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Original Research

Knowledge, acceptance and willingness to pay for malaria vaccine among residents of a semi-urban community in Kaduna State, North-western Nigeria.

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Abstract

Background: Malaria is a life-threatening parasitic infection associated with high morbidity and mortality in endemic regions. The World Health Organization (WHO) has approved two malaria vaccines for use in children and as countries begin the phased rollout of these vaccines, uncertainties around community awareness, attitudes, and willingness to accept the vaccines remain.

Methodology: This study used a multistage sampling to select 200 mostly female caregivers of children under the age of five years in Samaru, a semi-urban community in Kaduna State, North-western Nigeria. Data on knowledge, attitude, and willingness to accept the malaria vaccine was obtained using a structured questionnaire and analysed using IBM SPSS Statistics. Knowledge and attitude were scored and graded into good and poor categories. The data was presented using frequency tables and a chi-square test was used to check for associations between willingness to accept malaria vaccine and relevant variables. A P value < 0.05 was considered statistically significant.

Results: The majority of the respondents were females (65.5%) and married (93.0%), with a mean age of 33.1 (±9.3) years. Fifty-seven (28.5%) caregivers heard of the malaria vaccine mostly through healthcare workers and traditional media, while 39 (19.5%) showed good knowledge of the vaccine. A total of 194 (97.0%) had a good attitude towards the vaccine, 188 (94.0%) were willing to accept the vaccine, and 176 (88.0%) said they were willing to pay for it. Factors associated with vaccine acceptance included the caregiver being vaccinated as a child, having at least one child who is vaccinated, and having a good attitude toward the vaccine.

Conclusion: Despite low awareness, willingness to accept the malaria vaccine was high in the community. It is recommended that immediate steps be taken by relevant stakeholders to educate the public and begin the rollout of the vaccine to avoid the spread of rumours and misconceptions.

Keywords: Malaria; Malaria Vaccine; Malaria Control; R21; RTS,S; Nigeria; NMEP.

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Introduction

Malaria is a life-threatening parasitic disease caused by the *Plasmodium* parasite and transmitted through the bite of an infected female *Anopheles* mosquito. Several species of parasite exist, but the *falciparum* species are the deadliest, implicated in most cases, and associated with the most severe forms of the disease.[1] Infection with malaria is largely preventable, with safe and effective treatment options available to cure it. However, delay in appropriate treatment can lead to adverse clinical outcomes including death.[1] Children, pregnant women, and non-immune travelers are predisposed to severe forms of malaria due to insufficient quantities of protective antibodies.[1]

In 2023, an estimated 263 million cases of malaria were reported from 83 malaria-endemic countries, up from the 252 million cases reported in 2022.[2] The African Region accounted for 246million (94%) cases, with only five African countries (Nigeria, Democratic Republic of Congo, Uganda, Ethiopia, and Mozambique) contributing more than half to the global burden. Nigeria alone accounted for 68 million cases and over 184,000 deaths, representing 25.9% and 30.9% of global cases and deaths due to malaria respectively.[2] In Nigeria, the North-west region is one of six geopolitical regions, comprising seven states with a combined population in excess of 60 million.[3] In 2021, the prevalence of malaria among children aged 6-59months in the region was 29.8%, far above the national prevalence of 22.3%.[4]

Over the years, the National Malaria Elimination Programme (NMEP) has approved and deployed several malaria intervention strategies including case management with Artemisinin-based Combination Therapy(ACT), long-lasting insecticidal nets (LLINs), and seasonal malaria chemoprevention (SMC)for children under the age of five years.[1,5] However, Nigeria remains endemic to malaria due to a myriad of factors including behavioural, environmental, and health system challenges. There cent approval of two malaria vaccines by the World Health Organization (WHO) represents an important landmark in the ongoing fight against malaria.[6,7]The vaccines work by stimulating the human immune system to synthesize antibodies capable of neutralising infective *sporozoites* in the bloodstream, thus preventing the parasite from establishing an infection.[8] In rigorous clinical trials, the two vaccines showed favourable safety and efficacy profiles in children, including those living with human immunodeficiency virus (HIV) and malnutrition.[9]

In April 2023, Nigeria approved the use of malaria vaccines in children on a schedule of four doses to be administered to children after the age of five months. However, anecdotal evidence has shown that vaccine hesitancy, defined as “a delay in the acceptance or refusal of vaccination despite the availability of vaccination services” is a common phenomenon globally and could limit the acceptance and uptake of the new malaria vaccines.[10] Vaccine hesitancy may be fueled by the spread of misinformation, negative beliefs, and attitudes towards immunization, as well as a lack of genuine and accurate information from healthcare professionals, which creates avenues for the spread of rumours and misconceptions around the safety and efficacy of new vaccines.[11,12]

