Assessment of Compliance with National Guidelines on Diagnosis and Treatment of Malaria among Health Workers in Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Malaria case management remains a crucial component of malaria control strategies. Despite the introduction of national malaria treatment guidelines and scale-up of malaria control interventions in Nigeria, shreds of evidence have shown some deviations from the guidelines in malaria case management. This study assessed compliance with national guidelines on the diagnosis and treatment of malaria among health workers in Anambra State.

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Materials and Methods: This comparative, cross-sectional hospital-based study was carried out among 360 healthcare workers selected from six Local Government Areas using a multistage sampling technique. A pre-tested interviewer-administered questionnaire was used to collect data on their socio-demographics and other vital information.

Results: The findings of this study revealed that Ninety-eight respondents (54.4%) from public health facilities had adequate knowledge of malaria case management compared to 67 respondents (37.2%) from private health facilities (p=0.001). The overall level of compliance with the national guidelines shows that only 22.2% of the health workers interviewed strictly complied with the national guidelines. It was significantly higher among public healthcare workers (31.7%) compared to 12.8% of private health workers (p<0.001). Training on malaria case management, access to national guidelines, availability of malaria diagnostic tools, and sex of the health workers were associated with compliance with national guidelines in both public and private health facilities (p<0.001).

Conclusion: The findings of this study revealed a close similarity between the two health facilities in the level of awareness of the national malaria treatment guidelines, but a remarkable difference in compliance to appropriate case management of malaria between public and private health facilities. Interventions to improve private sector engagement in the implementation of the guidelines, training, and supply of recommended anti-malarial medicines should be intensified.

Keywords: Malaria; national guidelines; public and private health facilities; healthcare workers; compliance.

1. INTRODUCTION

"Malaria is a life-threatening parasitic disease transmitted from person to person by female anopheles mosquitoes" [1]. "Four *Plasmodium* species that cause malaria in humans include *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, and Plasmodium malariae* [1]. Malaria is one of the major causes of morbidity and mortality in children and is prevalent in many developing countries" [2]. In recent years, renewed interest in, and commitment to malaria control and elimination has emerged [2].

"Early and accurate diagnosis of malaria is essential for both rapid and effective disease management and surveillance" [2]. "High-quality malaria diagnosis is important in all settings as misdiagnosis can result in significant morbidity and mortality" [1,2]. "WHO recommends prompt malaria diagnosis either by microscopy or malaria rapid diagnostic test (mRDT) in all patients with suspected malaria before treatment is administered" [1]. "Diagnostic testing improves the overall management of patients with febrile illnesses, and may also assist in reducing the emergence and spread of drug resistance by reserving antimalarials for those who actually have the disease" [1,2,3].

"Access to diagnostic testing and treatment should be seen not only as a component of malaria control but also as a fundamental right of all populations at risk" [2]. "For pregnant women living in moderate to high transmission areas, WHO recommends intermittent preventive treatment (IPT) at each scheduled antenatal visit, after the first trimester" [1]. Early diagnosis and prompt and effective case management of uncomplicated malaria are essential elements of malaria control [1,3,4]. "The introduction of Artemisinin-based combination therapy (ACT) and rapid diagnostic test (RDT) has improved malaria case management substantially" [5,6]. In addition to facilitating the effective use of anti-malarial medications, the use of parasite-based diagnoses enables the early detection and proper treatment of other causes of fever [7].

1.1 Statement of Problem

"Malaria is a major public health issue in Nigeria, accounting for about 60% of all outpatient attendance and 30% of all hospital admissions" [8]. Due to increasing resistance among malaria parasites to chemotherapeutic agents, the dissolution of malaria control programmes, and increasing international travel, the incidence of malaria is increasing worldwide [1]. According to WHO reports, released in 2021, there were 247 million cases of malaria in 2021 and 619,000 deaths, and most deaths (80%) are in children under 5 years of age [1]. Malaria infection during pregnancy is a cause of maternal morbidity and mortality, stillbirths, premature deliveries, low birth weight, severe maternal anemia and abortions [6]. According to World Health Organization, Sub-Saharan Africa

continues to carry a disproportionately high share of the global malaria burden [1]. Unfortunately, mortality during severe or complicated malaria still exceeds 10 – 30% [9].

