

Availability and Cost-Effectiveness of Antimalarial Medicines in the Niger Delta Region of Nigeria

ABSTRACT

Background: Despite the change from Chloroquine to Artemisinin Combination Therapies as first-line treatment for malaria, Chloroquine is still widely used in Nigeria. **Objectives:** This study aimed to assess the affordability and availability of antimalarials and evaluate factors that affect their choice. **Method:** Two (2) distinct questionnaires were developed to determine affordability and availability respectively and distributed to three (3) Local Government areas each in two representative states of the Niger Delta region (Delta and Bayelsa). The questionnaires on affordability were distributed to individual respondents and of availability to various facilities like pharmacies, medicine stores, and hospitals. Data was analyzed using SPSS. **Results:** The total number of respondents surveyed was 582, and 62.9% (366) agreed they knew about ACTs. Only 24.9% agreed ACTs are very affordable. Also, about 65% of respondents who agreed that ACTs are affordable are people with a tertiary degree, as it was clearly shown that respondent earnings increased with educational status. ACTs are fairly available about 63.1% availability profile but are rarely available in government-owned primary health centers. Hence, there is still a high preference for antimalaria monotherapy as only 28.9% of the respondents were seen to have a preference for ACTs, the WHO-recommended first-line treatment of malaria. **Conclusion:** ACTs are fairly available, but factors such as cost, availability, and drug efficacy affect the choice of antimalarial agents.

Keywords: *Artemisinin-Based-Combination therapy, Availability, affordability, antimalarials, Niger Delta.*

INTRODUCTION

Malaria is a known endemic disease in sub-Saharan Africa, causing about 85%–90% of deaths (Provost, 2011; Charles et al., 2024). Malaria is responsible for more than 25-30% of infant deaths in Nigeria (Oprehet *al*, 2008). The resistance of *Plasmodium falciparum* to Chloroquine has contributed substantially to malaria morbidity and mortality, hence the introduction of Artemisinin Combination Therapy (ACTs) has received great hope as a breakthrough in the treatment of malaria (Mwaet *al*, 2009). Despite the change from Chloroquine and sulfadoxine-pyrimethamine to ACTs as first-line treatment for malaria, literature evidence shows that Chloroquine is still being widely used in Nigeria (Ukwe and Ekwunife, 2008) and evidence exists that healthcare facilities in the country are yet to fully comply since chloroquine, sulfadoxine-pyrimethamine and artesunate monotherapy are still prescribed for the treatment of malaria (Odiliet *al*, 2010). Poverty is significantly associated with an increased risk for malaria (Oprehet *al*, 2008) and a study has shown that poor patients are not prepared to pay the costs of ACTs (Wiseman *et al*, 2005) even though

combination therapy dominates the effectiveness of monotherapy (Wiseman *et al.*, 2006). This implies that the poor lack access to appropriate malaria treatment.

Malaria may have been a human pathogen for the entire history of the species (Bruce-Chatt, 1986) and Humans may have originally caught *Plasmodium falciparum* from gorillas (Hayakawa *et al.*, 2008). Malaria is caused by *Plasmodia spp*; *Plasmodium vivax* is rare in Africa where much of the black population lacks the erythrocyte cell surface receptor for infection. *P. falciparum* and *P. ovale* are the most predominant species in Africa and *P. malariae* is the least common and mildest form of malaria (Rubin *et al.*, 2005). In sub-Saharan Africa, there are 85-90% of malaria fatalities (Sallares, 2003). In Africa, malaria is present both in rural and urban settlements though the risk is lower in larger cities (James *et al.*, 2009). Prevention of malaria can aim at either preventing infection by avoiding bites by parasite-carrying mosquitoes or prevention of the disease by using antimalarial drugs prophylactically (Tizifa *et al.*, 2018). Antimalarials are drugs taken for the treatment of chronic or acute attack or prophylaxis of malaria. They are classified based on their chemical structure and also their mode of action (Ajibola, 2005). There are several classes including gametocides: primaquine, quinine, mepacrine; casual prophylactics: primaquine proguanil, pyrimethamine; sporonticides: primaquine; schizonticides: sulphonamides; blood schizonticide: quinine, mepacrine, chloroquine, artemisinin-based family, etc., (Bunu *et al.*, 2020; Ebeshi *et al.*, 2023; Samuel *et al.*, 2023). Resistance has emerged to virtually all classes of antimalarials except the ACTs (White, 2004). The choice of ACT in a country or region is based on the level of resistance of the partner medicine in the combination. In areas of multidrug resistance, artesunate-mefloquine or artemether-lumefantrine is recommended or artesunate sulfadoxine-pyrimethamine can be used (Arya *et al.*, 2021; Hanboonkunupakarn *et al.*, 2022).

Affordability refers to the price of a commodity or service concerning the client's ability to pay (Larson *et al.*, 2006). In developing countries, most people who need medicine have to pay for them out of their own pockets. Unaffordable prices in countries (Larson *et al.*, 2006). The potential value of drug combinations particularly ACTs is widely acknowledged and accepted and high costs are still a major barrier to their effective use. The unaffordable price could lead to the use of sub-optimal doses, ineffective treatment, increased chances of developing resistance, and perhaps ultimately to increase malaria death (WHO, 2008). Availability refers to the physical presence of the medicine at the service delivery point (Levesque *et al.*, 2013; Brambifa *et al.*, 2020). Even when ACTs are provided free in public, non-governmental, availability in peripheral public health facilities remains a challenge

(Larson et al, 2006; Wasunnaet al., 2008).

