

Health Literacy and Socioeconomic Determinants of Attitudes and Willingness to Accept Malaria Vaccines Among Caregivers of Under-Five Children in Plateau State, Nigeria

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Abstract

Background:

Health literacy plays a critical role in shaping health behaviors and informed decision-making, particularly in the context of newly introduced vaccines. In malaria-endemic countries such as Nigeria, caregivers' ability to access, understand, and apply vaccine-related information can significantly influence acceptance and uptake. This study assessed the role of health literacy and socioeconomic factors in shaping attitudes and willingness to accept malaria vaccines among caregivers of under-five children in Plateau State, Nigeria.

Methods:

A community-based cross-sectional study was conducted among 408 caregivers selected using multistage sampling. Data were collected using a structured interviewer-administered questionnaire assessing vaccine-related knowledge, attitudes, exposure to health education, and willingness to accept malaria vaccines. Descriptive statistics, chi-square tests, and multivariate logistic regression were performed, with statistical significance set at $p < 0.05$.

Results:

Caregivers demonstrated overwhelmingly positive attitudes toward malaria vaccines, with 94.9% exhibiting favourable perceptions. However, important gaps in vaccine-specific health literacy were identified. While most respondents recognized the potential benefits of malaria vaccination, concerns regarding vaccine safety, effectiveness, and religious considerations persisted. Overall, 85.3% of caregivers expressed willingness to accept malaria vaccines. Education level, occupation, family structure, and religion were significantly associated with attitudes, while occupation independently predicted willingness to vaccinate. Caregivers exposed to health education were more likely to demonstrate positive attitudes and willingness, underscoring the role of health literacy in shaping vaccine-related decision-making.

Conclusion:

Although attitudes toward malaria vaccines were largely favorable, gaps in vaccine-specific health literacy and socioeconomic disparities influenced willingness to vaccinate. Strengthening health communication, improving community-based health education, and addressing socioeconomic barriers are essential to enhance malaria vaccine acceptance and equitable uptake. Improving health literacy related to malaria vaccination will contribute to achieving Sustainable Development Goal 3 (Good Health and Well-being) by supporting informed health decisions and reducing health inequities.

INTRODUCTION

Malaria remains one of the most significant public health challenges globally, particularly in sub-Saharan Africa. According to the World Health Organization (WHO), an estimated 249 million malaria cases and approximately 608,000 deaths occurred worldwide in 2022, with children under five years accounting for the majority of mortality (1). Nigeria bears the largest malaria burden globally, contributing about 27% of global malaria cases and a substantial proportion of malaria-related deaths (1,2). Despite sustained malaria control strategies including insecticide-treated nets (ITNs), indoor residual spraying (IRS), seasonal malaria chemoprevention, prompt diagnosis, and effective treatment malaria transmission remains persistently high in many endemic regions (1,3).

The introduction of malaria vaccines into routine immunization programmes represents a major milestone in malaria prevention. The RTS,S/AS01 malaria vaccine demonstrated moderate but meaningful protection against severe malaria and child mortality following pilot implementation in Ghana, Kenya, and Malawi (4). Based on this evidence, the WHO recommended broader use of RTS,S among children living in moderate-to-high malaria transmission settings in 2021 (5). More recently, the R21/Matrix-M malaria vaccine demonstrated efficacy levels of up to 77% in phase 2 trials and has received WHO recommendation and prequalification for broader deployment, including introduction in several African countries such as Nigeria (6).

However, the success of malaria vaccination programmes depends not only on vaccine availability but also on community acceptance, particularly among caregivers who make health decisions for young children. Evidence shows that positive attitudes toward vaccines are associated with higher uptake, whereas negative perceptions contribute to hesitancy and delayed vaccination (7). In many African contexts, concerns about vaccine safety, fear of adverse effects, limited trust in newly introduced vaccines, misinformation, and inadequate communication from health providers influence caregiver willingness to accept vaccination (8,9).

Health literacy plays a critical role in shaping vaccine-related perceptions and behaviours. Health literacy refers to the ability of individuals to access, understand, appraise, and apply health information to make informed health decisions (10). Limited health literacy has been associated with vaccine hesitancy, poor risk perception, and lower utilization of preventive health services, particularly in low- and middle-income countries (11). Caregiver attitudes toward new vaccines are influenced by multiple factors, including perceived benefits and risks, cultural and religious beliefs, exposure to health education, and trust in health systems (12). Early studies on malaria vaccine introduction in Kenya and Ghana reported generally positive caregiver attitudes but emphasized the need for improved community sensitization to address knowledge gaps and misconceptions (13,14).

