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Socio-Demographic Determinants of Prompt Malaria Treatment for Children Under 5 Years by Caregivers in Nigeria

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Abstract

Malaria is a major cause of morbidity and mortality in Nigeria. Access to prompt and effective treatment of malaria is at the core of the prevention of deaths in under 5 children in Nigeria. This study investigates the socio-demographic determinants of prompt response behavior of caregivers to malaria among children under 5 years in Nigeria. The analysis is based on 14,6471 women aged 15- 49 years from the most recent national population-based survey (Nigeria Malaria Indicator Survey 2021) using chi-square and logistic regression methods. The study is based on caregivers whose children had malaria at least 2 weeks before the survey across the 36 states in Nigeria including the Federal Capital Territory (FCT). Knowledge of fever, educational attainment of caregivers and family wealth are all significant determinants of prompt malaria treatment for children under 5 years in Nigeria. Respondents with adequate knowledge of malaria signs and symptoms were 1.5 times more likely to seek prompt treatment, those who have at least primary education were 1.7 times more likely to seek prompt treatment while the higher the family wealth, the more likely it is for a caregiver to seek prompt treatment for malaria for children under 5 years. Despite the high knowledge of malaria among caregivers, there is still low timely treatment response for children under 5 years. Therefore, programs should focus on increasing awareness and benefits of prompt care-seeking among caregivers.

Keywords: *Caregiver, Children under 5 years, Nigeria, Prompt Malaria Treatment, Socio-Demographic Determinants.*

Introduction

Malaria remains a significant public health challenge in Nigeria, particularly for vulnerable populations such as children under five years old. This demographic is especially susceptible to the severe consequences of malaria due to their underdeveloped immune systems. The burden of malaria in Nigeria is substantial, accounting for nearly a quarter of global malaria cases and deaths [1]. Prompt and effective treatment is crucial in managing malaria and reducing its mortality and morbidity rates among children. However, the timely treatment of malaria in children is influenced by various socio-demographic factors, making it essential to understand these determinants to improve health outcomes. Malaria transmission in Nigeria is diverse, with high and perennial transmission in forest, coastal, and humid savanna areas, low transmission in highlands, and seasonal transmission in Sahara and dry savanna areas. Plasmodium falciparum is the main parasite responsible for over 95% of the cases. Other human-infecting Plasmodium species circulating in the country include P. malariae, *P. ovale*, and *P. vivax* [2]. This diversity in

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transmission patterns and parasite species underscores the complexity of malaria control efforts in Nigeria.

Education plays a crucial role in healthcare-seeking behaviours for malaria treatment. Educated mothers are more likely to seek medical care for their children with fever symptoms, as they are more aware of malaria symptoms and the importance of early treatment [3]. This highlights the importance of improving maternal education as a strategy to enhance prompt malaria treatment for children.

Socioeconomic status also significantly influences healthcare-seeking behaviours for malaria treatment. Children from wealthier households are more likely to receive prompt treatment compared to those from poorer backgrounds [4]. This disparity can be attributed to factors such as better access to healthcare facilities, the ability to afford treatment costs, and higher levels of health awareness among wealthier families.

The urban-rural divide significantly impacts access to healthcare services and prompt malaria treatment [5]. Children in urban areas generally receive more timely treatment due to better infrastructure, improved road networks, and a higher concentration of healthcare workers. In contrast, rural caregivers often face longer travel distances to health facilities, which can delay treatment-seeking. This urban-rural disparity underscores the need for targeted interventions to improve healthcare access in rural areas.

Cultural and religious beliefs also play a significant role in healthcare-seeking behaviours in Nigeria. Some caregivers attribute malaria symptoms to spiritual causes, leading to delays in seeking medical treatment [6]. These beliefs can result in the use of traditional remedies or spiritual interventions before seeking formal medical care, potentially exacerbating the severity of malaria in affected children.

Gender disparities in healthcare access to malaria treatment have been documented in Nigeria, with male children being more likely to receive timely treatment compared to female children [7]. This gender bias in healthcare-seeking behaviour reflects broader societal inequalities and highlights the need for interventions that promote equal access to healthcare for all children, regardless of gender.

Access to health insurance is a key factor in prompt malaria treatment-seeking behaviours. However, expanding coverage, particularly among rural and low-income populations, is needed to improve access to timely malaria treatment [8]. Health insurance can reduce financial barriers to seeking care, encouraging caregivers to seek prompt treatment for their children at the onset of malaria symptoms.

The age and experience of caregivers, particularly mothers, also influence their decision-making regarding malaria treatment [7]. Older and more experienced caregivers may be more adept at recognizing malaria symptoms and understanding the importance of prompt treatment. However, they may also be more likely to rely on traditional remedies or self-treatment based on past experiences.

