

Knowledge, attitudes and practices associated with malaria vaccine acceptance among primary caregivers of children under two years in Lurambi Sub-County, Kakamega County, Kenya

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ABSTRACT

Malaria remains a major public health threat and a leading cause of mortality among children under five years globally. Despite the launch of the malaria vaccine in Kenya, high malaria transmission persists alongside declining completion rates of the four-dose vaccine schedule, highlighting the need to understand factors influencing vaccine acceptance. This study assessed the knowledge, attitudes and practices associated with malaria vaccine acceptance among primary caregivers of children under two years in Lurambi Sub County. Guided by the Health Belief Model, a community based cross-sectional mixed methods study design was employed. The target population comprised primary caregivers of children under two years and key informants. Quantitative data were collected from 417 primary caregivers using structured questionnaires while qualitative data were obtained via focus group discussions and 15 key informant interviews. The sample size was calculated using the Cochran formula and multistage sampling was used to select the study participants. Quantitative data were analyzed using descriptive statistics, chi-square tests and binary logistic regression while qualitative data were analyzed thematically. The findings revealed high awareness of the malaria vaccine (97%) and generally positive attitudes from caregivers (73%). However, 51% were classified as knowledgeable and only 13% correctly identified the recommended age for vaccination. Additionally, 95% had attempted to vaccinate their children and 96% had received at least one dose. Despite this, only 40% had completed the full four dose schedule, indicating substantial dropout. Vaccine stock outs, long waiting times and distance to health facilities were identified as major barriers to vaccine uptake. Both knowledge level ($\chi^2=12.13$, $p<0.01$) and caregivers' attitudes ($\chi^2=10.87$, $p<0.01$) were significantly associated with vaccine acceptance. Caregivers with high knowledge were more than twice as likely to accept the vaccine (OR=2.11, $p<0.01$), while those with negative attitudes were significantly less likely to accept it (OR=0.49, $p<0.01$). Therefore, although awareness and willingness to vaccinate are high in Lurambi Sub County, incomplete knowledge, and high dropout rates and health system challenges limit full vaccine uptake. Strengthening vaccine supply chains, improving service delivery efficiency, reducing access barriers and enhancing community based health education are essential to improve malaria vaccine acceptance and completion.

Keywords: Attitudes, Caregivers, Knowledge, Malaria Vaccine, Practices

I. INTRODUCTION

Malaria continues to be one of the main causes of morbidity and mortality, especially in Sub-Saharan Africa where transmission rates are the highest. The World Health Organization (WHO) estimated that 249 million people became ill with malaria globally and that 608,000 people died of the disease in 2022, compared with 233 million who became ill with malaria in 2019 (WHO, 2023). Children under five years old bear the highest burden of the disease accounting for over three quarters of malaria deaths around the world (WHO, 2023).

The introduction of malaria vaccine was a remarkable breakthrough in prevention of malaria. In 2021, the WHO recommended the widespread use of the Mosquirix vaccine for children aged 5–17 months (WHO, 2021). These vaccines have demonstrated promising results in reducing the incidence of clinical and severe malaria. For instance, Mosquirix vaccine reduced clinical malaria by approximately 36% in children over a four-year follow-up period (Laurens, 2020; Dattoo *et al.*, 2024). However, the success of malaria vaccination programs depends not only on vaccine efficacy but also on the acceptance and participation of caregivers, particularly mothers.

Globally, the knowledge, attitudes, and practices (KAP) of caregivers have been found to significantly influence vaccine uptake and completion rates (Brewer *et al.*, 2017; Bhartiya *et al.*, 2021; Shafie *et al.*, 2023). Moreover,

insufficient knowledge, lack of awareness about the availability and purpose of the malaria vaccine, fear of side effects, perceived low risk of malaria, and mistrust in health systems have been reported as barriers to vaccine acceptance (Failoc-Rojas *et al.*, 2023; De Figueiredo *et al.*, 2020; Bam *et al.*, 2023).

Despite Sub Saharan Africa bearing 94% of the Malaria burden globally, vaccine hesitancy remains an issue due to concerns over vaccine safety, insufficient public awareness campaigns, and limited accessibility in remote areas (Venkatesan, 2024). The roll out of the malaria vaccine pilot programme with RTS,S/AS01 further illustrated the role that the knowledge, perceptions and practices of caregivers play in maintaining vaccine uptake. The pilot programme launched in Kenya, Ghana and Malawi in 2019, targeted children in malaria endemic regions. The first dose of the vaccine was well received, but the coverage rate for each additional dose was lower. WHO data shows that first dose coverage fell from 96% to 87%, second dose coverage dropped from 78% to 78%, and the coverage for the fourth dose was 39% (WHO, 2022; WHO, 2023).

