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Prescription patterns of antimalarial medicines in selected primary health care (PHC) facilities of Jos north local government area (LGA) of plateau state, Nigeria

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Abstract
Objectives: The high prevalence of malaria in sub-Saharan Africa has been linked to irrational treatment practices. The present study evaluates prescription patterns of antimalarial drugs in PHC facilities of Jos North LGA of Plateau state, North-Central Nigeria.
Materials and methods: Nine hundred (900) patients' data were extracted retrospectively using Patients' Medication Review Form (PMRF), and analyzed using Statistical Package for Social Sciences (SPSS) version 20.
Results: Out of 900 patients that were treated for the disease in the selected primary healthcare facilities, majority (61.2%) were female and artemether-lumefantrine combination was the most prescribed drug (28.7%) by the prescribers, followed by paracetamol (26.2%) as co-medication. The average number of drugs per prescription was 5.33±0.58 (Mean ±SD). The result indicated irrational prescription practices by the prescribers based on the observed poly-pharmacy practices (5.33±0.58 (Mean ±SD)), prescription by generic (66.4%), and inclusion of injectables (18.0%), while their use of antibiotics (21.5%) and prescription from essential drug list were in accordance with the WHO/INRUD optimal levels.
Conclusion: The result shows irrational prescription practices in the PHC facilities as there were high practices of poly-pharmacy, poor prescription by generics, and unnecessary inclusion of injectable in patients' regimens.

Keywords: antimalarial drugs, malaria, primary healthcare, rational prescription

1. Introduction
Malaria is a vector-borne disease caused by a parasitic protozoan of the genus plasmodium, phylum apicomplexa, and is transmitted to humans through infected female anopheles mosquitoes known as anopheles gambia which is one of the over 3,000 identified species of mosquitoes [1, 2]. This is because the female species depends on blood as source of nutrients for their eggs [3, 4]. The disease is caused by five species of plasmodium, namely, *plasmodium falciparum, p. ovale, p. malariae, p. vivax, and p. knowlesi,* with *p. falciparum* been responsible for about 98% of malaria cases in Nigeria [5-8]. Due to development of resistance by *p. falciparum* infections to chloroquine which had been the common antimalarial monotherapies, in addition to sulphadoxime-pyrimethemine (S-P) and amodiaquine in malaria endemic countries, the use of monotherapies were discouraged by World Health Organization (WHO) [9], and such countries were advised to change treatment policies to combination therapies, such as artemisinin-based combination therapies – (ACTs)"(Federal Ministry of Health [10]. The concept behind the use of multiple drug therapy was based on the synergistic potential of 2 or more drugs to improve treatment efficacy and retard the development of resistance to the individual components of the combination [10]. Despite all efforts aimed at eliminating the disease in Nigeria, the incidence kept on increasing, and this have been linked to many factors which include medically-related factors, such as inappropriate diagnosis and use of anti-malarial drugs; or non-medically related factors such as weather condition of the country, and poverty condition of the citizens [11, 12]. According to the current malaria treatment guideline, appropriate patients management implied effective diagnosis either through microscopy or rapid diagnostic test (RDTs) approach for the identification of the malaria parasites, and malaria-positive patients treated with the recommended artemether- lumefantrine drugs or artesunate amodiaquine [13, 14], the resultant outcome been improved patients outcome of treatment and quality of life at minimal cost [15], and this might be more effective when both the healthcare providers and patients adhered to the recommended treatment guidelines during their medication practices [16, 17]. On the contrary, inappropriate patients' management implied inability to identify the presence or absence of the parasite before administration of the recommended artemesinin-based combination therapy on the patients [14]. In some instances, even when the parasite is correctly identified, prescription of wrong antimalarial drugs to the patients would still not solve the problem and this might encourage the possibilities of the malaria parasite becoming resistant to the drug with subsequent high morbidity and mortality, unwanted effects, and cost of treatment on patients and the system [18, 19, 20].
Due to the reported high prevalence of inappropriate use of anti-malarial drugs in Nigeria, with their health and economic consequences [12, 21, 22], understanding how healthcare professionals renders management practices to malaria-infected patients, especially at the PHC facilities would help in providing appropriate intervention measures were needed. One of the popular approaches to this kind of study involved the use of measurement instruments that captured all the relevant information needed to describe how prescribers perform their prescription practices. The international network for rational use of drugs and the World Health Organization (WHO/INRUD) action programme on essential drugs [23, 24] had jointly produced an instrument that consisted of three main subsections, namely prescribing indicator, patients care indicators and facility indicators, with specific standards for use in the assessment of rational practices by the prescribers [23, 24]. The aim of this study was to assess how healthcare professionals perform their prescription practices in selected primary healthcare (PHC) facilities of Jos North Local Government area (LGA) and environs using prescribing indicator form.