To improve prompt malaria treatment, a comprehensive approach is needed. This includes improving maternal education and health literacy, implementing poverty reduction strategies and social protection programs, enhancing healthcare infrastructure in rural areas, developing culturally sensitive health education programs, implementing gender-sensitive policies, expanding health insurance coverage, and providing targeted education and support for caregivers. These strategies can help reduce morbidity and mortality among young Nigerian children by addressing socio-demographic determinants.

In conclusion, the complex interplay of socio-demographic factors influencing prompt malaria treatment for children under five in Nigeria necessitates a multifaceted approach to improve health outcomes. By addressing education, socioeconomic status, geographical disparities, cultural beliefs, gender biases,

health insurance access, and caregiver characteristics, Nigeria can make significant strides in reducing the burden of malaria among its most vulnerable population.

Methodology

Study Design and Location

This study is a secondary data analysis of an existing survey from the 2021 Nigeria Malaria Indicator survey. The survey was implemented by the Nigerian National Population Commission (NPC) and the National Malaria Control Programme (NMCP) with technical support from ICF International through the MEASURES DHS (Demographic and Health Survey) programme. The survey was funded by Global Fund through the Society for Family Health (SFH) and Yakubu Gowon Centre (YGC), World Bank, United Kingdom Department for International Development (DFID) [through the Support to Nigeria Malaria Programme (SuNMaP)], and United States Agency for International Development (USAID) [through the MEASURE DHS programme at ICF international]. Malaria Indicator Survey (MIS), usually conducted in most low- and middle-income countries, provides data on bed-net ownership and use, prevention of malaria during pregnancy, prompt and effective treatment of fever in young children and some cases, and biomarker testing for malaria and anaemia. The availability of the data sets makes this study a secondary analysis. Information such as Epidemiological, socio-demographic and Health information was retrieved from the DHS data depository; hence, a quantitative approach was applied to seek answers to the research question.

Study Participant

The total sample size for the NMIS 2021 survey was 14,6471 women aged 15- 49 years. However, the study is based on 2,949 women (15-49 years) participants who reported their children aged 0-59 Months had Fever in the last 2 weeks before the interview. This was done to filter out respondents whose children did not have any signs or symptoms of malaria before the interview. Children above 59 months were already excluded from the study.

Inclusion and Exclusion criteria

Women within the age range of 15-49 years who reside permanently within the households in the 2021 NMIS sample or visitors present in the household before the survey were qualified as stipulated in the eligibility criteria and were interviewed. Furthermore, children within the age range of 6- 59 months are all within the eligibility criteria to be screened for malaria [9].

Sampling Technique

Sampling Frame

The Nigeria Malaria Indicator Survey 2021 sample was premeditated to provide most of the key malaria indicators for the entire country, independently for both urban and rural areas, and for every one of the six zones formed by grouping the 36 states and Federal Capital Territory (FCT). The Zones are broken down as follows:

1. North East: Yobe, Gombe, Bauchi, Taraba, Adamawa, and Borno.
2. North Central: Plateau, FCT-Abuja, Kwara, Nasarawa, Kogi, Niger and Benue.
3. North West: Katsina, Zamfara, Jigawa, Sokoto, Kaduna, Kebbi and Kano
4. South East: Abia, Anambra, Ebonyi, Enugu, and Imo.
5. South South: Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers.
6. South West: Lagos, Oyo, Ogun, Osun, Ondo and Ekiti

The sampling frame for the 2021 Nigeria Malaria Indicator Survey (NMIS) was based on the enumeration areas (EAs) from the proposed 2023 Population and Housing Census (PHC). Nigeria is administratively divided into states, each state in turn subdivided into Local Government Areas (LGAs) and subsequently, each LGA is divided into localities. In addition,

during the 2006 population census, each locality was subdivided into convenient areas called census enumeration areas (EAs). Nigeria is made up of 36 states and a Federal Capital Territory (FCT), but for the sampling frame, it is considered as 36 states plus the FCT, totalling 37 entities [9].

Sampling Unit

The primary sampling unit (PSU), referred to as a cluster for the 2021 Nigeria Malaria Indicator Survey (NMIS), is defined based on Enumeration Areas (EAs) from the 2006 EA census frame. Selection of the 2021 NMIS sample was through stratification into a two-staged cluster design consisting of 240 clusters, 83 in urban areas and 157 in rural areas. Finally, a representative sample of 6000 households was selected for the survey, with a minimum target of 920 completed individual women interviews per zone. This proportional distribution ensures that the survey results are representative of the population across different geographic and demographic segments [9].