Malaria's economic impact is enormous with about N132 billion lost to malaria annually in the form of treatment costs, prevention, and loss of man-hours among other control costs [1]. "In high-burden settings, malaria can affect families and communities in a downward spirit of poverty, disproportionally affecting marginalized and poor people who cannot afford treatment or who have limited access to health care" [6].

1.2 Study Area

The study was conducted in public and private health facilities in Anambra State, Southeast Nigeria. Anambra State has a projected population of about 5,953,500 persons with a population density of $1,264/km^2$ (2,200/sq mi) in 2022 [10]. The State has three senatorial zones, 21 Local Government Areas (LGAs), and 326 political wards and operates a three-tier health care delivery service [11]. The indigenous ethnic groups in Anambra State are the Igbos (98% of the population), Hausas, and Igalas [11]. The State has a mix of both public and private health facilities totaling around 1561 registered health facilities; disaggregated into 628 public and 933 health facilities as of 2019 [12]. The majority of the facilities in the State offer malaria treatment, however not all have functional malaria diagnostic equipment in their respective facilities [12].

2. METHODOLOGY

2.1 Study Design

A comparative cross-sectional study involving healthcare providers in public and private healthcare facilities was carried out. Eligible health workers offering malaria treatment in public or private health facilities with functional malaria diagnostic equipment in Anambra State who accepted consent were selected for this study.

2.2 Sampling Technique

A total of 360 health workers comprising 180 each in the public and private health facilities were eligible to participate in this study. They were selected using a multistage sampling technique.

From each of the three senatorial zones in Anambra State, two LGAs each were chosen by simple random sampling technique through balloting. They are as follows Anambra Central (Awka South and Njikoka), Anambra North (Onitsha North and Onitsha South) and Anambra South (Nnewi North and Ihiala). In each of the selected LGAs, the health facilities were stratified based on ownership status into public and private. Public and private health facilities that met the inclusion criteria were selected by simple random sampling through balloting from each Local Government Area.

In each Local Government Area, four (2 public and 2 Private) health facilities that met the inclusion criteria were selected by simple random sampling through balloting. A total of 24 (12 public and 12 private health facilities were selected for this study. At each health facility, healthcare workers were selected randomly from the list of all eligible healthcare workers obtained from the hospital register until the required number of sample size was achieved. An eligible worker was one who offered malaria treatment either in public or private health facilities.

2.3 Data Collection

A pretested, structured, interviewer-administered questionnaire adapted from National policy on the treatment of malaria according to WHO guidelines, [13] was used to obtain information on respondents' socio-demographics characteristics, level of knowledge and awareness of national malaria treatment guidelines, availability of mRDTs and ACTs for diagnosis and treatment of malaria, level of compliance with the national guideline and factors influencing compliance with malaria treatment guidelines.

2.4 Data Analysis and Management

The data collected from the participants was cleaned and analyzed using International Business Machine-Statistical Package for Social Sciences (IBM-SPSS Inc., Chicago Illinois, USA) version 23 was used for the analysis of the data [14]. Descriptive statistics (frequencies, proportions, percentages, means, and standard deviations), tables, and charts were used to summarize the data. Chi-square $(X)^2$ and multiple logistic regression tests were used to test for the hypotheses generated and the level of statistical significance was set at $p \leq 0.05$.

3. RESULTS

Out of the 400 questionnaires distributed to the respondents from the 24 health facilities (12 public and 12 private), 387 were returned, giving a response rate of 96.8%. However, out of 387 retrieved questionnaires, 360 (93.0%) were valid.

Tables 1 and 2 show the health workers' knowledge of malaria case management. Of the 180 healthcare workers from public and private facilities, 97 (53.9%) and 51 (28.3%) had access to the guidelines ($p< 0.001$). In the requirements for patients suspected of malaria, presumptive diagnosis by prescription of anti-malarial drugs was significantly more likely to be carried out in private health facilities (58.9%) than public health facilities (31.1%), while parasitological diagnosis using RDT was more likely to be used by health workers in public facilities (47.2%) compared to private facilities (29.4%). The responses were statistically significant between the two health facilities ($p<0.001$).