As Nigeria begins the phased rollout of the vaccine, it is important to assess the level of awareness, perceptions and other community factors that could either facilitate or militate against the success of the campaign, since different communities have different peculiarities, and health interventions need to be designed and implemented within such contexts. Understanding the community views and addressing local barriers will aid vaccine programming and community mobilization efforts toward promoting individual and community-level acceptance.[13] This study aimed to assess the knowledge, attitude, and willingness to accept the malaria vaccine among residents of a semi-urban community in Kaduna State, including the factors associated with willingness to accept the vaccines.

Methodology

Study area

This was an analytic cross-sectional study conducted among residents of Samaru, a semi-urban community in Sabon-Gari Local Government Area (LGA) of Kaduna State, North-western Nigeria. The community is located at longitude 7º 39′ 20″ and latitude 11º 09′ 30″ with an altitude of 550–700 metres above sea level in the Northern Guinea Savannah.[14] The community experiences two distinct seasons; dry and rainy seasons, and the mean temperatures range from 13.8ºC to 36.7ºC.[15] With an estimated population of 286,671 during the 2006 national census, the Samaru community enjoys amenities and public institutions including the main campus of Ahmadu Bello University Zaria and the National Institute of Leather and Science Technology.[16] The predominant ethnic groups in the community included Hausa, Fulani, Yoruba, Igbo, and Bajju, among several others, whereas the predominant occupations of people in Samaru were academic activities, agriculture, and small-scale businesses.[16]

Selection of participants

Participants in this study comprised men and women who cared for children aged less than five years and residing in the community for at least one year. Using Cochran's formula,[17] a minimum sample size of 174 was calculated based on a previous study that reported malaria vaccine acceptance level of 87% across five communities in South-western Nigeria.[18] Further parameterization of the formula included a complementary probability of 13%, a standard normal deviation of 1.96, and a 5% margin of error. To account for non-response, a 20% allowance was made, which increased the sample size to 208 respondents.

Accordingly, eligible participants were selected through a multistage sampling technique. In the first stage, four streets were selected randomly from a list of all the streets in Samaru, obtained from the local health department. A complete house numbering and household listing then followed, which allowed for the subsequent stages of the selection, including the random selection of 52 houses per street, a random selection of one household per house, and the random selection of one eligible caregiver per household.

Data collection

Four trained research assistants collected data from eligible respondents using a structured interviewer-administered questionnaire. The questionnaire, which was deployed electronically using the Kobo collect® application, was adapted from three previous studies and modified to suit the objectives of the study and the local context.[19–21] The questionnaire, which was scripted in English language and translated into Hausa language, comprised four sections, namely: sociodemographic characteristics (A), knowledge ofmalaria and malaria vaccine (B), attitude and acceptance of malaria vaccine (C), and willingness to pay for malaria vaccine (D). For the knowledge of malaria vaccine and attitude towards malaria vaccine sections, scores were given for correct answers and favourable attitudes respectively.

Statistical analysis

The data collected was downloaded from the Kobo toolbox® servers as a spreadsheet and managed in Microsoft Excel®. The data was subsequently analysed using IBM SPSS Statistics® (version27.0). For the univariate analysis, appropriate measures of central tendency were used to present relevant variables including the mean (SD) for the age of respondents. Other categorical variables were presented using frequency distribution tables. A total of five questions were used to assess the level of knowledge on the malaria vaccine and each correct answer was awarded a score of 1, while incorrect answers were scored zero. Thus, for each respondent, the minimum score was zero and the maximum score was five. These knowledge items included (i) knowing the age group of children to be vaccinated, (ii) knowing the recommended number of doses, (iii) knowing the route of administration of the vaccine, (iv) knowing that the vaccine may have minor side effects, and (v) knowing that other malaria preventive measures

will remain essential. Respondents were classified as having good knowledge if they scored a minimum of 3 out of 5, else they were classified as having poor knowledge.