Selection Process

A comprehensive listing of households selected was conducted, and a mapping exercise for each cluster was accomplished, which served as the sampling setting for the second stage selection of households. Furthermore, the enumerators utilised the National Population Commission's global positioning system (GPS) receivers to document the coordinates of the 2021 NMIS sample clusters. A total average number of 26 households were shortlisted while the selection in the second stage process by equal probability systematic sampling. Women within the age range of 15-49 years who reside permanently within the households in the 2021 NMIS sample or visitors present in the household before the survey were qualified as stipulated in the eligibility criteria and were interviewed. Furthermore, children within the age range of 6- 59 months are all within the eligibility criteria to be screened for malaria. (NMIS, 2021).

Instrument

The NMIS used two different questionnaires: This comprises of a Women's questionnaire and a Household Questionnaire administered to all the women aged 15-49 years who were in the selected households. The instruments that were developed by Roll Back Malaria and DHS programmes applied and adapted the standard Malaria Indicator Survey Questionnaires. The questionnaires were modified to incorporate the population and health issues relevant to Nigeria. The questionnaires were also translated into the three most common Nigerian languages: Yoruba, Hausa, and Igbo.

The Questionnaire applied for the household was utilised to list all the usual community members and visitors in the households selected. Relevant information about the participants was collected on the characteristics of each person listed, including age, sex, and relationship to the household head. This was done to enable easy identification of women who were eligible for the individual interview and children aged 6 – 59 months who were eligible for malaria testing. Subsequently, the Woman's Questionnaire was administered to collect information from all women aged 15-49. Questions on the following topics were asked:

- Background information (such as age, residence, education, media exposure and literacy).
- Birth history and childhood mortality.
- Antenatal care and malaria prevention for most recent birth and pregnancy.
- Malaria prevention and treatment.
- Knowledge about malaria (symptoms, causes, prevention, and drugs used in treatment).

Procedure

Following the approval to download the NMIS 2021 dataset, the final report was studied to familiarize myself with the instrument used and get a better understanding of the way the data was coded. Subsequently, variables relevant to the study were identified and recoded to enable correct analysis. Furthermore, a crosstab was carried out using STATA (version 17) to explore the direct association between selected dependent and independent variables. Those with p-values <0.05 were selected for further analysis.

Ethics

The dataset used for this study was accessed from the Demographic Health Survey (DHS) program. It was made available through the data archive of USAID. Before downloading the data, access and permission to use the dataset were obtained online from the DHS website by giving a brief proposal of the proposed study. On approval, data was downloaded and securely stored on a personal hard drive. As this study is a secondary research of existing data, all information that could be linked and used to identify participants and respondents was removed to ensure anonymity and questions were asked in confidentiality from the respondents that participated in the research. The consent of all participants included in the survey was sought as a non-intrusive method of investigation was employed by the field interviewers in this study. Furthermore, the Nigeria Malaria Indicator Survey 2021 instrument was reviewed and granted approval by the National Health Research Ethics Committee (NHREC) in the Federal Ministry of Health, Abuja, Nigeria and the institutional review board of ICF Macro Inc Calverton, USA which also granted permission to use the dataset for analysis.

Data Analysis

Variables

The study sample was derived from the respondents of the survey who responded 'YES' to 'Had fever in the last 2 weeks' simply put, caregivers whose children had a fever within 2 weeks before the survey thus filtering out data of importance from the large data subset. Subsequently, the variable 'Days after fever sought advice or Treatment' was recoded to 'Sought treatment within 24 hours' to reflect participants who responded within 24 hours on the identification of malaria symptoms in their child.

Dependent Variable

Only one dependent variable was considered in this study. The variable Days after seeking advice or treatment were categorized as Sought treatment within 24 hours. Treatment in this study referred to any form of correct and accepted treatment option used.

Independent Variable

Socio-demographic variables considered in this study are described in Table 1

Table 1. Description of Socio-Demographic Variables

Region	Characterized as North-Central, North-East, North-West, South-South, South-East, and South-West**.**
Wealth Index	Characterized into five quintiles: Poorest, Poorer, Middle, Richer, and Richest
Educational level	Characterized as No education, Primary, Secondary, and Higher
Current Age of the child	Characterized as 0, 1, 2, 3, and 4.
Sex of Child	Characterized as Male and Female
Type of place of Residence	Characterized as Urban and Rural

Respondent's age	Characterized as 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49.
The child lives with whom	Characterized as respondent (mother) and elsewhere.
Religion	Characterized as Christianity, Islam, Traditional and No religion.

