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**Acceptance of Malaria Vaccine and its Determinants among Caregivers of Children
under 5 Years at Mulago National Referral Hospital -a Mixed Methods Study**

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Medicine in Paediatrics and Childhealth of Makerere University**

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Declaration

I, Dr ABITO OBUA SHARON, hereby declare that all the work presented in research dissertation entitled ACCEPTANCE OF MALARIA VACCINES AND ITS DETERMINANTS AMONG CAREGIVERS OF CHILDREN UNDER 5 YEARS AT MULAGO NATIONAL REFERRAL HOSPITAL–A MIXED METHODS STUDY is original and has not been presented to any other university or higher institution for any academic award, publication or otherwise.

Signature: 

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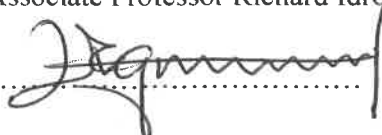
APPROVAL

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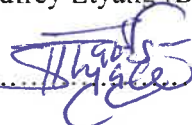
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DEDICATION

To God Almighty, for grace that is sufficient and strength that is renewed daily. To my parents, for love that never faltered and sacrifices that made this possible. To my husband, for patience that never waned and a quiet belief and faith in me that never failed. To my son Shepherd; resilient, remarkable and heaven sent.

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To caregivers and children who opened their hearts and shared their stories, your experiences are the heart of this research and am deeply grateful for the trust you placed in me.

And to the residents who will one day hold this work in their hands -may it spark curiosity, deepen your compassion and remind you that behind every data point is a child and a family who trusted us with their story. This journey will test you in ways you never expected. Let it. Then rise and finish what you started because somewhere, a child is waiting for the answer only your work can give.

TABLE OF CONTENTS

DECLARATION	i
APPROVAL	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF FIGURES	viii
LIST OF TABLES	viii
LIST OF ACRONYMS	ix
OPERATIONAL DEFINITIONS	x
ABSTRACT	xi
CHAPTER ONE: INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement	2
1.3 Study Justification	2
1.5 Study Objectives	3
1.5.1 General Objective	3
1.5.2 Specific Objectives	3
1.6 Theoretical Model	4
CHAPTER TWO: LITERATURE REVIEW	7
2.1 Epidemiology of Malaria	7
2.1.1 Globally	7
2.1.2 Uganda	7
2.1.3 Etiology of malaria	7
2.1.4 Prevention of Malaria	9
2.2 Determinants of Malaria Vaccine Hesitancy	9
2.2.1 Knowledge of Malaria Vaccine Benefits and Side Effects	10
2.2.2 Perceptions of Malaria Vaccine Effectiveness and Safety	10
2.2.3 Willingness to Accept Malaria Vaccine and Associated Factors	11
2.2.4 Factors associated with willingness to accept the malaria vaccine	12
CHAPTER THREE: METHODOLOGY	13
3.1 Study Design	13

3.2 Study Setting.....	13
3.3 Study Population	14
3.3.1 Target Population.....	14
3.3.2 Accessible Population.....	14
3.3.3 Study population	14
3.4 Eligibility Criteria	14
3.4.1 Inclusion Criteria	14
3.4.2 Exclusion Criteria	14
3.5 Sample Size Determination.....	14
3.6 Sampling Procedure	17
3.7 Data Collection Methods and Tools	17
3.7.1 Data Collection Methods	17
3.7.2 Data Collection Tools	17
3.8 Quality Assurance and Quality Control.....	18
3.9 Data Collection	18
3.10 Data Analysis.....	19
3.11 Dependent Variables	20
3.12 Independent variables	20
3.13 Ethical Considerations	21
3.14 Dissemination of Results	21
CHAPTER FOUR: RESULTS	22
4.1 RESULTS FOR QUANTITATIVE DATA.....	22
4.11 Study flow diagram.....	22
4.12 Socio demographic characteristics of participants.....	23
4.13 Acceptance and Knowledge of the Malaria Vaccine	24
4.14 Trusted Sources of Health Information.....	25
4.15 Vaccine Administration Preferences.....	26
4.16 Bivariable Analysis for Factors Associated with Acceptance and Knowledge of the Malaria Vaccine	27
4.17 Multivariable Analysis for Factors Associated with Acceptance and Knowledge of the Malaria Vaccine	27

4.2 RESULTS FOR THE QUALITATIVE ANALYSIS	28
4.21 Demographic Characteristics of the Interviewees	28
4.22 Analytical Interpretation of Caregivers' Perceptions on Malaria Vaccine	29
CHAPTER 5 DISCUSSION	35
5.1 Study Strengths	37
5.2 Study Limitations.....	37
CHAPTER 6: CONCLUSION AND RECOMMENDATION	38
6.1 Conclusion	38
6.2 Recommendations.....	38
REFERENCES	39
APPENDICES	46
Appendix 1: Work Plan	46
Appendix ii: Proposed Budget	47
Appendix iii: Informed Consent Form.....	49
Appendix iv: Questionnaire For Caregivers Attending Mulago National Referral Hospital ..	53
Appendix V: English Informed Consent Form for Caregivers Attending Mulago National Referral Hospital for Qualitative Data	60
Appendix vi: Semi Structured In Depth Interview Guide For Caregivers Attending Mulago National Referral Hospital	64
Appendix vii: Luganda Version of The Consent For Qualitative Data	66
Appendix viii; Luganda Version Of The Consent For Quantitative Data	69
Appendix ix:Code Book Summary	72

LIST OF FIGURES

Figure 1. Theoretical Model	5
Figure 2. Conceptual Framework	6
Figure 3. Lifecycle of malaria.....	19
Figure 4. Study flow diagram	323
Figure 5. Sources of information	26
Figure 6. Framework of caregivers' perceptions of malaria vaccine guided by the health belief model	434

LIST OF TABLES

Table 1. Socio demographic characteristics of study participants	24
Table 2. Frequency of acceptance and knowledge of the malaria vaccine	25
Table 3. Caregiver preferences for malaria vaccine administration route and number of doses	26
Table 4. Bivariate analysis of factors associated with acceptance and knowledge of the malaria vaccine.	27
Table 5. Multivariable Analysis for Factors Associated with Acceptance and Knowledge of the Malaria Vaccine.	28
Table 6: Demographic characteristics of the IDI respondents.....	29

LIST OF ACRONYMS

AS01:	Adjuvant System 01 (vaccine component)
LMICs:	Low- and Middle-Income Countries
MNRH:	Mulago National Referral Hospital
MoH:	Ministry of Health
R2:	R21/Matrix-M malaria vaccine
RTS, S:	Malaria vaccine (specific type)
SOMREC:	School of Research and Ethics Committee
SSA:	Sub-Saharan Africa
UDHS:	Uganda Demographic and Health Survey
UNCST:	Uganda National Council of Science and Technology
WHO:	World Health Organization

OPERATIONAL DEFINITIONS

Knowledge of malaria vaccine: A Caretaker's awareness about the existence, purpose, and benefits of the malaria vaccine, as measured by the responses to specific questions in the questionnaire.

Malaria vaccine: A biological preparation (recombinant adjuvant vaccine) that provides active acquired immunity to malaria, aiming to prevent the disease's symptoms and complications and death. To date, there are two malaria vaccines: the RTS, S/AS01 and the R21/Matrix-M malaria vaccines. Uganda introduced the R21/Matrix-M into routine immunization for children.

Perceptions towards malaria vaccine: A Caretaker's attitudes and beliefs about the malaria vaccine, including its safety, efficacy, and importance, as measured by the responses to specific questions in the questionnaire.

Willingness to accept malaria vaccine: A Caretaker's expressed intention to vaccinate their child with the malaria vaccine, as measured by the response to a specific question in the questionnaire.

ABSTRACT

Background: Malaria remains a major public health challenge in Uganda. Although the malaria vaccine offers a promising additional control measure, its successful uptake depends on caregiver acceptance. There's a critical gap in understanding caregivers' willingness to accept the vaccine which poses a challenge in effective vaccine implementation.

Objective: To investigate the acceptance, knowledge, and perceptions of the malaria vaccine among caregivers of children under the age of five attending Mulago National Referral Hospital.

Methodology: This was a convergent parallel mixed methods cross-sectional study. The quantitative component involved a cross-sectional survey of 385 caregivers of children under five attending the Paediatrics Outpatient Clinic at Mulago National Referral Hospital, selected through systematic sampling. An interviewer administered questionnaire was used to collect data on willingness to accept the malaria vaccine, knowledge and perceptions. The qualitative component comprised in-depth interviews with 24 caregivers, selected purposively. Qualitative data was analysed using thematic content analysis.

Results: Vaccine acceptance was high at 86.5% though this fell markedly when a hypothetical fee was introduced. Good vaccine knowledge was the strongest independent predictor of acceptance (aOR 2.658, 95% CI: 1.005-7.033, $p=0.049$). Health worker contact (aOR 2.984, 95%CI: 1.146-7.775, $p=0.025$) was the primary independent predictor of knowledge. Caregivers perceived the malaria vaccine as beneficial for immunity and cost reduction but expressed safety concerns and unrealistic expectations. Despite high acceptance driven by high malaria burden and trust in government programs, hesitancy persisted due to fear of side effects and negative experiences from COVID 19 spill over within a contested social environment.

Conclusions: Malaria vaccine acceptance was near universal but conditional on free delivery and vulnerable to safety misinformation and cross-vaccine distrust. Knowledge was the most critical modifiable determinant of acceptance and health workers were its most powerful driver. Structured health worker counselling and preservation of cost-free vaccine delivery even in an urban setting are essential to translating high acceptance intent into complete, schedule adherent vaccine uptake.

CHAPTER ONE: INTRODUCTION

1.1 Background

Malaria results from infection with *Plasmodium* species that are vectored by female *Anopheles* mosquitoes. In 2023 the World Health Organization recorded roughly 263 million episodes and 597 000 fatalities, of which about 94 % occurred in the African region (World Health Organisation, 2024) . Uganda contributes an estimated one-twentieth of sub-Saharan Africa's malaria cases, placing it among the five highest-burden countries (Centres for Disease Control, 2025; World Health Organisation, 2024) . In Ugandan health-care statistics, malaria still tops outpatient morbidity and inpatient mortality lists: children under five years generate nearly one-third of clinic encounters and one-sixth of all admissions due to the disease (Mpimbaza et al., 2020)

Core control tools ITNs, IRS and ACTs are failing: net insecticide potency wanes, IRS campaigns are resource-intensive, and partial resistance to artemisinin compounds is being documented time (Gachelin et al., 2018; Rosenthal, 2025; Santos et al., 2019).

Two malaria vaccines have been recommended for use in children living in moderate- to high-transmission areas: RTS,S/AS01 (Mosquirix) and R21/Matrix-M (World Health Organisation, 2021, 2023). RTS, S /AS01 demonstrated 36.3% efficacy in children aged 5–17 months and 25.9% in infants aged 6–12 weeks (White et al., 2015). Pilot use in Malawi, Ghana, and Kenya reduced all-cause mortality by 9% and hospitalizations for severe malaria by 32% (Asante et al., 2024). The R21/Matrix-M vaccine showed up to 75% efficacy in children aged 5–36 months in areas of seasonal malaria transmission and 68% in standard transmission settings (Dattoo et al., 2024) . To date, 19 African countries, including Uganda, had integrated malaria vaccines into routine immunization (World Health Organisation, 2025) .

Uganda introduced the R21/Matrix-M vaccine in April 2025, starting with high-transmission districts such as Apac, which records over 1,500 mosquito bites per person per year (World Health Organisation, 2025).

Studies on malaria vaccine acceptance in sub-Saharan Africa reveal variable results. A multi-country study in Uganda, Ghana, and Nigeria reported 58.3% awareness (Aremu et al., 2022), while awareness in northern Nigeria was 40.3% but with high acceptance (91.9%) (M. Y. Ajayi & D. C. Emeto, 2023). In Gulu district, Uganda, pre-rollout acceptance reached 91.45% (F. Bongomin et al., 2024). However, despite evidence of safety and efficacy, vaccine uptake

depends largely on caregivers' awareness and willingness (Maamor et al., 2024) , which may be negatively influenced by misinformation on social media

Despite promising malaria vaccine outcomes, there is limited information on caregivers' willingness to accept these vaccines in Uganda, particularly in referral hospital settings. This study assessed these factors, which are crucial in informing communication strategies and improving uptake.

1.2 Problem Statement

Uganda ranks among the three most affected countries with malaria globally, with the disease continuing to be a leading cause of illness and death among children and a major contributor to outpatient visits and hospital admissions, placing a significant burden on the country's healthcare system (World Health Organisation, 2024) .

Following the World Health Organization's approval of the R21/Matrix-M vaccine, Uganda launched its rollout in 2025 across high transmission districts (World Health Organisation, 2025) .

However, vaccine uptake depends largely on acceptance among caregivers, whose perceptions are critical to the success of malaria control efforts (Adedire et al., 2021; Felix Bongomin et al., 2024; Mwingira et al., 2025) . While studies have reported high rates of acceptance of malaria vaccine (Felix Bongomin et al., 2024) , this was before the roll out of the vaccine and was done in a regional referral hospital. There is no data on acceptance rates since the introduction of the vaccine, more so at a national referral level. Malaria vaccine acceptance may potentially be low. This gap is critical to the current reality of the social media driven post covid 19 vaccine hesitancy that may easily affect the uptake of Malaria vaccine in urban centres.

Despite the national rollout, vaccine impact is in part dependent on caregivers' knowledge and consent. Yet evidence on acceptance of the malaria vaccine at Mulago National Referral Hospital is lacking, leaving a gap in strategy for maximizing uptake.

1.3 Study Justification

Malaria remains a major cause of morbidity and mortality among Ugandan children under five, despite existing preventative interventions. The recent roll out of the R21/Matrix-M vaccine provides a new opportunity to reduce this burden, but its uptake will depend on caregivers, knowledge, perceptions and willingness to vaccinate.

Uganda launched the world's largest malaria vaccine rollout strategies. The success of this depends on many factors. This study contributes to the malaria vaccine rollout efforts by generating evidence on acceptance informing national malaria vaccine communication strategies and policy decisions.

Health planners will find lessons and insights from this study useful in strengthening the uptake of the malaria vaccine, ultimately reducing malaria-related morbidity and mortality in children under five years.