The role of pharmacists has increased over the last decade in many countries, thus resulting in their increasing involvement in patient care and active participation in public health care programs (Bruce-Chatt, 1986). Pharmacists should have a thorough understanding of the medical and socio-economic problems associated with the disease, including the vulnerable groups, know the various diagnostic methods, and their advantages and disadvantages, and familiarize themselves with the various national and international anti-malarial treatment guidelines and protocols (Bunu&Otuaga, 2020; Samuel et al., 2021; Midia et al., 2023). In addition, they should have in stock the recommended, good quality anti-malarial medications such as ACTs, and long-lasting ITNs, have sufficient public health care focus in their practice to fully appreciate the problem, and also be ready to provide wide-scale community-based malaria-related services (Krezanoski, 2016; Agudelo et al., 2021; Chu & White, 2021). The Pharmacist being a member of the healthcare team has a unique role to play in ensuring good quality antimalarial drugs are available and that they are rationally administered to patients at every level of health care (Ehijie, 2010). The study aimed to assess the availability and affordability status of antimalarial especially the first-line treatment drugs in the Niger Delta region.

METHOD

Study Area

The study was conducted in selected local government areas (LGAs) of Bayelsa and Delta states. For Bayelsa State, Southern Ijaw LGA, Sagbama, and Yenagoa LGAs were selected, while Delta State, Udu, Uvwie, and Ughelli North local government areas were selected, respectively.

Study Design and Data Collection Instrument

A descriptive-cross-sectional study design was used in this research. A well-structured study questionnaire was prepared for the affordability and availability of antimalarial drugs. The affordability component was a descriptive cross-sectional survey to determine levels of affordability in selected local government areas in Delta and Bayelsa States. The study includes administering a structured questionnaire to respondents to collect data on the affordability of antimalarial medications. The questionnaire utilized for this investigation included demographic questions. A total of 600 questionnaires were administered in the two states, but only 582 were retrieved, having a percentage response rate of 97%. The questionnaires were intended for patent medicine stores, community pharmacies, and primary, secondary, and tertiary health

centers and were disseminated throughout the states in the specified LGA. The surveys included a list of antimalarial medications, as well as information about their availability and pricing. The respondents were asked to rate availability (YES/NO) and include the price for each medicine. The cost of malaria prevention (the cost of insecticide-treated bed nets, or ITNs) and malaria parasite tests were also considered.

Sample Size

A sample size of 300 respondents was drawn from the 3LGAs in Delta State, while 283 respondents were obtained from Bayelsa State, making a total of 582 respondents. Inclusion criteria were those respondents who have had malaria and had bought antimalarial drugs, age brackets of 16 years and above, and those who gave their informed consents. Each respondent was given enough time to fill the questionnaires and non-educated respondents were helped to fill the questionnaires based on their answers to the questions they were asked.

Ethical Issues and Data Analysis

The study was approved by the research and ethic committee of the Faculty of Pharmacy, Niger Delta University, Bayelsa State, Nigeria. Data retrieved from the study were analyzed with SPSS software utilizing ANOVA and simple descriptive statistics.

RESULTS

Demographics

All the respondents interviewed were 582 and were between the ages of 16 to >60 years of age. About 47.9% of the respondents were students, 22.9% (133) were civil servants, 18.9% (110) were traders, and 10.3% (60) engaged in other activities. Also, 62.2% (362) had tertiary education, 28% (163) secondary, 6.7% (39) had primary education, and 3.1% (18) had no formal education. 59.6% (347) were single, 33.7% (196) married, 1.2% (7) divorced and 5.5% (32) separated. 11.2% (65) of the respondents were pregnant. This is depicted in Table 1. Appropriate treatment-seeking behavior about malaria was high; 84% (489) of the respondents claimed they treated malaria using the orthodox method.

Table 1. Participants Demographic data

Variables		Frequency(N)	Percentage(%)
Sex	Male	256	44

	Female	326	56
Age (years)	16-25years	240	41.2
	26-40years	251	43.1
	41-60	76	13.1
	>60 years	15	2.6
Occupation	Student	279	47.9
	Civilservant	133	22.9
	Trader	110	18.9
	Other	60	10.3
LevelofEducation	Primary	39	6.7
	Secondary	163	28
	Tertiary	362	62.2
	None	18	3.1
State origin & LGA	Delta state	300	51.5
	Udu	100	17.2
	UghelliNorth	100	17.2
	Uvwie	100	17.2
	Bayelsa state	282	48.5
	SouthernIjaw	100	17.2
	Sagbama	82	14.1
	Yenagoa	100	17.2
MaritalStatus	Single	347	59.6
	Married	196	33.7
	Separated	32	5.5
	Divorced	7	1.2
PregnancyStatus	Positive	65	11.2
	Negative	243	41.8
	Notapplicable	247	47

Antimalarial Affordability

About 62.9% (366) of the respondents knew about ACTs, 24.9% knew about ACTs as very affordable and 23% indicated unaffordability. 36.6% (213) of the respondents earn between NGN5000–NGN 10,000 and only 2.4% earn >NGN100,000 monthly. 19.4% (113) were willing to spend NGN2000 for the treatment of malaria for a child under 5 years of age and adults, 21.8% (127). Then, 38% (221) were willing to spend NGN1000 for the treatment of malaria for a child under 5, and 33.2% (193) could pay NGN1000 for the treatment of an adult. About 32.3% (188) were willing to spend NGN1000 for the prevention of malaria for a child under 5 years of age and adult, 30.1% (175). Three factors that majorly dictated the choice of antimalarials by patients are cost (29.2%), availability (21.5%), and drug efficacy (37.5%).

It was observed that 314 respondents with tertiary education preferred to use the orthodox method in treating malaria and only 31 persons with primary education

preferred to use the orthodox. The affordability of ACTs was highest in people with tertiary education and then people with tertiary education were seen to earn the most. The results also showed that 50 and 63 persons can willingly spend NGN2000 for treatment of malaria in under-fives in Delta State and Bayelsa respectively. Then 101 and 92 persons can spend NGN1000 for the treatment of malaria in adults in Delta and Bayelsa respectively. 74 respondents in Delta and 66 persons in Bayelsa prefer artesunate malaria while 68 persons in Delta and 100 persons in Bayelsa prefer ACTs in treating malaria. Also, it was seen from the result that 213 respondents earn within NGN5000-NGN10,000 and only 36.3% (77) of this individual prefer chloroquine as drug choice for treatment of malaria. Furthermore, 22 respondents were seen to earn between NGN51,000-NGN100,000 and 59.1% (13) of this group of individuals tend to prefer ACT drug choice malaria.