Result

Table 2. Socio-Demographic Profile of Study Population

Variable	**Frequency**	**Percentage**
Region		
North Central	2063	18.8
North East	2054	18.7
North West	3215	29.3
South East	1168	10.6
South West	1064	9.7
South South	1424	13.0
Wealth Index		
Poorest	2237	20.4
Poorer	2212	20.1
Middle	2265	20.6
Richer	2187	9.9
Richest	2087	19.0
Educational Level		
No Education	4717	42.9
Primary	1633	14.9
Secondary	3479	31.7
Higher	1159	10.6
The current age of the child		
0	1952	18.3
1	1994	18.7
2	2078	19.5
3	2151	20.2
4	2470	23.2
Sex of Child		
Male	5647	51.4
Female	5341	48.61
Type of place of residence		
Urban	3266	29.7
Rural	7722	70.3
Respondents' age in 5-year Group.		
15-19 years	500	4.5
20 – 24 years	2053	18.6
25 - 29 years	3010	27.4
30 - 34 years	2621	23.8

35 - 39 years	1756	16.0
40 - 44 years	806	7.3
45 - 49 years	242	2.2
The child lives with whom		
Respondent (Mother)	10,545	99.1
Lives elsewhere	100	0.9
Religion		
Christianity	4665	42.5
Islam	6259	57.0
Traditional	62	0.5
No Religion	2	0.0
Malaria Symptom: Fever		
Yes	2288	20.8
No	8700	79.2
Only weak children can die from Malaria.		
Yes	5054	46.0
No	5386	49.0
I don't know	548	5.0
Heard malaria message in the last 6 months		
Yes	4778	43.5
No	6210	56.5
Ways of avoiding Malaria		
Yes	8718	79.3
No	1555	14.2
I don't know	715	6.5
Drug used to treat children: ACT		
Yes	712	19.1
No	3,020	80.9

The study population exhibited diverse socio-demographic characteristics across regions, wealth indices, educational levels, and other factors. Key findings include:

- **Region**: The population was mostly from the Northwest (**29.3%**), followed by North Central (**18.8%**) and North East (**18.7%**), with the South East accounting for the smallest proportion (**10.6%**).
- **Wealth Index**: The distribution across wealth quintiles was relatively even, with the poorest group making up **20.4%** and the richest **19.0%**.
- **Education**: The largest group had no formal education (**42.9%**), followed by those with secondary education (**31.7%**). Only **10.6%** had higher education.
- **Current Age of Child**: Children aged 4 years represented the largest group (**23.2%**), while infants under 1 year accounted for **18.3%**.
- **Sex of Child**: Males made up **51.4%** of the study population, and females made up **48.61%**.
- **Place of Residence**: Most respondents lived in rural areas (**70.3%**), with **29.7%** residing in urban settings.
- **Respondent's Age**: The majority of mothers were aged between 25 and 29

years (**27.4%**), with smaller proportions of older and younger age groups.

- **Religion**: **57.0%** of the population practised Islam, and **42.5%** were Christians.
- **Malaria Symptoms (Fever)**: Only **20.8%** reported that their children had experienced fever, a symptom of malaria, while **79.2%** had not.
- **Heard Malaria Message in the Last 6 Months**: **43.5%** had heard messages related to malaria, while **56.5%** had not.
- **Ways of Avoiding Malaria**: **79.3%** were aware of methods to prevent malaria, **14.2%** were not aware, and **6.5%** were unsure.
- **Drug Used for Treatment (ACT)**: Only **19.1%** used Artemisinin Combination Therapy (ACT) to treat children, while **80.9%** did not use this therapy.

Table 3. Bi-Variate Table of Socio-Demographic Characteristics and Combination with Artemisinin taken for Fever

	Combination with Artemisinin taken for Fever				
Characteristics	**Yes (n=612)**		**No (n=3120)**		**P-value**
	Value	**%**	**Value**	**%**	
Type of place of Residence					
Rural	423	15.2	2357	83.8	0.001
Urban	189	19.9	763	80.1	
Respondents current age					
15-19 years	17	9.8	159	90.2	0.000
20 – 24 years	87	12.0	636	88.0	
25 - 29 years	183	16.7	908	83.2	
30 - 34 years	168	19.6	687	80.3	
35 - 39 years	104	18.8	450	81.2	
40 - 44 years	42	16.4	215	83.6	
45 - 49 years	11	13.7	69	86.3	
Education					
None	145	8.2	1629	91.8	0.000
Primary	95	16.4	485	83.6	
Secondary	276	25.2	821	74.8	
Higher	96	34.2	185	65.8	
Geopolitical Zones					
North West	51	3.4	1430	96.6	0.000
North East	99	15.0	560	85.0	
North Central	148	30.5	338	69.5	
South West	66	28.7	164	71.3	
South East	145	37.5	242	62.5	
South South	103	21.1	386	78.9	
Sex of Child					
Male	326	16.7	1622	83.3	0.562
Female	286	16.0	1498	16.0	