In Nigeria, evidence on caregiver attitudes and willingness to accept RTS,S and R21 malaria vaccines remains limited, especially during the early stages of vaccine introduction. Plateau State, located in North-Central Nigeria, continues to experience substantial malaria transmission despite ongoing control efforts. Understanding caregiver attitudes and willingness to accept malaria vaccines is therefore

essential to inform demand-generation strategies, strengthen health communication, and ensure equitable vaccine uptake. This study assesses caregivers' attitudes and willingness to accept malaria vaccines among caregivers of under-five children in Plateau State, Nigeria, and provides evidence to support effective malaria vaccine implementation and progress toward Sustainable Development Goal 3 (Good Health and Well-being).

MATERIALS AND METHODS

Study Area

This study was conducted in Plateau State, located in North-Central Nigeria. The state comprises 17 Local Government Areas (LGAs) with both urban and rural settlements and experiences year-round malaria transmission, with seasonal peaks during the rainy period. Variations in health system capacity and access to vaccination services exist across LGAs, particularly in rural communities where healthcare access remains relatively limited (15).

Study Design

A community-based cross-sectional study design was employed. This paper focuses specifically on caregivers' attitudes and willingness toward malaria vaccines (RTS,S and R21).

Study Population

The study population comprised caregivers of children aged 0–59 months residing in selected LGAs in Plateau State. A caregiver was defined as a parent or primary guardian responsible for the daily care and health-related decision-making of the child. Caregivers aged 18 years and above who had resided in the community for at least six months, were caring for a child under five years, and provided informed consent were eligible for inclusion in the study. Caregivers who were ill during data collection, non-residents, or temporary visitors were excluded.

Sample Size Determination

A total of 408 caregivers were included in the analysis. The sample size was calculated using Cochran's formula for prevalence studies and adjusted for design effect and anticipated non-response (16).

Sampling Technique

A multistage sampling technique was used to obtain a representative sample. First, three LGAs—Jos North (urban), Wase (peri-urban), and Kanam (rural) were selected to ensure geographic representation. Second, one ward was randomly selected from each LGA using updated administrative ward lists. Third, settlements within each selected ward were randomly chosen. Fourth, households were selected using systematic sampling based on household listings. Finally, one eligible caregiver was selected per household using simple balloting where more than one eligible respondent was present.

Data Collection Instrument

Data were collected using a structured interviewer-administered questionnaire adapted from validated tools used in vaccine hesitancy and acceptance research (7,12). The instrument captured sociodemographic characteristics, attitudes toward malaria vaccines using Likert scale statements, willingness to accept malaria vaccines, exposure to health education, and perceived benefits, risks, and safety concerns related to vaccination. Although a standardized health literacy scale was not administered, the study incorporated key functional dimensions of health literacy through the assessment of caregivers' knowledge of malaria and vaccination, exposure to health education, ability to understand and interpret vaccine benefits and potential risks, and communication with health workers. These components reflect core domains of health literacy access, comprehension, appraisal, and application of health information and have been widely used as proxy indicators in public health research, particularly in resource-limited settings.

Translation and Pretesting

The questionnaire was translated into Hausa and back-translated into English to ensure semantic accuracy. Pretesting was conducted among caregivers in a neighboring LGA, and necessary modifications were made to improve clarity, cultural appropriateness, and reliability of the instrument.

Measurement of Attitudes

Attitudes toward malaria vaccines were assessed using a five-point Likert scale evaluating perceived effectiveness of malaria vaccines, trust in vaccine safety, concerns about side effects, preference for alternative malaria prevention methods, and confidence in health workers and government. Attitude scores were computed and dichotomized into positive and negative categories using standard scoring procedures commonly applied in immunization research (7).

Measurement of Willingness

Willingness to vaccinate was assessed using a direct question: "Would you allow your child to receive the malaria vaccine?" Responses were categorized as willing or not willing. Follow-up questions explored reasons for unwillingness, including fear of side effects, doubts about effectiveness, misinformation, cultural concerns, and lack of trust.

Data Collection Procedure

Trained research assistants conducted face-to-face household interviews. Supervisors reviewed completed questionnaires daily to ensure completeness, accuracy, and data quality.

Data Analysis

Data were analyzed using IBM SPSS version 25. Descriptive statistics were used to summarize participant characteristics, while chi-square tests assessed associations between sociodemographic

variables and caregivers' attitudes and willingness. Multivariate logistic regression analysis was performed to identify independent predictors of attitudes and willingness to accept malaria vaccination, with statistical significance set at $p < 0.05$. Variables with theoretical relevance and those found to be significant at the bivariate level were included in the logistic regression model to control for potential confounding. Diagnostic assessment for multicollinearity was conducted and no significant collinearity was observed among predictor variables, thereby strengthening the robustness and validity of the model.