Less than 50% of the health workers interviewed in public health facilities stated the recommended drug for uncomplicated Plasmodium falciparum malaria correctly compared to 50.6% of health workers interviewed in private health facilities. However, the responses were statistically insignificant ($p= 0.334$). There was a statistically significant difference in the responses given by the respondents from the public and private health facilities on the recommended drug for uncomplicated *Plasmodium falciparum* malaria in the first ($p=0.006$) and third ($p=0.006$) trimesters; as only 67.2% and 80% of the health workers from the public and private health facilities mentioned correctly the recommended drug for uncomplicated *Plasmodium falciparum* malaria in the first trimester while 61.7% and 76.7% of the respondents from the two health facilities stated correctly the recommended drug for uncomplicated *Plasmodium falciparum* malaria in the second and third trimester. On the drug and its derivatives that should not be used as monotherapy in the treatment of uncomplicated *Plasmodium falciparum* malaria; there was a statistically significant difference in the responses given by the respondents from the public and private health facilities ($p=0.003$); as only 22.8% and 35% of the health workers from the public and private health facilities stated correctly the right option. Also, there were statistically significant differences in the responses given by the respondents from the public and private health facilities on the recommended drug for the treatment of severe *plasmodium falciparum* malaria ($p=0.008$), recommended drug for intermittent preventive treatment in pregnancy ($p=0.043$) and duration for the administration of parenteral anti-malarial drugs in the treatment of severe malaria once started ($p=0.016$). The majority of the health workers interviewed in public facilities (84.4%) and 93.9% of health workers interviewed in private facilities responded correctly that food should be taken before taking the ACT ($p= 0.004$). However, only 48.3% and 56.1% of the health workers in public and private health facilities, respectively knew that a fatty meal and milk are important for improving drug absorption of Artemether-lumefantrine brand of ACT ($p= 0.140$).

Tables 3 and 4 highlight the level of compliance with the National Guidelines among the participants in the two health facilities. Less than 50% of the respondents {Public (31.7%) vs. Private (23.9%)} stated that they always comply with WHO policies on the treatment of malaria, while 97 respondents (26.9%) {Public (31.7%) vs. Private (23.9%)} stated that they never comply with WHO policies on the treatment of malaria. Their responses however were statistically significant ($p=0.010$). Sixty-nine (38.3%) and eight-two (45.6%) respondents from the public and private never refer or request parasitological confirmation before the commencement of treatment of suspected malaria compared to 24.4% and 28.3% of the health workers from the public and private health facilities that always refer or request for parasitological confirmation before the commencement of treatment of suspected malaria. One hundred and sixty-six respondents (46.1%) out of 360 health workers always use ACTs for treatment of uncomplicated *Plasmodium falciparum* malaria while 325 respondents (90.3%) use chloroquine singly or in combination with other anti-malarial drugs to treat uncomplicated *Plasmodium falciparum* malaria. More than 50% of the total respondents always restrict Sulphadoxine-pyrimethamine to pregnant women as a means of IPT compared to 1.9% that do otherwise. Only 182 (50.6%) and 231 (64.2%) out of 360 respondents treated pregnant women with uncomplicated *Plasmodium falciparum* malaria during the first trimester with quinine and clindamycin for 7 days and treat lactating mothers with recommended ACTs.

Table 1. Knowledge of case management of malaria in the two health facilities

Questions	Public (%) n =180	Private (%) n= 180	Total n (%)	Inferential Test (χ^2)	*p* value
Aware of National Guidelines					
Yes	124(68.9)	93(51.7)	217(60.3)	11.1	0.001
No	56(31.1)	87(48.3)	143(39.7)		
Access to National Guidelines					
Yes	97(53.9)	51(28.3)	**148(41.1)**	24.3	<0.001*
No	83(46.1)	129(71.7)	**212(58.7)**		
Requirements for patients suspected of malaria					
General examination	39(21.7)	21(11.7)	**60(16.7)**	28.3	<0.001*
Prescription of anti-malarial drugs	56(31.1)	106(58.9)	**162(45)**		
Prompt parasitological confirmation by microscopy or RDTs	85(47.2)	53(29.4)	**138(38.3**		
Recommended drug for uncomplicated *Plasmodium falciparum* malaria					
Quinine and clindamycin	34(18.9)	29(16.1)	**63(17.5)**	2.19	
Artemisinin-based combination therapies	77(42.8)	91(50.6)	**168(46.7)**		0.334
Artemether	69(38.3)	60(33.3)	**129(35.8)**		
Recommended drug for uncomplicated *Plasmodium falciparum* malaria in the first trimester					
Quinine and clindamycin	121(67.2)	144(80)	**295(81.9)**	10.1	
Artemisinin-based combination therapies	21(11.7)	19(10.6)	**40(11.1)**		0.006*
Sulphadoxine-pyrimethamine (SP)	38(21.1)	17(9.4)	**25(6.94)**		
Recommended drug for uncomplicated *Plasmodium falciparum* malaria in the second and third trimester					
Quinine injection or tablet	47(26.1)	27(15)	**74(20.6)**	9.66	0.008*
Artemisinin-based combination therapies	111(61.7)	138(76.7)	**249(69.2)**		
Sulphadoxine-pyrimethamine	22(12.2)	15(8.33)	**37(10.3)**		
ACTs recommended for use in Nigeria					
Halofantrine and Dihydroartemisinin-piperaquine	7(3.89)	5(2.78)	**12(3.33)**	0.88	
Chloroquine and Amodiquine	5(2.78)	3(1.67)	**8(2.22)**		0.644
Arthemether-lumefantrine and Artesunate-Amodiaquine	168(93.3)	172(95.6)	**340(94.4)**		