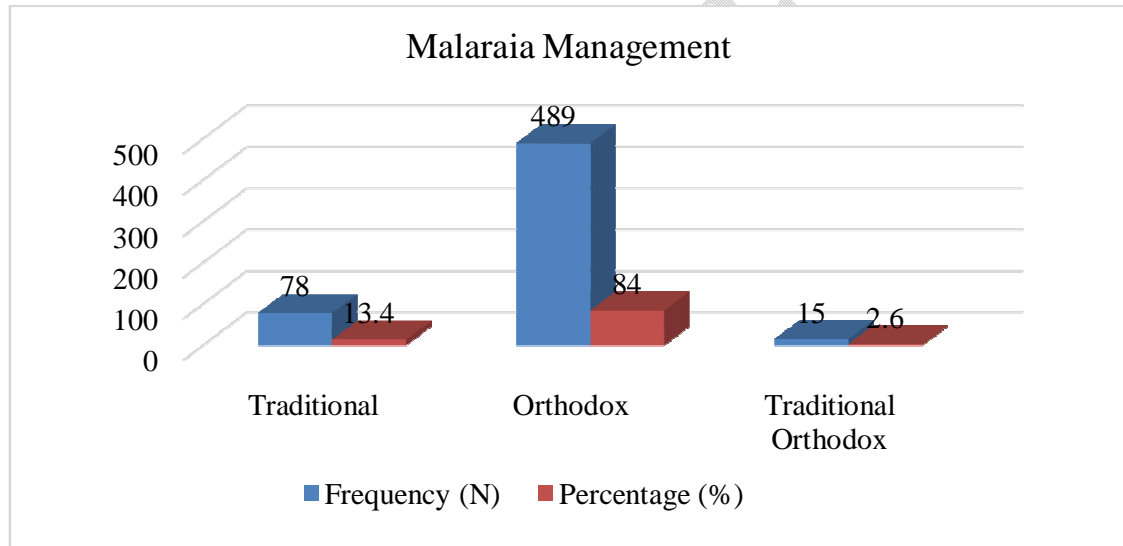


Figure 1. Malaria treatment pattern

Table 2. The reason behind the use of traditional treatment patterns, perception of availability & affordability of ACTs

Variables	Frequency (N)	Percentage (%)
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Why traditional treatment?	More cost-effective	60	10.3
	Less side effect	26	4.5
	Not applicable	468	80.4
	More efficacious	21	3.6
	Because of faking of orthodox medicine	4	0.7
	Unavailability of orthodox drugs	2	0.5
Perception of availability	Always available	144	24.7
	Frequently available	156	26.8
	Rarely available	68	11.7
	Don't know	212	36.4
	Never available	2	0.3
Perception of affordability	Very affordable	91	15.6
	Somewhat available	193	33.2
	Not affordable	84	14.4
	Don't know	214	36.8

Table 3. The amount respondents can spend willingly for treatment and prevention of a child <5 years and an adult.

Amount (NGN)	Prevention of a child <5 years (n)(%)	Prevention in an adult (n)(%)	Treatment of a child <5 years (n)(%)	Treatment of an adult (n)(%)
2000	83(14.3)	91(15.6)	113(19.4)	127(21.8)
1000	188(32.3)	175(30.1)	221(38)	193(33.2)
800	83(14.3)	103(17.7)	52(8.9)	80(13.7)
500	147(25.3)	129(22.2)	138(23.7)	115(19.8)
400	34(5.8)	31(5.3)	22(3.8)	31(5.8)
300	20(3.4)	20(3.4)	13(2.2)	11(1.9)
200	17(2.9)	20(3.4)	12(2.1)	14(2.4)
100	10(1.7)	13(2.2)	11(1.9)	11(1.9)

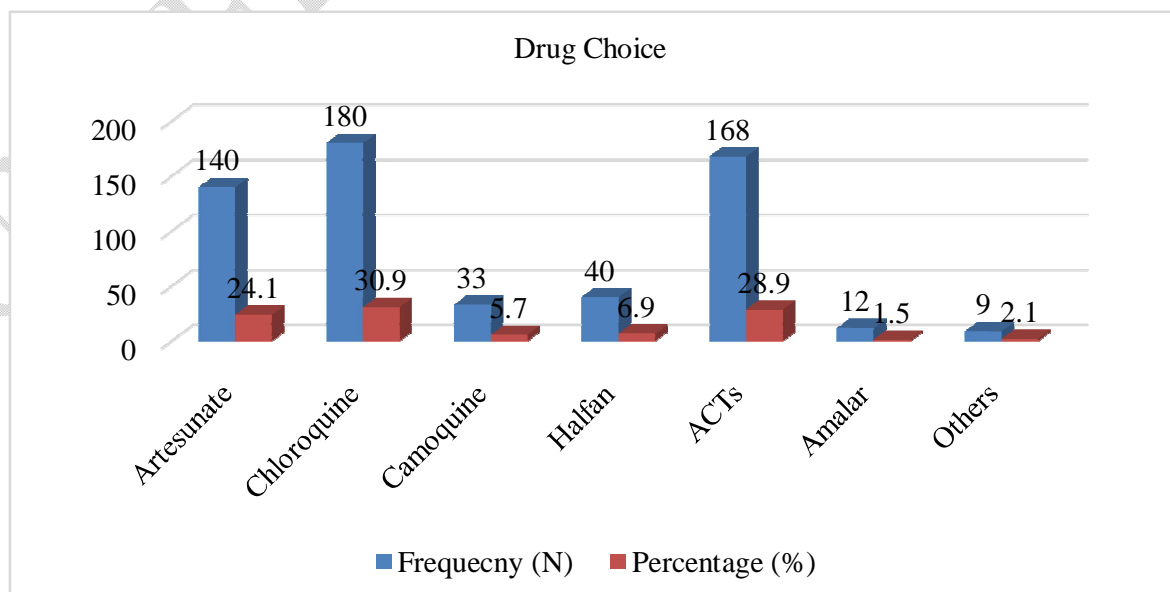


Figure 2. Respondent's Drug of Choice

Table 4. Reasons behind the drug choice and preferred place of drug purchase

	Variables	Frequency(N)	Percentage(%)
Reasons behind the drug choice	Costs	170	29.2
	Always Available	125	21.5
	Less Side Effect	65	11.2
	Efficacy	218	37.5
	Others	1	0.2
	Not Applicable	3	0.5
Preferred place of drug purchase	Pharmacy	311	53.4
	Chemist	224	38.5
	Market	8	1.4
	Hawkers	7	1.2
	Hospital	26	4.5
	Not applicable	6	1.0