Ethical Considerations

Ethical approval was obtained from the Plateau State Health Research Ethics Committee. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and confidentiality of information was strictly maintained throughout the study.

RESULTS

A total of 412 questionnaires were administered, of which 408 were correctly completed and included in the analysis, yielding a response rate of 99.0%.

Sociodemographic Characteristics of Respondents

The mean age of caregivers was 29 ± 5.75 years. As presented in Table 1, nearly half of the respondents were aged 25–34 years (46.8%), and the majority were female (76.7%) and married (91.9%). Slightly more than half were Muslims (52.9%), while Ngas (34.3%) and Hausa (32.8%) were the predominant ethnic groups.

Regarding education, 48.5% had secondary education, 24.5% had tertiary education, and 16.2% had primary education. The most common occupation was business (40.2%), followed by housewives (23.8%) and petty traders (17.4%). Most caregivers reported a monthly income between ₦30,000–₦70,000 (65.7%). More than half lived in polygamous households (55.6%), and 34.3% had one under-five child.

(See Table 1)

Attitudes Toward Malaria Vaccines

Overall, caregivers expressed favorable attitudes toward malaria vaccines (Table 2). The majority strongly agreed that malaria is a serious health problem (88.2%) and that malaria can result in death among children (77.0%).

Most respondents strongly agreed that:

Vaccines are generally safe for children under five (76.7%)

Vaccination against preventable diseases is important (75.5%)

They would trust a malaria vaccine if available (66.7%)

However, concerns were also reported:

Concern about side effects (60.0% strongly agreed)

Concern about vaccine effectiveness (52.2% strongly agreed)

Religious concerns related to malaria vaccination (62.3% strongly agreed)

Trust-related indicators were high:

Trust in health workers (73.3% strongly agreed)

Comfort discussing malaria vaccination with health workers (70.8% strongly agreed)

Willingness to follow religious leaders' recommendation (64.0% strongly agreed)

Perceived usefulness of community vaccination campaigns (73.8% strongly agreed)

(See Table 2)

Overall Attitude Score

Based on composite scoring:

94.9% of caregivers had a positive attitude

5.1% had a negative attitude

(See Table 2.1)

Willingness to Uptake Malaria Vaccine

A total of 85.3% of caregivers reported willingness to vaccinate their children if the malaria vaccine becomes available, while 14.7% were unwilling (Table 3). Reported reasons for unwillingness included fear of side effects, doubts about vaccine safety, and religious misconceptions.

Factors Associated with Attitudes Toward Malaria Vaccine

Chi-square analysis (Table 4) showed statistically significant associations between caregiver attitudes and:

Religion ($p = 0.008$)

Occupation ($p = 0.002$)

Education ($p < 0.001$)

Family type ($p = 0.010$)

No significant associations were observed for age, gender, marital status, income, ethnicity, or number of under-five children.

Predictors of Attitudes Toward Malaria Vaccine

Multivariate logistic regression (Table 6) identified the following significant predictors:

Islamic caregivers were more likely to have negative attitudes compared to Christians (aOR = 4.02; 95% CI: 1.33–12.15; $p = 0.014$)

Employed caregivers were less likely to have negative attitudes (aOR = 0.23; $p = 0.004$)

Formally educated caregivers were less likely to have negative attitudes (aOR = 0.11; $p < 0.001$)

Caregivers from extended families were more likely to have positive attitudes (aOR = 3.33; $p = 0.015$)

Factors Associated with Willingness to Accept Malaria Vaccine

Chi-square analysis (Table 5) showed that willingness was significantly associated only with occupation ($p < 0.001$), with employed caregivers more likely to be willing to vaccinate their children.

No significant associations were observed for age, gender, religion, education, ethnicity, marital status, family type, income, or number of under-five children.

Predictors of Willingness to Accept Malaria Vaccine

Multivariate logistic regression (Table 7) showed:

Unemployed caregivers were less likely to be willing to vaccinate compared to employed caregivers (aOR = 0.35; 95% CI: 0.199–0.628; $p < 0.001$)

Religion and education were included in the model but were not statistically significant predictors of willingness.

DISCUSSION

This study assessed caregivers' attitudes and willingness to accept malaria vaccines among caregivers of under-five children in Plateau State, Nigeria. Overall, caregivers demonstrated overwhelmingly positive attitudes toward malaria vaccination, with nearly all respondents expressing favorable perceptions. However, concerns regarding vaccine safety, effectiveness, and religious implications remained notable. These findings highlight the complex interaction between health literacy, trust, and sociocultural factors

in shaping vaccine-related decision-making. While the cross-sectional design does not permit causal inference, the findings provide important associative evidence regarding the relationship between health literacy, socioeconomic factors, and vaccine-related attitudes and willingness in a real-world setting.