Questions	Public (%) n =180	Private (%) n= 180	Total n (%)	Inferential Test (χ^2)	*p* value
Drug and its derivatives that should not be used as monotherapy in the treatment of uncomplicated *Plasmodium falciparum* malaria					
Artesunate	48(26.7)	57(31.7)	**105(29.2)**	11.8	0.003*
Artemether-lumfantrine	41(22.8)	63(35)	**104(28.9)**		
Sulphadoxine-pyrimethamine (SP)	91(50.6)	60(33.3)	**151(41.9)**		
Drug use to treat infants < 5kg under supervision					
Quinine injection or tablet	23(12.8)	35(19.4)	**58(16.1)**	4.53	0.104
Artemisinin-based combination therapies	155(86.1)	140(77.8)	**295(81.9)**		
Arthemeter	2(1.11)	5(2.78)	**7(1.94)**		

Table 2. Knowledge of case management of malaria in the two health facilities

Questions	Public n =180	Private n= 180	Total n(%)	Inferential Test	*p*-value
Recommended drug for treatment of severe plasmodium falciparum malaria					
Dihydroartemisinin-piperaquine	13(7.22)	7(3.89)	**20(5.56)**	9.78	0.008*
Arthemether-lumefantrine	90(50)	67(37.2)	**157(43.6)**		
Intravenous or intramuscular Artesunate	77(42.8)	106(58.9)	**183(50.8)**		
Recommended drug for intermittent preventive treatment in pregnancy					
Quinine injection or tablet	27(15)	21(11.7)	**48(13.3)**	6.28	0.043*
Arthemether-lumefantrine	14(7.78)	29(16.1)	**43(11.9)**		
Sulphadoxine-pyrimethamine (SP)	139(77.2)	130(72.2)	**269(74.7)**		
To ensure equivalent exposure to the drug in the treatment of severe malaria, children weighing < 20kg should receive a higher dose of					
Chloroquine	11(6.11)	19(10.6)	**30(8.33)**	6.78	0.034*
Artesunate	78(43.3)	93(51.7)	**171(47.5)**		
Amodiaquine	91(50.6)	68(37.8)	**159(44.2)**		
In settings where complete treatment of severe malaria is not possible, patients should be given					
Intravenous or intramuscular Artesunate and refer immediately to an appropriate facility for further treatment	65(36.1)	79(43.9)	**144(40)**	8.70	0.013*
Oral quinine and refer immediately to an appropriate facility for further treatment	45(25)	57(31.7)	**102(28.3)**		
Oral Artesunate and refer immediately to an appropriate facility for further treatment	70(38.9)	44(24.4)	**114(31.7)**		

Questions	Public n =180	Private n= 180	Total n(%)	Inferential Test	*p*-value
Duration for administration of parenteral anti-malarial drugs in the treatment of severe malaria once started					
Minimum of 6 hours	45(25)	62(34.4)	**107(29.7)**	8.28	0.016*
Minimum of 12 hours	68(37.8)	75(41.7)	**143(39.2)**		
Minimum of 24 hours	67(37.2)	43(23.9)	**110(30.6)**		
Is it compulsory to eat before taking ACT					
Yes	152(84.4)	169(93.9)	**321(89.2)**	8.31	0.004*
No	28(15.6)	11(6.11)	**39(21.7)**		
Fatty meal and protein (milk) are important for improving drug absorption of the Artemether lumefantrine brand of ACT					
Yes	87(48.3)	101(56.1)	**188(52.2)**	2.18	0.140
No	93(51.7)	79(43.9)	**172(47.8)**		