2. Material and method
2.1 Study location
This study was conducted in five selected PHC facilities in Jos north LGA, Plateau state. The state is located in the north-

central geopolitical zone of Nigeria with a population of 5,178,712 [25]. Jos North Local Government has a total of 24 government-owned PHC facilities and 21 privately owned health facilities; it has a total of 20 political wards each hosting between 1 and 4 health facilities. The Local Government has an estimated population of 437,217 [25]. Plateau state, especially the northern zone where the study was conducted has favourable climatic conditions for the survival and reproduction of anopheles mosquito [20, 26]. This is possible since the parasites' temperature and fluid levels are determined by the climatic conditions of the environment due to lack of thermostatic mechanisms in them [27, 28].

2.2 Study design and population
A facility-based cross-sectional retrospective evaluation was conducted at five (5) selected health facilities using the PHC patients' medication records. The study population consisted of past prescriptions of patients of all age groups that were managed for malaria between September 2015 and August 2016 in the selected PHC facilities.

2.3 Sampling method and data collection
A multistage sampling technique was employed in selecting the sample. The local government was zoned into North, South, West, East and Central with each zone comprising of between 3 to 5 wards out of the 20 political wards in the LGA.

Stage 1-Selection of wards: One ward was selected in each of the five zones by balloting. They included Tafawa Balewa, Naraguta B, JentaApata, Lamingo, and Tudun Wada ward.

Stage 2- Selection of PHC: From each of the identified political ward, one PHC facility was also selected, including PHC Township, Fudawa, JentaApata, Lamingo, and Tudun Wada by based on balloting to represent the geographical section of the LGA.

Stage 3: one hundred and eighty (180) patients' records treated for malaria from each of the selected facilities between September 2015 and August 2016 were selected by simple random sampling and the relevant data extracted for statistical analysis.

2.4 Inclusion criteria
Government PHC facilities within Jos north LGA and environs were qualified for selection for the retrospective study, and records of patients of both gender and ages that had been treated for malaria between September 2015 and August 2016 in the selected PHC facilities were qualified for retrieval for the study.

2.5 Exclusion criteria
Private and all other PHC facilities that were not under the government were excluded from the study; similarly, records of patients whose primary diagnoses were other ailments outside malaria were excluded from the study.

2.6 Data collection
Written permission to conduct the survey was granted by the office of the Director of Primary Health Care (PHC) Jos North Local Government Area, Plateau State. The present study used the prescription indicator form [23, 24] to extract relevant information from past prescriptions records of 900 patients of all age groups that were managed for malaria between September 2015 and August 2016 in the selected PHC facilities. The form consisted of date of prescription, signature of prescribers and dispensers, gender and age of patients, and the details information about the prescription practices.

2.7 Statistical analysis
The extracted patients' treatment information was appropriately coded and entered into Microsoft Excel software, followed by descriptive analysis and Chi-square test for association set at $p < 0.05$ levels of significance using Statistical Package for Social Sciences (SPSS) version 20 software programmer, IBM Incorporation. The followings prescribing indicators limits proposed by WHO/INRUD [23, 24] were used in describing the prescribing patterns of healthcare professionals:

Percentage non-Polypharmacy prescriptions ≤3
Percentage drugs prescribed by generic name = 100%
Percentage drugs prescribed from EDL or formulary = 100%
Percentage prescriptions including antibiotic ≤30
Percentage prescriptions including injection ≤10

3. Results
3.1 Patients' demography
In all, 900 patients' prescriptions were evaluated, with majority of the patients as female (61.2%). Higher percentage (44.6%) of the patients that were treated for malaria across the PHC facilities within the time frame selected for the retrospective data extraction were between 18 – 40 years old, with those of <5 years constituting 15. 2% of the study population, while the least were aged > 40 (9.9%) (Table 1).

