew the current national malaria diagnosis and treatment guidelines. In this current version, intermittent preventive treatment of malaria in children under five years is done during the peak season of malaria transmission in which children aged 3-59 months get an entire course of treatment consisting of sulfadoxine-pyrimethamine and amodiaquine at monthly intervals, starting at the commencement of the malaria transmission season and up to four doses in total during the season (provided both drugs retain sufficient antimalarial efficacy) [8,19].

Examining the association between healthcare workers' sociodemographic characteristics and compliance with this under-five seasonal malaria chemoprevention practice in this study, it was found that there is a statistically significant association between healthcare workers' duration of work (in years) ($p<0.001$), their location of the place of practice ($p=0.001$), and their marital status ($p=0.018$) with their compliance with the practice of the strategy in public PHC facilities in the study location.

As for the location of practice, though the practice was generally poor for both categories of workers, a majority (88.3%) of the HCWs practicing in semi- urban/urban locations had poorer practice compared to their counterpart rural healthcare practitioners who had 64.3% with poor practice. The relatively better practice of the strategy in rural areas may result from the likelihood of more utilization of the public PHC services in these rural areas than in urban areas where there could be other options of public secondary, tertiary or private orthodox healthcare services for the under-five children and others compare to what is obtainable in most rural locations in the low- and medium-income countries.

To reduce the frequency of malaria incidence in these children, the practitioner may want to consider other recommended strategies that would benefit the child. This is evident in what was seen in this study, in which the longer the duration of practice the HCW has put into work as a professional, the better practice this strategy exhibited. This association may reflect the knowledge from more training and the experiences the older HCWs gained than the newer HCWs. They may have learned the strategy in previous training programs, though it was yet to commence in Southern Nigeria as a

national policy issue [8]. There is no record of an assessment of implementation levels even in places where the policy had formally taken effect in Nigeria, although a similar study among clients showed that Ghana's stakeholders highly regarded the SMC [20]. The researchers did advise stakeholders to get thorough and ongoing health education about the advantages of SMC medicine since this could assist in increasing the program's acceptance [20].

Furthermore, in a binary multivariate logistic regression model for the predictors of the practice of this under-five malaria chemo-preventive strategy, only the HCW's length of practice was statistically significant for the probabilities of good compliance among HCWs in public PHC facilities in Edo State, Nigeria. For a work duration of 20 to 29 years (p=0.003 and 95 percent CI = 0.01–0.32) and at least 30 years (p=0.003 and 95 percent CI = 0.00–0.25), respectively, have 0.04 and 0.02 odds of good compliance with practice of this under-five malaria chemoprevention in the PHC, using less than ten years duration of work as the reference point. The older HCWs may be seen as they are only attempting to practice the strategy probably because they know its advantages. The reason for the low level of practice may be beyond the national policy directive in which implementation is only currently supported in some Northern States. Though the State is not prohibiting its implementation, training and material support may not have been made available by the State government for the implementation of the strategy locally. According to the WHO, 13 countries in the African Sahel subregion have adopted the SMC as of 2021 [21]. In addition, the WHO stated that many additional people could benefit from the intervention if well implemented [21].

Additionally, it has been advised that African governments and policymakers commit to spending political and monetary capital to combat malaria [22].

Therefore, the expansion of the strategy to all the regions and States in Nigeria needs to be implemented without further delays.

Conclusion

The practice of the malaria chemopreventive treatment for children under five years in line with the Nigerian national malaria diagnosis and treatment guidelines is already being implemented in Southern Nigeria, though done poorly. Despite the lack of national policy directives for its implementation in Edo State, Southern Nigeria, many HCWs already aware of the strategy. The practice was seen to be relatively better amongst the rural practitioners and HCWs with a longer duration of working in public PHC. Longer duration of work was seen as a predictor of good practice of the strategy. Given these baseline findings, it is recommended that plans should be put in place for the implementation of the strategy in Edo State and other Southern Nigeria with the respective state government possibly taking the initiative with provision of relevant policy framework, training, logistics, and supplies.

Declarations

This article was part of thesis work for the Doctor of Philosophy (Ph.D.) in Public Health.

Ethical Consideration

Institutional consent: Ethical clearance to conduct this research was sought and obtained from the Ethics and Research Committee of Irrua Specialist Teaching Hospital (ISTH), Irrua, Edo State, Nigeria.

Individual Consent

Before being included in the study, each research participant was asked for their written, informed consent.

Consent for Publication

Not applicable.

Availability of Data and Material

The datasets used and analysed for this study are available from the corresponding author upon a reasonable request.

Competing Interests

The researchers assert that they have no competing interests.

Acknowledgment

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The research was self-sponsored.

Authors' Contributions

EFO and PO conceived the study, and EFO developed the protocol with the guide of PO. EFO and ETO were involved in data collection, analysis, and all authors participated in manuscript drafting.

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