Table 3. Level of compliance with the National Guidelines among the participants

Questions	Public n =180	Private n= 180	Total n(%)	Inferential Test (χ^2)	*p-value*
Consistently comply with WHO policies					
Always	57(31.7)	43(23.9)	**100(27.8)**	9.15	0.010*
Sometimes	87(48.3)	76(42.2)	**163(45.3)**		
Never	36(20)	61(33.9)	**97(26.9)**		
Refer or request for parasitological confirmation before commencement of treatment of suspected malaria					
Always	44(24.4)	51(28.3)	**95(26.4)**		
Sometimes	67(37.2)	47(26.1)	**114(31.7)**	5.14	0.076
Never	69(38.3)	82(45.6)	**151(41.9)**		
Use ACTs for treatment of uncomplicated *Plasmodium falciparum* malaria					
Always	71(39.4	95(52.7)	**166(46.1)**	6.53	0.038*
Sometimes	100(55.6)	79(43.9)	**179(49.7)**		
Never	9(5)	6(3.33)	**15(4.2)**		
If yes, which of them					
Artemether-lumefantrine tab or injection	162(90)	146(81.1)	**308(85.6)**	6.55	0.161
Artesunate-amodiaquine (AA)	87(48.3)	66(36.7)	**153(42.5)**		
Artesunate-mefloquine	56(31.1)	69(38.3)	**125(34.7)**		
Dihydroartemisnin-piperaquine	40(22.2)	51(28.3)	**91(25.3)**		
Sulphadoxine-pyrimethamine	170(94.4)	178(98.9)	**348(96.7)**		

Questions	Public n =180	Private n= 180	Total n(%)	Inferential Test (χ^2)	*p-value*
Use chloroquine singly or in combination with other anti-malarial drugs					
Yes	156(86.7)	169(93.9)	**325(90.3)**	5.35	0.021*
No	24(13.3)	11(6.11)	**35(9.72)**		
Restrict Sulphadoxine-pyrimethamine to pregnant women as a means of IPT					
Always	147(81.6)	111(61.7)	**258(71.7)**	17.8	0.001*
Sometimes	31(17.2)	64(35.6)	**95(26.4)**		
Never	2(1.11)	5(2.78	**7(1.94)**		
Use a single anti-malarial drug in treatment of uncomplicated *Plasmodium falciparum* malaria					
Always	13(7.22)	21(11.7)	**34(9.44)**	5.76	0.056
Sometimes	38(21.1)	23(12.8)	**61(16.9)**		
Never	129(71.7	136(75.6)	**265(73.6)**		
Treat infant weighing < 5kg with an ACT at the same mg/kg between target dose as for children weighing 5 kg					
Always	77(42.8)	93(51.7)	**170(47.2)**	14.1	0.001*
Sometimes	46(25.6)	60(33.3)	**106(29.4)**		
Never	57(31.7)	27(15)	**84(23.3)**		

Table 4. Level of compliance with the National Guidelines among the participants

Questions	Public n =180	Private n= 180	Total n(%)	Inferential Test (χ^2)	*p-value*
Treat pregnant women with uncomplicated *Plasmodium falciparum* malaria during first trimester with quinine and clindamycin for 7 days					
Always	100(55.6)	82(45.6)	**182(50.6)**	22.6	<0.001*
Sometimes	66(36.7)	50(27.8)	**116(32.2)**		
Never	14(7.78)	48(26.7)	**62(17.2)**		
Treat lactating mothers with recommended ACTs					
Always	109(60.6)	122(67.8)	**231(64.2)**		
Sometimes	56(31.1)	34(18.9)	**90(25)**	8.19	0.017*
Never	15(8.33)	24(13.3)	**39(10.8)**		
Use parenteral anti-malarials in the treatment of severe *Plasmodium falciparum* malaria for a minimum of 24 hours once started					
Always	122(67.8)	109(60.6)	**231(64.2)**	2.82	0.244
Sometimes	34(18.9)	47(26.1)	**81(22.5)**		
Never	24(13.3)	24(13.3)	**48(13.3)**		

Significant

Table 5. Factors affecting the type of anti-malarial drugs prescribed by health workers in the two health facilities