3.2 General prescription patterns in PHC facilities of Jos north LGA
Table 2 showed the general prescription patterns of the healthcare professionals in the selected PHC facilities, with antimalarial drugs been the most patronized (28.7%) compared to other co-medications. The details of the prescription records indicated that some of the patients were prescribed more than one antimalarial medicines which explained why the number of antimalarial medicines were more than the total number of patients whose treatment records were evaluated. Many adjunct medications were included in most of the prescriptions for uncomplicated malaria treatment in the selected PHC facilities, and analgesics, especially oral paracetamol were the most commonly prescribed adjunct medication (26.2%) to patients, followed by multivitamins (21.7%) like b-complex tablets for adults and syrups for children. Antibiotics such as amoxicillin and metronidazole were also prescribed to patients (21.5%), and 99.7, 91.1, and 60.0% of the analgesics, multivitamins, and antibiotics prescriptions were by generic names, respectively (Table 2).

Most of the antimalarial medicines (66.4%) were prescribed by generic names and the differences in the healthcare professionals' prescription by generic and brand names were statistically significant ($p < 0.001$) for all the prescribed medicines, including the adjunct medicines, except anti-emetics and other less prescribed medicines such as anti-hypertensive and anti-diabetic drugs (Table 2). The non-artemether-lumefantrine combination therapy (non-ACTs) constituted 52.5% of the prescribed antimalarial medicines to patients, with artemether-lumefantrine combination therapy (ACTs) formulations constituting 47.5% (Table 3). The details of the non-ACTs medicines indicated artemether (22.4%) as the most patronized by the prescribers, followed by artsunate (16.9%) and sulphadoxime-pyrimethemine (S-P) (11.9%) (Table 4). The prescription patterns were observed to be 100% by generic in PHC Apata, followed by PHC Lamingo (96.7%), while PHC Fudawa, Tudun Wada, and Township had 57.01, 44.0, and 43.6% in that order (Table 3). All the differences were statistically significant at $P < 0.05$.

3.3 Antimalarial drugs categorization base on formulations
Most of the antimalarial drugs prescribed were oral dosage formulations (82.1%), with only 18.0% as parenteral (injectables) dosage form. While artemisinin-based combination therapy (ACT), quinine, and sulphadoxime-

pyrimethemine (S-P) were 100% oral formulations, about 75.7% and 90.0% of artemether and chloroquine were respectively in the injectable forms. PHC Township, Apata, and Tudun Wada had a majority of the antimalarial drugs in oral dosage forms compared to those of PHC Fudawa and Lamingo (Table 4).

3.4 Average number of drugs per prescription

Table 5 showed that the average number of medicines (antimalarials and adjuncts) prescribed by healthcare professionals to patients in the PHC facilities was 5.33±0.67, and the differences across gender was statistically insignificant (P = 0.285), but was significant (P = 0.041) across the various age groups with age groups of > 40 years old having the highest number of drugs (6.36±0.56). Similar numbers were observed across the selected PHC facilities, except that of PHC Apata with the highest average number of 6.18±0.62 medicines per prescription, and the difference was statistically significant (P = 0.000).

3.5 Prescription indicators based on WHO/INRUD prescribing Indicators

Table 6 gives the summary of prescription indicators in PHC facilities of Jos North. An average number of drugs prescribed to each patient was 5.33±0.05, and almost all the antimalarial drugs (99.9%) prescribed were from the essential drug list. The percentage of antimalarial drugs prescribed by generic was 66.43%, while 21.51 and 17.95% of the prescriptions had antibiotics and injections, respectively.