1.4 Research Questions

1. What proportion of caregivers are willing to accept the malaria vaccine for their children under 5 years?
2. What are the factors associated with willingness to accept the malaria vaccine?
3. What are the caregivers' perceptions about the malaria vaccine for children under five years?
4. What is the level of knowledge about the malaria vaccine among caregivers of children under five years attending Mulago National Referral Hospital?
5. What factors are associated with caregivers' knowledge regarding the malaria vaccine among children under five years attending Mulago National Referral Hospital?

1.5 Study Objectives

1.5.1 General Objective

To determine the level of acceptance, knowledge and perceptions regarding the malaria vaccine among caregivers of children under five years attending Mulago National Referral Hospital.

1.5.2 Specific Objectives

1. To determine the proportion of caregivers willing to accept the malaria vaccine for their children under five years.
2. To determine the factors associated with willingness to accept the malaria vaccine among caregivers of children under five years attending Mulago National Referral Hospital.

3. To determine the level of knowledge regarding the malaria vaccine among caregivers of children under five years attending Mulago National Referral Hospital.
4. To determine the factors associated with caregivers' knowledge regarding the malaria vaccine among children under five years attending Mulago National Referral Hospital.
5. To explore the perceptions of caregivers about the malaria vaccine's effectiveness and safety for children under five years.

1.6 Theoretical Model

This study was guided by the Health Belief Model (HBM), which argues that an individuals' health-related behaviors are influenced by their perceptions of health risks and the benefits versus barriers of taking action (Strecher & Rosenstock, 1997) . According to the HBM, an individual's likelihood of adopting a preventive health behavior: such as accepting vaccination is determined by key constructs:

Perceived susceptibility and severity: Caregivers' perception of their children's risk of contracting malaria and the seriousness of the disease may influence their willingness to accept the malaria vaccine.

Perceived benefits: Belief that vaccination effectively protects children from malaria can promote acceptance.

Perceived barriers: Concerns about vaccine safety, side effects, cost, or access may reduce willingness.

Cues to action: Information from health workers, media, or community leaders may increase awareness of the threat posed by malaria and highlight the benefits of vaccination.

Self-efficacy: Caregivers' personal judgment of being confident enough to implement their ability to access vaccination services for their children can influence acceptance.

The Theoretical Model

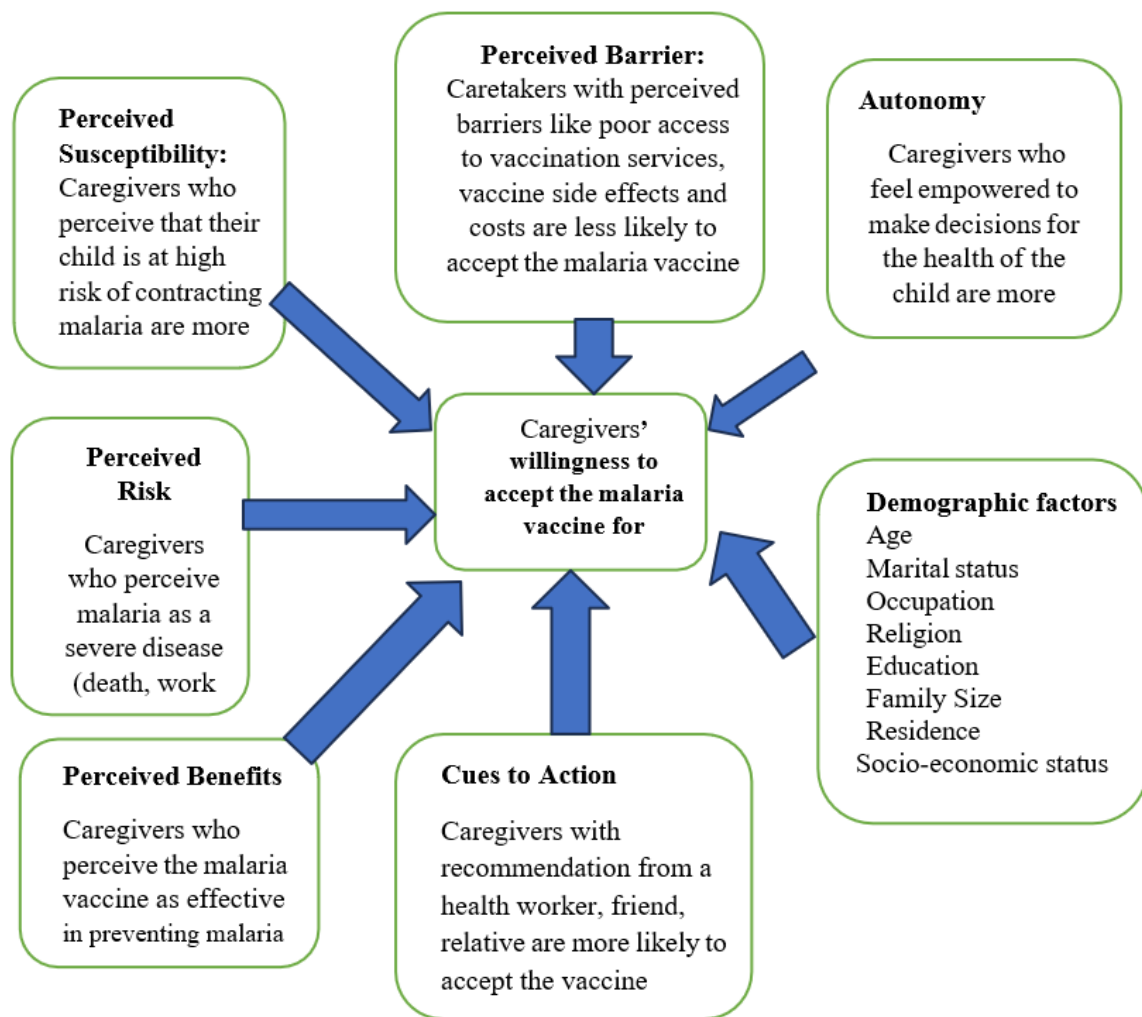


Figure 1. Theoretical Model

1.7 The Conceptual framework

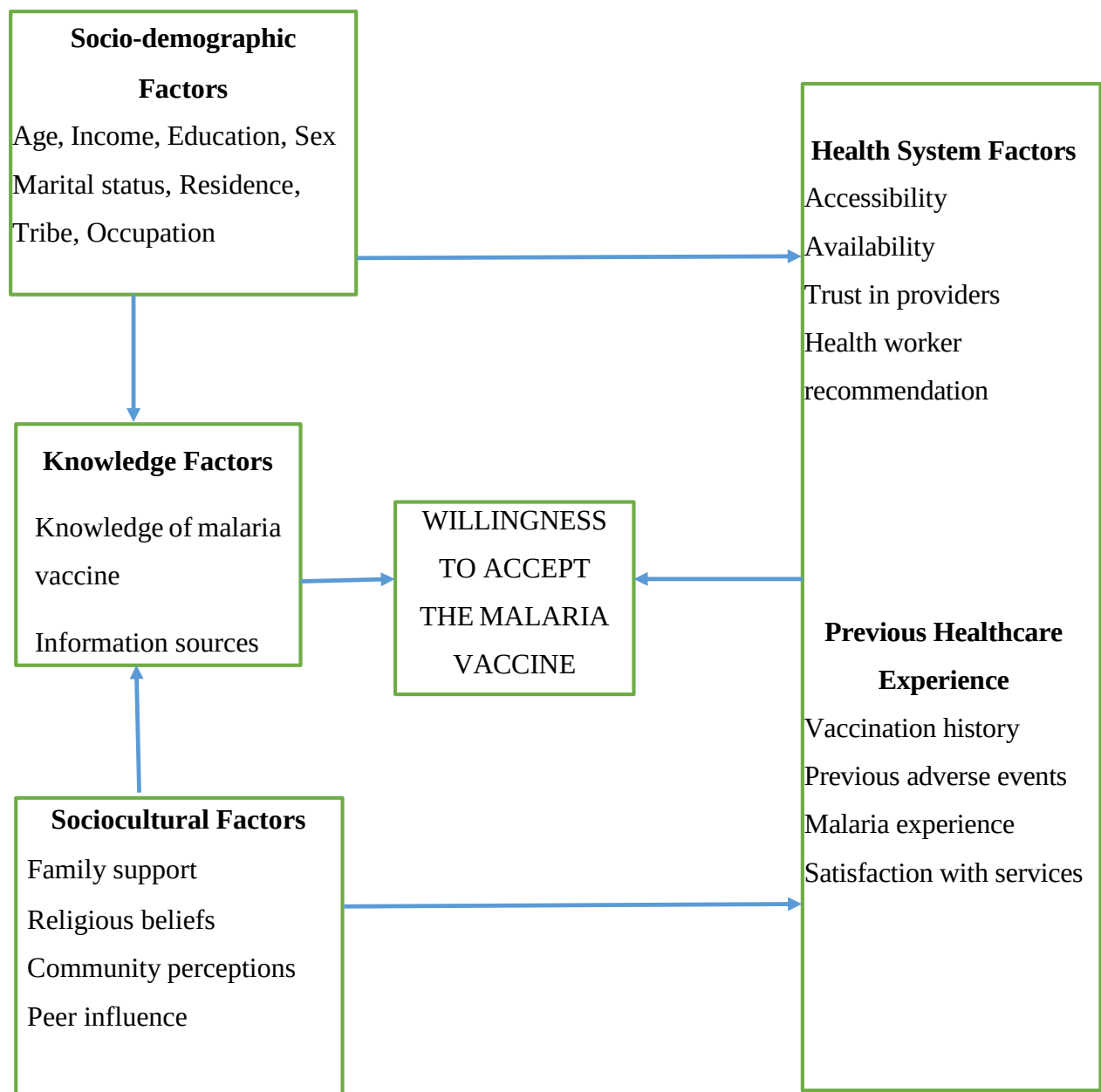


Figure 2. Conceptual Framework

This conceptual framework posits that acceptance of the malaria vaccine is influenced by socio-demographic characteristics, knowledge, health system-related factors, sociocultural influences, and previous healthcare experiences. These factors may collectively affect caregivers' decisions regarding malaria vaccine uptake among eligible children.

CHAPTER TWO: LITERATURE REVIEW

2.1 Epidemiology of Malaria

2.11 Globally

Malaria remains a serious public health problem globally, despite breakthroughs in disease control. The WHO predicts 263 million malaria infections and 597,000 fatalities worldwide by 2023. Sub-Saharan Africa is disproportionately impacted by malaria, with an expected 233 million infections and 580,000 deaths by 2023 (World Health Organisation, 2024).

2.12 Uganda

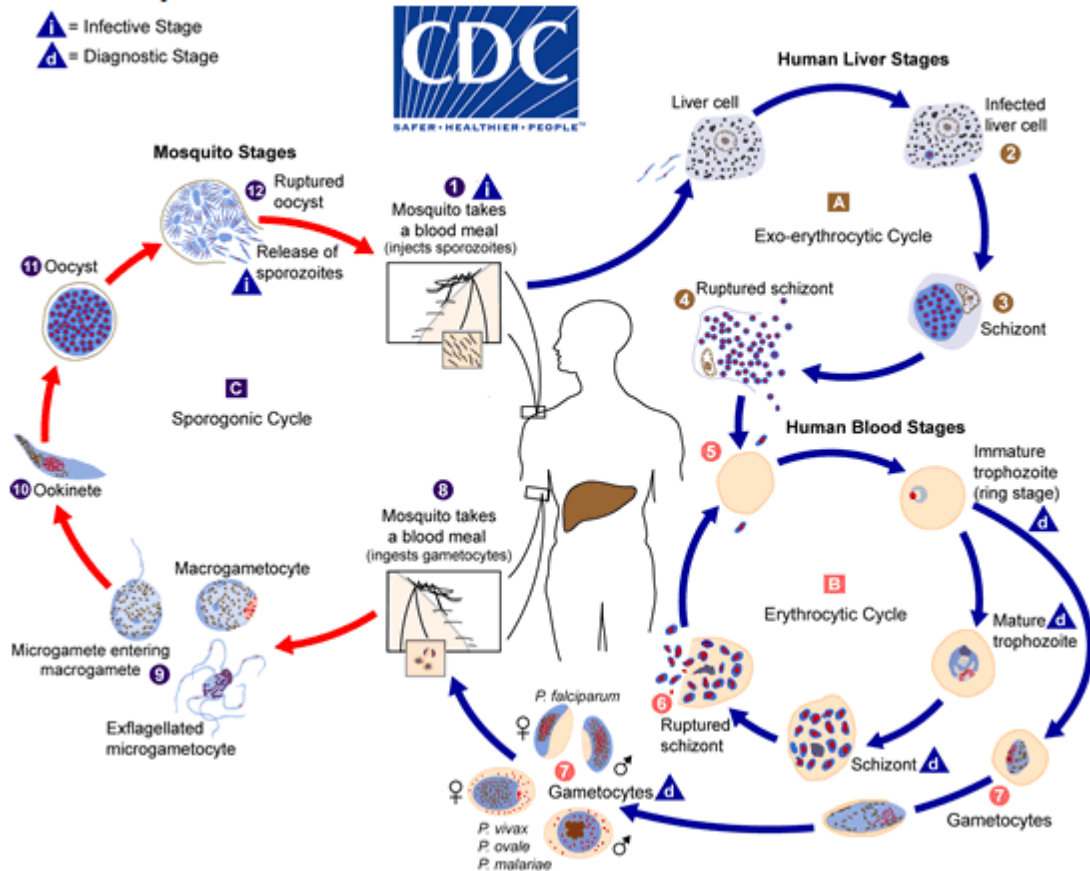
Malaria is still the top cause of illness and mortality among Ugandan children under five years old (Nankabirwa et al., 2022) . Malaria caused 26% of hospital admissions in 2023/2024, with children under 5 accounting for 44% (Ministry of Health (Uganda), 2024).

2.13 Etiology of malaria

Malaria is an infectious disease caused by plasmodium parasites that spreads through bites of a female anopheles mosquito with children under five years more susceptible to severe disease and can present with fevers, poor appetite, and difficulty sitting upright, vomiting and yellow eyes (Namayanja et al., 2025) .

There are approximately 156 named species of plasmodium which infect various species of vertebrates. Five species are considered true parasites of humans as they utilize humans almost exclusively as a natural intermediate host; Plasmodium faciparam, Plasmodium vivax, Plasmodium ovale, Plasmodium malarae and Plasmodium knowlesi. Figure 3 illustrates the life cycle of the malaria parasite.