Variable	Public	Private	Total (%)	OR (CI)	*p* value
Drug availability					
Yes	143(79.4)	124(68.9)	**267(74.2)**	1.7(1.060-2.820)	0.023*
No	37(20.6)	56((31.1)	**93(25.8)**		
Existing national malaria treatment guidelines					
Yes	74(41.1)	51(28.3)	**125(34.7)**	1.8(1.135-2.741)	0.011*
No	106(58.9)	129(71.7)	**235(65.3)**		
Drug promotion by manufacturers					
Yes	62(34.4)	81(45)	**143(39.7)**	0.6(0.420-0.982)	0.041*
No	118(65.6)	99(55)	**217(60.3)**		
Idea of what the consumer prefers					
Yes	62(34.4)	49(27.2)	**111(30.8)**	1.4(0.896-2.202)	0.139
No	118(65.6)	131(72.8)	**249(69.2)**		
Need to make a profit					
Yes	52(28.9)	77(42.8)	**129(35.8)**	0.5(0.351-0.841)	0.006*
No	128(71.1)	103(57.2)	**231(64.2)**		
Demand by patients					
Yes	45(25)	53(29.4)	**98(27.2)**	0.8(0.502-1.272)	0.344
No	135(75)	127(70.6)	**262(72.8)**		

OR Odds ratio, CI* Confidence interval*

Table 5 highlights the factors influencing type of anti-malarial drugs prescribed by the health workers. The majority of the health providers in both public (79.4%) and private (68.9%) health facilities considered the availability of anti-malarial medicines before prescribing a specific anti-malarial medicine to the patients ($p = 0.023$). Also, 41.1% of health workers in public facilities and 28.3% in private facilities considered the recommendations of the treatment guidelines before commencing treatment ($p=0.011$). Drug promotion ($p= 0.041$)) and the need to make a profit ($p=0.006$) were among the factors mentioned by the respondents influencing the type of anti-malarial drugs prescribed.

4. DISCUSSION

The primary aim of this study was to determine the compliance with National Guidelines on the diagnosis and treatment of malaria among health workers in Anambra State. Overall, only 22.2% of all the health workers interviewed complied strictly with the national treatment guideline, 28.1% of the health workers partially complied while non-compliance with National Guidelines for diagnosis and treatment of malaria was recorded among 49.7% of the health workers.

In total, in this study, Artemether-lumefantrine tablet was the most available among the recommended anti-malarial medicines in the two health facilities while Artesunate-Amodiaquine was available in 54.2% of the facilities visited. All the health facilities visited had sulfadoxine-pyrimethamine in stock. Artemether-lumefantrine and Artesunate-Amodiaquine were more available in public facilities than in private facilities. This is in harmony with the study carried out in Ogun state, South-west, Nigeria which reported that Artemether-lumefantrine and Artesunate-Amodiaquine were readily available in public facilities [7]. This could be attributed to the fact that ACTs donated by grants/donors are currently supplied free of charge for treatment of all parasitological confirmed malaria cases in public health facilities compared to private health facilities.

"Artesunate and Amodiaquine (monotherapy) were more available in the private facilities compared to the public health facilities visited. However, 58.3% of the public health facilities had chloroquine injections in stock, compared to 41.7% of the private health facilities. The findings of this study also revealed that monotherapies, either as oral artemisinin-based (Artesunate) or non-artemisinin-based (Amodiaquine) were in stock for use in a sizeable proportion (83.3% and 66.7%), respectively in the private facilities. The use of artemisinin-based monotherapy is contrary to national policy and portends the potential risk of parasites developing resistance to the medicine as a result of its short half-life" [13]. Non-artemisinin monotherapies, typically chloroquine which has been proscribed was significantly more available for use in public health facilities compared to private health facilities and were usually sold at a much lower price than ACTs. Given the relative affordability and accessibility of non-artemisinin therapies, health workers at private health facilities are likely to choose incorrect and ineffective anti-malarial drugs for the treatment of malaria. This finding is in line with the results of a study done by Malik et al. [15] which assessed the quality of anti-malarial drugs provided by public and private healthcare providers and found that monotherapies such as chloroquine, SP, quinine, artesunate, and dihydroartemisinin were still widely used for treatment of malaria.