In Kenya the MoH estimates that Malaria contributes to around 13–15% of all outpatient consultations and nearly 70% of the population reside in areas where there is a risk of malaria transmission. The country is estimated to have suffered from 3.4 million malaria cases and over 12,000 malaria deaths in 2021, of which the majority were children under five years (Kenya National Bureau of Statistics [KNBS], 2023; WHO, 2022). The Kenya Malaria Strategy (2019-2023) categorizes the country into four malaria epidemiological zones including lake endemic, coastal endemic, highland epidemic prone and low risk zones (Ministry of Health [MoH], 2019). Kakamega county is located in the lake endemic region and is among the areas having the highest malaria transmission rates in the country.

Although Kenya has introduced the malaria vaccine, there is limited evidence on the knowledge, attitudes, and practices of caregivers regarding the acceptance of the malaria vaccine in Lurambi Sub-County. Existing studies show that caregivers can be open to vaccinating their children but their knowledge and understanding of malaria vaccine is inadequate (Musa-Booth *et al.*, 2020). Therefore, it is important to understand caregivers' knowledge, attitudes and practices in Lurambi sub county. This will provide evidence to guide interventions in enhancing coverage and sustaining the success of malaria vaccination programmes.

1.1 Statement of the Problem

Malaria continues to be a significant public health concern in Kenya, with approximately 3.4 million malaria cases and over 12,000 deaths reported in 2021, the majority occurring among young children (KNBS, 2023; WHO 2022). To reduce this burden, the malaria vaccine was introduced as a complementary intervention to existing malaria control measures such as insecticide treated nets and antimalarial treatment. Kenya, Ghana and Malawi were the first three African Countries to pilot the RTS, S malaria vaccine in 2019. Eight malaria endemic counties in western Kenya were targeted for the pilot. The Malaria Vaccine Implementation Programme revealed challenges in sustaining vaccine uptake documenting that 96% of children received the first dose with coverage declining to 87%, 78% and 39% for the second, third and fourth doses respectively (WHO, 2022; WHO, 2023).

The sharp decline in dose completion suggests the presence of underlying barriers affecting adherence to the full vaccination schedule. Previous studies attribute such patterns to gaps in caregiver knowledge, attitudes and practices (KAP), as well as structural and behavioral factors affecting vaccination decisions (Bhartiya *et al.*, 2021; Shakeel *et al.*, 2022; Amin *et al.*, 2023). Despite the integration of malaria vaccine into routine immunization programs, uptake remains suboptimal. This is evident from malaria vaccine pilot program indicating that vaccine availability alone does not guarantee full utilization when behavioral, informational and access related barriers exists (WHO, 2023; Ansar *et al.*, 2024).

In Kenyan particularly in areas such as Lurambi Sub County, the reasons for incomplete vaccination and declining dose completion remains insufficiently documented. This raises a key public health concern regarding why malaria vaccine uptake remains low despite the availability of the vaccine as a malaria prevention intervention. Prior studies on malaria vaccine have also highlighted methodological, contextual and policy gaps in terms of data source, study population and community level health communication strategies (Ansar *et al.* 2024; Musa-Booth *et al.*, 2021; Amin *et al.*, 2023). Therefore, generating context specific evidence on caregiver knowledge, attitudes and practices on malaria vaccine acceptance is crucial for informing targeted health communication strategies and improving vaccine uptake in Lurambi Sub County.

1.2 Research Objectives

- i. To assess the level of knowledge about malaria vaccine acceptance among primary caregivers of children under two years in Lurambi Sub-County.
- ii. To examine the attitudes of primary caregivers of children under 2 years towards the malaria vaccine acceptance in Lurambi Sub-County.
- iii. To determine the vaccination practices related to malaria vaccine acceptance among primary caregivers of children under two years in Lurambi Sub-County.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 The Health Belief Model (HBM)

The Health Belief Model is a psychological model which originated in the 1950s to explain and predict health related behaviors, particularly the use of health services (Janz & Becker, 1984; Rosenstock, 1974). The HBM states that individuals are more likely to engage in a health behavior when they think that they are at risk of a health issue, that the health issue has serious consequences, that they believe they can take a specific action to reduce the vulnerability or severity of the health issue, and that the benefits of taking the action outweigh any costs or barriers (Janz & Becker, 1984; Champion & Skinner, 2008).

The Health Belief Model, has been extensively utilized to understand and predict health behaviors, encompassing the uptake of vaccines. It provides a comprehensive psychological lens to examine the risk perception and health motivation that underpin mothers' decisions regarding their children's vaccinations (Chan et al., 2023). In low- and middle-income settings, the HBM has been adopted to explain variations in uptake of maternal and child health interventions, including immunization programs, by accounting for sociocultural beliefs and perceived barriers (Shakeel et al., 2022). The Health Belief Model has also been utilized in understanding COVID-19 vaccine hesitancy, perceived barriers and perceived benefits (Limbu et al., 2022).