Similarly, for the attitude section, Likert-type responses were scored from 1 to 5, where 5 indicates the highest agreement with a positive attitude statement, whereas 1 indicates the opposite. Because a total of five attitude items were included in the questionnaire, the minimum achievable score for a respondent was 5 and the maximum was 25. Respondents were classified as having a positive (favourable) attitude if they scored a minimum of 13 out of 25, else they were considered to have a negative attitude. To test for association between willingness to accept the malaria vaccine and relevant variables (sociodemographic characteristics, knowledge and attitude), a chi-square test of independence was performed, or where appropriate, Fisher's exact test. For decision-making, a *P* value less than 0.05 was considered statistically significant.

Ethical considerations

The protocol for this study received ethical approval from Ahmadu Bello University Health Research Ethics Committee on 13thOctober 2023 (NHREC/TR/ABUTH-NHREC/01/02/23). Consents were obtained from respondents after informing them of the voluntary nature of the research, including their rights to withhold consent without prejudice. Respondents were interviewed at their homes and in their most preferred language (English or Hausa). The researchers made no attempt to collect any identifying information such as names of respondents, addresses, or phone numbers. The respondents were assured of confidentiality in the data handling process and that the findings would be used strictly for academic purposes as explained in the consent form.

Results

At the end of two weeks of data collection, a total of 205 responses were obtained from eligible respondents in the community (98.6% response rate). After preliminary checks, five additional responses were discarded due to missing data, while the remaining 200 were considered valid and included in the analysis.

Sociodemographic characteristics

Table 1 shows the sociodemographic characteristics of the respondents. The mean (SD) age of the caregivers was 33.1 (±9.3) years and about two-thirds were females (65.5%). In terms of cultural background, the majority of the respondents were Hausa (78.0%) and Muslims (89.0%). Most of the respondents were married (93.0%), and about half (54.5%) of the respondents had two or more children under the age of five years. Regarding educational attainment, the majority (72.0%) had at least a secondary school education, whereas trading constituted the most common occupation (42.0%). Regarding monthly income, the majority of the respondents (82.0%) earned less than ₦50,000 per month.

Table 1: Sociodemographic characteristics of the respondents (N=200)

Variable	Frequency (%)
Age (years)	
15-19	3 (1.5)
20-24	33 (16.5)
25-29	37 (18.5)
30-34	41 (20.5)
35-39	36 (18.0)
40-44	25 (12.5)
45-49	12 (6.0)
>50	13 (6.5)
Mean ± SD = 33.14 (±9.31)	

Sex	
Male	69 (34.5)
Female	131 (65.5)
Ethnicity	
Hausa	156 (78.0)
Igbo	8 (4.0)
Yoruba	14 (7.0)
Others*	22 (11.0)
Religion	
Islam	178 (89.0)
Christianity	22 (11.0)
Marital status	
Single	3 (1.5)
Married	186 (93.0)
Divorced	7 (3.5)
Widowed	4 (2.0)
Level of education	
None	7 (3.5)
Informal	11 (5.5)
Primary	38 (19.0)
Secondary	111 (55.5)
Tertiary	33 (16.5)
Occupation	
Civil Servant	24 (12.0)
Trader	84 (42.0)
Farmer	10 (5.0)
Housewife	46 (23.0)
Others†	36 (18.0)
Average monthly income (₦)	
<20,000	84 (42.0)
20,000-49,999	80 (40.0)
50,000-10,0000	30 (15.0)
>100,000	6 (3.0)
Number of children	
1-4	134 (67.0)
≥5	66 (33.0)
Number of children (<5 years)	
1	91 (45.5)
≥2	109 (54.5)

*Others: Fulani, Nupe, Ebira, Zuru, Efik, Babur, Igala and Kanuri, †Others: Tailoring, Business, Fish farming, Teaching, Students

Regarding the general knowledge of malaria, the majority of the respondents heard of malaria and up to 185 (92.5%) correctly described it as a fever caused by a mosquito bite. In addition, 191 (95.5%) perceived it as a deadly disease, with many of the caregivers able to identify common household malaria prevention methods such as the use of insecticide-treated nets (95.0%), insecticide sprays (85.5%), drainage of stagnant waters (68.0%) and clearing of bushes (61.0%). Only nine (4.5%) respondents identified the malaria vaccine as one of the preventive methods. In terms of preventive practices, most of the caregivers reported using insecticide-treated nets (88.5%), mosquito coils (64.5%), insecticide sprays (62.5%), and screening of doors and windows (41.0%). At the time of data collection, 14 (7.0%) respondents were not using any malaria prevention method.