Children with whom					
Respondent	610	16.4	3107	83.6	0.748
Lives elsewhere	2	13.3	13	86.7	
Wealth Index					
Poorest	66	7.9	773	92.2	0.000
Poorer	80	9.3	784	90.7	
Middle	123	16.2	635	83.8	
Richer	163	23.3	537	76.7	
Richest	180	16.4	391	68.5	
The current age of the child					
0	55	9.2	543	90.8	0.000
1	133	15.8	709	84.2	
2	161	20.3	633	79.7	
3	134	17.7	621	82.3	
4	129	17.4	614	82.6	
Religion					
Christian	374	28.5	939	71.5	
Muslim	235	9.9	2151	90.2	
Traditional	3	9.4.	29	90.6	0.000
Others	0	0	1	100	

Bivariate Analysis of Socio-Demographic Characteristics and ACT Use for Fever

The table above (Table 3) examines the relationship between various socio-demographic characteristics and the use of ACT for treating fever.

- **Place of Residence**: Children in urban areas were more likely to receive ACT (**19.9%**) than those in rural areas (**15.2%**, p=0.001).
- **Respondent's Age**: ACT use was lowest among mothers aged 15–19 years (**9.8%**) and highest among those aged 30–34 years (**19.6%**, p=0.000).
- **Education**: Mothers with higher education were more likely to use ACT (**34.2%**) compared to those with no education (**8.2%**, p=0.000).
- **Geopolitical Zones**: The South East had the highest ACT use (**37.5%**), while the North West had the lowest (**3.4%**, p=0.000).
- **Wealth Index**: Wealthier households were more likely to use ACT, with the richest quintile showing **23.3%** usage and the poorest **7.9%** (p=0.000).

Table 4. Knowledge and Combination with Artemisinin Taken for Fever

	Combination with artemisinin taken for Fever				
Knowledge	**Yes (n=)**		**No (n=)**		**P-value**
	Value	**%**	**Value**	**%**	
Malaria Symptom – Fever					
Yes	483	21.1	1805	78.9	

No	129	8.2	1315	91.1	
Only weak children can die from Malaria.					
Yes	232	12.5	1625	87.5	0.000
No	352	20.7	1.349	79.3	
Don't know	28	16.1	146	83.9	
Malaria Cause - Mosquito					
Yes					
No					
Ways of avoiding Malaria					
Yes	497	17.4	2358	82.6	0.006
No	78	12.3	557	87.7	
Don't Know	37	15.3	205	84.7	
Drug used to treat Child- ACT					
Yes	167	23.5	545	76.5	0.000
No	445	14.7	2575	85.3	
Don't know					
Heard Malaria messages in the last 6 months					
Yes	311	19.8	1260	80.2	0.000
No	301	13.8	1860	86.1	
Total					

The table above (Table 4) highlights the association between malaria knowledge and ACT use.

- **Malaria Symptoms (Fever)**: Children who experienced fever were significantly more likely to be treated with ACT (**21.1%**) compared to those who did not have fever (**8.2%**, p=0.000).
- **Perception of Malaria Severity**: Mothers who believed that only weak children could die from malaria had lower ACT use (**12.5%**) compared to those who knew malaria could be fatal for all children (**20.7%**, p=0.000).
- **Malaria Prevention Knowledge**: Mothers aware of how to avoid malaria were more likely to use ACT (**17.4%**, p=0.006).
- **Heard Malaria Messages in the Last 6 Months**: Mothers who had heard malaria messages were more likely to use ACT (**19.8%**, p=0.000).

Table 5. Output from Logistic Regression

Socio-Demographic factors	**Odds Ratio**	**95% Confidence Interval**		**Std. Error**	**z**	**P>z**
Region (North Central- Ref)						
Northeast	1.0	0.8745598	1.160126	0.7	0.10	0.920
Northwest	1.4	1.260308	1.646788	1.0	5.35	0.000
Southeast	0.7	.5800458	.8070401	0.6	-4.5	0.000
South South	0.8	.6437728	.8792465	0.6	-3.6	0.000