In this study, the HBM is applied to demonstrate how primary caregivers' perceptions of their children's susceptibility to malaria, the disease's severity, the perceived barriers and the perceived benefits to vaccination and likewise cues to action and self-efficacy influence their decision to accept or reject the malaria vaccine. The model provides a structured framework for understanding how knowledge translates into perceptions which ultimately determine vaccine uptake among children under two years.

2.2 Empirical Review

2.2.1 Knowledge about Malaria Vaccine Among Primary Caregivers

Knowledge is a key factor that shapes health behavior, including understanding the malaria vaccine and its acceptance (WHO, 2019). While pilot studies have demonstrated the safety and efficacy of the malaria vaccine (WHO, 2021), the uptake is critically shaped by knowledge, experiences with past vaccination, health communication and local belief systems of caregivers. Inadequate vaccine knowledge has been reported as a driver of low vaccination rates thus contributing to the rise of vaccine preventable diseases (Bussink-Voorend et al., 2022). Cadeddu et al. (2021), emphasized the need for accurate information on malaria risk and vaccine effectiveness to support informed decision making. Similarly, Ajayi and Emeto (2023), found that vaccine acceptance was strongly associated with prior experience with childhood immunization and awareness of the malaria vaccine. Studies conducted in low and middle-income countries further highlight the significant influence of maternal knowledge on malaria vaccine acceptance. While caregivers with improved understanding of malaria vaccine safety and effectiveness reported higher acceptance levels, highly educated parents were more hesitant than those with lower levels of education (Oster, 2018; Alsubaie et al., 2019). Similarly, Amin et al. (2023), noted that level of education and occupation is associated with the caregivers' willingness to accept the malaria vaccine.

2.2.2 Attitudes Towards Malaria Vaccine among Primary Caregivers

The attitudes of mothers towards immunization are strongly influenced by their perceptions of vaccine safety and effectiveness. An improved understanding of the effectiveness and safety of vaccines may boost uptake (Shakeel et al., 2022). Maternal attitudes toward vaccination are shaped by their beliefs regarding effectiveness and safety, social interactions, exposure to misinformation, as well as religious and cultural beliefs (Bam et al., 2023). A lot of caregivers have concerns about the safety of vaccines, and that plays a significant part in their decision making. Mothers who had faith in the safety and effectiveness of vaccines were more likely to be accepting vaccines for their children (Smith et al., 2017). However, concerns over the safety of vaccines and uncertainties about their effectiveness have been linked to the reluctance and rejection of vaccines (WHO, 2019).

Likewise, Mitiku and Assefa (2017), found that caregivers who viewed malaria as a significant danger were more inclined to consent to vaccinating their children. On the other hand, negative attitudes towards vaccines, often shaped by false information, are obstacles to uptake (Mace, 2018; Mitiku & Assefa 2017). Ajayi and Emeto (2023), reported that over half of caregivers hesitant to embrace the vaccine expressed that their top concern was the risk of experiencing adverse reactions. Using a qualitative approach, Kajungu et al. (2020), noted that in Uganda most women who were aware of maternal immunization generally held positive attitudes towards vaccination. However, actual vaccine acceptance was influenced by several barriers, including fear of adverse events, misconceptions, and socio-cultural factors. Male partner resistance was also mentioned as a factor that affected caregivers' willingness to accept routine childhood vaccines (Smith et al., 2017).

2.2.3 Practices Influencing Malaria Vaccine Acceptance Among Primary Caregivers

The attitudes of mothers towards immunization are strongly influenced by their perceptions of vaccine safety and effectiveness. An improved understanding of the effectiveness and safety of vaccines may boost uptake (Shakeel et al., 2022). Maternal attitudes toward vaccination are shaped by their beliefs regarding effectiveness and safety, social interactions, exposure to misinformation, as well as religious and cultural beliefs (Bam et al., 2023). A lot of caregivers have concerns about the safety of vaccines, and that plays a significant part in their decision making. Smith et al. (2017) noted that mothers who had faith in the safety and effectiveness of vaccines were more likely to be accepting vaccines for their children. Supporting this view, WHO (2019) reported that concerns over the safety of vaccines and uncertainties about their effectiveness have been linked to the reluctance and rejection of vaccines. Ajayi and Emeto (2023) reported that over half of caregivers hesitant to embrace the vaccine expressed that their top concern was the risk of experiencing adverse reactions.

III. METHODOLOGY

3.1 Study Area

The study was conducted in Lurambi Sub-County, Kakamega County, and an area within the lake endemic region of Kenya. Kakamega County is among the counties characterized by perennial transmissions of malaria with a persistently high malaria prevalence of 33% (Lumumba et. al., 2025). Lurambi Sub County was selected because it has both peri-urban and rural populations, making it suitable for assessing variations in malaria vaccine knowledge, attitudes, practices and acceptance among caregivers of children under two years. Three wards including Butsotso Central, Shieywe and Shirere were selected by simple random sampling technique to capture variations in socio-economic, cultural, and infrastructural factors.