The high proportion of caregivers who recognized malaria as a serious health problem and a leading cause of childhood mortality reflects widespread awareness of malaria burden in endemic settings. Similar patterns of high malaria risk perception have been reported across sub-Saharan Africa following sustained malaria control and health promotion campaigns (1,3). High perceived disease severity has been shown to positively influence uptake of preventive health interventions, including vaccination (12).

Caregivers in this study demonstrated overwhelmingly positive attitudes toward malaria vaccines (94.9%). This finding aligns with studies conducted in Kenya and Ghana following pilot implementation of the RTS,S malaria vaccine, which reported generally favorable caregiver perceptions toward malaria vaccination (13,14). Positive attitudes may reflect increasing awareness of malaria burden, trust in immunization programmes, and exposure to public health messaging regarding malaria vaccine introduction. However, despite favorable attitudes, notable concerns persisted regarding vaccine safety, side effects, and effectiveness. Fear of adverse effects is a well-established determinant of vaccine hesitancy globally and is particularly common during early introduction of new vaccines (7,9). The coexistence of overwhelmingly positive attitudes alongside persistent concerns regarding vaccine safety and effectiveness suggests that general awareness of malaria does not necessarily translate into complete vaccine confidence. This gap highlights the distinction between basic health awareness and vaccine-specific health literacy, which plays a critical role in shaping informed vaccination decisions.

Religious concerns were reported by a considerable proportion of caregivers in this study. Similar patterns have been documented during vaccination campaigns in northern Nigeria, where sociocultural and religious factors influenced vaccine perceptions and acceptance (8). Importantly, many caregivers reported willingness to follow recommendations from religious leaders, highlighting the influential role of faith-based institutions in shaping community health behaviour. Engagement of religious leaders has been shown to improve vaccination acceptance and reduce misinformation in community-based immunization programmes (17).

Trust in health workers emerged as a strong facilitator of positive attitudes in this study. Most caregivers reported confidence in health workers and comfort discussing malaria vaccination with them. Previous research consistently identifies healthcare providers as the most trusted source of vaccine information and a key predictor of vaccine acceptance (7,12). Strengthening health worker communication and ensuring accurate dissemination of vaccine information will therefore be critical for successful malaria vaccine rollout.

Overall willingness to accept malaria vaccines was high (85.3%), indicating a favorable environment for malaria vaccine introduction. This level of willingness is comparable to findings from malaria-endemic African settings, where caregiver willingness ranged between 70% and 90% following vaccine awareness initiatives (13). However, the proportion of caregivers unwilling to vaccinate due to safety concerns and

misinformation highlights the continued need for targeted communication strategies to address residual hesitancy.

Sociodemographic analysis revealed that education, occupation, religion, and family structure significantly influenced caregiver attitudes. Caregivers with formal education were significantly less likely to exhibit negative attitudes, supporting evidence that education improves health literacy, enhances understanding of vaccine benefits, and strengthens trust in immunization programmes (10,11). Similarly, employed caregivers were more likely to demonstrate positive attitudes and willingness, possibly due to better access to health information and greater interaction with formal healthcare systems. Socioeconomic inequalities have been widely recognized as important determinants of vaccine acceptance and health literacy (18).

Caregivers from extended family settings demonstrated more favorable attitudes compared to those from nuclear families. This may reflect the influence of social support networks and collective decision-making within households. Previous studies in similar contexts have shown that family structure and social networks influence maternal and child health behaviors and health service utilization (19).

Occupation emerged as the only independent predictor of willingness to vaccinate. Unemployed caregivers were significantly less likely to be willing to accept malaria vaccines, possibly reflecting reduced exposure to health information, lower trust in formal health systems, or socioeconomic constraints. Similar associations between lower socioeconomic status and reduced vaccine willingness have been reported in malaria-endemic African settings (20).

Although religion and education were not statistically significant predictors of willingness in multivariate analysis, their theoretical importance in shaping vaccine perceptions remains well established (7,11). Their influence may operate indirectly through health literacy, trust, and exposure to health education rather than directly determining behavioral intention.

Overall, this study demonstrates that caregivers exhibit high perceived malaria risk, overwhelmingly positive attitudes, and strong willingness to accept malaria vaccines, yet concerns regarding safety, effectiveness, and religious beliefs persist. This gap highlights the central role of health literacy in translating awareness into vaccination behavior. These findings provide actionable evidence for policymakers and immunization programme managers by identifying modifiable determinants of vaccine acceptance, including health communication, community engagement, and socioeconomic disparities, which are essential for achieving equitable malaria vaccine uptake. Strengthening community health education, culturally appropriate communication, and engagement with trusted health workers and religious leaders will be essential to improve confidence and ensure equitable malaria vaccine uptake as Nigeria expands malaria vaccination programmes.