Knowledge of malaria vaccine

Table 2 shows the knowledge of respondents on the malaria vaccine. Only 57 (28.5%) of the caregivers ever heard of the malaria vaccine. Most of those who heard of the vaccine identified healthcare workers (68.4%) and traditional media (38.6%) as their sources of information. In addition, 41 (71.9%) knew the correct age group eligible for the vaccine, while 10 (17.5%) respondents wrongly indicated all ages. Another six (10.5%) correctly identified the recommended number of malaria vaccine doses, while 50 (87.7%) knew that injection would be the route of administration. However, eight (14.0%) respondents believed that the vaccine would have side effects.

Table 2: Knowledge of the respondents on malaria vaccine (N=200)

Variable	Frequency (%)
Ever heard of the malaria vaccine (n=200)	
Yes	57 (28.5)
No	143 (71.5)
Source of information (n=57)*	
Healthcare workers	39 (68.4)
TV/Radio/Newspapers	22 (38.6)
Family and friends	9 (15.8)
Social media (Facebook, WhatsApp, etc.)	6 (10.5)
Others (workplace, etc.)	8 (14.0)
Age group to be vaccinated (n=57)	
All age groups	10 (17.5)
Infants (less than 12 months)	4 (7.0)
Children under the age of five years	41 (71.9)
School age children (7-12 years)	1 (1.8)
Pregnant women (15 to 49 years)	1 (1.8)
Number of doses (n=57)	
One	17 (29.8)
Two	12 (21.1)
Three	8 (14.0)
Four	6 (10.5)
Don’t know	14 (24.6)
Route of administration (n=57)	
Oral	4 (7.0)
Injection	50 (87.7)

Don't know	3 (5.3)
Side effects of vaccine (n=57)	
Yes	8 (14.0)
No	28 (49.1)
Don't know	21 (36.8)
Additional preventive practices remain essential (n=57)	
Yes	175 (87.5)
No	25 (12.5)

*Multiple response items

Regarding the knowledge score on the malaria vaccine, a total of 39 (19.5%) respondents were found to have good knowledge of malaria vaccine, while the remaining 161 (80.5%) were found to have poor knowledge based on the adopted cut-off.

Attitude towards malaria vaccine

Table 3 shows the attitude of the respondents towards the malaria vaccine. Most of the respondents strongly agreed that getting vaccinated against malaria is important (72.0%); the malaria vaccine will reduce illness and deaths among children (70.0%); malaria vaccine will save money spent on treating malaria (69.0%); and that the government should introduce malaria vaccine (73.5%). In addition, more than two-thirds of the respondents (72.0%) agreed that the government should make the vaccine compulsory. Regarding attitude scores, a total of 194 (97.0%) were classified as having positive attitudes, while the remaining six (3.0%) were classified as having negative attitude towards the malaria vaccine based on the adopted cut-off.

Acceptance of malaria vaccine

Table 4 shows the willingness to accept and pay for the malaria vaccine among the respondents. The overwhelming majority of the respondents (94%) were willing to accept the malaria vaccine if introduced. The remaining 12 respondents who were not willing to accept the vaccine gave various reasons including personal preference (75%), anticipated lack of spousal support (33.3%), concerns about vaccine safety (33.3%), and anticipated cost of the vaccine (8.3%). Interestingly, up to 185 (92.5%) respondents were willing to bring their children four times to a healthcare facility to receive the vaccine, while another 183 (91.5%) said they would allow their children to receive the vaccine even if it would be administered by injection.

Table 3: Attitude of the respondents towards malaria vaccine (N=200)

Attitude	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)
Getting vaccinated against malaria is important	144 (72.0)	40 (20.0)	6 (3.0)	6 (3.0)	4 (2.0)
Malaria vaccine will reduce illness and deaths among children	140 (70.0)	38 (19.0)	12 (6.0)	6 (3.0)	4 (2.0)
Malaria vaccine will save money spent on treating malaria	138 (69.0)	47 (23.5)	9 (4.5)	3 (1.5)	3 (1.5)
The government should introduce malaria vaccine	147 (73.5)	38 (19.0)	13 (6.5)	0 (0)	2 (1.0)
The government should make the vaccine compulsory	112 (56.0)	32 (16.0)	27 (13.5)	17 (8.5)	12 (6.0)

Table 4: Willingness to accept and pay for malaria vaccine among the respondents(N=200)