3.2 Study Design

The study employed a cross-sectional design with a mixed method approach combining quantitative and qualitative research methods. This allowed the use of both qualitative and quantitative methods to provide a more comprehensive understanding. The approach was chosen to capture comprehensive data on primary caregivers' knowledge, attitudes, and practices on acceptance of the malaria vaccine, as it allows collection of numerical data and in-depth insights (Creswell & Poth, 2018).

3.3 Target Population

The study targeted primary caregivers of children under two years of age residing in Lurambi Sub-County. This group was considered central to the study because primary caregivers are the main decision-makers regarding healthcare for young children, particularly in relation to immunization and preventive health services. In addition, key informant interviews were conducted with healthcare workers, including nurses, public health officers, community health assistants, and local administrators such as chiefs. These participants provided contextual insights into immunization practices and vaccine uptake within Lurambi Sub-County.

3.4 Sample Size Determination and Sampling Procedure

Cochran (1977), formula was used to determine the sample size. Using an average vaccine uptake rate of 57% (Moturi et al., 2023), a confidence level of 95% with a margin of error of 5% was used which corresponds to a Z-score of 1.96. The sample size was calculated as follows:

$$n = \frac{1.96^2 0.57(1-0.57)}{0.05^2}$$

$$n = 376$$

Adjusting for a 10% non-response rate brought the total sample size to 417 participants.

Multistage sampling method was utilized. Lurambi Sub County was selected purposively and divided into six strata. Three wards were selected using simple random sampling technique. Using proportionate stratified random sampling method, eleven community units were selected out of a total of twenty community units in the three wards, Shirere ward four community units, Shieywe ward four community units and Butsotso Central ward three community units. A household list of caregivers with children under two years of age was generated based on registry by community health promoters. Simple random sampling was used to select primary caregivers of children under two years in the selected community units.

3.5 Data Collection Instruments

Quantitative data were collected using structured questionnaires administered to the primary caregivers of children under two years. The questionnaire covered sociodemographic information, knowledge, attitudes and practices

associated with malaria vaccine. Qualitative data were gathered through 5 focus group discussions with the care givers and 15 key informant interviews with healthcare workers, administrators, and community leaders involved in immunization activities across the three wards.

3.6 Data Analysis

Quantitative data collected using KoboCollect were exported to SPSS version 26 for analysis. Descriptive statistics (frequencies and percentages) were used to summaries socio-demographic characteristics and key variables, including knowledge, attitudes, and practices. Inferential statistics including Chi-square tests and logistic regression were used to assess associations between categorical variables and to identify predictors of vaccine acceptance. Results were presented using tables, bar charts, and pie charts. Qualitative data from FGDs and KIIs were analyzed thematically, with emerging themes triangulated with quantitative findings to enhance interpretation.

IV. FINDINGS & DISCUSSION

4.1 Socio-Demographic Characteristics of Participants

The study recruited 417 respondents from three wards with Shieywe contributing the highest proportion 46% and achieved 100% response rate. The respondents were aged between 15-60 years with a mean age of 32 years (SD = 9) and most were married (about two thirds) while 26% were single. Most caregivers (87%) were employed with the majority earning between Ksh. 5000 and Ksh. 20000 per month.

Table 1

Socio-demographic characteristics of caregivers

Factor	Category	Frequency	Percentage
Age	Mean (SD)	Median	Min, Max
	31.7(9.3)	30	15, 60
Marital status	Single	107	25.6
	Married	264	63.2
	Widowed	22	5.3
	Divorced	25	6.0
Education level	No formal education	6	1.4
	Primary	44	10.5
	Secondary	209	50.0
	Tertiary	153	36.6
	Postgraduate	6	1.4
Main occupation	Unemployed	54	13.0
	Farmer	75	17.9
	Trader	95	22.7
	Employed	97	23.2
	Casual laborer	97	23.2
Income	Below 5,000	86	20.6
	5,001 - 10,000	133	31.8
	10,001 - 20,000	139	33.3
	Above 20,000	60	14.4
Ward	Shieywe	191	45.7
	Shirere	144	34.4
	Butsotso	83	19.9