CONCLUSION

This study assessed caregivers' attitudes and willingness to accept malaria vaccines among caregivers of under-five children in Plateau State, Nigeria. The findings revealed overwhelmingly positive attitudes toward malaria vaccination and high willingness to vaccinate, indicating a favourable environment for malaria vaccine introduction. However, important concerns regarding vaccine safety, effectiveness, and religious implications persist, highlighting residual hesitancy among a minority of caregivers.

Education, occupation, religion, and family structure significantly influenced caregiver attitudes, while occupation independently predicted willingness to vaccinate. These findings underscore the critical role of health literacy and socioeconomic factors in shaping vaccine-related perceptions and decision-making. Although general awareness of malaria was high, gaps in vaccine-specific understanding remain, suggesting that improved health communication is essential for translating positive attitudes into sustained vaccine uptake.

Strengthening malaria vaccine related health literacy, enhancing trust in vaccination programmes, and addressing sociocultural concerns will be vital to ensure equitable and successful malaria vaccine implementation. Improving informed decision-making and vaccine confidence will contribute to achieving Sustainable Development Goal 3 (Good Health and Well-being) by reducing malaria burden and improving child survival in malaria-endemic settings.

Strengthening vaccine-specific health literacy and addressing socioeconomic barriers will be critical to translating favorable attitudes into sustained malaria vaccine uptake and improving child health outcomes in malaria-endemic regions.

RECOMMENDATIONS

1. Strengthen Health Education and Vaccine Literacy

Targeted community-based health education programmes should be implemented to improve caregivers' understanding of malaria vaccines, including safety, effectiveness, and benefits. Health literacy interventions should focus on translating scientific vaccine information into clear, culturally appropriate messages.

2. Enhance Health Worker Communication Capacity

Healthcare providers should receive training on malaria vaccine communication, risk counselling, and addressing vaccine concerns. As trusted sources of information, well-informed health workers can significantly improve caregiver confidence and vaccine acceptance.

3. Engage Religious and Community Leaders

Given the influence of religious and sociocultural factors, collaboration with religious leaders and community influencers should be strengthened to address misconceptions, promote accurate vaccine information, and support community acceptance of malaria vaccination.

4. Address Socioeconomic Inequalities in Health Information Access

Targeted strategies should be developed to reach caregivers with lower education and limited access to health information, including rural populations and vulnerable groups, to ensure equitable dissemination of malaria vaccine information and reduce disparities in vaccine uptake.

5. Strengthen Risk Communication and Community Engagement

Public health authorities should implement sustained, multi-channel communication strategies to address safety concerns, counter misinformation, and build long-term trust in malaria vaccination programmes.

6. Integrate Malaria Vaccine Education into Routine Immunization Services

Malaria vaccine awareness and counselling should be incorporated into existing maternal and child health services, including antenatal care, immunization clinics, and community outreach programmes.

7. Future Research

Further longitudinal and implementation studies are recommended to assess actual malaria vaccine uptake, behavioural changes following vaccine introduction, and effectiveness of health literacy interventions in improving vaccine acceptance.

WHAT THIS STUDY ADDS

What is already known on this topic

Malaria remains a leading cause of morbidity and mortality among children under five in sub-Saharan Africa, particularly in Nigeria.

Introduction of malaria vaccines (RTS,S and R21) represents a major advancement in malaria prevention.

Vaccine acceptance is influenced by caregiver perceptions, trust, and exposure to health information, while concerns about safety and misinformation may contribute to hesitancy.

What this study adds

This study demonstrates very high positive attitudes (94.9%) and strong willingness (85.3%) among caregivers toward malaria vaccination in a malaria-endemic Nigerian setting.

Despite favourable attitudes, persistent concerns regarding safety, effectiveness, and religious implications highlight residual vaccine hesitancy linked to gaps in vaccine-specific health literacy.

Education, occupation, religion, and family structure significantly influenced attitudes, while occupation independently predicted willingness, emphasizing the role of socioeconomic factors in vaccine decision-

making.

The study provides evidence that strengthening health literacy, risk communication, and community engagement is essential for translating positive perceptions into sustained malaria vaccine uptake.