Life Cycle



The malaria parasite life cycle involves two hosts. During a blood meal, a malaria-infected female *Anopheles* mosquito inoculates sporozoites into the human host ①. Sporozoites infect liver cells ② and mature into schizonts ③, which rupture and release merozoites ④. (Of note, in *P. vivax* and *P. ovale* a dormant stage [hypnozoites] can persist in the liver and cause relapses by invading the bloodstream weeks, or even years later.) After this initial replication in the liver (exo-erythrocytic schizogony A), the parasites undergo asexual multiplication in the erythrocytes (erythrocytic schizogony B). Merozoites infect red blood cells ⑤. The ring stage trophozoites mature into schizonts, which rupture releasing merozoites ⑥. Some parasites differentiate into sexual erythrocytic stages (gametocytes) ⑦. Blood stage parasites are responsible for the clinical manifestations of the disease.

The gametocytes, male (microgametocytes) and female (macrogametocytes), are ingested by an *Anopheles* mosquito during a blood meal ⑧. The parasites' multiplication in the mosquito is known as the sporogonic cycle C. While in the mosquito's stomach, the microgametes penetrate the macrogametes generating zygotes ⑨. The zygotes in turn become motile and elongated (ookinetes) ⑩ which invade the midgut wall of the mosquito where they develop into oocysts ⑪. The oocysts grow, rupture, and release sporozoites ⑫, which make their way to the mosquito's salivary glands. Inoculation of the sporozoites into a new human host perpetuates the malaria life cycle.

Figure 3 Showing the lifecycle of the malaria parasite.

2.14 Prevention of Malaria

Malaria prevention involves vector control and chemotherapy however they have shortcomings with recent reports on emergence of resistance to artemisinin based combination therapies (World Health Organisation, 2024) .

Malaria vaccine research has largely focused on pre-erythrocytic vaccines, which aim to prevent infection before parasites enter the blood stream; blood stage vaccines which seek to reduce disease severity by limiting parasite multiplication in red blood cells; and transmission blocking vaccines, which interrupt parasite development in mosquitoes to reduce community transmission (Moorthy et al.,2004; Hill,2006, Qualiata et al, 2023).

Despite decades of research, many vaccine candidates failed to progress into routine immunization schedules because of limited efficacy, short duration of protection, the complex life cycle and antigenic diversity of the plasmodium parasite, and challenges in inducing strong and long lasting immune responses against multiple parasite stages(Hill 2006,Moorthy et al).Additionally, some transmission blocking vaccines offered mainly indirect community benefits rather than direct individual protection, reducing their attractiveness for large scale implementation.

Against this backdrop, two vaccines, the RTS, S/AS01 (Mosquirix) and R21/Matrix-M (R21 malaria) have emerged as promising tools to reduce the malaria burden (World Health Organisation, 2021, 2023) with 19 African countries, including Uganda in April 2025, integrating them into national immunization schedules (World Health Organisation, 2025) .

However, the introduction of a new vaccine alone does not guarantee uptake; willingness to accept the vaccine, knowledge and perceptions are equally critical determinants of its success.

2.2 Determinants of Malaria Vaccine Hesitancy

According to the Strategic Advisory Group of Experts (SAGE) on immunization, vaccine hesitancy can be understood using the 5C model which comprises confidence, complacency, constraints, calculation and collective responsibility. This identifies key determinants of malaria vaccine hesitancy which include confidence in the vaccines safety and efficacy and effectiveness, complacency resulting from low perceived risk of malaria or reliance on other preventive measures, constraints like limited access to vaccination services, calculation through weighing the benefits and risks of vaccination, and collective responsibility, which reflects willingness to vaccinate for the protection of the wider community. Understanding

these factors is essential for designing interventions that enhance malaria vaccine acceptance and uptake in malaria endemic settings.

2.21 Knowledge of Malaria Vaccine Benefits and Side Effects

Evidence consistently shows that knowledge of new vaccines varies widely across populations, shaped by education, socioeconomic status, and access to healthcare. Studies on Human Papillomavirus (HPV) and COVID-19 vaccines demonstrate that targeted awareness campaigns significantly improve both knowledge and acceptance among caregivers, (Hong et al., 2022; López et al., 2020; Xie et al., 2021; Zanolini et al., 2022) further established that education level and socioeconomic status are independent predictors of vaccine awareness in the context of influenza vaccination. Taken together, these findings suggest that awareness is not simply a matter of information access but is deeply mediated by structural and social factors.

In Sub-Saharan Africa (SSA), this pattern holds but knowledge levels are considerably lower in rural and underserved communities. In Nigeria, only 23.7% of mothers reported prior knowledge of the malaria vaccine (Alagbe et al., 2025) while studies in Ghana and Kenya demonstrate that structure awareness campaigns can meaningfully improve uptake (Mugasia et al., 2024; Saaka et al., 2024).

Within Uganda specifically, knowledge of the HPV vaccine has been found to be low among women (Einarson et al., 2025) , suggesting a broader pattern of limited vaccine literacy that is likely to extend to the malaria vaccine. Collectively, these findings underscore the need to understand the current state of malaria vaccine knowledge among Ugandan caregivers before the vaccine can be effectively promoted.

2.22 Perceptions of Malaria Vaccine Effectiveness and Safety

Perceptions of vaccine safety and effectiveness are among the most powerful drivers of vaccine acceptance across diverse settings. Global evidence from COVID-19 vaccine research demonstrates that transparent communication about vaccine development and testing is essential in building public trust and shaping favorable perceptions (World Health Organization, 2021) .When this trust is absent, hesitancy follows, a pattern observed consistently across different vaccines and contexts.

In SSA), concerns about vaccine safety have been documented in Ghana, Nigeria, and Kenya in relation to both the malaria vaccine and other vaccines (Alagbe et al., 2025; Maamor et al.,

2024; Saaka et al., 2024). These studies emphasize the importance of culturally sensitive and accessible communication about vaccine benefits and risks.

Importantly, these perceptions do not rise in a vacuum, they are shaped by cultural and social norms (Hornsey et al., 2020; Ko et al., 2019), prior vaccination experiences (Kimotho, 2025), and the quality of information received from healthcare providers (Lin et al., 2021). This interplay between individual beliefs and broader socio-cultural influences highlights the complexity of vaccine perception and the limitations of purely information-based interventions.

Given the documented influence of cultural and social factors on health seeking behavior in Uganda, understanding how caregivers perceive the malaria vaccine's safety and effectiveness is critical to designing contextually appropriate communication strategies.

2.23 Willingness to Accept Malaria Vaccine and Associated Factors

Willingness to accept vaccines is shaped by a confluence of individual, social, and structural factors, and the malaria vaccine is no exception. Globally, education and socioeconomic status have emerged as consistent predictors of vaccine acceptance, individuals with higher education and better economic standing demonstrate greater uptake, largely due to improved health literacy and a deeper understanding of vaccine benefits and risks (Kirbiš, 2023; Zanobini et al., 2022).

In SSA, this relationship is well documented. In Ghana, more educated individuals showed greater willingness to accept the HPV vaccine (Williams et al., 2019) while studies in Nigeria and Kenya identified healthcare provider recommendations as a significant driver of COVID-19 vaccine acceptance (Okafor et al., 2022; Orangi et al., 2024). In south Africa, safety concerns emerged as the primary barrier to acceptance (Di Valerio et al., 2024). These findings, while drawn from different vaccine contexts, converge a common theme: acceptance is not determined by a single factor but by the interaction between individual knowledge, provider influence, and institutional trust.

In Uganda, educated mothers have been shown to be more likely to accept vaccines for their children (Kajungu et al., 2020) and perceptions of vaccine safety have been found to influence acceptance of the tetanus toxoid vaccine among pregnant women (Mugasia et al., 2024). Healthcare providers play a pivotal role in bridging information gaps and addressing concerns (Einarson et al., 2025). However, evidence specific to malaria vaccine acceptance among

caregivers in Uganda remains limited, representing a critical gap that this study seeks to address.

2.24 Factors associated with willingness to accept the malaria vaccine

Beyond individual level factors, demographic and sociocultural characteristics including ethnicity, religion, tribe, gender, and geographic location have been shown to influence vaccination behavior at population level. A large multi country study spanning 149 nations found that minority religious groups consistently demonstrated lower vaccine uptake, while confidence in vaccines varied significantly by country of origin (De Figueiredo et al., 2020).

In SSA, an analysis of 25 countries confirmed that higher maternal education and greater household income were associated with increased vaccination uptake, while socially disadvantaged groups remained with disproportionately lower uptake (Bobo et al., 2022) .

A descriptive analysis on COVID 19 uptake in Uganda between 2021 and 2022 found that females, individuals over 50 years and those from Western region had higher uptake rates (King et al., 2023) .A study on HPV vaccine uptake among adolescent girls further identified parental education and distance from health facilities as significant barriers(Asiimwe et al., 2025) .These findings suggest that geography, gender, and socioeconomic access intersect in shaping vaccination behavior in Uganda, patterns that are likely relevant to malaria vaccine uptake as well.

Examining these factors in the context of malaria vaccine among caregivers is therefore essential, as they inform both hesitancy patterns and the design of targeted, equity sensitive interventions.

CHAPTER THREE: METHODOLOGY

3.1 Study Design

This study employed a convergent parallel mixed methods cross-sectional design utilizing both qualitative and quantitative methods of data collection and analysis. Quantitative and qualitative data were collected concurrently, analysed separately, and integrated at interpretation stage. A cross-sectional design was the most suitable for this study because it allowed for the collection of data from caregivers at a single point in time and provided a snapshot of their awareness, perceptions, and willingness to accept the malaria vaccine. This design was particularly useful for identifying associations between variables and generating hypotheses for future studies. Additionally, it was efficient and cost-effective and made it an ideal choice for this research (Cvetkovic-Vega et al., 2021).

The study was done for three months conducted from January 2026 to March 2026.

3.2 Study Setting

The study was conducted at Mulago National Referral Hospital (MNRH), Uganda's largest tertiary and teaching hospital, located in Kawempe Division, Kampala, the capital city. The hospital provides comprehensive curative and preventive services, including immunization and malaria management, across multiple specialties such as paediatrics, oncology, cardiology, and neurosurgery.

MNRH serves both as a national referral center for patients from across Uganda and a general hospital for the Kampala Metropolitan Area, catering to a diverse population from varied socio-economic backgrounds. At the time of the study, the malaria vaccine had not yet been introduced at this facility.

This diversity of the patient population and the hospital's central role in healthcare delivery made it an appropriate setting for the study. The hospital's Pediatric Outpatient Department was specifically targeted for data collection, as it offers outpatient services to approximately 150 to 200 fairly stable children daily. The high volume of patients attending the pediatric outpatient clinic enabled the researcher to achieve the desired sample size within a relatively short period.

3.3 Study Population

3.3.1 Target Population

The target population for this study were the caregivers of children under 5 years who reside in Uganda.

3.3.2 Accessible Population

The accessible population were the caregivers of children under 5 years who attended Mulago National Referral Hospital (NRH) for healthcare services.

3.3.3 Study population

The actual study population consisted of a sample of caregivers of children under 5 years who attended Mulago NRH during the study period and met the inclusion criteria. This sample was representative of the accessible population and provided insights into the acceptance, perceptions, and knowledge of the malaria vaccine among caregivers in Uganda.

3.4 Eligibility Criteria

3.4.1 Inclusion Criteria

The following inclusion criteria was applied to select participants for the study:

Caregivers of children under 5 years of age.

Attended Mulago National Referral Hospital (NRH) for healthcare services. Caregivers who gave consent.

3.4.2 Exclusion Criteria

The following exclusion criteria was applied to exclude participants from the study:

Caregivers who were unable to communicate effectively due to language barriers (e.g., neither English nor Luganda speakers) or speech disorders.

Caregiver whose child was critically ill and required immediate emergency healthcare services.

3.5 Sample Size Determination

For the quantitative component of the study, the sample size was calculated using the Kish Leslie formula for cross-sectional studies as below: Since the prevalence of acceptance after

vaccine roll out in Uganda in April 2025 was unknown, an estimated prevalence of 50% was assumed and used

$$n = \frac{z^2 p(1-p)}{d^2}$$

Where:

Z = 1.96 (95% confidence level)

p = 0.5 (estimated proportion, conservative estimate) d = 0.05 (margin of error)

Therefore:

$$n = \frac{1.96^2(0.5)(1 - 0.5)}{0.05^2}$$

$$n = 384.16$$

The sample size was approximately 385 caregivers

Sample size determination for factors associated with willingness to accept malaria vaccine;

The sample size for determination of factors associated with willingness to accept the malaria vaccine was calculated using the Fleiss' formula for comparing two proportions which was as follows:

$$N = \frac{[z_{\alpha/2}\sqrt{(r+1)(pq)} + z_{1-\beta}\sqrt{rp_1q_1 + p_2q_2}]^2}{r(p_1 - q_1)^2}$$

Where;

N= required sample size per group

$\alpha = 0.05$, the probability of type I error (significance level) is the probability of rejecting the true null hypothesis; $z_{\alpha/2} = 1.96$

$\beta = 0.2$, the probability of type II error (1 - power of the test) is the probability of failing to reject the false null hypothesis, $z_{1-\beta} = 0.84$

P_1 = Proportion of cases with the exposure (40%). The primary exposure of interest was having heard of the malaria vaccine; $q_1 = 1-p_1$

P_2 = Proportion of controls with the exposure (60%); $q_2 = 1-p_2$

r = Ratio of controls to cases; 1: Assuming equal populations.

$$P = (p_1 + rp_2)/(r+1)$$

$$N = \frac{[1.96\sqrt{(1+1)(0.5)(0.5)} + 0.84\sqrt{1(0.4)(0.6) + (0.6)(0.4)}]^2}{1(0.4 - 0.6)^2}$$

$$N = [1.96^2 * (0.4 + 10.6)/(1+1) * [(1 - (0.4 + 10.6)/(1+1))]/0.05^2] N = [3.8416 * 0.5] * [0.5]/0.0025$$

$$N = 96.8$$

Sample size is approximately 96.8 caregivers

This yielded a sample size of 97 per group yielding a total of 194 participants.

The larger sample size of 385 caregivers was adopted to ensure adequate precision for the primary objective and sufficient power for analysis of associated factors.