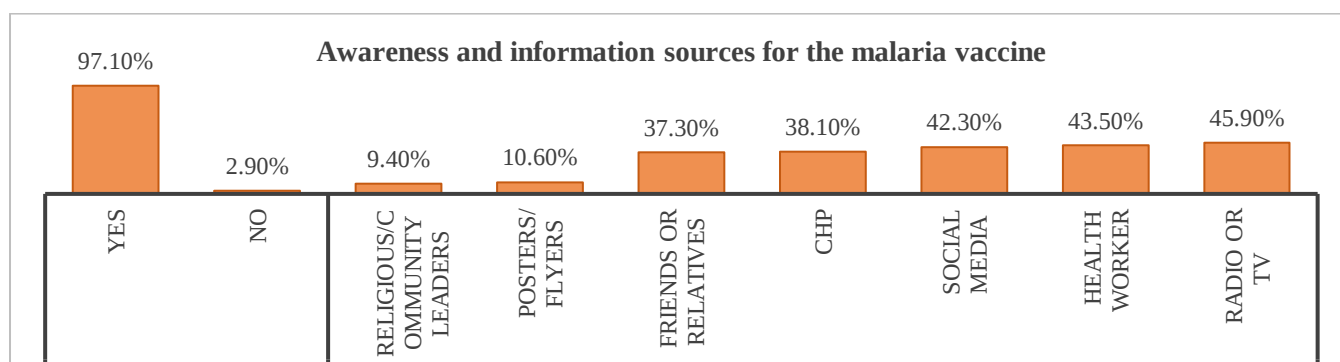
A total of 15 key informant interviews were conducted involving 5 cadres; local administrative leaders, nurses, public health officers, health promotion officers and Community Health Promoters from each of the 3 wards. The key informants all had at least 5 years' experience in their positions. Five FGDs consisting of primary caregivers were also conducted.

Table 2*Key informants' characteristics*

Factor	Frequency	Percentage
Age	Mean (SD)	(Min, Max)
	36.3(7.6)	25,53
Gender		
Female	8	53.3
Male	7	46.7
Cadre		
Local administrators	3	20
Community health promoter	3	20
Community health nurse	3	20
Health promotion officer	3	20
Public health officer	3	20
Experience		
< 6 years	4	26.7
6-10 years	8	53.3
>10 years	3	20.0

4.1.1 The Level of Knowledge About Malaria Vaccine Among Primary Caregivers

The level of awareness of the malaria vaccine for children was high, 97% (n=405) among caregivers. Mass media (46%), health workers (44%), and social media (42%) were the most cited sources of information about the vaccine as illustrated in Figure 1.

**Figure 1***Vaccine awareness*

The majority (79%) of the respondents correctly identified the role of the vaccine as a prevention measure, over half, 57%, correctly identified the required number of doses as four, and almost all, n=406, knew where to access the vaccine. However, only 55 respondents (13%) knew the correct age for vaccination.

Table 3*Awareness of vaccine role and dosage*

Factor	Response	Frequency	Percentage
Role of vaccine	To prevent malaria	330	79.3
	To treat malaria	68	16.3
	All the above	18	4.3
Full doses needed	Don't know	25	6.0
	1 dose	23	5.5
	2 doses	88	21.2
	3 doses	42	10.1
	4 doses	238	57.2
Age of vaccination	Don't know	108	25.8
	Before 5 months	89	21.3
	6 to 12 months	166	39.7
	5 to 24 months	55	13.2
Know where to access vaccine	No	8	1.9
	yes	406	98.1

Respondents who correctly identified the role, doses, age, and where to access the vaccine were deemed to be highly knowledgeable. On this criterion, slightly over half (51%) of the respondents were highly knowledgeable, as illustrated in Figure 2. These findings are consistent with findings of a study in Tanzania which determined that almost half of the mothers did not understand how the vaccine works nor the target age group (Mwingira et al., 2025). Similarly, Bam et al., (2023), reported that although caregivers exhibited widespread awareness and knowledge of both malaria and the malaria vaccine they were unable to accurately identify the required dosage and age of vaccination.

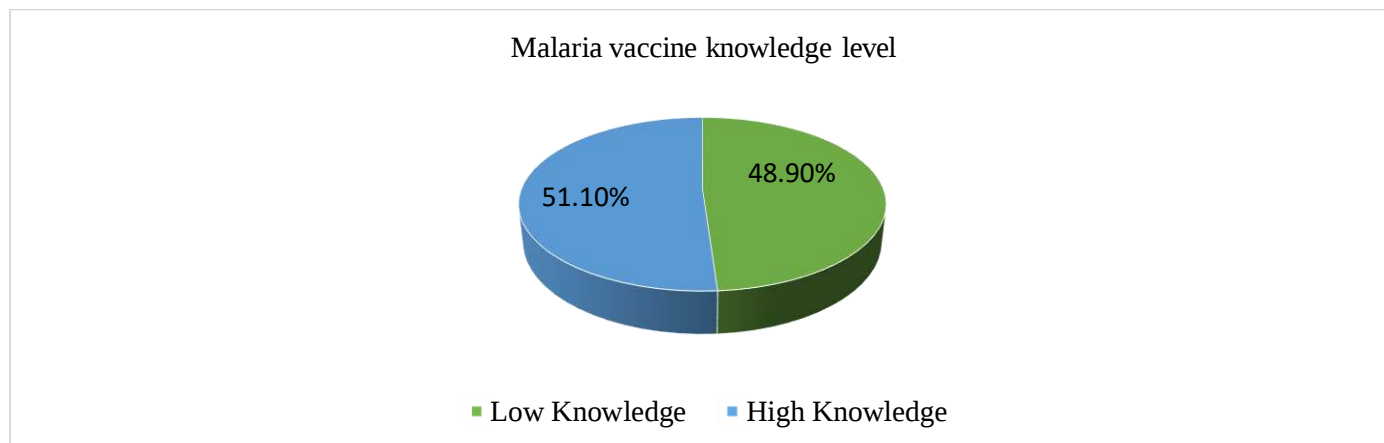


Figure 2
Vaccine knowledge level

Knowledge level was significantly associated with vaccine acceptance, ($\chi^2 = 12.13$, $P < 0.01$). There was more acceptance among highly knowledgeable respondents (58%), than the low knowledge caregivers. This aligns with findings from a study in Northern Nigeria which reported that caregivers with prior knowledge of the malaria vaccine were significantly more likely to accept it (Ajayi & Emeto, 2023).