Table 5. Comparative analysis: how much respondents are willing to pay for treatment and prevention for a child and an adult in both states

Amount	T <5 DE	T <5 BY	P <5 DE	P <5 BY	T Adult DE	T Adult BY	P Adult DE	P Adult BY
2000	50	65	27	56	52	75	40	51
1000	104	117	84	104	101	92	94	81
800	24	28	43	40	44	36	55	48
500	86	52	94	53	66	49	67	62
400	15	7	24	10	16	15	15	16
300	8	5	14	6	6	5	13	7
200	6	6	8	9	8	6	9	11
100	7	4	6	4	7	4	7	6

T-Treatment, P-Prevention, BY – Bayelsa, DE – Delta, <5 – less than 5 years

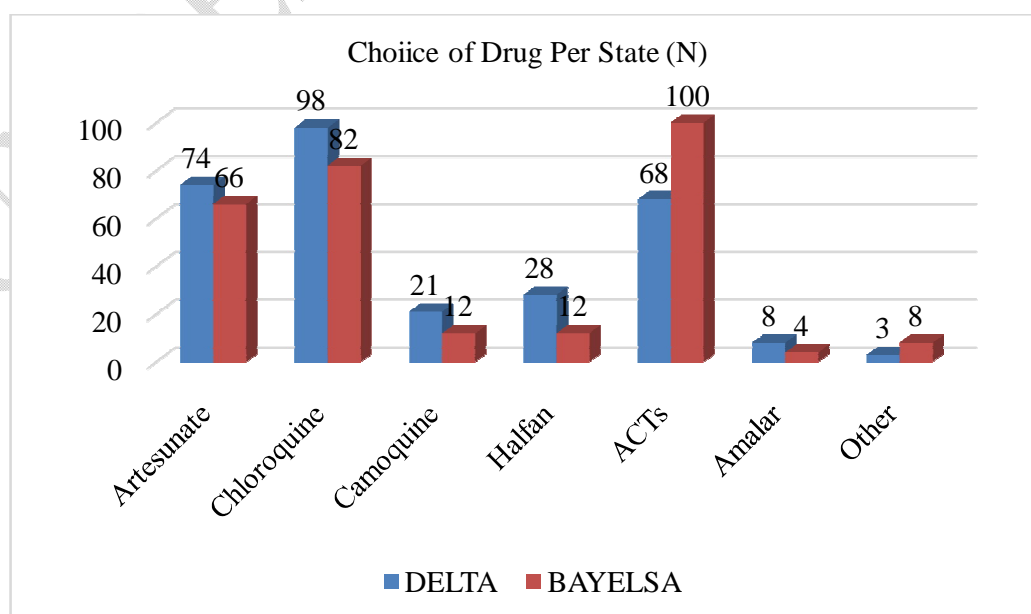


Figure 3. Respondent's drug preference vs state of origin

Table 6. Comparative analysis: treatment pattern, monthly salary, etc., to their educational status

Variables: Educational level→		Primary	Secondary	Tertiary	None
How Respondents Treat Malaria	Orthodox	31	133	314	11
	Traditional	6	27	38	7
	Orthodox Traditional	2	3	10	0
Affordability	Very Affordability	5	25	59	2
	Somewhat Affordable	6	35	149	3
	Not Affordable	2	34	48	0
	Don't Know	26	69	106	13
Monthly Income (NGN)	5000-10000	10	68	30	5
	11000-20000	19	40	100	5
	21000-40000	2	20	60	4
	41000-50000	4	19	31	2
	51000-100000	1	4	15	2
	>100000	1	1	12	0

Availability of Antimalarial

Patient medicine stores were more common than hospitals and even pharmacies as indicated in the study. It was seen that only 24.6% (16) use fans, refrigerators, and air conditioners to improve the convenience status of the premises as well as storage Condition. Also, pharmacists had the highest frequency as dispensers (35.4%) followed by nurses (30.8%), which is fairly good. 50.8% (23) of the facilities surveyed had insecticide-impregnated bed nets available and 35.4% (23) did not have them. Only 9.2% (6) facilities had ITNs free of charge to all patients. For 13.8% (9) of the facilities surveyed that had nets, the cost was between NGN501-NGN1000, and only 3.2% (2) facilities sold for less than NGN500.

The result for availability of ACTs shows that ACTs are overtly available as Artemether Lumefantrine had 90.8% Artesunate Amodiaquine had 63.1% Artesunate Mefloquine had 43.1%. However, the cost ranges from NGN500.00 to NGN1500.00. Also, antimalarial monotherapy drugs were seen to have a higher availability profile as well only that are much more affordable than ACTs between <NGN50 as in chloroquine to NGN 300 for artesunate and also sulfadoxine-pyrimethamine (SP). Lastly, it was observed that malaria parasite test was conducted in 12 pharmacies and 3 secondary health centers. The cost ranges from NGN300-NGN500. Only in the primary health center of the facility was the malaria parasite test conducted for free. The four primary health facilities visited in Delta State had no drug in stock for sale to patients. Health workers only diagnose and send patients to buy drugs from outside. The cost of drugs was seen to be slightly higher in

pharmacy shop than in other facilities, and drugs cost little or nothing in primary health centers only that they are rarely available. From the results obtained, there is no significant difference in the prices of ACTs in both states.