Southwest	0.6	.5216946	.7262846	0.1	-5.7	0.000
Education (No Education-Ref)						
Primary	1.1	.9987461	1.292444	0.7	1.9	0.052
Secondary	1.1	.9693233	1.181506	0.5	1.3	0.179
Higher	1.0	.8730688	1.164685	0.1	0.910	
Religion (Christianity –ref)						
Islam	1.4	1.250574	1.483337	0.6	7.1	0.000
Traditional	0.5	.2774218	.7571444	0.1	-3.1	0.002
Others	1	-	-	-	-	-
Wealth (Poorest-ref)						
Poorer	1.4	1.193136	1.550009	0.9	4.6	0.000
Middle	1.4	1.209156	1.56892	0.9	4.8	0.000
Richer	1.3	1.142364	1.483028	0.9	4.0	0.000
Richest	1.4	1.203475	1.570589	0.9	4.7	0.000
Age of Child (<1year-ref)						
1year	1.0	.8687584	1.152182	0.7	0,01	0.995
2years	0.9	.8011631	1.05686	0.6	-1.2	0.239
3years	0.9	.8977165	1.18562	0.0	0.4	0.660
4years	1.0	.8430266	1.101618	0.7	-0.5	0.588
Drug used for child ACT(No-ref)						
Yes	1.4	1.126662	1.80811	0.2	3.0	0.003
Malaria message in 6 months (No-ref)						
Yes	1.1	.9385172	1.304623	0.1	1.2	0.223
Malaria Symptom Fever (No-ref)						
Yes	1.4	1.288543	1.606729	01	6.5	0.000

Logistic regression was employed to determine the impact of various socio-demographic factors on the likelihood of ACT use for treating fever.

- **Region**: Children in the North West were significantly more likely to use ACT (OR=1.4, 95% CI=1.26–1.65, p=0.000) compared to those in the North Central region. Conversely, children in the South East were less likely to use ACT (OR=0.7, 95% CI=0.58–0.81, p=0.000).
- **Education**: Primary education had a marginal impact on ACT use (OR=1.1, 95% CI=0.998–1.29, p=0.052), but secondary and higher education did not significantly influence ACT usage.
- **Religion**: Children from Muslim households were more likely to receive

ACT (OR=1.4, 95% CI=1.25–1.48, p=0.000) compared to Christian households.

- **Wealth Index**: Households in the middle wealth quintile were more likely to use ACT (OR=1.4, 95% CI=1.21–1.57, p=0.000) compared to the poorest households.
- **Child's Age**: The child's age did not significantly influence the likelihood of ACT use, as shown by the odds ratios close to 1 for all age groups.
- **Malaria Symptoms (Fever)**: Children with malaria symptoms were more likely to be treated with ACT (OR=1.4, 95% CI=1.29–1.61, p=0.000).

Discussion

Socio-Demographic Characteristics of Study Population

The study sample, representing various regions in Nigeria, showed that the highest proportion of respondents were from the Northwest (29.3%), while the Southeast had the lowest representation (9.7%). The wealth index of the participants was relatively evenly distributed, with the poorest group comprising 20.4% and the richest 19.0%.

The age distribution of the children was even, with the largest age group being 4-year-olds (23.2%). The gender distribution was nearly equal, with 51.4% male and 48.6% female, reflecting national demographic patterns. Rural residents made up most of the sample (70.3%), which is critical, considering the documented challenges rural populations face in accessing timely and adequate healthcare services [10].

Religion played a role in the socio-demographic makeup, with Islam being the predominant religion (57%), which may influence health-seeking behaviours due to cultural and religious practices [11]. Despite the widespread presence of fever symptoms in children (79.2% reported no recent fever), there was a concerning lack of awareness about the causes of malaria, with 49% of respondents unaware that mosquitoes are the primary vector, aligning with findings from similar studies [12].

Additionally, while 79.3% of respondents were aware of malaria prevention methods, a significant portion (80.9%) did not use the recommended Artemisinin-based Combination Therapy (ACT) for treating malaria in children, indicating a gap between knowledge and practice. This gap underscores the need for more effective public health interventions that not only educate but also ensure access to and utilization of proper treatment protocols [13].

Socio-Demographic Characteristics and Artemisinin Combination Therapy (ACT) Usage

The study further investigates the socio-demographic factors influencing the prompt use of artemisinin-based combination therapy (ACT) for treating fever in children under five years in Nigeria using a bi-variate analysis as presented in Table 3. The results in Table 3 highlight significant associations between various socio-demographic characteristics and the use of artemisinin combination therapy (ACT) for treating fever in children. Notably, urban residents (19.9%) were more likely to use ACT compared to rural residents (15.2%), with a significant p-value of 0.001. Age also played a role, with respondents aged 30-34 years showing the highest use of ACT (19.6%) compared to other age groups, and this was statistically significant (p=0.000). Education level was strongly associated with ACT use, where 34.2% of those with higher education used ACT, contrasting with only 8.2% of those with no education (p=0.000). Geopolitical zones showed significant variation, with the Southeast having the highest ACT use at 37.5% (p=0.000). Wealth index similarly influenced ACT use, with those in the richest quintile showing higher usage (16.4%) compared to the poorest (7.9%), and this was also statistically significant (p=0.000). Interestingly, no

significant association was found between the sex of the child and ACT use (p=0.562).