Table 4
Chi square analysis for knowledge and vaccine acceptance

Knowledge level	Vaccine Acceptance		Chi (P value)
	No	Yes	
Low Knowledge	121(59.3)	83(40.7)	12.13(<0.01)
High Knowledge	90(42.3)	123(57.7)	

Qualitative findings revealed that caregivers' knowledge level was moderate, but on an upward trend. Participants reported that there is a persistent distinction between caregivers' awareness of the vaccine and their understanding of the malaria vaccine. They noted that while caregivers know that the malaria vaccine is available, many still do not understand its role, schedule, and dosage. To support this argument, one of the respondents said:

"Awareness is growing, but the knowledge is still shallow. Many mothers know that the vaccine exists, but they don't fully understand how it works or why four doses are required." (Shirere- 5, public health officer, 27/08/2025.)

Another key informant said,

"Caregivers who frequently attend Maternal and Child Health (MCH) clinics know about the malaria vaccine, but many are still confused about the schedule" (Sweywe-7-CHP 27/08/2025)

4.1.2 Attitudes of Primary Caregivers towards the Malaria Vaccine Acceptance

Majority of the mothers believed the vaccine to be effective; 40% deemed the vaccine effectiveness high, and 52% moderate. Similarly, 55% of the respondents perceived the vaccine to be moderately safe for children, and a further 31% perceived it highly safe. Trust in the vaccine was high, 80%, with equally high (94%) family support of the vaccine. This was reinforced by findings from the FGDs, whereby one caregiver reported:

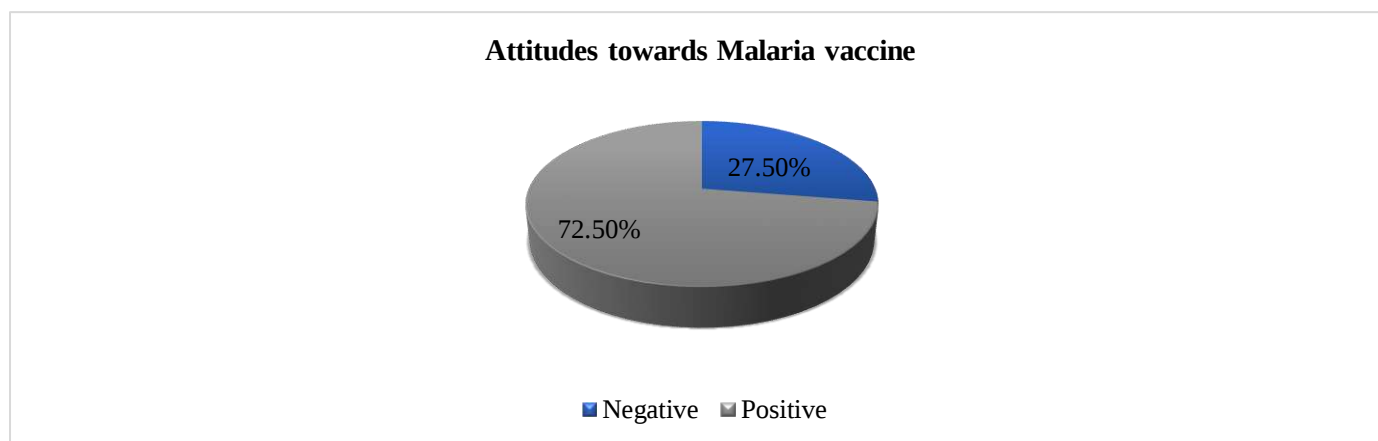
"I think the malaria vaccine is safe. My child has received three doses already. ...since then, my child has not suffered severe malaria, so I trust it." (R3, FDG4, Shieywe 03/9/2025)

Vaccine unavailability was the most prevalent perceived barrier to vaccine uptake (50%), with long waiting times (38%) being the second most prevalent. High access cost was the least common perceived barrier to vaccine uptake.