For the qualitative component of the study, maximum variation sampling was used to purposely select participants who were eligible for the study (Wutich et al., 2024). Demographic characteristics included age, gender, caregiving role, education and past exposure to malaria. The participants were distributed along 6 stratifications which were male caregivers, adolescent female caregivers, and older female caregivers, attained up to primary level of education, attained above primary level of education and had a past exposure with severe malaria. Each of the 6 stratifications had roughly 4 participants, altogether contributing 24 participants for this component study. (Racines, 2024).

3.6 Sampling Procedure

For the quantitative component of the study, a systematic sampling procedure was employed to select participants for the quantitative arm of the study. At 9:00am in the morning, a general talk about the study was given to the caregivers by the researcher. The sampling interval (k), was estimated by the average monthly attendance of caregivers of children attending the Pediatric Outpatient Clinic at Mulago National Referral Hospital (NRH) which was estimated to approximately 4550 caregivers and then divided by the desired sample size of 385 which gave k as 12. Therefore, randomly started with the second caretaker, every 12th caretaker who attended the clinic that day was approached and invited to participate in the study, then an individual informed consent obtained before the questionnaire was administered. If the selected caretaker did not meet the study criteria, the next caretaker was approached and invited to participate in the study until the desired sample size was achieved. This systematic sampling approach helped ensure a representative sample of caregivers who attended Mulago NRH and minimized selection bias and enhanced the generalizability of the study findings.

For the qualitative component of the study, maximum variation purposive sampling was used to recruit 24 caregivers of children under five years from six predefined strata based on gender, age, educational attainment and previous experience with severe malaria to obtain diverse perspectives on malaria vaccine acceptance. Participants who met the inclusion criteria were approached by the Principal Investigator or trained research assistant and requested to participate in the study by giving voluntary informed consent.

3.7 Data Collection Methods and Tools

3.7.1 Data Collection Methods

Quantitative data were collected using interviewer-administered questionnaires, whereas qualitative data were obtained using in-depth interview guides.

3.7.2 Data Collection Tools

For the quantitative component of the study, the data collection tool was pre-tested among 30 caregivers to assess clarity, relevance and consistency of the tool and necessary modifications were made prior to main data collection. The close-ended structured questionnaire captured information on socio-demographic characteristics and knowledge about the malaria vaccine, perceptions towards it, and willingness to accept it for their children. The questionnaire was uploaded to the Kobo Collect app on mobile devices which enabled efficient, accurate, and real-time data collection and minimized errors therefore assured data quality.

For the qualitative component of the study, an in-depth interview was conducted using a pretested semi structured in-depth interview guide in a private and quiet room within the pediatrics outpatient department. The interview was either in Luganda or English in a private quiet area and audio recordings and scribing was done.

3.8 Quality Assurance and Quality Control

The questionnaire was adopted from a study done in Gulu Northern Uganda on Malaria vaccine acceptance among next of kin of children under 5 years of age in 2023 (Felix Bongomin et al., 2024) . To ensure the questionnaire's effectiveness, it was pre-tested among 30 caregivers attending Mulago NRH to assess its validity and reliability. Necessary adjustments were made based on the feedback received.

Research assistants were trained on the study protocol, use of the Kobo Collect app, and data collection procedures which ensured consistency and accuracy.

The Kobo Collect app was configured to validate data entries, detect inconsistencies, and prevent missing values.

Additionally, supervisors reviewed data daily, identified issues, provided feedback to data collectors, and ensured data quality throughout the data collection process, real-time data capture, minimized data entry errors, and facilitated efficient data management and analysis.

The audio recordings from the in-depth interviews and data in the Kobo Collect app were safely stored in a password secured computer for confidentiality.

3.9 Data Collection

For the quantitative component of the study, to determine baseline prior exposure to information about the malaria vaccine, a single screening question was administered asking caregivers whether they had previously heard of the malaria vaccine. Responses were recorded as either yes or no, and this item served as an initial indicator of exposure to malaria vaccine information prior to the study.

Knowledge regarding malaria infection and vaccination was assessed using 11 structured questions, yielding a maximum possible score of 11, with a score of 7 and above classified as good knowledge and 6 and below as poor knowledge.

Acceptance was assessed using a 16-item composite scale comprising 10 binary yes/no items and 6 items measured on a five-point Likert scale ranging from strongly disagree to strongly agree, giving a maximum score of 34. A score of 24 and above was classified as good acceptance and 23 and below as poor acceptance.

These cut off points, set approximately 60%-70% of the maximum score for each construct, are consistent with thresholds applied in comparable studies on vaccine related knowledge and attitudes among caregivers (Mary Yetunde Ajayi & Daniel Chukwuyere Emeto, 2023; Felix Bongomin et al., 2024; Puleh et al., 2026) .

Trust in health information sources was assessed by asking caregivers to rate each source on a five-point Likert scale ranging from 1(least trusted) to 5(most trusted). Sources evaluated included healthcare workers including community health workers, family and friends, social media, community leaders, radio and television. A mean trust score was calculated for each source, and sources subsequently ranked according to their mean scores to identify the most and least trusted channels of health information among caregivers.

For the qualitative component of the study, the audio recordings from the in-depth interviews were transcribed verbatim from Luganda to English by trained personnel. They were then checked by the principal investigator for accuracy and consistency.

3.10 Data Analysis

For the quantitative component of the study;

Descriptive statistics were summarized using means and medians for continuous data and proportion for categorical data.

Bivariate logistic regression analysis was conducted to assess the association between malaria vaccine acceptance and the independent variables. Crude odds ratios(cORs) and their corresponding 95% confidence intervals (CIs) were used to quantify the associations between the independent variables and malaria vaccine acceptance. Variables with a p-value <0.2 were subsequently included in the multivariable logistic regression model.

Multivariable logistic regression analysis was conducted to identify factors independently associated with malaria vaccine acceptance while controlling for potential confounders. Variables with a p-value < 0.2 at bivariate analysis were included in the multivariable model.

Adjusted odds ratios(aORs) and their corresponding 95% confidence intervals (CIs) were used to quantify the associations between the independent variables and malaria vaccine acceptance. Statistical significance was set at p-value <0.05.

For the qualitative component of the study;

The audio recordings from the in-depth interviews were transcribed verbatim from Luganda to English by trained personnel. They were then checked by the principal investigator for accuracy and consistency who then familiarized with the collected data, and organized the textual data, categorized it, and coded into themes and subthemes (Mocănașu, 2020) . Key emerging themes that were similar were grouped. The study findings were then described into summaries enhanced by quotes from the participants.

3.11 Dependent Variables

Malaria vaccine knowledge referred to a caregiver's understanding of the vaccine's existence, purpose, and benefits. This included whether they had heard about the vaccine, source of information about the vaccine, availability of the vaccine, who qualifies for it, the benefits of the vaccine, and the number of shots required for complete vaccination. Caregivers' willingness to vaccinate their child with malaria vaccine was determined by their responses to questions such as whether they accept the vaccine, have all recommended doses, recommend it to a friend, accept it at a cost, the extent of protection, and any concerns about the vaccine.

3.12 Independent variables

Social demographic factors: Age, gender, marital status, religion, tribe, place of residence, level of education, employment status, occupation, family size, monthly household income.

Source of the health information: Health professionals, radio, television, newspaper, internet, social media, friends and family, community leaders.

Perception of malaria: As a severe disease, preventable disease, cause of malaria, previous experience with malaria.

Perception of malaria vaccine: Perceived efficacy, safety, need, cost and misconceptions about the malaria vaccine.

3.13 Ethical Considerations

This study adhered to the Declaration of Helsinki and other ethical criteria. The project was approved by the Institutional Review Board (IRB), the School of Medicine Research and Ethics Committee (SOMOREC), and the Uganda National Council for Science and Technology (UNCST).

Informed consent was obtained from each participant before the questionnaire was administered. Participants were assured of confidentiality, anonymity, and the freedom to withdraw from the study at any time without consequences. The study did not involve any invasive procedures or pose significant risks to participants.

All data collected were securely stored and accessed only by authorized personnel. The study's findings were reported in a way that maintained participant confidentiality and anonymity.

3.14 Dissemination of Results

Results were prepared as a dissertation for the award of Master of Medicine in Pediatrics and Child Health. The study's findings will be disseminated through peer-reviewed publications, Department of Pediatrics and Child Health, Mulago National Referral Hospital Immunization Department, Makerere University library, National Malaria Prevention Division of the Ministry of Health.

CHAPTER FOUR: RESULTS

4.1 RESULTS FOR QUANTITATIVE DATA

4.11 Study flow diagram

Figure 4.1a: Quantitative Component Study Flow Diagram

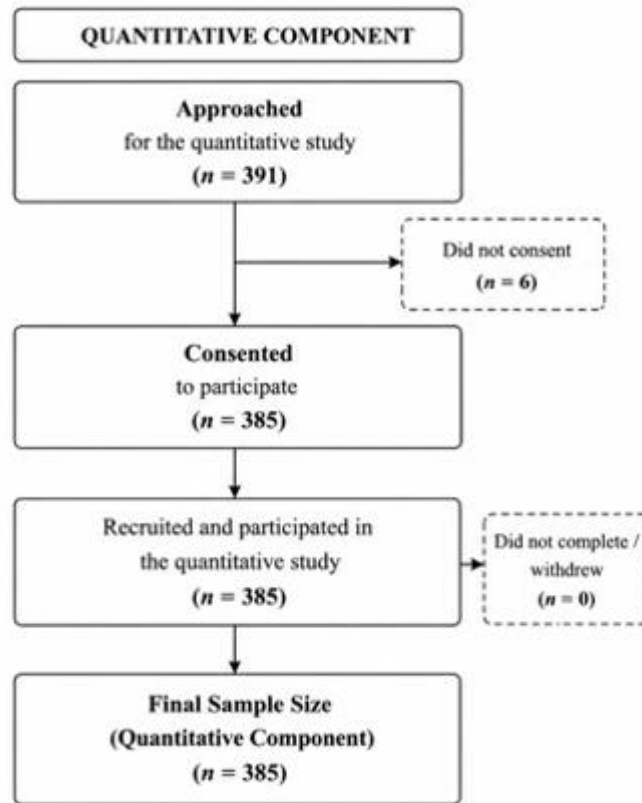
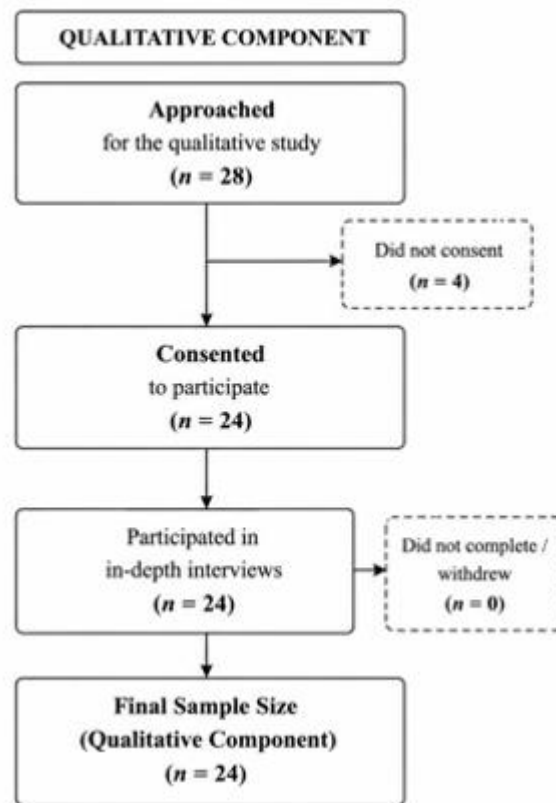


Figure 4. Study flow diagram for quantitative component of the study.

Figure 4.1b: Qualitative Component Study Flow



1

Figure 5. Study flow diagram for qualitative component of the study.

4.12 Socio demographic characteristics of participants

A total of 385 caregivers of children under five years of age were enrolled in this study. The majority were female (90.1%, n=347). The median age of respondents was 29 years (IQR: 18-69) Most caregivers were mothers of the index child (80.5%, n=310). Monthly income was unknown for 155 (40.2%) participants: of those with a known income, 43.4% (n=167) earned less than UGX 500,000 monthly. Majority were married (75.6%, n=291). Most participants were urban dwellers (76.9%, n=296). Sociodemographic characteristics of the study participants are summarized in Table 1.

Table 1. Socio demographic characteristics of study participants

Variable	Frequency (N)	Percentage (%)
Age (years) – Median (IQR)	29 (18 - 69)	
18 – 29	200	52.2
30 – 75	183	47.8
Sex		
Female	347	90.1
Relationship		
Father	32	8.3
Mother	310	80.5
Other	43	11.2
Education Level		
None	13	3.4
Primary	89	23.1
Secondary	207	53.8
Tertiary	76	19.7
Income		
<500,000	167	43.4
≥500,000	63	16.4
Unknown	155	40.2
Marital Status		
Single	73	19.0
Married	291	75.6
Cohabiting	21	5.4
Residence		
Rural	22	5.7
Peri urban	67	17.4
Urban	296	76.9

Table 1. Sociodemographic characteristics represented as frequency (N) and percentages (%). Age represented as median and interquartile range (IQR).

4.13 Acceptance and Knowledge of the Malaria Vaccine

Acceptance of the malaria vaccine was high. A total of 333(86.5%) caregivers indicated willingness to accept the malaria vaccine for their children. Acceptance of the malaria vaccine dropped to 49.9% when a hypothetical cost was introduced.

At the time of the study, 70 % of the participants had heard of the malaria vaccine. The overall level of knowledge about malaria and malaria vaccination was high among study participants, with 353 (91.7%) demonstrating good knowledge. These findings are summarized in Table 2.

Table 2. Frequency of acceptance and knowledge of the malaria vaccine

Variable	Frequency (N)	Percentage (%)
Acceptance		
Yes	333	86.5
No	52	13.5
Knowledge		
Yes	353	91.7
No	32	8.3

Table 2. Frequency of acceptance and knowledge of malaria vaccine provided as frequency (N) and percentages (%).