LIMITATIONS OF THE STUDY

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to establish causal relationships between predictors and caregivers' attitudes or willingness to accept malaria vaccination; therefore, the associations observed should be interpreted with caution. Second, the data were based on self-reported responses and may be subject to recall bias and social desirability bias, particularly regarding sensitive issues such as vaccine perceptions, safety concerns, and religious influences. Third, the study was conducted in selected LGAs and may not fully represent all caregivers across Plateau State. However, the inclusion of urban, peri-urban, and rural populations enhances the contextual relevance and potential applicability of the findings to similar malaria-endemic settings in Nigeria and sub-Saharan Africa. Finally, the study was conducted during the early phase of malaria vaccine introduction, when community awareness, exposure to vaccine information, and public understanding of malaria vaccination were still evolving, which may have influenced caregiver perceptions and responses.

Abbreviations

WHO

World Health Organization

ITNs

Insecticide-Treated Nets

IRS

Indoor Residual Spraying

RTS,S

Recombinant malaria vaccine RTS,S/AS01

R21

R21/Matrix-M malaria vaccine

LGA

Local Government Area

Declarations

ETHICS STATEMENT

Ethical approval for this study was obtained from the Plateau State Health Research Ethics Committee. Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and confidentiality and anonymity were strictly maintained throughout the study. The study was conducted in accordance with ethical principles outlined in the Declaration of Helsinki.

FUNDING STATEMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. (Edit if applicable.)

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

(Abbas Sani Muhammad) conceived and designed the study. Adamu Alhaji and Hadiza Musa Abdullahi supervised data collection. Abbas Sani Muhammad performed data analysis and drafted the manuscript. All authors contributed to interpretation of results, critically reviewed the manuscript, and approved the final version.

DATA AVAILABILITY STATEMENT

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Tables

Table 1: Sociodemographic Characteristics of Respondents (n=408)

Socio-Demographic Characteristics	Frequency	Percentage (%)
1. Age (Years)		
19-24	155	38.0
25-34	191	46.8
35-44	49	12.0
>44	13	3.2
Total	408	100
Mean $\pm$ SD =29 $\pm$ 5.75		
2. Gender		
Female	313	76.7
Male	95	23.3
Total	408	100
3. Religion		
Islam	216	52.9
Christianity	192	47.1
Total	408	100
4. Ethnicity		
Hausa	134	32.8
Fulani	39	9.6
Berom	81	19.9
Ngas	140	34.3
Others	14	3.4
Total	408	100
5. Educational Level		
Primary	66	16.2
Secondary	198	48.5
Tertiary	100	24.5
Islamic only	36	8.8

Socio-Demographic Characteristics	Frequency	Percentage (%)
None	8	2.0
Total	408	100
6. Occupation		
Farmer	10	2.5
House wife	97	23.8
Business man/woman	164	40.2
Petty trader	71	17.4
Artisan	0.0	0.0
Civil servant	66	16.2
Total	408	100
7. Average Monthly Income		
Below ₦30,000	55	13.5
₦30,000–₦70,000	268	65.7
Above ₦70,000	85	20.8
Total	408	100
8. Marital Status		
Married	375	91.9
Divorced	9	2.2
Widowed	24	5.9
Separated	0.0	0.0
Total	408	100
9. Family type		
Monogamous	181	44.4
Polygamous	227	55.6
Total	408	100
10. Number Of under-five Children		
1	140	34.3
2	110	27.0

Socio-Demographic Characteristics	Frequency	Percentage (%)
3	75	18.4
4	48	11.8
>4	35	8.5
Total	408	100

Table 2: Attitudes of caregivers of under five children towards the malaria vaccine in plateau state.

Variables	Frequency	Percentage
1. Malaria is a serious health problem in plateau state		
Strongly Agree	360	88.2
Agree	44	10.8
Neutral	2	0.5
Disagree	2	0.5
Strongly disagree	0	0.0
Total	408	100
2. Malaria can result in death of children		
Strongly Agree	314	77.0
Agree	90	22.0
Neutral	4	1.0
Disagree	0	0.0
Strongly disagree	0	0.0
Total	408	100
3. Vaccine are generally safe for children under five.		
Strongly Agree	313	76.7
Agree	74	18.1
Neutral	9	2.2
Disagree	6	1.5
Strongly disagree	6	1.5
Total	408	100
4. It is important to vaccinate children against preventable disease		
Strongly Agree	308	75.5
Agree	85	20.8
Neutral	9	2.2
Disagree	6	1.5
Strongly disagree	0	0.0
Total	408	100

Variables	Frequency	Percentage
5. If a malaria vaccine becomes available, I would trust it.		
Strongly Agree	272	66.7
Agree	105	25.7
Neutral	29	7.1
Disagree	2	0.5
Strongly disagree	0	0.0
Total	408	100
6. I am concerned about the side effects of the malaria vaccine		
Strongly Agree	245	60.0
Agree	127	31.1
Neutral	26	6.4
Disagree	10	2.5
Strongly disagree	0	0.0
Total	408	100
7. I am concerned about the effectiveness of the malaria vaccine		
Strongly Agree	213	52.2
Agree	107	26.2
Neutral	79	19.4
Disagree	9	2.2
Strongly disagree	0	0.0
Total	408	100
8. I am concerned about the religious implications of the malaria vaccine.		
Strongly Agree	254	62.3
Agree	104	25.5
Neutral	39	9.6
Disagree	4	1.0
Strongly disagree	7	1.7