Variable	Frequency (%)
Willing to accept malaria vaccine (n=200)	
Yes	188 (94.0)
No	12 (6.0)
Reasons for not willing to accept (n=12)	
Personal choice	9 (75.0)
Spousal refusal	4 (33.3)
Vaccine safety concerns	4 (33.3)
Cost of vaccine	1 (8.3)
May paralyse children	4 (33.3)
May reduce the fertility rate	3 (25.0)
Measures to promote acceptance (n=12)*	
Recommendations by health workers	9 (75.0)
Spousal/parental persuasion	7 (58.3)
Support from political/religious leaders	3 (25.0)
House-to-house vaccination	1 (8.3)
Make the vaccine free of charge	1 (8.3)
Willing to bring child 4 times for vaccination (n=200)	
Yes	185 (92.5)
No	15 (7.5)
Willing to accept the vaccine as an injection (n=200)	
Yes	183 (91.5)
No	17 (8.5)
Willing to pay for the vaccine (n=200)	
Yes	176 (88.0)
No	24 (12.0)

Reasons for not willing to pay (n=24)*	
Not willing to accept the vaccine	9 (37.5)
Not ready to pay	8 (33.3)
Lack of affordable means to pay	5 (20.8)
Amount willing to pay in ₦ (n=176)	
100-499	26 (14.8)
500-999	50 (28.4)
1,000-1,999	46 (26.1)
2,000-4,999	14 (8.0)
5,000-9,999	6 (3.4)
≥10,000	34 (19.3)

*Multiple response items

Similarly, 176 (88.0%) of the respondents said they would be willing to pay for the vaccine if introduced by the government, and of the remaining 24 (12.0%) respondents who were not willing to pay for the vaccine, various reasons were offered including not willing to accept the vaccine in the first place and lack of affordable means to pay for the vaccine. Regarding the amount willing to pay for the vaccine, up to 50 (28.9%) caregivers reported willing to pay ₦500-999, while another45 (26.1%) said they would pay ₦1,000-1,999. However, 34 (19.3%) said they would be Willing to pay ₦10,000 and above for the vaccine.

Factors associated with willingness to accept malaria vaccine

Table 5 shows the association between the willingness to accept the malaria vaccine and the sociodemographic characteristics of the caregivers. There was a statistically significant association between the willingness to accept malaria vaccine and history of the caregiver being vaccinated as a child (χ^2=17.376, *P*<0.001), having at least one child who is vaccinated (χ^2=77.862, *P*<0.001) and having a positive attitude towards malaria vaccine (χ^2=65.589, *P*<0.001). However, there was no statistically significant association between willingness to accept the malaria vaccine and the age of the respondent, gender, ethnic background, level of education, income, or knowledge of the respondent on malaria vaccine.

Table 5: Association between the willingness to accept malaria vaccine and selected attributes of the respondents

Variable	Willingness to accept malaria vaccine		χ^2	*p* value
	Yes n (%)	No n (%)		
Age (years)				
18-27	58 (89.2)	7 (10.8)	3.510	0.281
28-37	72 (94.7)	4 (5.3)		
38-47	42 (97.7)	1 (2.3)		
≥48	16 (100.0)	0 (0.0)		
Sex				
Male	64 (92.8)	5 (7.2)	0.290	0.401
Female	124 (94.7)	7 (5.3)		
Ethnicity				
Hausa	147 (94.2)	9 (5.8)	0.067[a]	0.729
Non-Hausa	41 (93.2)	3 (6.8)		
Level of education				
Primary or less	52 (92.9)	4 (7.1)	0.180[a]	0.742

Post-primary	136 (94.4)	8 (5.6)		
Average monthly income (₦)				
<50,000	153 (93.3)	11 (6.7)	0.808	0.328
1≥50,000	35 (97.2)	1 (2.8)		
Caregiver vaccinated as a child				
Yes	156 (97.5)	4 (2.5)	17.376[a]	**<0.001**
No/I don't know	32 (80.0)	8 (20.0)		
At least one child vaccinated				
Yes	181 (98.4)	3 (1.6)	77.862	**<0.001**
No	7 (43.7)	9 (56.3)		
Level of knowledge				
Good	39 (20.8)	149 (79.2)	3.092[a]	0.079
Poor	0 (0.0)	12 (100.0)		
Level of attitude				
Positive	187 (96.4)	7 (3.6)	65.589[a]	**<0.001**
Negative	1 (16.7)	5 (83.3)		