4.14 Trusted Sources of Health Information

Caregivers were asked to rate their trust in various sources of health information on a five-point Likert scale (1=least trusted, 5=most trusted). Healthcare providers including nurses, doctors, and community health workers were the most trusted source, with 159 respondents assigning the highest trust rating (score 5) and 183 assigning a score of 4. Radio and television were the second most trusted medium, with 85 caregivers assigning a score of 5 and 160 a score of 4. Community leaders were moderately trusted, receiving a score of 5 from 75 respondents and scores of 4 and 3 from 123 and 108, respectively. Social media was the least trusted source, with 114 caregivers assigning the lowest trust score 1. The distribution of trust ratings is shown below.

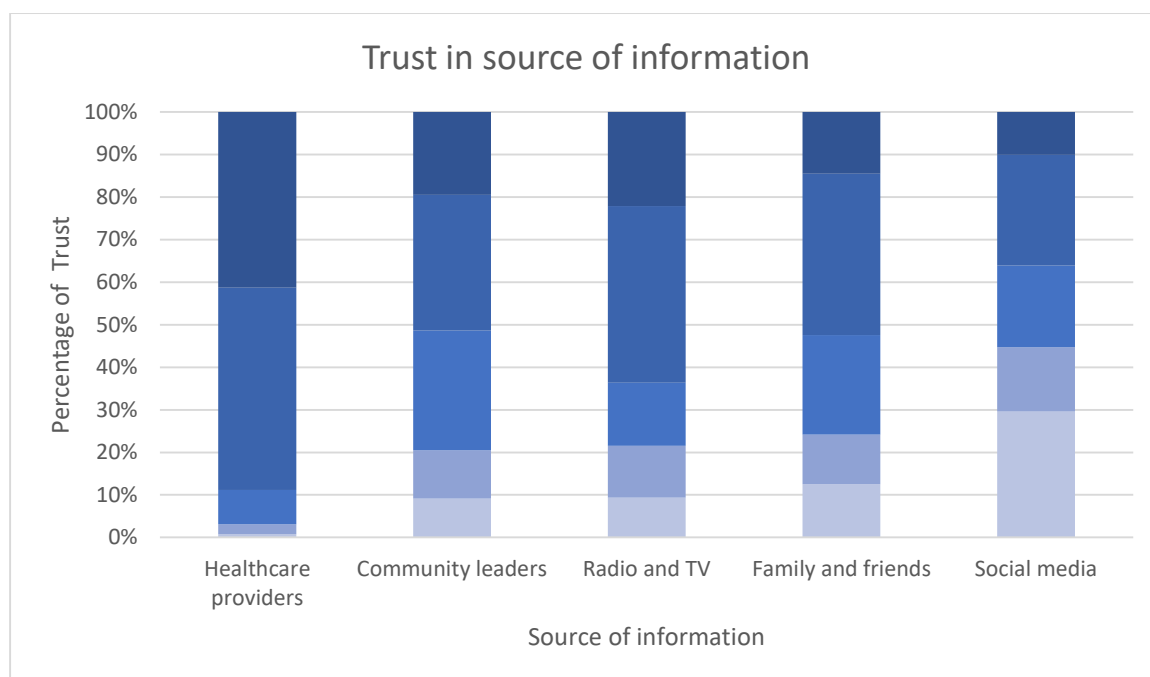


Figure 6. Sources of information

4.15 Vaccine Administration Preferences

Caregivers were asked about their preferences regarding vaccine administration route and dosing schedule. A slight majority preferred the injectable route (52.2%, n=201), while 184 (47.85%) preferred the oral route. Regarding the number of doses, 175 (45.5%) preferred a two-dose schedule, 114 (29.6%) preferred a single dose, and 96 (24.9%) were willing to accept three or more doses. The preferences are presented in Table 3.

Table 3. Caregiver preferences for malaria vaccine administration route and number of doses

Variable	Frequency(N)	Percentage (%)
Preferred route of administration		
Injection	201	52.2
Oral	184	47.8
Preferred number of doses		
1 dose	114	29.6
2 doses	175	45.5
3 doses or more	96	24.9

Table 3. Preferred route of the vaccine and doses provided as frequency (N) and percentages (%).

4.16 Bivariable Analysis for Factors Associated with Acceptance and Knowledge of the Malaria Vaccine

Bivariate logistic regression analysis was conducted to assess association between malaria vaccine acceptance and independent variables, inclusive of knowledge.

Table 4. Bivariate analysis of factors associated with acceptance and knowledge of the malaria vaccine.

Variable	Acceptance			Knowledge		
	cOR	95% CI	p-Value	cOR	95%CI	p-value
Age	0.630	0.349-1.138	0.126*	1.121	0.536-2.345	0.761
Gender	0.282	0.132-0.603	0.001*	1.064	0.308-3.672	0.922
Education	0.678	0.448-1.023	0.065*	1.587	0.988-2.459	0.056*
Income	0.590	0.394-0.883	0.010*	1.355	0.797-2.306	0.262
Marriage	1.314	0.936-1.843	0.114*	1.528	1.026-2.276	0.037*
Residence	0.863	0.499-1.494	0.600	0.661	0.303-1.440	0.298
Healthworker	2.055	0.638-2.143	0.001*	2.519	1.061-5.979	0.036*
Internet	0.241	0.100-0.579	0.001*	1.045	0.235-4.650	0.953
Newspaper	0.241	0.096-0.608	0.003*	1.961	0.255-15.074	0.518
Routes	0.576	0.318-1.043	0.069*			
Doses	2.055	1.335-3.161	0.001*			
Knowledge	2.821	1.225-6.496	0.015*			

Table 4. Bivariable analysis *Statistically significant

4.17 Multivariable Analysis for Factors Associated with Acceptance and Knowledge of the Malaria Vaccine

Variables that were statistically significant at the bivariate level ($p < 0.2$) were entered into multivariate logistic regression models to identify independent predictors of acceptance and knowledge, of the malaria vaccine while controlling for potential confounders.

Table 5. Multivariable Analysis for Factors Associated with Acceptance and Knowledge of the Malaria Vaccine.

Variable	Acceptance			Knowledge		
	aOR	95% CI	p-Value	aOR	95%CI	p-value
Age	0.717	0.361-1.424	0.342	1.129	0.485-2.630	0.778
Gender	0.342	0.100-1.163	0.086	0.393	0.076-2.028	0.265
Education	0.799	0.487-1.312	0.375	1.465	0.832-2.579	0.186
Income	0.559	0.276-1.132	0.106	1.174	0.477-2.889	0.727
Marriage	1.230	0.814-1.860	0.325	1.798	1.134-2.852	0.013*
Residence	0.954	0.505-1.803	0.885	0.436	0.180-1.056	0.066
Healthworker	1.757	0.833-3.710	0.139	2.984	1.146-7.775	0.025*
Newspaper	0.368	0.805-1.682	0.197	0.567	0.043-7.847	0.667
Internet	0.406	0.101-1.637	0.205	0.270	0.038-1.906	0.189
Routes	0.937	0.474-1.852	0.851			
Doses	1.651	1.035-2.632	0.035*			
Knowledge	2.658	1.005-7.033	0.049*			

Table 5. Multivariable analysis *Statistically significant.

4.2 RESULTS FOR THE QUALITATIVE ANALYSIS

This chapter represents and analytically discusses the qualitative findings generated from in-depth-interviews (IDIs) conducted with caregivers of children under five years at Mulago National Referral Hospital. The findings are organized thematically across five major areas: caregivers' understanding of malaria, their experiences with malaria within their families, protective measures adopted against malaria, perceptions of malaria vaccine, and factors influencing acceptance or hesitancy toward the malaria vaccine. A total of 24 in-depth-interviews were conducted with caregivers. Verbatim participant quotations are used throughout to ground the analysis in the lived experiences of respondents, thereby enhancing the credibility and transferability of the findings.

4.21 Demographic Characteristics of the Interviewees

A total of 24 participants were recruited in the study. The mean age of the participants was 28.3 years. Majority were females accounting for 20 participants. 13 respondents had 1 child under 5 years whereas 11 of them had 2 children under 5 years.

Table 6: Demographic characteristics of the IDI respondents

Variable	Frequency(n)	Percentage (%)
Sex distribution		
Female	20	83.3%
Male	4	16.7%
Age distribution		
Age group (Years)		
<20	4	16.7%
20-29	11	45.8%
30-39	7	29.2%
40-49	1	4.2%
>50	1	4.2%
Relationship with child		
Biological Mother	18	75%
Biological Father	3	12.5%
Other Caregiver	3	12.5%
Number of children under 5 years		
1	13	54.2%
2	11	45.8%

Table 6. Demographic characteristics represented as frequencies (n) and percentages (%)

4.22 Analytical Interpretation of Caregivers' Perceptions on Malaria Vaccine

Caregivers' perceptions of the malaria vaccine are shaped by a complex interaction of lived disease experience, trust systems, socio-economic realities, social dynamics, information environments, and community narratives. When interpreted through the Health Belief Model (HBM), these findings reveal that vaccine acceptance is not a single decision but a multi-layered cognitive and social process.

Perceived Susceptibility and Severity: Experience-Driven Motivation for Vaccine Acceptance

Caregivers' willingness to accept the malaria vaccine is strongly rooted in their direct and indirect experiences with malaria burden. The near-universal desire to protect children and high reporting of prior malaria experiences indicate that caregivers perceive malaria as both highly likely and highly dangerous.

This is further reinforced qualitatively:

“First malaria is a killer disease and it also affects the child severely and so if chance has come and they are vaccinating against malaria then I have to vaccinate mine too.” (IDI-024, 20-year-old mother of 2 children under 5)

“So, being in an area with high prevalence of malaria, we think anytime the child can get malaria so it's better to do prevention. Exactly, we are near the lake swamps.” (IDI-020, 32-year-old father of 2 children under 5)

These narratives demonstrate that geographical exposure (e.g., swampy areas) and past illness experiences heighten perceived susceptibility, while recognition of malaria as a “killer disease” reflects strong perceived severity. Together, these constructs create a powerful motivational base for vaccine acceptance.

Perceived Benefits: Framed Around Immunity, Economic Relief, and Risk Reduction

Caregivers conceptualize the malaria vaccine primarily in terms of three interrelated benefits: enhanced immunity, reduced treatment costs, and minimized disease consequences.

Boosting Immunity and Reducing Severity

“It is a good initiative because once a child is vaccinated and gets a disease attack, his condition will be much fairer than that one who is not completely vaccinated.” (IDI-001-39-year-old mother of 2)

“An immunized child progressively grows well; they will not be sickly like this one.” (IDI-003-38-year-old, mother of 1 child under 5)

Here, vaccination is not perceived as absolute prevention but as risk attenuation, aligning with a nuanced understanding of partial protection.

Economic Benefits: Cost of Prevention vs Treatment

“You reduce on the medical expenses for example where you would get like one hundred thousand for treatment...” (IDI-014, 28-year-old mother of 2 children under 5)

This reflects a cost-benefit calculation, where caregivers weigh the financial burden of repeated malaria treatment against preventive vaccination. This economic framing significantly strengthens perceived benefits.

Minimizing Severe Outcomes and Death

“Like I said the good things that they say is that it prevents the kids from anybody deformity” (IDI-005, 26-year-old of 1 child under 5)

Caregivers extend vaccine benefits to include prevention of long-term complications and mortality, even where biomedical understanding may be imprecise. This reflects high perceived utility of vaccination.

Perceived Barriers: Safety Concerns, Misinformation, and Social Resistance

Despite strong perceived benefits, barriers remain substantial and multifaceted, particularly at the community level.

Fear of Side Effects and Harm

“You know some people can be like talking, you know that medicine is not good that they can give the kid, maybe be lame, can spoil the kid.” (IDI-017- Mother of 6months baby)

Misinformation and Conspiracy Beliefs

“Okay according to them, they think that some vaccines will cause infertility to these babies.” (IDI-005, 26-year-old of 1 child under 5)

“Others you hear them say that the government sees when the vaccines are expired then they bring them for our children...” (IDI-018, 30-year-old sister to 2 children under 5)

Negative Comparisons with Past Vaccines (e.g., COVID-19)

“People say that the vaccine may not be safe and they compare these vaccines to those of Covid...” (IDI-023, 27-year-old mother of 2 children under 5)

These findings show that perceived barriers are largely socially constructed, emerging from collective narratives rather than individual experience. Importantly, they can directly undermine otherwise strong perceived benefits.

Cues to Action: Multi-Channel but Uneven Information Ecosystem

Caregivers' awareness and motivation to vaccinate are shaped by multiple external cues to action, including:

Media and Public Health Messaging

"Yes, I heard through media announcements sometimes via TV and radio..." (IDI-003-38-year-old, mother of 1 child under 5)

Health Worker Engagement

"Hospitals, they were teaching us that a child has to be vaccinated..." (IDI-021, mother of 1 child under 5)

Community Mobilization

"An announcement by the chairman [LC1] was broadcast in the community..." (IDI-003-38-year-old, mother of 1 child under 5)

These cues are critical in shaping awareness; however, the fact that only 50% had prior awareness indicates gaps in information coverage and consistency.

Additionally, caregivers rely on informal cues, including:

"Because there is Google, It's the first-place people go to." (IDI-011, 19-year-old, caregiver of 1 child under 5 years)

This highlights the growing role of digital information ecosystems, which may both inform and misinform.

Trust as a Cross-Cutting Determinant (Bridging Benefits and Barriers)

Trust emerges as a central mediating factor influencing how caregivers interpret both benefits and barriers.

Trust in Government and Health Systems

"I have confidence in government programs... I don't think that government could be expected to do something bad to the people..." (IDI-007, 42-year-old father of 2 children under 5)

Trust in Health Workers

“There the health workers who are there to me I think that they are more competent...” (IDI-013, 22-year-old mother of 1 child under 5)

Trust acts as a filter when high, it amplifies perceived benefits and reduces barriers; when low, it amplifies fear and misinformation.

Self-Efficacy: Conditional and Socially Negotiated Decision-Making

Caregivers’ confidence in vaccinating their children is not purely individual, but socially mediated, particularly through:

Spousal and Family Influence

“I need to first consult with their father...” (IDI-002-29-year-old mother of 2)

This indicates that decision-making authority is shared or negotiated, and in some cases constrained.

Professional and Peer Validation

“I can consult the professionals in the vaccine...” (IDI-005, 26-year-old of 1 child under 5)

“Those who have already taken the vaccine...” (IDI-024, 20-year-old mother of 2 children under 5)

Self-efficacy is therefore conditional on reassurance, rather than purely internal confidence.

Autonomy in Some Cases

“I will not lie to you... I don’t first ask people out there apart from my partner.” (IDI-002-29-year-old mother of 2)

This shows variability, with some caregivers exercising independent decision-making.