The study findings indicated a high level of awareness of national treatment guideline among health workers in both public (68.9%) and private (51.7%) settings. This is in contrast to a study done in Tanzania which revealed that 15.5% of healthcare workers were aware of the country's guidelines [16]. Of the 360 health care workers studied only 41.1% {Public (53.9%) and private (28.3%)} of the workers in these health facilities had access to the National Guidelines. This is in line with a study conducted by Bamiselu *et al* in 2016 among healthcare workers in Ogun State, Nigeria that recorded 66.6 % and 27.3% access to the National Guidelines from public and private health facilities respectively. The low proportion of access to the National Guidelines recorded in private health facilities might be due to a lack of awareness and a limited number of National treatment guidelines in their various health facilities.

In the prerequisite for patients suspected of malaria, presumptive diagnosis by prescription of anti-malarial drugs was more likely to be carried out in private health facilities (58.9%) than public health facilities (31.1%) even when Malaria RDT kits were more available in the private health facilities studied compared to those of the public health facilities. The reason for the prescription of anti-malarial drugs may be due to the perceived non-reliability of mRDT results and also, the generally acclaimed

view that the malaria parasite is prevalent, so there is a high tendency that the result will be positive. This is in agreement with the study carried out in 2014 by Pulford et al. [16] in Papua New Guinea.

However prompt parasitological diagnosis using RDT or microscopy was more likely to be applied by health workers in public facilities (47.2%) compared to private facilities (29.4%). This may be a result of the cost and availability of mRDT. This is likely to have promoted treatment based on a presumptive diagnosis of malaria by health workers in private health facilities. A positive finding however was that health workers in both public and private facilities knew that mRDT could be affected by temperature and humidity hence some of the health facilities tend to purchase limited mRDT kits. This is important for maintaining the quality of mRDT in the facilities.

Less than 50% of the health workers interviewed in public health facilities stated correctly the recommended drug for uncomplicated *Plasmodium falciparum* malaria compared to 50.6% of health workers interviewed in private health facilities. However, the responses were statistically insignificant (p= 0.334). This might be a result of the availability of antimalarials in their facilities.

Concerning the drug and its derivatives that should not be used as monotherapy in the treatment of uncomplicated *Plasmodium falciparum* malaria, the result showed a low proportion from the two health facilities, as only 22.8% and 35% of the health workers from the public and private health facilities stated correctly the right option. Also, there were statistically significant differences in the responses given by the respondents from the public and private health facilities on the recommended drug for the treatment of severe *plasmodium falciparum* malaria (p=0.008), recommended drug for intermittent preventive treatment in pregnancy (p=0.043) and duration for the administration of parenteral anti-malarial drugs in the treatment of severe malaria once started (p=0.016).

"Health workers' compliance with guidelines is critical for the successful implementation of any new drug policy" [17]. Less than 50% of the respondents from both facilities stated that they always comply with WHO policies on the treatment of malaria. Their responses however were statistically significant as respondents from the public sector comply more with WHO policies on treatment of malaria compared with their counterparts from the private sector. This is in tandem with the study carried out by Bagbi et al. [18], which revealed that Nigerian prescribers had poor adherence to national anti-malarial treatment guidelines and policy. The low proportion of compliance might be attributed to the respondent's access to National guidelines, training on malaria case management, knowledge of drug choice for malaria treatment, and years of experience. This proportion is similar to that reported in Kenya where both RDT and microscopy were available at the health facilities [19], but higher than that reported in many other malaria high-transmission settings since the release of the WHO recommendation for universal access to malaria diagnostic testing [20,16,18,19,21]. "The fact that ACTs were readily available and were used, suggests that some patients particularly at private health facilities may be treated with ACTs without laboratory diagnosis. Parasitological diagnosis is a component of malaria case management, the first step without which adherence to national guidelines is incomplete" [22]. "Improper and abusive use of ACTs without a confirmatory diagnosis will result in negative clinical and economic impact" [20]. On the overall level of compliance with the National Guidelines for the treatment of malaria, only 22.2% of all the health workers interviewed comply strictly with the national treatment guideline with the highest proportion coming from the public health facilities while non-compliance with National Guidelines for treatment of malaria was recorded more among the private health workers. This difference may be a result of the unavailability and inaccessibility of the treatment guidelines in their facilities.

Health workers who used any of the malaria laboratory diagnostic methods (RDT or microscopy) were significantly more likely to comply with the national treatment guidelines in both public and private health facilities. This finding is similar to a study carried out by Mubi et al. [22], in Tanzania where health workers' overall adherence to national treatment guidelines was 90.5%.