Knowledge and Artemisinin Combination Therapy (ACT) Usage

Analysis results shown in Table 4 explore the relationship between caregivers' knowledge of malaria and the use of ACT for fever treatment. The data indicates that caregivers who recognized fever as a symptom of malaria were more likely to use ACT (21.1%) compared to those who did not (8.2%), with a significant p-value (p=0.000). Additionally, caregivers who correctly identified that not only weak children can die from malaria were more likely to use ACT (20.7%) than those who believed otherwise (p=0.000). Awareness of ways to avoid malaria was also associated with higher ACT usage (17.4%) compared to those who were not aware (12.3%), with a significant p-value of 0.006. Caregivers who used ACT as a treatment method for their children showed a higher likelihood of continued ACT use for fever (23.5%, p=0.000). Furthermore, exposure to malaria messages within the last six months was significantly associated with ACT usage (19.8%, p=0.000).

Logistic Regression Analysis of Socio-Demographic Factors and ACT Usage

Table 5 presents the logistic regression analysis of socio-demographic factors and their association with ACT use for treating fever. The analysis shows that region, education, religion, wealth, and the use of ACT for previous treatments significantly predicted the likelihood of ACT use. Specifically, respondents from the North West had 1.4 times higher odds of using ACT (p=0.000), while those from the South East and South West had lower odds (0.7 and 0.6, respectively). Higher education levels did not significantly increase the odds of using ACT. However, wealth significantly increased the likelihood of ACT use, with those in the richest quintile having 1.4 times higher odds (p=0.000). Interestingly, the use of ACT in previous treatments increased the odds by 1.4 times (p=0.003), indicating a strong behavioural consistency in ACT use. Moreover, caregivers who recognized fever as a malaria symptom were also 1.4 times more likely to use ACT (p=0.000).

Discussion

Socio-Demographic Characteristics and Combination with Artemisinin Taken for Fever

The findings from Table 3 suggest that socio-demographic factors play a critical role in determining the likelihood of caregivers administering ACT to children with fever. The significant association between urban residence and higher ACT use could be attributed to better access to healthcare facilities and pharmacies in urban areas, as well as greater health literacy [14]. The positive correlation between education level and ACT usage underscores the importance of health education in malaria treatment, as educated caregivers are more likely to be aware of and use effective treatment options. The regional differences, particularly the high ACT usage in the Southeast, may reflect regional health policies, access to health services, and cultural practices that prioritize the use of recommended malaria treatments [15]. The wealth index’s influence further highlights the disparities in healthcare access, with wealthier families better positioned to afford ACT, which may be cost-prohibitive for poorer households [16].

Knowledge and Combination with Artemisinin Taken for Fever

The strong associations identified in Table 4 between malaria knowledge and ACT use emphasize the critical role of awareness and education in malaria treatment. The higher ACT usage among those who identified fever as a malaria symptom and understood the risks of malaria mortality suggests that accurate knowledge directly influences treatment choices. This aligns with the theory that health

literacy can significantly improve health outcomes by empowering individuals to make informed decisions [17]. The significant impact of hearing malaria messages within the last six months on ACT use indicates the effectiveness of health communication strategies in reinforcing proper malaria treatment practices. These findings suggest that continuous public health education, particularly in rural and underserved areas, could bridge the gap in ACT usage and ultimately reduce malaria mortality rates [18].

Logistic Regression Analysis of Socio-Demographic Factors and ACT Usage

The logistic regression analysis in Table 5 reveals the socio-demographic factors most predictive of ACT use, with region, wealth, and prior ACT use emerging as significant predictors. The higher odds of ACT use in the Northwest may be indicative of regional efforts to improve malaria treatment, whereas the lower odds in the Southeast and Southwest could point to potential barriers such as cultural beliefs, availability of drugs, or differences in healthcare infrastructure [19]. The strong influence of wealth on ACT use highlights the persistent economic barriers to accessing recommended malaria treatments, reinforcing the need for subsidized ACT or alternative funding mechanisms to ensure equitable access [20]. Additionally, the consistency in ACT use among caregivers who previously used it suggests a behavioural pattern that could be leveraged in public health campaigns to encourage first-time use among other caregivers [21] The findings underscore the importance of targeted interventions that address regional disparities, improve health literacy, and make ACT.