Access and Structural Factors: Enabling or Constraining Action

Access-related findings indicate that geographical proximity, cost, and service quality influence uptake:

“For me I find it convenient to go to St. Joseph’s because it is near where I stay...” (IDI-004-39-year-old father of 1 child under 5)

Free government services enhance uptake:

“The vaccines are free which is not the case for the private clinics” (IDI-013, 22-year-old mother of 1 child under 5)

These factors interact with self-efficacy caregivers are more confident when services are accessible and affordable.

Figure 7. Framework of Caregivers’ Perceptions of malaria vaccine

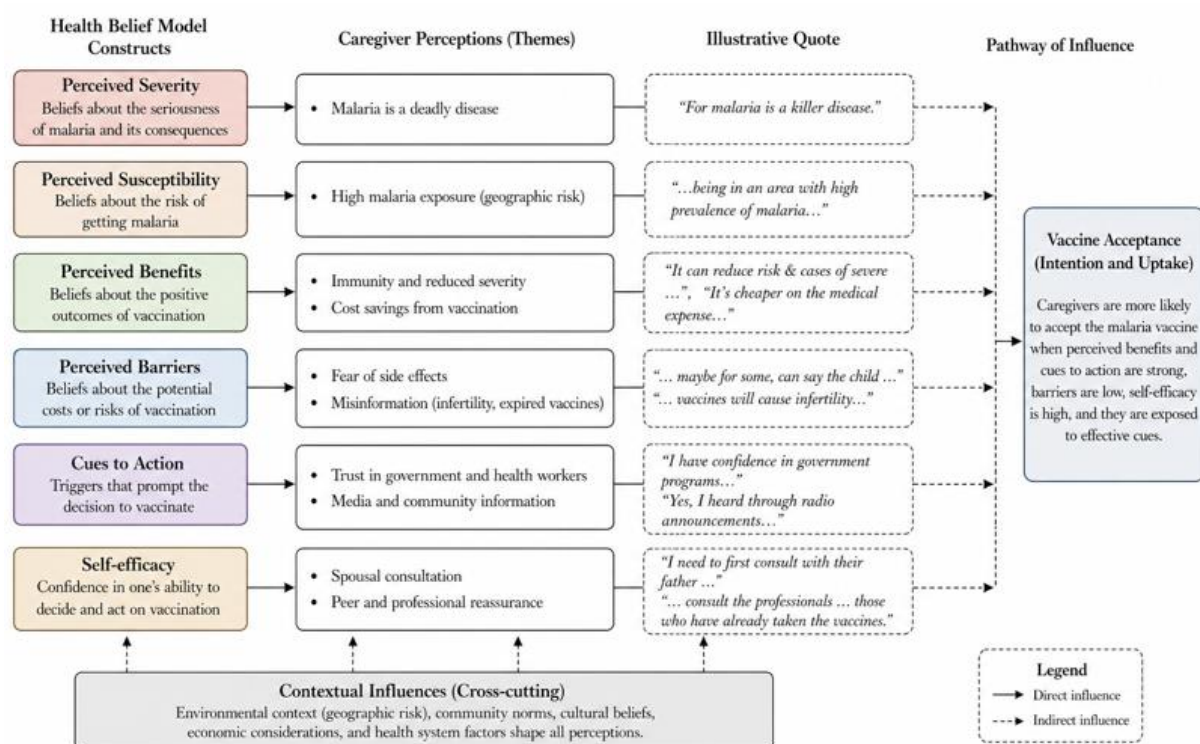


Figure7. Framework of caregivers’ perceptions of malaria vaccine guided by the health belief model

CHAPTER 5 DISCUSSION

This chapter discusses the findings of this mixed methods study on the Acceptance of the Malaria Vaccine and its Determinants among Caregivers of Children Under Five Years at Mulago National Referral Hospital, and compares them with existing regional and global evidence.

Uganda remains among the countries with the highest malaria burden globally. The R21/Matrix-M vaccine is expected to reduce severe malaria and save families approximately UGX 15,000 per case averted, making caregiver acceptance crucial to the success of the vaccination programme.

Acceptance of the malaria vaccine among caregivers in this study was high, with 86.5% meeting the composite acceptance criterion. This finding is comparable to reports from Nigeria(91.9%), Gulu in Northern Uganda (91.2%), and higher than estimates from Guinea(76%) and sierra Leone (81%)(Mary Yetunde Ajayi & Daniel Chukwuyere Emeto, 2023; Röbl et al., 2023) Felix Bongomin et al., 2024).These findings suggest strong caregiver willingness to adopt the malaria vaccine in Uganda.

The qualitative findings provided important context for the high malaria vaccine acceptance observed in this study. Caregivers consistently linked their willingness to vaccinate their children to the frequent occurrence and consequences of malaria, confidence gained from success of previous childhood vaccination programs, and trust in government led health interventions (Group, 2014). These perceptions likely enhanced the perceived need for and benefits of vaccination, thereby promoting acceptance. The findings suggest that acceptance was driven not only by awareness of the malaria burden but also by positive vaccination experiences and confidence in health system. Similar factors have been identified as key facilitators of malaria vaccine acceptance in other settings, indicating strong community readiness for vaccine implementation (Kigongo et al., 2025).

Although the overall acceptance of the malaria vaccine was high, willingness to vaccinate declined substantially when a cost was introduced, with only 49.9% of caregivers indicating definite acceptance. This suggests that acceptance is highly dependent on the vaccine remaining free and accessible through the routine immunization program even in an urban setting. Unlike findings from Nigeria, where willingness to pay was generally high despite cost

related concerns among low income households (Dim et al., 2025), our findings highlight the importance of maintaining free vaccine provision to sustain high uptake in Uganda.

In this study, 70.1% of caregivers had heard of the malaria vaccine, with health professionals identified as the primary source of information. This finding is consistent with a systemic review of 33 studies across sub-Saharan Africa which found healthcare workers were identified as the main information source across studies and education as a key determinant of positive vaccine uptake (Ekhatior et al., 2025).

In this study, knowledge was independently associated with acceptance of the malaria vaccine at multivariable analysis indicating that caregivers who were better informed were more likely to accept malaria vaccination. A community based study among caregivers of under five children in southwest Ethiopia similarly found knowledge was the strongest independent predictor of willingness to accept the malaria vaccine, further affirming this association (Asmare, 2022). This implies that every intervention that improves caregiver knowledge of the malaria vaccine: its purpose, the R21 Four dose schedule, its efficacy profile, safety record, and what to expect after vaccination will generate proportionate gains in acceptance.

Receiving information from a health worker was independently associated with knowledge at multivariable analysis. This places the health worker as the most consequential actors in converting acceptance potential into sustained, complete vaccine uptake.

Despite the high acceptance rates, several barriers to malaria vaccine uptake emerged in the qualitative component of the study. Some caregivers expected complete protection from malaria, which may lead to disappointment if vaccinated children still develop malaria. Similar concerns were reported in Western Kenya (Hoyt et al., 2023), highlighting the need for clear communication that malaria vaccines provide substantial, but not complete protection and should be used alongside other malaria prevention strategies (Dattoo et al., 2021).

Concerns about malaria vaccine safety emerged as an important source of hesitancy among caregivers. Fears of side effects such as fever and convulsions, together with negative experiences associated with previous vaccination programs particularly COVID -19 vaccines, contributed to mistrust of the malaria vaccine. These findings are consistent with evidence suggesting that perceptions of vaccine safety (Chutiyami et al., 2024), previous vaccine experiences, and trust in the health system play a critical role in shaping acceptance of new

vaccines. Community narratives may further amplify concerns about adverse events, potentially increasing vaccine hesitancy (Suru & Ugwu, 2025).

The qualitative findings revealed mixed community perceptions regarding malaria vaccination, with some caregivers viewing vaccinated children as healthier and less prone to illness, while others questioned the vaccine's benefits because unvaccinated children also appeared healthy. These perceptions, coupled with broader distrust in health authorities among some community members contributed to malaria vaccine hesitancy. Similar findings have been reported in Northern Uganda, where trust, fear, and perceptions of vaccine safety and effectiveness influenced malaria vaccine uptake (Puleh et al., 2026). However, evidence suggests that safety concerns often diminish over time as caregivers gain positive experiences with vaccination and receive trusted information, highlighting the importance of sustained community engagement and health education (Price et al., 2023).

5.1 Study Strengths

This study has several strengths that make its findings credible:

The mixed methods design integrated quantitative data with qualitative insights, providing a comprehensive understanding of caregiver perceptions of the malaria vaccine.

Additionally, by capturing caregiver experiences before the introduction of the R21 malaria vaccine in an urban context, the study offers contextually relevant and practical insights that will guide the future roll out in similar settings.

5.2 Study Limitations

Some of the limitations to consider in this study include:

The study's findings may not be applicable to the broader community as they were based on caregivers at Mulago National Referral Hospital, where the malaria vaccination has not yet been implemented.

Social desirability bias: Participants possibly offered socially desired replies rather than their real thoughts, which might have impacted the study's conclusions. This was countered by having research assistants who held no medical background training.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study demonstrates that malaria vaccine acceptance among caregivers of children under five years at Mulago National Referral Hospital is high, and that the social and motivational conditions for a successful vaccine roll out are largely favorable.

However, knowledge gaps, inflated efficacy expectations, active safety concerns, cost sensitivity, community level misinformation, particularly COVID 19 vaccine distrust constitute addressable but urgent vulnerabilities that if unattended, risk undermining adherence to the four-dose schedule and long-term community trust in the malaria vaccine program.

Knowledge is the most powerful modifiable lever for improving acceptance and health worker contact is the most powerful modifiable lever for improving knowledge. The healthcare provider therefore stands as the single most consequential actor in converting the high acceptance potential documented in this study into actual, sustained, schedule complete vaccine uptake.

6.2 Recommendations

The drop in acceptance when cost was introduced makes it clear that zero-cost provision model is a prerequisite for equitable uptake even in an urban setting. The Ministry of Health should actively communicate at community and facility levels that the malaria vaccine is provided free within the routine immunization schedule, countering any rumors or misinformation about associated fees.

Given the critical role of knowledge in predicting acceptance, the Ministry should develop and disseminate a nationally standardized counselling package for health workers that will address the malaria vaccine misinformation.

Conduct longitudinal studies tracking actual vaccine uptake through all four doses will generate the implementation evidence needed to identify at what dose, and for what reasons caregivers disengage from the vaccination program.

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APPENDICES

Appendix 1: Work Plan

No	Activity	May-25	June-25	Oct-25	Dec-25	Jan-26	Feb-26	Mar-26-April 26	Apr-26
1	Concept development								
2	Proposal writing								
3	Proposal Submission								
4	IRB approval and hospital clearance								
5	Data collection								
6	Data analysis								
7	Report writing and dissertation submission								

Appendix ii: Proposed Budget

Item	Quantity	Unit cost	Total Cost
PROPOSAL STAGE			
Proposal production (Printing and binding of drafts to be reviewed)	12 copies	9,000/=	108,000/=
Payment for translation of questionnaire and consent form to Luganda	Lump sum	150,000/=	150,000/=
Payment to SOMREC for IRB clearance		100,000/=	100,000/=
RESEARCH ASSISTANTS			
Recruiting and training of research assistants	2 people	50,000/=	100,000/=
Payment for research assistants	2 people	600,000/=	1,200,000/=
Compensation for study participants of quantitative research	385	10,000	3,045,000
DATA COLLECTION STAGE			
Questionnaire development by IT personnel	1 form	200,000/=	200,000/=
Consent forms production (printing)	Approx. 920 copies	200/=	184,000/=
Airtime for phone calls and data for submission of forms	3	70,000/=	210,000/=
DATA ANALYSIS, REPORTING AND DISSEMINATION			

Data analysis	Lump sum	1,200,000/=	1,200,000/=
Presentation of thesis at the departmental level (printing and binding)	5 copies	12,000/=	60,000/=
Final dissertation production (printing and binding)	5 copies	20,000/=	100,000/=
TOTAL			6857000

Appendix iii: Informed Consent Form

English Informed Consent Form for Caregivers Attending Mulago National Referral Hospital for Quantitative Data

Title of the proposed study: Acceptance of Malaria Vaccines and its Determinants Among Caregivers of Children Under 5 Years at Mulago National Referral Hospital

Principal investigator:

Abito Obua Sharon

Supervisors:

Dr. Bernard Kikaire

Professor Richard Idro

Dr Godfrey Siu Etyang

Dr Jane Nabakooza

Purpose:

The objective of this study is to investigate the willingness to accept the malaria vaccine among caregivers of children under five attending Mulago National Referral Hospital, including knowledge, beliefs and personal factors. The findings of this study will help to inform strategies to improve vaccine uptake and reduce malaria transmission.

Sponsors of the study:

It's a self-sponsored study

Study Duration

The estimated duration the research participant will take in the research project. Every participant will take approximately 15-20 minutes with a member of our team on a single occasion to fill in the questionnaire on willingness to accept the malaria vaccine for your child, including your knowledge, beliefs and personal factors regarding malaria vaccine.

Procedures:

If you agree to participate in this study, you will be asked to participate in the survey with the researcher. The survey will take approximately 15-20 minutes and will be conducted at a time and place convenient to you after your child has been reviewed by the health worker. You will be asked questions about your perceptions and willingness to accept the malaria vaccine for your child, including your knowledge, beliefs and personal factors regarding malaria vaccine.

Who will participate in the study?

We are talking to caregivers of children under five years attending Mulago National Referral Hospital. We expect to involve 385 caregivers who will participate in the survey.

Study site

The study will be conducted at Mulago National Referral Hospital (MNRH), Uganda's final general National Referral Hospital (NRH) at the Pediatrics Outpatient Department.

Risks/Discomforts:

Some questions may cause emotional distress to you, in case that happens, we shall link you to a counselor in hospital. However, you may benefit from the opportunity to contribute to improving malaria vaccine uptake and reducing malaria transmission.

Benefits:

You will not benefit directly from participating in the study however the findings will generate evidence to guide policy makers and health programmers in improving communication on malaria vaccines, strengthen caregiver trust and increase vaccine uptake ultimately helping to reduce malaria illness and deaths among children under five.