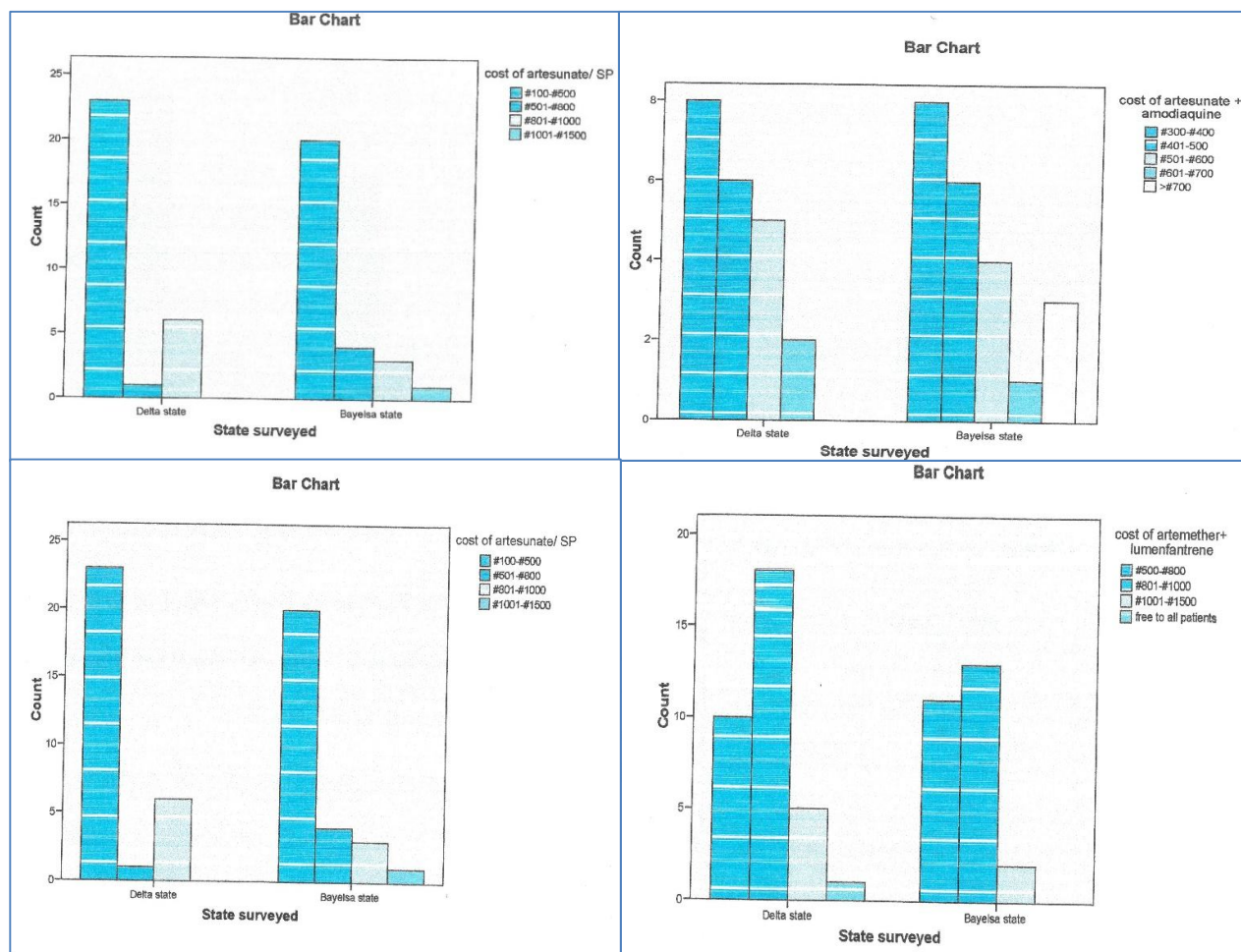


Figure 4. Comparative analysis of the cost-effectiveness of antimalarial among the two states

Table 7. Facility status

Variables		Frequency(N)	Percentage(%)
Facility	Patent medicine store	34	52.3
	Pharmacy	26	40
	Primary health center	1	1.5
	Secondary health center	4	6.2
Registration status of pharmacy	Yes	29	44.6
	No	1	1.5
	Not applicable	35	53.8
Storage	Fan	26	40
	Air conditioner	7	10.8
	Refrigerator	8	12.3
	Fan air conditioner	1	1.5

condition/convenience	Fan air conditioner refrigerator	16	24.6
	Fan refrigerator	4	6.2
	Air conditioner & refrigerator	1	1.5
	None	2	3.1
Dispenser	Pharmacist	23	35.4
	Sales attendant	15	23.1
	Nurse	20	30.8
	Others	3	4.6
	Pharmacist and Nurse	2	3.1
	Pharmacist, Nurse, and Sales attendant	2	3.1
Availability of ITNs	Yes	33	50.8
	No	23	35.4
	Not applicable	9	13.8
Is ITN free to all patients?	Yes	6	9.2
	No	32	49.2
	Not applicable	27	41.5
Cost of bednet (NGN)	<500	2	3.1
	501-1000	9	13.8
	1001-1500	7	10.8
	1501-2000	5	7.7
	2001-3000	1	1.5
	>3000	1	1.5
	Not applicable	40	61.5
Location of facility	Delta State	37	56.9
	Bayelsa State	28	43.1

Table 8. Availability of antimalarials

Availability and % availability of antimalarials		
Antimalarials/test	Available N (%)	Not available N (%)
Artesunate + Amodiaquine	41(63.1)	24(36.9)
Amodiaquine+Dihydroartemisinin	10(15.4)	55(84.6)
Artemether + Lumefantrine	59(90.8)	6(9.2)
Artesunate+Mefloquine	28(43.1)	37(56.9)
Amodiaquine	49(75.4)	16(24.6)
Artemether	46(70.8)	29(29.2)
Artesunate+Sulfadoxine/Pyrimethamine	58(89.2)	7(10.8)
Artesunate	59(90.8)	6(9.2)
Chlorproguanil + Dapsone	10(15.4)	55(84.6)
Chloroquine	52(80)	13(20)
Dihydroartemisinin	47(36.9)	18(27.7)