Variables	Frequency	Percentage
Total	408	100
9. I feel comfortable discussing malaria vaccination with a health worker.		
Strongly Agree	289	70.8
Agree	88	21.6
Neutral	25	6.1
Disagree	4	1.0
Strongly disagree	2	0.5
Total	408	100
10. I trust health workers regarding vaccines.		
Strongly Agree	299	73.3
Agree	62	15.2
Neutral	43	10.5
Disagree	4	1.0
Strongly disagree	0	0
Total	408	100
11. I would follow a recommendation from a religious leaders to vaccinate my child.		
Strongly Agree	261	64.0
Agree	100	24.5
Neutral	33	8.1
Disagree	10	2.5
Strongly disagree	4	1.0
Total	408	100
12. Community campaign on malaria vaccination are helpful		
Strongly Agree	301	73.8
Agree	86	21.1
Neutral	19	4.7
Disagree	2	0.5

Variables	Frequency	Percentage
Strongly disagree	0	0.0
Total	408	100

Table 2.1: Attitude score of caregivers of under five children regarding malaria vaccine

Scoring: Strongly Agree = 5, Agree = 4, Neutral = 3, Disagree = 2, Strongly Disagree = 1

Category	Frequency	Percentage (%)
Positive Attitude (36-60)	387	94.9
Negative Attitude (12-35)	21	5.1

Table 3: Willingness to uptake malaria vaccine among Caregivers of under-fives

Variables	Frequency	Percentage (%)
If the malaria vaccine becomes available, would you vaccinate your child?		
Yes	348	85.3
No	60	14.7
Total	408	100

Table 4: Factors associated with Caregivers attitudes towards malaria vaccine among caregivers of under five children

Variables	Attitudes of Caregivers		Total (%)	χ2	p-value
	Positive (%)	Negative (%)			
Age(in years)					
≤29	172 (42.2)	7 (1.7)	179(43.9)	0.999	0.318
>29	215 (52.7)	14 (3.4)	229(56.1)		
Total	387 (94.9)	21 (5.1)	408(100)		
Gender					
Male	300 (73.5)	13 (3.2)	313(76.7)	2.719	0.099
Female	87 (21.4)	8 (1.9)	95(23.3)		
Total	387 (94.9)	21 (5.1)	408(100)		
Religion					
Islam	199 (48.8)	17 (4.2)	216(52.9)	6.973	0.008*
Christianity	188 (46.1)	4 (0.9)	192(47.1)		
Total	387 (94.9)	21 (5.1)	408(100)		
Occupation					
Employed	225 (55.2)	5 (1.2)	230(56.4)	9.545	0.002*
Self employed	162 (39.7)	16 (3.9)	178(43.6)		
Total	387 (94.9)	21 (5.1)	408(100)		
Education					
Formal	353 (86.6)	11 (2.7)	364(89.2)	31.221	<0.001*
Non Formal	34 (8.3)	10 (2.4)	44(10.8)		
Total	387 (94.9)	21 (5.1)	408(100)		
Tribe					
Hausa/Fulani	160 (39.3)	13 (3.2)	173(42.4)	3.448	0.063
Ngas/Berom/others	227 (55.6)	8 (1.9)	235(57.6)		
Total	387 (94.9)	21 (5.1)	408(100)		
Monthly					
≤70,000	213 (52.2)	15 (3.7)	228(55.9)	2.170	0.141
>70,000	174 (42.7)	6 (1.4)	180(44.1)		

Total	387 (94.9)	21 (5.1)	408(100)		
Marital Status					
Married	356 (87.3)	19 (4.7)	375(91.9)	0.061	0.804
Not Married	31 (7.6)	2 (0.4)	33 (8.1)		
Total	387 (94.9)	21 (5.1)	408(100)		
Family type					
Monogamous	166 (40.7)	15 (3.7)	181(44.4)	6.571	0.010*
Polygamous	221 (54.2)	6 (1.4)	227(55.6)		
Total	387 (94.9)	21 (5.1)	408(100)		
Number of Under-five					
≤2	281(69.0)	13 (3.2)	294(72.1)	1.134	0.287
>2	106 (25.9)	8 (1.9)	114(27.9)		
Total	387 (94.9)	21 (5.1)	408(100)		