Table 5*Vaccine attitude and perception*

Factor	Category	Frequency	Percentage
Perceived effectiveness	Low	35	8.4
	Moderate	216	51.7
	High	167	40.0
Perceived safety	Low	60	14.4
	Moderate	228	54.5
	High	130	31.1
Trust vaccine	Distrust	82	19.6
	Trust	336	80.4
Family supporting vaccination	No	27	6.5
	Yes	391	93.5
Perceived barriers			
Vaccine unavailability	Yes	203	50.0
Long waiting time	Yes	156	38.4
Adverse reaction	Yes	61	15.0
Unfriendly staff	Yes	31	7.6
High access cost	Yes	15	3.7
High transport cost	Yes	25	6.2

Caregivers who trusted the vaccine, and perceived the vaccine to be safe and effective were deemed to have a positive overall attitude towards the malaria vaccine. The overall perception of the malaria vaccine was positive among the majority of the respondents (73%) as illustrated in Figure 3. This finding is in line with research from Western Kenya which found a positive community perception towards the vaccine despite identified barriers to uptake (Hoyt et al., 2023). Similarly, Kimotho (2025), observed that mothers in central Kenya expressed trust in vaccines despite having an incomplete understanding of dosage schedules.

**Figure 3***Overall attitudes towards Malaria vaccine*

The association between attitudes and vaccine acceptance was statistically significant, ($\chi^2 = 10.87$, $P < 0.01$). Among caregivers with positive perception about vaccines, 55% accepted the vaccine, in contrast to 37% among those with negative perceptions. This finding aligns with Smith et al. (2017), who reported that mothers who had faith in the safety and effectiveness of vaccines were more likely to be accepting vaccines for their children.

Table 6*Chi square analysis for attitudes and vaccine acceptance*

Overall perception	Acceptance		Chi (P value)
	No	Yes	
Negative	72(62.6)	43(37.4)	10.87(<0.01)
Positive	135(44.6)	168(55.4)	

Additionally, the key informants noted that the overall attitude of the mothers towards the vaccine was positive, driven primarily by the high prevalence of malaria and the susceptibility of children. Despite this, there were reports of side effects, and misinformation of the vaccine affecting the perception. stock outs and waiting times due staff shortages were also cited as systemic barriers to vaccination. One respondent affirmed that:

“A major motivator is personal experience with malaria. Mothers who have lost a child or seen severe cases in their families tend to be the most consistent with vaccination.” (Shirere-4- Lurambi health promotion officer 27/08/2025)

Another respondent further clarified the barriers stating:

“The main challenges are vaccine stock-outs due to supply chain delays. Distance to health facilities especially for mothers in rural villages. Also, inadequate staffing, which increases waiting time.” (Sheywe-2- community health nurse 27/08/2025).

These qualitative findings agree with a study in Uganda which reported that most women who were aware of maternal immunization generally held positive attitudes towards vaccination (Kajungu et al., 2020). Similarly studies in Tanzania (Mwingira et al., 2025) and Ghana (Bam et al., 2023) have shown that having high levels of trust in the vaccine at community level, and family support are facilitators of vaccine uptake. However, stock outs, inconsistent supply and long queues at the health facilities were identified as barriers which discouraged caregivers from completing the full vaccine schedules, even when willingness to vaccinate was high. (Hoyt et al., 2023; Moturi et al., 2023).

4.1.3 Practices on Malaria Vaccine Acceptance Among Caregivers of Children Under Two Years

Majority of the respondents (90%) reported having access to the malaria vaccine alongside the normal immunization schedule. Similar findings were reported in western Kenya, where integration of malaria vaccination into routine services was feasible and widely accepted (Hoyt et al., 2023). The waiting time for vaccination time was long, with only 40% having to wait less than half an hour. Long queues and delays have been consistently identified as deterrents to immunization uptake in Kenya and other Sub-Saharan African countries (Ng’ang’a, 2021). Transport cost was also found to be low; 15% spent over Ksh 100, with a 30-60-minute modal walking time to the facility. Similarly, transportation costs long queues and waiting times were reported among the main deterrents to completing the full vaccine schedule (Price et al., 2023).

Table 7

Vaccine accessibility

Factor	Frequency	Percent
Distance to facility		
Less than 30 minutes’ walk	150	36.0
30 to 60 minutes’ walk	186	44.6
More than one hour walk	33	7.9
Requires vehicle transport	48	11.5
Waiting time at facility		
Less than 30 minutes	165	39.5
30 to 60 minutes	174	41.6
More than one hour	79	18.9
Transport cost to facility		
Not applicable	75	18.1
Less than Ksh 50	92	22.2
Ksh 51 – 100	187	45.1
More than Ksh 100	61	14.7
Access vaccine with regular immunization		
No	44	10.5
Yes	374	89.5

Almost all the respondents, (95%) had tried to have their children vaccinated against malaria, with a similar proportion of children under 24 months having received the vaccine. If availed to them, 95% of the mothers indicated their willingness to accept the vaccine, although almost two thirds (60%) had partially completed the malaria vaccine schedule. Similar findings found high initial uptake of the Malaria vaccine, but lower completion rates as caregivers failed to present eligible children for subsequent doses (Chilanga et al., 2022). Caregivers are generally supportive of malaria vaccination, even when their knowledge of its protective effect was incomplete (Moturi et al., 2023).