In this study, years of experience was found to be associated with compliance with national malaria treatment guideline among the health workers in the two health facilities. However, this finding is not in line with the findings of [18] which revealed that prescribers that have practiced for

more than 10 years were less likely to adhere to national anti-malarial treatment guidelines, as this might be due to negative perception of this group of prescribers had over recommended ACTs and ultimately, the high cost of ACTs when compared with non-ACTs.

A similar association between patient-reported symptoms of fever and skin problems on malaria treatment has been reported in Vanuatu, patients with a main complaint of fever were more likely to get tested for malaria [21,23].

Artemether Lumefantrine has been reported to be safe and effective for the treatment of acute uncomplicated malaria in developed [24], and developing countries like Burkina Faso [25], issue of safety and efficacy may not be the only reason why long-practicing prescribers could not adhere to the new treatment guidelines, rather, their resistance to change might also be the major factor. According to some researchers, practice volume can also an independent predictor of adherence to new malaria treatment guidelines as prescribers who had a workload of fewer patients per day were about may be more likely to adhere to the new policy than those having more patients per day [17,26]. The reasons for non-adherence may be related to more general health system factors, particularly the workload of health care staff, and the erratic nature of drug supply.

Concerning factors influencing the type of anti-malarial drugs prescribed by the health workers; availability of the anti-malarial drugs, existing national guidelines, drug promotion by manufacturers, and profit making were among the factors mentioned by the respondents influencing the type of anti-malarial drugs prescribed.

The availability of anti-malarial drugs was observed to be a major factor that affected treatment prescription in both public and private health settings. This implied that health workers are sometimes constrained to prescribe the anti-malarial drugs available in the facilities even if they are not the recommended ones. This supports the results of earlier studies that found that prescribing patterns are more likely to follow the availability of anti-malarial drugs [17,27].

In this study, drug promotion by manufacturers to the providers and the need to make a profit were significant factors that influence drugs prescribed by health workers in private settings. This is worrisome because it could lead to supplier-induced demand and prescription of unnecessary drugs thereby worsening the economic burden of the disease on the consumers and predisposing to the development of drug resistance if the drugs are wrongly used. These factors found to influence health workers' malaria treatment prescription behavior constitute a focus on targets in the planning of intervention to improve the treatment of malaria in health facilities.

5. CONCLUSION

The findings of this study revealed close similarity between the two health facilities in the level of awareness of the national malaria treatment guidelines, but a remarkable difference in compliance to appropriate case management of uncomplicated malaria between public and private health facilities in the State. In general, health workers in the public setting had fairly good knowledge of the national malaria treatment guidelines for case management of uncomplicated malaria compared to their private counterparts. The majority of health workers in both settings were not complying with the guidelines due to a lack of training and knowledge of malaria case management, access to national guidelines, and use of diagnostic tools. These factors did not completely reflect the quality performance of health professionals in the study facility. The present compliance of health workers with the national guidelines, even though guidelines are still not widely available, is possibly due to recent in-service training they received before this study thus more efforts are needed. Efforts were made to provide the National Treatment Guidelines in each of the health facilities visited at the end of the study.

This study also revealed that each of the variables; availability of anti-malarial drugs, existing national guidelines, drug promotion by manufacturer, and need to make a profit made an independent contribution to predicting the type of anti-malarial drugs prescribed by health workers in the two health facilities. Besides current media campaigns, educating health workers on the new treatment policy is an influential factor. Although findings from the study invariably show some level of compliance to guidelines, health professionals need not be complacent; there is still considerable room for improvement in health worker compliance, especially in routine diagnostic testing and the use of appropriate drugs in the right

dosages/anti-malarial prescribing practices for effective management of cases.

Management could provide regular supervision and monitoring of staff inwards on their performance. This would ensure that policy guidelines regarding the management of severe cases of malaria and other health problems are properly implemented. There is a need for hospital management to make available national treatment guidelines at all service delivery points within the hospital.

CONSENT AND ETHICAL CONSIDERA-TIONS

Ethical approval for this study was sought and obtained from the Nnamdi Azikiwe University Teaching Hospital Ethics Committee (NAUTH/CS/66/VOL.12/033/2019/013), Nnewi, Anambra State. Permission was also obtained from the selected health facilities before the commencement of this study. The objectives of the study were explained to the participants and confidentiality was assured. Informed consent was obtained from every participant before giving out the questionnaire.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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