*Statistically significant (p=<0.05)

Table 6: Predictors of Attitude towards malaria vaccine among care givers of under five children in Plateau state

Variables	Attitude		aOR	(95% CI)		p-value
	Positive(%)	Negative(%)		Lower	Upper	
Religion						
Islam	199(92.1)	17(7.9)	4.02	(1.33	12.15)	*0.014
Christianity	188(97.9)	4(2.1)	1			
Occupation						
Employed	225(97.8)	5(2.2)	0.23	(0.81	0.63)	*0.004
Self employed	162(91.0)	16(9.0)	1			
Education						
Formal	353(97.0)	11(3.0)	0.11	(0.04	0.27)	*<0.001
Non Formal	34(77.3)	10(22.7)	1			
Family type						
Nuclear	166(91.7)	15(8.3)	1			
Extended	221(97.4)	6(2.6)	3.33	(1.26	8.76)	*0.015

Table 5: Factors associated with willingness to uptake malaria vaccine among caregivers of under five children

Variable	Caregivers Willingness		Total (%)	χ2	p-value
	Willing (%)	Not Willing (%)			
Age (in years)					
≤29	159 (39.0)	20 (4.9)	179 (43.9)	3.173	0.075
>29	189 (46.3)	40 (9.8)	229 (56.1)		
Total	348 (85.3)	60 (14.7)	408 (100)		
Gender					
Female	270 (66.2)	43 (10.5)	313(76.7)	1.004	0.316
Male	78 (19.1)	17 (4.2)	95(23.3)		
Total	348 (85.3)	60 (14.7)	408 (100)		
Religion					
Islam	185 (45.3)	31 (7.6)	216(52.9)	0.046	0.830
Christianity	163 (40.0)	29 (7.1)	192(47.1)		
Total	348 (85.3)	60 (14.7)	408 (100)		
Occupation					
Employed	209 (51.2)	21 (5.1)	230(56.4)	13.065	<0.001*
Self employed	139 (34.1)	39 (9.6)	178(43.6)		
Total	348 (85.3)	60 (14.7)	408 (100)		
Education					
Formal	313 (76.7)	51 (12.5)	364(89.2)	1.299	0.254
Non Formal	35 (8.6)	9 (2.2)	44(10.8)		
Total	348 (85.3)	60 (14.7)	408 (100)		
Tribe					
Hausa/Fulani	154 (37.7)	19 (4.7)	173(42.4)	3.319	0.068
Ngas/Berom/Others	194 (47.61)	41 (10.0)	235(57.6)		
Total	348 (85.3)	60 (14.7)	408(100)		
Monthly income					
≤70,000	192 (47.1)	36 (8.8)	228 (55.9)	0.484	0.487
>70,000	156 (38.2)	24 (5.9)	180 (44.1)		

Variable	Caregivers Willingness		Total (%)	χ^2	p-value
	Willing (%)	Not Willing (%)			
Total	348 (85.3)	60 (14.7)	408 (100)		
Marital Status					
Married	319 (78.2)	56 (13.7)	375(91.9)	0.191	0.662
Not Married	29 (7.1)	4 (1.0)	33 (8.1)		
Total	348 (85.3)	60 (14.7)	408 (100)		
Family type					
Monogamous	156 (38.2)	25 (6.1)	181(44.4)	0.207	0.649
Polygamous	192 (47.1)	35 (8.6)	227(55.6)		
Total	348 (85.3)	60 (14.7)	408(100)		
Number of under five					
≤ 2	252 (61.8)	42 (10.3)	294(72.1)	0.148	0.700
>2	96 (23.5)	18 (4.4)	114(27.9)		
Total	348 (85.3)	60 (14.7)	408(100)		

*Statistically significant ($p < 0.05$)

Table 7: Predictors of willingness to uptake malaria vaccine among care givers of under five children in Plateau state

Variables	Willingness		aOR	(95% CI)		p-value
	Willing (%)	Not Willing (%)		Lower	Upper	
Occupation						
Employed	209(88.7)	21(5.1)	1			
Unemployed	139(81.5)	39(9.6)	0.354	(0.199	0.628)	*<0.001
Total	348 (85.3)	60 (14.7)				
Religion						
Islam	185 (45.3)	31 (7.6)	0.847	(0.471	1.523)	0.579
Christianity	163 (40.0)	29 (7.1)	1			
Total	348 (85.3)	60 (14.7)				
Education						
Formal	313 (76.7)	51 (12.5)	0.561	(0.240	1.311)	0.182
Non Formal	35 (8.6)	9 (2.2)	1			
Total	348 (85.3)	60 (14.7)				

*Statistically significant; aOR, Adjusted odds ratio; CI=Confidence interval