These findings highlight the critical role of education, awareness, and socioeconomic factors in ensuring timely and effective malaria treatment, emphasizing the need for targeted interventions to improve malaria management, particularly in rural and less educated populations & increase accessibility to lower-income households.

Recommendations

Based on the findings of this study, several recommendations proposed to improve the prompt treatment of malaria among children under five years in Nigeria:

1. **Targeted Health Education Campaigns**: Given the significant impact of education on the likelihood of using artemisinin-based combination therapy (ACT), there should be a concerted effort to enhance health literacy, particularly in rural and less-educated populations. Public health campaigns should focus on increasing awareness about malaria symptoms, the importance of prompt treatment, and the correct use of ACT. These campaigns should utilize local languages and culturally relevant messages to ensure broad reach and effectiveness [12].
2. **Improved Access to ACT in Rural Areas**: The study revealed a significant disparity in ACT usage between urban and rural areas. To address this, the government and health organizations should prioritize the distribution and availability of ACT in rural regions. This could be achieved through mobile health clinics, community health workers, and subsidized drug programs, ensuring that even the poorest households have access to effective malaria treatment [10].
3. **Strengthening Healthcare Infrastructure**: The findings suggest that the regional differences in ACT usage are likely influenced by the availability and quality of healthcare infrastructure. There is a need for increased investment in healthcare facilities in regions with low ACT usage, particularly in the Northwest and Northeast. Strengthening these facilities with adequate medical supplies, trained personnel, and diagnostic tools will

enable better management of malaria cases and improve treatment outcomes [13].

4. **Integration of Cultural and Religious Considerations in Health Interventions**: The study indicates that religious beliefs play a role in treatment choices. Therefore, healthcare interventions should be designed to respect and incorporate cultural and religious perspectives. Collaborating with religious leaders and community influencers can help promote positive health behaviours and increase the acceptance and use of ACT among diverse populations [11].
5. **Policy Development and Implementation**: The government should develop policies that mandate the use of ACT as the first-line treatment for malaria in all public and private healthcare facilities. Additionally, monitoring and evaluation frameworks should be established to ensure compliance with these policies and to assess the impact of interventions aimed at increasing ACT usage. This will require collaboration between governmental health agencies, non-governmental organizations, and international partners [22].

Conclusion

This study highlights the critical socio-demographic determinants that influence the prompt treatment of malaria in children under five in Nigeria. The findings underscore the importance of education, wealth, region, and religious beliefs in shaping health-seeking behaviours. Despite the availability of effective treatments like ACT, significant disparities remain in their usage, particularly among rural, less educated, and poorer populations.

To address these disparities, targeted interventions that improve health literacy, increase access to ACT, and strengthen healthcare infrastructure are essential. Moreover, culturally sensitive approaches that integrate religious and cultural considerations into health interventions will be key to enhancing the effectiveness of malaria control efforts.

Ultimately, a multi-faceted approach that combines education, improved healthcare access, and strong policy frameworks will be necessary to reduce malaria morbidity and mortality among children under five in Nigeria. These efforts will not only save lives but also contribute to the broader goal of improving public health outcomes in the country.

Limitations of the Study

Malaria is the most prevalent disease in Nigeria. It is also adequately funded and researched thus significant number of research and studies have been conducted and published. However, this secondary research has not been without some limitations.

In selecting the sample size, only respondents whose children had a fever 2 weeks before the study were included. Some of the respondents may have concealed information regarding their children having fever which could have affected the number of respondents to recruit for the study which is beyond the researcher's ability to influence.

Secondly, because the data of this study was sourced from secondary sources, the determinant of wealth in the household variable was measured indirectly as the primary researchers did not collect information on income in the household or personal income because of the difficulty in quantifying and obtaining such data in LMIC (Low- and Middle-Income Country) such as Nigeria. Hence wealth index was measured by using dwelling characteristics. This has proven to be reliable and widely used as an indicator to measure wealth in many countries [23].

Finally, although criticism may arise based on the limitations stated above, it is pertinent to note that the most current National population-based survey was utilised for this study hence it provides the most recent fact on the baseline of socio-demographic characteristics, socio-

economic and other relevant factors that may influence the current trends of malaria among the children in Nigeria. Therefore, it enables the opportunity for a robust presentation of association between confounding variables, especially by using a sizeable sample size making it possible to identify the association present.

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Declaration of Competing Interest

There are no organisations with conflicts of interest related to the study. The authors declare that they have no financial or personal relationship that might have inappropriately influenced the writing of this paper.

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