[a]Fisher's exact test

Discussion

This study aimed to assess the knowledge, acceptance, and willingness to pay for malaria vaccine among residents of a semi-urban community in Kaduna State, North-western Nigeria. At the time of the study, no state in Nigeria had started the rollout of the malaria vaccine as a public health intervention. The respondents in the study were primarily female caregivers and of Hausa ethnic background. This finding reflected the sociocultural composition of the Samaru community and is consistent with studies done in other parts of Nigeria, which observed that women tend to be the caregivers of children. [13,21,22] Despite having at least secondary education, most of the respondents were earning less than ₦50,000 monthly, which could affect their ability to pay for health-related expenditures including the potential costs associated with the vaccine. Despite having good knowledge about malaria and its prevention, the majority of the respondents had poor knowledge of the vaccine. This is to be expected, given that the malaria vaccine is a relatively new intervention and community members may not be fully aware of it. In a study among 180highly-educated women in Abuja, the Federal Capital Territory, a similar pattern was observed, where despite having a high level of awareness and knowledge on malaria infection, only 36 (30%)respondents heard of the malaria vaccine.[21] This points to an important gap and calls for rapid actions from health authorities and development partners to institute health education measures before rumours and misinformation spread in the communities. Encouragingly, most caregivers were willing to accept the vaccine for their children, similar to the findings reported from Tanzania, where caregivers showed a high willingness to accept the malaria vaccine (94.3–96.8%) despite knowing very little about it.[23]

Evidence has shown that the acceptance rate for malaria vaccine, although variable, is generally high across a number of African settings. For instance, a study among 156 household heads in a rural community in South-eastern Nigeria showed that the majority of the respondents (91.6%) were willing to accept malaria vaccines.[24] Similarly, in a meta-analysis of the acceptance of malaria vaccine in Africa, the acceptance rate was shown to be very high (Mean acceptance rate = 95.5%,95% Uncertainty Interval: 93.0 – 97.2%).[25] Several reasons may explain such high levels of acceptance, including familiarity with malaria as a significant cause of ill health and the perceived need to protect all persons against it. Although acceptance does not always translate to vaccine uptake, nevertheless, this finding is promising and speaks to the need for health authorities to leverage this acceptance to promote and facilitate the uptake of malaria vaccine when it becomes available.

In this study, the acceptance of the malaria vaccine was further supported by a relatively high proportion of respondents willing to pay for the vaccine and this is a good indicator of the sustainability of the intervention should the vaccine not be publicly funded or the funding be withdrawn in the future. However, for the few that were not willing to accept or pay for the vaccine, personal preference was the most cited reason, suggesting that some caregivers might have specific reservations about vaccination, likely influenced by cultural beliefs, misinformation, or past negative experiences with vaccines.

This study found no significant association between acceptance of the malaria vaccine and sociodemographic characteristics of respondents such as age or educational status of the caregiver, which is at variance with other studies in Nigeria and other parts of Africa, where younger caregivers, educated caregivers and caregivers belonging to certain religious affiliations were all shown to be more likely to accept the vaccine.[25] Other studies noted that married women were more likely to accept the vaccine compared to their unmarried counterparts, whereas women from low socioeconomic class were less likely to accept the vaccine compared to their counterparts from higher socioeconomic class.[26] This is hardly surprising, given that previous studies have reported conflicting associations between acceptance of the vaccine and certain sociodemographic characteristics including socioeconomic status and age of caregivers.[26,27] Such contrasts may equally result from the different sociocultural contexts and the relatively limited sample size in some of the studies.

This study showed that acceptance of the malaria vaccine is influenced by favourable attitude towards the vaccine, as well as the history of receiving previous vaccines either for self or for children. Although this association is crude and does not account for confounding, it aligns with findings from previous studies which reported that acceptance of the malaria vaccine was higher among caregivers who expressed satisfaction with health services or whose children never experienced adverse events following immunization.[25]

This study is not without limitations. The cross-sectional nature of the study meant that temporality or causality may not be implied when interpreting its findings. The limited sample size could have affected the precision around some of the estimates in the study, and the reporting of unadjusted measures of association means the effects of confounders could not be accounted for. Nevertheless, the use of a community-based approach targeting all categories of caregivers (including male participants) in a community that is endemic to malaria and where previous studies have been limited presents an important opportunity for relevant stakeholders to understand the community awareness, acceptance, and willingness to pay for malaria vaccines.

Conclusion

This study examined the knowledge, attitude, and willingness to accept malaria vaccine among caregivers at a semi-urban community in North-western Nigeria. The study further lends credence to the high acceptance of the malaria vaccine among communities in Nigeria, and while acceptance of the vaccine does not always translate to uptake, these findings are encouraging and should encourage all stakeholders to take immediate actions towards improving knowledge on the vaccine and fast-tracking the rollout before rumours and misconceptions spread in the communities.

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