Table 8
Vaccine practices

Factor	Response	Frequency	Percentage
Tried get vaccine	No	20	4.9
	yes	389	95.1
Child under 2yrs received vaccine doses	No	18	4.4
	yes	391	95.6
Number of doses received	Partial	234	59.8
	Full	157	40.2
Willingness to vaccinate	No	16	4.6
	yes	332	95.4
Child had side effects	No	292	69.9
	Yes	126	30.1

The distance to facility ($\chi^2 = 9.52$, $P=0.02$), transport cost to facility ($\chi^2=9.61$, $P=0.02$), having received at least one dose of malaria ($\chi^2=20.07$, $P<0.01$), and having actively tried to get the vaccine ($\chi^2=22.35$, $P<0.01$) were found to be statistically associated with vaccine acceptance. These findings are similar with previous studies which established that distance to the facility, transport cost, having at least one dose and having tried to get the vaccine have significant effect on malaria vaccine acceptance (Hamer et al., 2020; Bangura et al., 2020; Moturi et al., 2023; Ajayi & Emeto 2023),

Table 9

Factor	Category	Acceptance		Chi (P value)
		No	Yes	
Distance to facility	Less than 30 minutes' walk	66(44)	84(56)	9.52(0.02)
	30 to 60 minutes' walk	107(57.5)	79(42.5)	
	More than one hour walk	12(36.4)	21(63.6)	
	Requires vehicle transport	21(43.8)	27(56.3)	
Waiting time at facility	Less than 30 minutes	90(54.5)	75(45.5)	3.23(0.2)
	30 to 60 minutes	83(47.7)	91(52.3)	
	More than one hour	34(43)	45(57)	
Transport Cost to facility	Not applicable	30(40)	45(60)	9.61(0.02)
	Less than Ksh 50	57(62)	35(38)	
	Ksh 51 – 100	91(48.7)	96(51.3)	
	More than Ksh 100	26(42.6)	35(57.4)	
Access vaccine with immunization	No	19(43.2)	25(56.8)	0.79(0.37)
	Yes	188(50.3)	186(49.7)	
Side effects	No	153(52.4)	139(47.6)	3.21(0.07)
	Yes	54(42.9)	72(57.1)	
Child under 2yrs received vaccine doses	No	18(100)	0(0.0)	20.07(<.01)
	Yes	180(46)	211(56)	
Tried to get vaccine	No	20(100)	0(0.0)	22.35(<.01)
	Yes	178(45.8)	211(54.2)	

These findings were corroborated by findings from the FGDs were one of the respondents said,

“At times, the vaccine is not available at the facility. Sometimes I arrive at the clinic very early in the morning and still find many mothers already waiting. I personally missed one appointment because the health workers had run out. This inconsistency makes some mothers give up halfway.” (R6, FDG5, Shieywe 02/08/2025).

Another caregiver said,

“The biggest challenge I face is the long queues at the facility... Many mothers end up postponing or skipping doses because they cannot afford to lose the whole day at the clinic.” (R1, FDG1, Shirere, 02/08/2025).

These qualitative findings echo patterns reported from the malaria vaccine pilot implementation which indicates that some factors contribute to vaccine attrition including logistical issues with follow-up attendance, insufficient

community participation, limited understanding of the importance of completing 4 doses, and inadequate health worker training (WHO, 2022, Osoro et al., 2024).

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

This study demonstrates that while caregivers are generally aware of the malaria vaccine, their knowledge of its efficacy and recommended doses remains limited. This gap highlights the need for health education strategies to increase in-depth knowledge about the vaccine. Caregivers had positive attitudes towards malaria vaccination, reflecting their belief in its safety, effectiveness, and family support. However, these positive attitudes are offset by systemic barriers, particularly limited vaccine availability and long waiting times, which limit uptake even among caregivers who are willing to receive the vaccine. Caregivers reported low delivery costs, which is a benefit from the integration of the malaria vaccination program into the existing immunization schedule. In addition, they reported fewer concerns about side effects. However, the uptake of the final doses of the vaccine was found to be low. Service delivery limitations such as long queues, staffing shortages, and vaccine stockouts prevent children from completing the full vaccination schedule.

5.2 Recommendations

In collaboration with community health promoters, the Kakamega County health department should implement structured community based health education programs such as household visits and use of local media to improve caregivers' knowledge on malaria vaccine safety, dose regimen, benefits and eligibility. The Kakamega County health department should strengthen risk communication strategies by engaging trusted influencers such as community leaders and women groups through community dialogue forums to address misconceptions and negative attitudes towards malaria vaccine. Furthermore, the Ministry of Health should improve service delivery by establishing real time vaccine stock monitoring systems thus strengthening supply chain logistics to minimize stock outs and long waiting times.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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