Confidentiality:

All information collected about you or your child during this study will be kept strictly confidential. Whatever we ask you will only be used for this research, and a special number will be assigned to you. Your name will not appear on the papers used to collect information. The study team may have access to confidential information. Additionally, the Makerere University School of Medicine Research Ethics Committee and Uganda National Council for

Science and Technology may have access to private information that identifies the research participants by name.

The data collected will be stored securely and will only be accessible to the researcher and the research team. Data will be stored securely for five years as per university policy, after which it will be destroyed. Your responses will be identified by a participant number, not your name. Data will be stored securely for 5 years as per university policy, after which be destroyed.

Alternatives:

Participation in this study is not mandatory. One is free to agree or disagree with participating in this study. Participants are allowed to withdraw from the study at any point without penalty

Costs:

No costs will be met during the conduct of the study as far as the particular participant is concerned.

Compensation for participation in the study:

The participants will be compensated for their time, efforts, and inconveniences caused by study procedures. Compensation will be **ten thousand Ugandan shillings only** for each participant.

Questions about the study:

In Case of any questions related to the study, you can contact the principal investigators Dr. Abito Obua Sharon using the contact: 0776568997 or email abitosharon5@gmail.com

Questions about participants' rights:

In regards to questions or concerns to do with participants' rights, please contact the chairperson of School of Medicine Research Ethics Committee Prof. Ponsiano Ocama on +256 772421190.

Statement of voluntariness:

Participation in this study is entirely voluntary. Participants are allowed to withdraw from the study at any point in the course of the study.

STATEMENT OF CONSENT

..... has described to me what is going to be done, the risks, the benefits involved, and my rights regarding this study. I understand that my decision to participate in this study will not alter my usual medical care. In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Study participant

Name.....

Date.....

Signature/thumbprint.....

Witness

Name.....

Date.....

Signature.....

Name of person obtaining consent

Name.....

Date.....

Signature.....

Appendix iv: Questionnaire For Caregivers Attending Mulago National Referral Hospital

Study Title: Acceptance Of Malaria Vaccines and its Determinants Among Caregivers of Children Under 5 Years at Mulago National Referral Hospital

Introduction: This questionnaire aims to assess the willingness of caregivers to accept malaria vaccines for their children and identify factors influencing their decision. Your participation is entirely voluntary, and all responses will be kept confidential. The information collected will contribute to improving malaria vaccine uptake and reducing malaria transmission.

DATA COLLECTION TOOL: MALARIA VACCINE ACCEPTANCE

PART A. Sociodemographic characteristics

Age /Years

Sex of participant

Male

Female

Relationship with the child

Mother

Father

Sister

Brother

Others. Specify _____

Religion

Christian

Moslem

Level of education

No formal education

Primary

Secondary

Tertiary

Employment status

Civil servant

Self-employed (e.g., business etc.)

Unemployed

Monthly household income

Unknown

Below 500,000UGX

Above 500,000UGX

Family size___/household

Marital status

Single

Married

Cohabiting

Tribe

Central

Eastern

Northern

Western

Place of residence

Urban

Periurban

Rural

Part B: Knowledge regarding malaria infection and vaccination.

No	Question	Yes	No
1	Have you heard of the disease called malaria?		
2	Do you know the cause of malaria?		
3	Have you heard of malaria vaccine?		

4	Do you think malaria is preventable with the use of a malaria vaccine?		
5	Do you believe that a malaria vaccine will reduce the number of man-time lost due to malaria?		
6	Have you heard that the WHO recommended (R21) malaria vaccine for children in Uganda?		
7	Do you believe malaria is a serious health issue that needs vaccination?		
8	Do you agree that a malaria vaccine will reduce the expenditure on treatment?		
9	Do you believe the malaria vaccination will have a negative impact on your health?		
10	Does malaria kill you if it is untreated?		
11	With available treatment and nets, we don't need a vaccine		

PART C: Awareness of malaria and malaria vaccine.

Have you ever heard of malaria vaccine?

Yes.

No

Not sure

If yes, where did you learn about it from (tick all that applies)

Health professionals

Radio

TV

Newspaper

Internet

Social media

VHTs

Others, specify.

To your knowledge, is the malaria vaccine currently available for children in Uganda?

Yes, it is widely available

Yes, only in some areas

No, it is not available

I don't know

In your opinion, for which age group is the malaria vaccine intended?

Children less than 5 years

School going children

Adolescents

Adults

I don't know

What do you believe is the main benefit for the malaria vaccine?

Prevents malaria infection

Prevents children from getting severe malaria

Helps the child grow healthier

Cures existing malaria infections

I don't know

How many shots of the malaria vaccine are required to complete vaccination?

Single shot

Multiple shots

4 shots

2 shots

I don't know

Has your child had malaria in the past 12 months?

A. Yes B. No

Do you know of any child in this community who has died of malaria?

A. Yes B. No

Part D: Acceptance of malaria vaccination

No	Question	Yes	No
1	The Uganda Ministry of Health approved of a malaria vaccine which would reduce the occurrence of malaria by 75% among children younger than 5 years of age, would you be willing to have your child receive this vaccine?		
2	If NO, in case the above vaccine is free of charge and without adverse events, would you still be willing to have your child receive this vaccine?		
3	Do you want to be vaccinated with the malaria vaccine?		
4	Will you spend money to receive malaria vaccine?		
5	Will you take the malaria vaccine if it is given to you by the government?		
6	Should everyone receive malaria vaccine?		
7	Will you encourage your other family members and neighbours to vaccinate their children against malaria?		
8	Do you think the newly discovered WHO recommend (RTS, S) malaria Vaccine for children in 2021 is safe to take?		
9	Have your children received all their vaccines as per national schedules?		
10	Has your child received COVID-19 vaccine?		

If the malaria vaccine was made available at your local health facility, would you be willing to have your child vaccinated?

Yes, definitely

Probably yes

Undecided

Probably no

Definitely no

Would you have all the required doses of the malaria for your child?

Yes, definitely

Probably yes

Undecided

Probably no

Definitely no

Would you recommend the malaria vaccine to a friend?

Yes, definitely

Probably yes

Undecided

Probably no

Definitely no

Has your child already received the malaria vaccine?

.....

What concerns would you have about your child receiving the malaria vaccine?

.....

.....

.....

.....

.....

To what extent do you believe the malaria vaccine would protect your child from getting severe malaria?

Not at all

A little

Moderately

A lot

Completely

If there was a small cost attached to the malaria vaccine (e.g. a registration fee), would you still be willing to have your child vaccinated?

Yes, definitely

Probably yes

Undecided

Probably no

Definitely no

How much would you trust information about the malaria vaccine provided by the following sources (rate from 1 to 5, where 1= no trust at all and 5 = complete trust)

Healthcare providers (nurses, doctors, community health workers)

Community leaders

Radio and TV

Family and friends

Social media

19. Are there specific conditions or assurances that would make you more willing to accept the malaria vaccine for your child?

.....
.....
.....
.....
.....

If no, Reason for not accepting malaria vaccine

Fear of side effects

Ineffective

Others .

PART E: Vaccine preference

Which route of the vaccine administration would you prefer your child to receive?

Oral

Injection

How many doses of the vaccine do you prefer your child to receive?

1 dose

2 doses

3 doses or more

Appendix V: English Informed Consent Form for Caregivers Attending Mulago National Referral Hospital for Qualitative Data

Title of the proposed study: Acceptance of Malaria Vaccines and its Determinants Among Caregivers of Children Under 5 Years at Mulago National Referral Hospital

Principal investigator:

Abito Obua Sharon

Supervisors:

Dr. Bernard Kikaire

Professor Richard Idro

Dr Godfrey Siu Etyang

Dr Jane Nabakooza

Purpose:

The objective of this study is to investigate the willingness to accept the malaria vaccine among caregivers of children under five attending Mulago National Referral Hospital, including knowledge, beliefs and personal factors. The findings of this study will help to inform strategies to improve vaccine uptake and reduce malaria transmission.

Sponsors of the study:

It's a self-sponsored study

Study Duration

The estimated duration the research participant will take in the research project. Every participant will take approximately 30-40 minutes with a member of our team on a single occasion during an interview on willingness to accept the malaria vaccine for your child, including your knowledge, beliefs and personal factors regarding malaria vaccine.

Procedures:

If you agree to participate in this study, you will be asked to participate in an interview with the researcher. The interview will take approximately 30-40 minutes and will be conducted at a time and place convenient to you after your child has been reviewed by the health worker. You will be asked questions about your perceptions and willingness to accept the malaria vaccine for your child, including your knowledge, beliefs and personal factors regarding malaria vaccine.

Who will participate in the study?

We are talking to caregivers of children under five years attending Mulago National Referral Hospital. We expect to involve 24 participants in the in- depth interviews.

Study site

The study will be conducted at Mulago National Referral Hospital (MNRH), Uganda's final general National Referral Hospital (NRH) at the Pediatrics Outpatient Department.

Risks/Discomforts:

Some questions may cause emotional distress to you, in case that happens, we shall link you to a counselor in hospital. However, you may benefit from the opportunity to contribute to improving malaria vaccine uptake and reducing malaria transmission.

Benefits:

You will not benefit directly from participating in the study however the findings will generate evidence to guide policy makers and health programmers in improving communication on malaria vaccines, strengthen caregiver trust and increase vaccine uptake ultimately helping to reduce malaria illness and deaths among children under five.

Confidentiality:

All information collected about you or your child during this study will be kept strictly confidential. Whatever we ask you will only be used for this research, and a special number will be assigned to you. Your name will not appear on the papers used to collect information. The study team may have access to confidential information. Additionally, the Makerere University School of Medicine Research Ethics Committee and Uganda National Council for Science and Technology may have access to private information that identifies the research participants by name.

Data will be stored securely for five years as per university policy, after which it will be destroyed. Your responses will be identified by a participant number, not your name. We may use anonymized quotes from interviews in reports, but no one will be able to identify you. Audio recordings will be destroyed after transcription. We may use anonymized quotes from interviews in reports, but no one will be able to identify you.

Alternatives:

Participation in this study is not mandatory. One is free to agree or disagree with participating in this study. Participants are allowed to withdraw from the study at any point without penalty

Costs:

No costs will be met during the conduct of the study as far as the particular participant is concerned.

Compensation for participation in the study:

The participants will be compensated for their time, efforts, and inconveniences caused by study procedures. Compensation will be **ten thousand Ugandan shillings only (10,000)** for each participant.

Questions about the study:

In Case of any questions related to the study, you can contact the principal investigators Dr. Abito Obua Sharon using the contact: 0776568997 or email abitosharon5@gmail.com

Questions about participants' rights:

In regards to questions or concerns to do with participants' rights, please contact the chairperson of School of Medicine Research Ethics Committee Prof. Ponsiano Ocama on +256 772421190.

Statement of voluntariness:

Participation in this study is entirely voluntary. Participants are allowed to withdraw from the study at any point in the course of the study.

STATEMENT OF CONSENT

..... has described to me what is going to be done, the risks, the benefits involved, and my rights regarding this study. I understand that my decision to participate in this study will not alter my usual medical care. In the use of this information, my identity will be concealed. I am aware that I may withdraw at any time. I understand that by signing this form, I do not waive any of my legal rights but merely indicate that I have been informed about the research study in which I am voluntarily agreeing to participate. A copy of this form will be provided to me.

Study participant

Name..... Date.....
Signature/thumbprint.....

Witness

Name..... Date.....
Signature.....

Name of person obtaining consent

Name..... Date.....

Signature.....

Appendix vi: Semi Structured In Depth Interview Guide For Caregivers Attending Mulago National Referral Hospital

Study Title: Acceptance of Malaria Vaccines and its Determinants Among Caregivers of Children Under 5 Years at Mulago National Referral Hospital

Introduction: This semi structured in depth interview guide aims to assess the willingness of caregivers to accept malaria vaccines for their children and identify factors influencing their decision. Your participation is entirely voluntary, and all responses will be kept confidential. The information collected will contribute to improving malaria vaccine uptake and reducing malaria transmission.

Do you agree for this interview to be audio recorded? This helps us to ensure we capture all your valuable insights accurately.

Socio-Demographic Information

Age years

Gender..... Relationship to child.....

Number of children under 5 years..... Highest level of Education.....

Residence..... Occupation.....

Perceptions of Malaria

In your own words, what is malaria?

Can you share any experiences you have had with malaria in your family?

How do you protect your child from Malaria?

Perception of malaria vaccine

In your view, are vaccines important for child's health? Why or why not?

Where do you usually get vaccines for your children? Which sources do you trust most?

Have you heard about the Malaria vaccine? From where did you hear about it? If yes, what have you heard about it? If no, briefly introduce that the malaria vaccine has been rolled out to prevent severe malaria. What are their initial thoughts?

Acceptance and hesitancy of malaria vaccine

Would you be willing to let your child receive the malaria vaccine? Why or why not?

Who would you consult before deciding to vaccinate your child against malaria?

In your view, are there any beliefs in the community that might influence decisions about vaccine uptake?

Conclusion

Is there anything else you would like to share about the malaria vaccine that we haven't discussed?

(Thank the participant for their time and valuable insights)

Facilitators Initials..... Date.....

Note takers initials.....Date.....

The length of the interview in minutes.....

Appendix vii: Luganda Version of The Consent For Qualitative Data

Omutwe gw'Okunoonyereza: Acceptance of Malaria Vaccines and its Determinants Among Caregivers of Children Under 5 Years at Mulago National Referral Hospital

Omukugu akulira Okunoonyereza kuno:

Abito Obua Sharon

Ba supervisors:

Dr. Bernard Kikaire

Professor Richard Idro

Dr Godfrey Siu Etyang

Dr Jane Nabakooza

Ekigendererwa:

Ekigendererwa ky'okunoonyereza kuno kwekutegeera engeri abakuuma abaana gye bayambibwamu okukkiriza okugema omusujja gweensiri (Malaria). Ebiva mu kunoonyereza bino bijja kuyamba mu kutondawo engeri ez'okwongera ku kugema omusujja gweensiri n'okuggyawo obulwadde bwa malaria mu bantu.

Obudde okunoonyereza kuno bwekunatwala

Buli muntu anetaba mu kunonyereza kuno anatwala eddakika nga 30 ne 40, ne ba memba ba ttimu yaffe okujjuzamu ku bibuzo

Emitendero gyokunoonyereza kuno

Bw'okkiriziganya okwetaba, onooyogeragana n'omukugu w'okunoonyereza eddakika ezitwala wakati wa 30 ne 40. Ojja kubuzibwa ebibuuzo ebikwatagana nokugema omusujja gweensiri. Bino binakolebwa abakugu abatendekebwa munsonga zokunoonyerezebwa.