Dihydroartemisinin+Piperaquine+Trimethoprim	24(15.4)	41(63.1)
Halofantrine	48(73.8)	17(26.2)
Mefloquine	10(15.4)	55(84.6)
Malaria Parasite Test	26(40)	39(60)
Proguanil	38(58.5)	27(41.5)
Primaquine	16(24.6)	49(75.4)
Pyrimethamine	32(49.2)	33(50.8)
Quinine	54(83.1)	11(16.9)
Sulfadoxine/Pyrimethamine	63(96.9)	2(3.1)
Sulfamethopyrazine+Pyrimethamine	24(36.9)	41(63.1)
Sulfamethopyrazine+Pyrimethamine	17(26.2)	48(73.8)

Table 9. Costofantimalarials

Name of Antimalarial	Cost(NGN)						
	<100-200	201-400	401-600	601-800	801-1000	1001-1500	>1500
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Amodiaquine	39(60)	6(9.3)	5(7.7)	-	-	-	-
Artesunate+Amodiaquine	-	16(24.6)	21(32.3)	3(4.6)	3(4.6)	-	-
Artemether+ Lumefantrine	-	-	-	21(32.3)	31(47.7)	7(10.8)	-
Artesunate/SP	-	43(66.2)	-	5(7.7)	9(13.8)	1(1.5)	-
Artemether	-	-	9(13.8)	15(23.1)	-	11(16.9)	10(15.4)
Artesunate	-	25(69.2)	3(16.9)	6(4.6)	-	-	-
Artesunate+Mefloquine	-	1(1.5)	-	11(16.9)	-	16(25.0)	-
Chloroquine	34(52.2)	18(27.7)	-	-	-	-	-
Chlorproguanil+Dapsone	-	6(9.2)	-	-	4(6.2)	-	-
Dihydroartemisinin	-	-	-	42(64.6)	-	3(4.6)	-
Dihydroartemisinin + Piperaquine +Trimethoprim	-	10(15.4)	-	-	14(21.5)	-	-
Amodiaquine + Dihydroartemisinin	-	-	-	4(6.2)	5(7.7)	-	-
Halofantrine	-	-	-	8(12.3)	9(13.8)	30(46.2)	1(1.5)
Mefloquine	-	-	-	5(7.7)	7(10.8)	-	-
Primaquine	-	-	10(15.4)	-	6(9.2)	-	-
Proguanil	-	-	12(18.5)	-	3(4.6)	23(35.4)	-
Pyrimethamine	32(49.2)	-	-	-	-	-	-
Sulfadoxine + Pyrimethamine	16(24.6)	45(69.2)	-	2(3.1)	-	-	-
SP+Mefloquine	-	20(30.8)	-	6(9.2)	-	-	-
Sulfamethopyrazine+Pyrimethamine	8(12.3)	10(15.4)	-	-	-	-	-
MalariaparasiteTest	-	9(13.8)	14(21.5)	1(1.5)	1(1.5)	-	-
Quinine	-	33(50.7)	21(32.3)	-	-	-	-

Table 10. Comparativeanalysisofavailability&costof antimalarial indifferent facilities

Variables		Patent Medicine Store	Pharmacy	Primary Health Center	Secondary Health Center
Availability	Yes	13	16	1	3
	No	21	10	0	1
Is it free to patients?	Yes	4	0	1	1
	No	30	16	0	3
What's the Cost?(NGN)	<500	2	0	0	0
	501-1000	3	6	0	0
	1001-1500	1	5	0	1
	1501-2000	0	5	0	0
	2501-3000	1	0	0	0
	>3000	1	0	0	0
Availability Status of Drug (N)		Patent Medicine Store	Pharmacy	Primary Health Center	Secondary Health Center
Artemether+ Lumefantrine	Yes	30	24	1	4
	No	4	2	0	0
Artesunate+ Mefloquine	Yes	10	16	0	2
	No	24	10	1	2
Artesunate+SP	Yes	30	25	0	3
	No	4	1	1	1
Artesunate+ Amodiaquine	Yes	20	19	0	2
	No	14	17	1	2

Table 11. Comparative cost of ACTs in different facilities

Cost of Drugs (NGN)		Patent Medicine Store	Pharmacy	Primary Health Center	Secondary Health Center
Artemether+ Lumefantrine	500-800	13	7	0	1
	801-1000	13	15	0	3
	1001-1500	5	2	0	0
Artesunate+ Amodiaquine	300-400	13	2	0	1
	401-500	5	6	0	1
	501-600	3	6	0	0
	601-700	1	2	0	0
	>700	0	3	0	2
Artesunate+SP	100-500	25	17	0	1
	501-800	2	2	0	1
	801-1000	3	5	0	1
	1001-1500	0	1	0	0
Artesunate+ Mefloquine	>500	1	0	0	0
	501-1000	4	6	0	1
	1001-1200	4	9	0	1
	1201-1500	1	1	0	0

DISCUSSION

The affordability analysis showed that the poor will have difficulty and may not be so willing to pay for their antimalarial medicines (ACTs). This is consistent with a study conducted in Benin City, Nigeria, which revealed that first-line antimalarial drugs are not cost-effective to the majority of the people who live in poverty, as the least paid government employee must work for 5.53 to 10.38 days before they can pay for one full dose of artemether/lumefantrine tablet, which is the recommended first-line anti-malarial drug in the national malaria treatment policy (Waka and Cyril 2011). Another research on the perception of healthcare providers towards chloroquine and ACTs showed that though respondents (pharmacist and doctor) preferred ACTs to chloroquine they did not believe that the ACTs were affordable to their patients (Waka and Oguagbaka, 2011). This lack of affordability will hurt drug compliance and reduction in malaria morbidity and mortality will not be achieved. Antimalarial drugs were seen to be less affordable in private pharmacies than in other facilities. This seems to imply that dispensers are making up their drugs excessively to make a larger profit. This is in line with a study carried out in Kenya which showed in some settings patients pay less at medicine stores than in other facilities to obtain a drug (Amin et al, 2003). This tendency of increased profits could lead to irrational drug use has been reported in Zimbabwe where a desire to increase income was associated with less clinically and economically appropriate prescribing (Trap B al, 2002). The results suggest that individuals are prepared to spend the same amount of money, if not more, on malaria prevention and treatment for both children under the age of five and adults. This describes the popular adage "prevention is better than cure." However, there are numerous and unquantifiable costs connected with malarial disease, such as the cost of pain and suffering, time spent in the hospital, and, most crucially, the cost of absenteeism from work owing to illness.