4. Discussion

The prescriptions patterns of antimalarial drugs showed that oral Artemether/Lumefantrine combination was the most commonly prescribed (47.6%) by the health practitioners for treatment of malaria compared to other individual antimalarial medicines across the PHC facilities in Jos North LGA (Table 3). This agreed with Nigeria malaria treatment guideline for uncomplicated malaria and report of similar study conducted in north-eastern Nigeria [13, 29]. Similarly, artemether was the second most frequently prescribed (22.4%) antimalaria, and this might be due to the inadequate stock of the recommended artesunate (16.9%) for severe cases, or the patronage might be out of prescribers' preference. Whichever the reason might be, the guideline allows the use of artemether for severe malaria in the absence of the recommended artesunate, with clear instruction on switching the patients to oral artemisinin-based combination therapy when such patient has been stabilized and able to take oral medications [13]. There was similar high patronage of oral sulphadoxine-pyrimethamine (S-P) (11.9%) by prescribers, and this might be connected to the reported high incidence of malaria in pregnant women in Nigeria [30], which has adverse consequences on both the fetus and mother [14], in addition to the safety and effectiveness of the drug for intermittent preventive treatment (IPT) in pregnant women [14, 31].

Table 2 showed adjunct medicines prescription patterns by the prescribers when treating their patients, and analgesics (26.2%), multivitamins (21.7%), and antibiotics (21.5%) were the most patronized adjunct medicines, in some case, the multiple prescriptions was observed to be due to co-infections that came with malaria. This was similar to previous related studies conducted within and outside Nigeria [22, 32]. Although, the use of analgesics, especially oral paracetamol have been encouraged in malaria treatment guideline when patients' temperature reaches 38.5^{o}C [13], the use of the adjunct drug most be under caution because of its reported harmful effects in children and also its negative effect on parasite clearance ability of antimalarial medicines [32]. Similarly, the importance of antibiotics in reversing some of the physiological abnormalities arising from malaria infection have also been documented [33]; but this might only be more useful in severe conditions where there is high tendency of pathological damages [34].

Although the need for prescribing some of the adjunct medicines cannot be compromised, especially analgesics and multivitamins, but it should be rationally carried out in order to reduce the practice of poly-pharmacy (too many drugs prescribed to one patient) as observed in the present study where an average of five (5.33±0.67) drugs was prescribed to one patient (Table 5 and 6); which was higher than the WHO/INRUD limits of ≤3 drugs per prescription and results of other related studies [23, 24].

Table 6 also showed that 99.9% of the prescribed medicines were from the essential drug list (EDL) or formulary of the ministry of health which was higher than result of similar work conducted in some selected PHC facilities in Nigeria [35 – 38]. Similarly, the inclusion of antibiotics in prescription by the healthcare professionals was within the maximum accepted limits of ≤ 30% [23, 24] and it was better than reports of similar study conducted by Babalola *et al*. [36] who reported poly-pharmacy practices among prescribers in PHC facilities of Osun state due to high prescription of antibiotics and injectables.

Table 1: Demographic Characteristics of Patients Treated for Malaria in Jos North PHC facilities (N = 900)

Variable		Frequency	Percentage
Sex	Male	349	38.8
	Female	551	61.2
Age category (in years)	<5	137	15.2
	5-<18	273	30.3
	18-40	401	44.6
	>40	89	9.9
Pregnancy status	Not applicable	547	60.8
	Pregnant	9	1.0
	Not pregnant	344	38.2
PHC attended	Fudawa	180	20.0
	Lamingo	180	20.0
	Township	180	20.0
	Tudun-wada	180	20.0
	Apata	180	20.0

Table 2: General prescription patterns in PHC facilities of Jos North LGA (N = 900)

Variable	Total n (%)	Generic n (%)	Brand n (%)	X^2	*P* value
Antimalarials	977(28.7)	649 (66.4)	328 (33.6)	54.3	0.000
Analgesics	890 (26.2)	887 (99.7)	3 (0.3)	566.0	0.000
Multivitamins	739 (21.7)	673 (91.1)	66 (8.9)	289.0	0.000
Antibiotics	732 (21.5)	439 (60.0)	293 (40.0)	14.7	0.000
Antiemetics	66 (1.9)	23 (37.7)	38 (62.3)	1.9	0.163
Antihypertensives	3 (0.1)	3 (100.0)	0 (0.0)		
Anti-diabetics	1 (0.03)	0 (0.0)	1 (100.0)		
General (all drugs)	3403 (100)	2674 (78.6)	729 (21.4)	605	0.000