Bani abetaba mukonyereza kuno:

Abakuuma abaana abato abatlina myaka 5 abaleetebwa e Mulago abawera omuwendo 24.

Ekifo kyokunoonyerezamu

Okunoonyereza kuno kugenda kuba wano ku ddwaliro ekulu eMulago, ku Pediatrics Out Patient Department, gyebajanjabira abaana abalwadde.

Obulabe obuli mu kwetaba mukonyereza kuno:

Tewali bulabe bungi mu kunoonyereza kuno. Ojja kumala obudde butono mu kunoonyereza. Era tojjakusanga buzibu bwona nga wetabye mu kunonyereza kuno

Emigaso gyokwegata mu kunonyereza kuno:

Ebinava mu kunonyereza kuno bijja kukuwebwa wammu nabasawo abakujjanjaba biyambeko abasawo okusalawo obulungi nga bakujanjaba. Tewali nsimbi ezikwasibwa, naye ebivuddeko bijja kuyamba mu kutumbula okukozesa okugema omusujja gwensiri (malaria).

Obukuumi bwebyama:

Ebikwatagana ku gwe byonna ebikunjaanyizibwa mu kunoonyereza kuno bijja kubeera ebyama. Erinnya lyo nendowoza zo zona tebijja kweyambisibwa mu ripooti yonna oba mu bitabo by'eby'okunoonyereza. Binakumibwa mu bifo ebyekyama nga abakugu boka abali mu kunonyereza kuno nga bebabivunanyizibwako boka. Empapula zona nga tumazze okufuna obubako bwo zinakumibwa bulungi nyo mubifo ebyekusiku. Akakiiko ka Makerere School of Health Sciences ne Uganda National Council for Science and Technology bayinza okulaba ku bubaka buno.

Ebirala Ebisobola Okukolebwa

Okwetaba mu kunonyereza kuno sikwabuwasze. Oli wa ddembe okukkiriza oba okugaana. Wadde oyingidde, osobola okuvaamu awatali buzibu bwona.

Ebikozesebwa

Tewali muweereza yenna anakusaba ssente, era tewajja kubeerawo kusasula ssente yona.

Okusasulwa Kuwolereza Ku Kyetabo (Compensation):

Abetaba mu kunonyereza kuno banawebwa essente enkalu **10,000/=** ng'akasimo akokwetaba mu kunonyereza kuno

Ebibuuzo Ku Kunoonyereza

Bw'oba n'ebibuuzo ebikwata ku kunoonyereza, oyinza okukubira omukugu omukulu:

Dr. Abito Obua Sharon ku ssimu: **0776568997** oba email: abitosharon5@gmail.com

Ebibuuzo Ku Ddembe Ly'oyo Eyetaba mukunonyereza kuno

Bw'oba n'ebibuuzo ku buyinza bwo, osobola okukubira Prof. Ponsiano Ocama, Ssentebe wa School of Medicine Research Ethics Committee ku +256 772 421190.

Okukiriza Okwetaba mu kunonyereza kuno nga tokakidwa

Okwetaba mu kunoonyereza kuno kwa kwagala kwo. Osobola okuvaamu ku buli kaseera nga okunonyereza kugenda mu maso

OKUKKIRIZA OKWEYUNGA KU KUNONYEREZA KUNO

..... anyinyode ebigendererwa byokunonyereza kuno wammu nebyo ebirungi bwokwegata kukunonyereza kuno okwo nga kwogasse neddembe lyange mukunonyereza kuno. Ntegedde nti okusalawo kwange okwetaba tekulina kye kukyusa ku bujjanjabi bwange bwa buli lunaku. Njagala okukakasa nti nkoze okusalawo kuno nga mmanyi era nga nzikiriza. Era kopi ya foomu eno ejja kumpebwa.

Erinnya ly'omuntu eyeetabye mukunonyereza kuno

Erinnya: Olunaku: Ekinkumu:

Omujulizi.

Erinnya: Olunaku: Ekinkumu:

Omunooonyereza

Erinnya: Olunaku: Ekinkumu:

Appendix viii; Luganda Version Of The Consent For Quantitative Data

Omutwe gw'Okunoonyereza: Acceptance of Malaria Vaccines and its Determinants Among Caregivers of Children Under 5 Years at Mulago National Referral Hospital

Omukugu akulira Okunoonyereza kuno:

Abito Obua Sharon

Ba supervisors:

Dr. Bernard Kikaire

Professor Richard Idro

Dr Godfrey Siu Etyang

Dr Jane Nabakooza

Ekigendererwa:

Ekigendererwa ky'okunoonyereza kuno kwekutegeera engeri abakuuma abaana gye bayambibwamu okukkiriza okugema omusujja gwensiri (Malaria). Ebiva mu kunoonyereza bino bijja kuyamba mu kutondawo engeri ez'okwongera ku kugema omusujja gwensiri n'okuggyawo obulwadde bwa malaria mu bantu.

Obudde okunoonyereza kuno bwekunatwala

Buli muntu anetaba mu kunonyereza kuno anatwala eddakika nga 30 ne 40, ne ba memba ba ttimu yaffe okujjuzamu ku bibuzo

Emitendero gyokunoonyereza kuno

Bw'okkiriziganya okwetaba, onooyogeragana n'omukugu w'okunoonyereza eddakika ezitwala wakati wa 30 ne 40. Ojja kubuzibwa ebibuuzo ebikwatagana nokugema omusujja gwensiri. Bino binakolebwa abakugu abatendekebwa munsonga zokunoonyerezebwa.

Bani abetaba mukonyereza kuno:

Abakuuma abaana abato abatlina myaka 5 abaleetebwa e Mulago abawera omuwendo 24.

Ekifo kyokunoonyerezamu

Okunoonyereza kuno kugenda kuba wano ku ddwaliro ekulu eMulago, ku Pediatrics Out Patient Department, gyebajanjabira abaana abalwadde.

Obulabe obuli mu kwetaba mukonyereza kuno:

Tewali bulabe bungi mu kunoonyereza kuno. Ojja kumala obudde butono mu kunoonyereza. Era tojjakusanga buzibu bwona nga wetabye mu kunonyereza kuno

Emigaso gyokwegata mu kunonyereza kuno:

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Obukuumi bwebyama:

Ebikwatagana ku gwe byonna ebikunjaanyizibwa mu kunoonyereza kuno bijja kubeera ebyama. Erinnya lyo nendowoza zo zona tebijja kweyambisibwa mu ripooti yonna oba mu bitabo by'eby'okunoonyereza. Binakumibwa mu bifo ebyekyama nga abakugu boka abali mu kunonyereza kuno nga bebabivunanyizibwako boka. Empapula zona nga tumazze okufuna obubako bwo zinakumibwa bulungi nyo mubifo ebyekusiku. Akakiiko ka Makerere School of Health Sciences ne Uganda National Council for Science and Technology bayinza okulaba ku bubaka buno.

Ebirala Ebisobola Okukolebwa

Okwetaba mu kunonyereza kuno sikwabuwasze. Oli wa ddembe okukkiriza oba okugaana. Wadde oyingidde, osobola okuvaamu awatali buzibu bwona.

Ebikozesebwa

Tewali muweereza yenna anakusaba ssente, era tewajja kubeerawo kusasula ssente yona.

Okusasulwa Kuwolereza Ku Kyetabo (Compensation):

Abetaba mu kunonyereza kuno banawebwa essente enkalu **10,000/=** ng'akasimo akokwetaba mu kunonyereza kuno

Ebibuuzo Ku Kunoonyereza

Bw'oba n'ebibuuzo ebikwata ku kunoonyereza, oyinza okukubira omukugu omukulu:

Dr. Abito Obua Sharon ku ssimu: **0776568997** oba email: abitosharon5@gmail.com

Ebibuuzo Ku Ddembe Ly'oyo Eyetaba mukunonyereza kuno

Bw'oba n'ebibuuzo ku buyinza bwo, osobola okukubira Prof. Ponsiano Ocama, Ssentebe wa School of Medicine Research Ethics Committee ku +256 772 421190.

Okukiriza Okwetaba mu kunonyereza kuno nga tokakidwa

Okwetaba mu kunoonyereza kuno kwa kwagala kwo. Osobola okuvaamu ku buli kaseera nga okunonyereza kugenda mu maso

OKUKKIRIZA OKWEYUNGA KU KUNONYEREZA KUNO

..... anyinyode ebigendererwa byokunonyereza kuno wammu nebyo ebirungi bwokwegata kukunonyereza kuno okwo nga kwogasse neddembe lyange mukunonyereza kuno. Ntegedde nti okusalawo kwange okwetaba tekulina kye kukyusa ku bujjanjabi bwange bwa buli lunaku. Njagala okukakasa nti nkoze okusalawo kuno nga mmanyi era nga nzikiriza. Era kopi ya foomu eno ejja kumpebwa.

Erinnya ly'omuntu eyeetabye mukunonyereza kuno

Erinnya: Olunaku: Ekinkumu:

Omujulizi.

Erinnya: Olunaku: Ekinkumu:

Omunooonyereza

Erinnya: Olunaku: Ekinkumu:

Appendix ix: Code Book Summary

Master Thematic Matrix Linking Caregiver Perceptions of Malaria Vaccine to the Health Belief Model (HBM)

Description	HBM Construct	Evidence (Illustrative Quote)	Sub-theme	Theme
High perceived susceptibility driven by continuous exposure increases openness to prevention but may also create fatalism.	Perceived Susceptibility	"In my view, malaria is a disease resulting from mosquitoes that bite us from outside either at night or before we go to sleep..."	Mosquito transmission (day & night exposure)	Understanding of Malaria
Malaria is framed as immediate and disruptive, reinforcing urgency but limited understanding of long-term complications.	Perceived Severity	"Malaria is that fever that attacks you when you didn't sleep under a net."	Malaria as fever/acute illness	Understanding of Malaria
Strong alignment with public health messaging; preventive benefits are recognized and internalized.	Perceived Benefits	"Malaria is that fever that attacks you when you didn't sleep under a net."	Mosquito nets as prevention	Understanding of Malaria
Perceived limitations of single interventions reduce confidence and may require multi-layered strategies.	Perceived Barriers	"...even if you are seated in the sitting room watching news it can come and bite you..."	Incomplete protection from nets	Understanding of Malaria
Indicates exposure to biomedical messaging, though uneven across caregivers.	Cues to Action	"Malaria is a febrile illness that is caused by malaria parasites."	Knowledge of parasites	Understanding of Malaria
Low perceived control may discourage reliance on single preventive methods and increase need for complementary interventions.	Self-efficacy	Implied across narratives of unavoidable bites	Limited control over exposure	Understanding of Malaria
Direct experiences reinforce perception of malaria as life-threatening, strengthening motivation for prevention.	Perceived Severity	"Because it reached a time when the baby was convulsing..."	Severe symptoms (convulsions, weakness)	Experience with Malaria

Repeated exposure normalizes malaria but also highlights persistent vulnerability.	Perceived Susceptibility	"...it is not the first time... she got serious malaria..."	Recurrent malaria episodes	Experience with Malaria
Confidence in treatment may reduce urgency for preventive innovations like vaccination.	Perceived Benefits	"...if it's tested and it's there, there's usually immediate treatment."	Effectiveness of treatment	Experience with Malaria
Treatment burden may motivate preventive uptake if alternatives are trusted and accessible.	Perceived Barriers	"...the situation becomes difficult because it brings about vomiting... worries that you may not recover..."	Burden of illness (stress, disruption)	Experience with Malaria
Nets are perceived as the most effective frontline defense.	Perceived Benefits	"I think a mosquito net is the best option..."	Use of mosquito nets	Protection Practices
High agency in environmental control demonstrates strong behavioral capacity at household level.	Self-efficacy	"Then clearing the bushes, stagnant water..."	Environmental control (bush clearing, water removal)	Protection Practices
Experiential success reinforces continued use of multiple protective strategies.	Perceived Benefits	"...that is the time that we have gone without falling sick."	Use of repellents and smoke	Protection Practices
Behavioral challenges limit consistent implementation of preventive measures.	Perceived Barriers	"...though at times they don't want to sleep under it."	Children resisting nets	Protection Practices
Weak and informal awareness indicates gaps in structured communication.	Cues to Action	"There is something I heard; that they brought a vaccine..."	Vaccination awareness (limited)	Protection Practices
Spiritual beliefs coexist with biomedical practices but may reduce perceived personal control.	Self-efficacy / Perceived Barriers	"...there is no way you can avoid your child from getting malaria... it is God..."	Reliance on divine protection	Protection Practices
Strong perception of severity increases likelihood of vaccine acceptance.	Perceived Severity	"First malaria is a killer disease..."	Malaria as deadly disease	Vaccine Perceptions
Environmental context reinforces urgency for preventive interventions.	Perceived Susceptibility	"...being in an area with high prevalence of malaria..."	High malaria exposure (geographic risk)	Vaccine Perceptions

Vaccines are perceived as reducing severity rather than fully preventing disease.	Perceived Benefits	"...his condition will be much fairer..."	Immunity and reduced severity	Vaccine Perceptions
Economic framing strongly supports vaccine acceptance.	Perceived Benefits	"You reduce on the medical expenses..."	Cost savings from vaccination	Vaccine Perceptions
Safety concerns remain a major deterrent to uptake.	Perceived Barriers	"...maybe be lame, can spoil the kid..."	Fear of side effects	Vaccine Perceptions
Community narratives significantly shape individual perceptions and resistance.	Perceived Barriers	"...vaccines will cause infertility..."	Misinformation (infertility, expired vaccines)	Vaccine Perceptions
Institutional trust enhances acceptance and reduces hesitancy.	Cues to Action	"I have confidence in government programs..."	Trust in government and health workers	Vaccine Perceptions
Multi-channel communication influences awareness but remains inconsistent.	Cues to Action	"Yes, I heard through media announcements..."	Media and community information	Vaccine Perceptions
Decision-making is socially negotiated, not purely individual.	Self-efficacy	"I need to first consult with their father..."	Spousal consultation	Vaccine Perceptions
Confidence is conditional and dependent on external validation.	Self-efficacy	"...consult the professionals... those who have already taken the vaccine..."	Peer and professional reassurance	Vaccine Perceptions