This study also showed that ACTs are fairly available however less available in primary health centers. This is in line with a study in Kenya that showed that a quarter of public health facilities had none of the nationally recommended ACT treatment in stock and three-quarters lacked the full range of weight-specific packs required (Wasunna et al, 2008). Meanwhile, modern medicine relies heavily on drugs as the main tool of therapeutics. Other therapeutic procedures such as diet surgery exercise etc are also important of course as deliberate non-intervention but none is so widely applied as drug-based therapeutics (Rang and Dale, 2007). Malaria is a major cause of death and illness in children and adults especially in tropical countries (WHO, 2010), preventivemeasures like the availability of insecticide-impregnated bed nets ought to be readily available and distributed for free for every household in the country

done in Ethiopia (Andualem, 2007).

Also, WHO guidelines emphasize testing malaria with RDTs or microscopy before treating it (evidence-based recommendation) (WHO, Guidelines for treating malaria, 2010). As a result, pharmaceutical vendors should be taught in RDTs to minimize ACTs expenses in cases where malaria parasites are not involved and to protect ACTs from resistance by assuring their reasonable usage. RDTs (RAPID DIAGNOSTIC TEST) detects plasmodium-specific antigens in a finger-prick blood sample using immunochromatographic methods and can be performed by anybody with minimum training (Uneke, 2008). Reducing multiple taxes levied by the state and local governments, as well as price regulation, may help to lower medicine prices in Nigeria. Drug prices in private facilities must be controlled and monitored to remain below reasonable limits. Furthermore, the government must raise minimum earnings above what they now are so that the poor can be buoyant enough to afford antimalarial drugs (Waka and Cyril, 2011).

CONCLUSION

When compared to antimalarial monotherapy medications, ACTs are more expensive for the vast majority of poor people. Furthermore, ACTs have not acquired traction as the first line of malaria treatment in the two states surveyed, as a large portion of the population has yet to learn about them. Furthermore, malaria management is suboptimal, as shown by a strong predilection for antimalarial monotherapy. Finally, ACTs are reasonably available, but the cost makes them inaccessible.

REFERENCES

- Agudelo Higueta, N. I., White, B. P., Franco-Paredes, C., & McGhee, M. A. (2021). An update on prevention of malaria in travelers. *Therapeutic advances in infectious disease*, 8, 20499361211040690. <https://doi.org/10.1177/20499361211040690>.
- Ajibola A. Olaniyi (2005); *Antiparasite Drugs in Essential Medicinal Chemical*, 3rd edition. P 404-425.
- Amin AA, Marsh V, Noor AM, Ochola SA, Snow RE, (2003). The use of formal and informal curative services in the management of pediatric fever in four districts in Kenya. *Trop Med Intl health*; 8:1143-52.
- Andualem Sisay, (2007). Ethiopia secures 18.4 million bed nets to fight malaria www.ethiopiainsight.com.
- Arya, A., Kojom Foko, L. P., Chaudhry, S., Sharma, A., & Singh, V. (2021). Artemisinin-based combination therapy (ACT) and drug resistance molecular markers: A systematic review of clinical studies from two malaria endemic regions - India and sub-Saharan Africa. *International journal for parasitology. Drugs and drug resistance*, 15, 43–56. <https://doi.org/10.1016/j.ijpddr.2020.11.006>
- Brambifa O. Evelyn, Bunu J. Samuel and Usifoh F. Stella (2020). Acceptability and availability of dispersible Amoxicillin tablets in Primary Healthcare: Implications in the Pharmacotherapeutic Management of Childhood Pneumonia. *World J Pharm*