P-value (P < 0.05)

Table 3: Antimalarial drugs prescription patterns in PHC facilities of Jos North LGA (N = 900)

Variable	Total n (%)	Generic n (%)	Brand n (%)	X^2	*P* value
Total antimalarials	977 (100)	649 (66.4)	328 (33.6)	54.3	0.000
ACTs	464(47.5)	345 (74.4)	119 (25.7)	105.0	0.001
Non-ACTs	513 (52.5)	79 (15.4)	434 (84.6)	35.4	0.000
Antimalarials base on facilities					
Fudawa	184 (18.8)	105 (57.1)	79 (42.9)	272.0	0.000
Lamingo	181 (28.8)	175 (96.7)	6 (3.3)		
Township	248 (25.4)	108 (43.6)	140 (56.5)		
Tudun wada	184 (18.8)	81 (44.0)	103 (56.0)		
Apata	180 (18.4)	180 (100.0)	0 (0.0)		

P-value (P < 0.05)

Table 4: Antimalarial drugs categorization based on formulation (N = 900)

Variable	Total n (%)	Oral n (%)	Parenteral n (%)	*P* value
Total antimalarials	975 (99.8)	800 (82.1)	175 (18.0)	**0.000**
ACT(A/L)	464(47.6)	436 (100.0)	0 (0.0)	**0.000**
Artesunate	165(16.9)	164 (99.4)	1 (0.6)	
Artemeter	218(22.4)	53 (24.3)	165 (75.7)	
Quinine	2(0.2)	2 (100.0)	0 (0.0)	
Chloroquine	10(1.0)	1 (10.0)	9 (90.0)	
S-P	116(11.9)	116 (100.0)	0 (0.0)	
PHC facilities				
Fudawa	255 (22.2)	184(72.2)	71(27.8)	**0.000**
Lamingo	271(23.6)	181(66.8)	90(33.2)	
Township	249(21.7)	247(99.2)	1(0.4)	
Tudunwada	193(16.8)	183(94.8)	10(5.2)	
Apata	182(15.8)	180(98.9)	2(1.2)	

P-value (P < 0.05)

Table 5: Average number of drugs per prescription across patients' demography and PHC facilities (N = 900)

Variable		(Mean ±SD)	*P* value
Average number of drug per prescription		5.33±0.67	
Based on gender	Male	5.40±0.64	0.285
	Female	5.29±0.81	
Based on age category	<5	5.12±0.57	0.041
	5-<18	5.23±0.58	
	18-40	5.18±0.59	
	>40	6.36±0.56	
Base on PHC	Fudawa	5.21±0.78	0.000
	Lamingo	5.10±0.41	
	Township	5.14±0.52	
	Tudun Wada	5.03±0.51	
	Apata	6.18±0.62	

P-value (P< 0.05)

Table 6: Analysis of antimalarial drugs Prescription in PHC facilities of Jos North LGA based on WHO/INRUD prescribing indicators (N = 900)

Indicators	Optimal level (%)	Result of study (%)
Percentage non-Polypharmacy prescriptions	≤3	5.33±0.67 (Mean±SD)
Percentage drugs prescribed by generic name	100	66.4
Percentage drugs prescribed from EDL or formulary	100	99.9
Percentage prescriptions including antibiotic	≤30	21.5
Percentage prescriptions including injection	≤10	18.0

5. Conclusion

This study showed irrational prescription practices by healthcare professionals in selected PHC facilities of Jos north during malaria treatment practices, as there were high practice of poly-pharmacy, poor prescription by generic and unnecessary inclusion of injectable in patients' regimens. The results could have significant implications for patients, healthcare professionals, and health care facilities, ministry of health, policy and decision makers toward ensuring rational use of antimalarials medicines as a step towards controlling the disease.

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