- Sci*; 8(11): 67-73.
- Bruce-Catt LJ (1986) *Chemotherapy of Malaria* (2nd edition WHO).
- Bunu JS, Vaikosen EN, Nnadozie KW (2020). Chloroquine Phosphate Metabolism and Gender-based Phenotypic Analysis in Healthy Subjects' Urine Following Oral Administration. *Pharmaceutical and Biomedical Research*; 6 (Special Issue on COVID-19):37-44. [http://dx.doi.org/10.18502/pbr.v6i\(s1\).4400](http://dx.doi.org/10.18502/pbr.v6i(s1).4400).
- Bunu SJ, M Otuaga (2020). The Roles of Pharmacists in Maternal and Child Health of Primary Health Care system. *South Asian Research Journal of Pharmaceutical Sciences*; 2(5): 74-78.
- Charles RO, Bunu SJ; Charles O, Orumwense DO (2024). Assessment of Malaria Pharmacotherapeutic Outcomes in Children under 12 Years of Age among Three Health-care Facilities, Bayelsa, Nigeria. *Journal of Integrated Health Sciences* 12(1): 49-58. DOI: 10.4103/jihs.jihs_1_24.
- Chu, C. S., & White, N. J. (2021). The prevention and treatment of Plasmodium vivax malaria. *PLoS medicine*, 18(4), e1003561. <https://doi.org/10.1371/journal.pmed.1003561>.
- Ebeshi UB, Bunu SJ, Egemba C, Vaikosen EN, Kashimawo A (2023). Evaluation of Stability and TLC Fingerprinting of the Artemether Component in Artemether Lumefantrine Combination Suspension Formulations Available in Nigeria Pharmaceutical Market. *Asian Journal of Research in Medical and Pharmaceutical Sciences*; 12(4): 183-190. Article no.AJRIMPS.110286.
- Ehijie FO Enato (2010). *Pharmaceutical Care in Malaria in; Essentials of Pharmaceutical Care*, edition by Azuka C. Oparah; pg393-407.
- Hanboonkunupakarn, B., Tarning, J., Pukrittayakamee, S., & Chotivanich, K. (2022). Artemisinin resistance and malaria elimination: Where are we now? *Frontiers in pharmacology*, 13, 876282. <https://doi.org/10.3389/fphar.2022.876282>
- Hayakawa T *et al* (2008), Big Bang in the evolution of extant antimalarial parasite, *MolBio Evol* 25 (10), 2233-2239.
- James LA, Webb Jr, Hummankind's Burden (2009). *A Global History of Malaria* (Cambridge University, 2009).
- Kreznoski P. J. (2016). Delivering insecticide-treated nets for malaria prevention: innovative strategies. *Research and reports in tropical medicine*, 7, 39-47. <https://doi.org/10.2147/RRTM.S83173>.
- Larson, B. A., Amin, A. A., Noor, A. M., Zurovac, D., & Snow, R. W. (2006). The cost of uncomplicated childhood fevers to Kenyan households: implications for reaching international access targets. *BMC Public Health*, 6, 314. <https://doi.org/10.1186/1471-2458-6-314>.
- Levesque, J. F., Harris, M. F., & Russell, G. (2013). Patient-centered access to health care: conceptualizing access at the interface of health systems and populations. *International journal for equity in health*, 12, 18. <https://doi.org/10.1186/1475-9276-12-18>.
- Midia Adugo, Samuel J. Bunu, Nanakede T. Jonathan, Dimie Ogoina (2023). Physicochemical Evaluation of the Potency and Viability of Alcohol-Based Hand Sanitizers. *EAS J Parasitol Infect Dis*, 5(6), 61-65.
- Odili VU, Okupa BC, Oleri HA, Udezi WA (2010). Compliance of a secondary health facility to the Nigerian Antimalarial Treatment Policy. *Nigerian Journal of Pharmaceutical Research*; 8(1):1-8.
- Opreh, O. P., Abioye-Kuteyi, E. A., Aboderin, A. O., Giebel, H., Bello, I. S., & Senbanjo, I. O. (2008). The pattern of malaria infection in under-fives in Ile-Ife, Nigeria. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 102(9), 868-874. <https://doi.org/10.1016/j.trstmh.2008.05.002>.
- Provost C (2011). World Malaria Day: Which Countries Are the Hardest Hit? Get the Full Data. *The Guardian* 2011. Archived from the Original in 2013 Available from: <https://www.theguardian.com/global-development/datablog/2011/apr/25/world->

- [malaria-day-data?view=mobile](#).
- RangandDale'sPharmacology(2007).Introductiontopharmacology6thedition;pg4Sachs J, Malaney P (2002); The Economic and Social Burden of Malaria, *Nature*415;673-679.
- Samuel BJ, Stella UF, Denmo OO (2021). Extensive Analysis of Pharmacists' Roles and Services towards Vaccine-Preventable Diseases in Bayelsa State, Nigeria. *RADS J Pharm Pharm Sci.*; 9(2):88-95.
- Samuel JB, Deghinmotei A, Ebiere D, Fawei KL (2023). In-vitro bioequivalence Analysis of some Artemether-Lumefantrine-Based Combination Formulations utilized in Nigeria. *Mod App in Pharmacy & Pharma Sci* 1(1). MAPPS. MS.ID.000104.
- Tizifa, T. A., Kabaghe, A. N., McCann, R. S., van den Berg, H., Van Vugt, M., & Phiri, K. S. (2018). Prevention Efforts for Malaria. *Current Tropical Medicine Reports*, 5(1), 41–50. <https://doi.org/10.1007/s40475-018-0133-y>.
- Trap, B., Hansen, E. H., &Hogerzeil, H. V. (2002). Prescription habits of dispensing and non-dispensing doctors in Zimbabwe. *Health policy and planning*, 17(3), 288–295. <https://doi.org/10.1093/heapol/17.3.288>.
- Ukwe, C. V., &Ekwunife, O. I. (2008). Drug utilization study of antimalarials for the treatment of hospitalized children under five in south-eastern Nigeria. *Pharmacoepidemiology and drug safety*, 17(12), 1183–1188. <https://doi.org/10.1002/pds.1669>.
- WakaAUandCyrilOU (2011).ProfitMarginsandProjectedAffordabilityoffirst-lineantimalarialDrugs.WestAfricanJournalofPharmacy;22(1)67-74.
- Waka AU and Oguagbaka M (2011), The perception of health care providers towardschloroquine and artemisinin combination therapies. *West African of Pharmacy*, 22(1); 91-96.
- Wasunna, B., Zurovac, D., Goodman, C. A., & Snow, R. W. (2008). Why don't health workers prescribe ACT? A qualitative study of factors affecting the prescription of artemether-lumefantrine. *Malaria journal*, 7, 29. <https://doi.org/10.1186/1475-2875-7-29>.
- WHO(2010)Geneva.GuidelinesfortreatingMalaria.
- WHO Booklet, (2008); Access to Antimalarial Medicines: Improving the AffordabilityandFinancingofArtemisinin Based Combination Therapies, pp33.
- Wiseman, V., Kim, M., Mutabingwa, T. K., & Whitty, C. J. (2006). A cost-effectiveness study of three antimalarial drug combinations in Tanzania. *PLoS medicine*, 3(10), e373. <https://doi.org/10.1371/journal.pmed.0030373>.
- Wiseman, V., Onwujekwe, O., Matovu, F., Mutabingwa, T. K., & Whitty, C. J. (2005). Differences in willingness to pay for artemisinin-based combinations or monotherapy: experiences from the United Republic of Tanzania. *Bulletin of the World Health Organization*, 83(11), 845–852.