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FACTORS INFLUENCING MALARIA VACCINE UPTAKE IN THE ABURA ASEBU KWAMANKESE DISTRICT

BY

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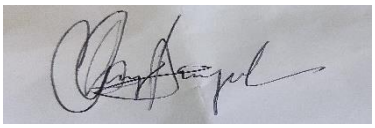
DECLARATION

I, Budu-Acquah Papa Obeng, hereby declare that apart from references to other people's works that have been duly acknowledged, this research work is a result of my independent work and has not been submitted for the award of any degree in any institution.



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DEDICATION

I dedicate this thesis to my beloved sister Nana Adwoa Buduwa Annan, whose enormous support enabled me to complete my studies.

I am also grateful to my entire family for their continuous care and prayers.

ACKNOWLEDGMENT

First and foremost, I express my gratitude to the Almighty God for the favor, blessings, and protection that He bestowed on me throughout my studies

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LIST OF ACRONYMS AND ABBREVIATIONS

AAK-	Abura Asebu Kwamankese
ACT-	Artemisinin Combination Therapy
AEFI	Adverse Event Following Immunization
ANC -	Ante Natal Clinic
AOR -	Adjusted Odds Ratio
BCG -	Bacille Calmette-Guérin
CHPS -	Community-Based Health Planning And Services
CWC -	Child Welfare Clinics
DHIMS-	District Health Information Management Systems
EPI -	Expanded Programme On Immunization
GHS-	Ghana Health Service
ITN -	Insecticide Treated Nets
Iptp-	Intermittent Preventive Treatment Of Malaria During Pregnancy
MVIP-	Malaria Vaccine Implementation Programme
NMCP -	National Malaria Control Programme.
OPV -	Oral Poliovirus Vaccines
OR -	Odds Ratio
PCV -	Pneumococcal Vaccines
PNC -	Post Natal Care
SDHMT-	Sub District Health Management Teams.
UNICEF-	United Nations International Children's Emergency Fund
WHO -	World Health Organization

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ABSTRACT

Background: Vaccination has proven to be one of the most cost-effective tools for infectious disease control in recent decades. RTS, S/AS01E (RTS,S,Mosquirix,) was the first parasite vaccine approved by WHO for widespread use in children in regions with moderate to high malaria transmission. However, low vaccination coverage rate were recorded in the selected districts where the vaccination program is being implemented. The objective of the study was to determine the factors responsible for this low coverage rate in the Abura Asebu Kwamankese district.

Methods: A cross-sectional analytical study was conducted among parents whose children were eligible for malaria vaccination in Abura Asebu Kwamankese district by. The study used questionnaires and maternal and child health records to collect data on factors influencing vaccination. An ordered logistic regression analysis was used to calculate crude(cOR) and adjusted odds ratio (aOR) and 95% confidence intervals (95% CI) with a $p<0.05$

Results: The mean age of respondents was of 28 ± 6 years. The vaccine coverage rate was: 97.77% for RTSS 1, 96.27% for RTSS 2, 95.03% for RTSS 3, and 67.73% for RTSS 4. In the univariate analysis; 'knowledge of the malaria vaccine', 'correct determination of vaccination schedule' 'attitude of health care workers' and "parents who had heard of negative rumors" had significant associations with an increased malaria vaccine uptake. A multivariate ordered logistic regression analysis revealed statistically significant associations between parents who had heard of negative rumors and full uptake (aOR 0.06, 95%CI; 0.02-0.29) and children whose parents rated health workers' attitude as "good" as compared to "bad" (aOR 13.83, 95%CI; (2.33-82.06)

Conclusion: The uptake showed a high vaccine coverage rate for the first three doses of the RTSS vaccine, however, fewer children had received all recommended four doses of vaccine

There is a need for the Abura Dunkwa District Health Directorate to increase awareness , acceptability and accessibility of the malaria vaccines through health education and promotion, professional conduct and public health policies.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Malaria is an infectious disease caused by Plasmodium parasites and transmitted by the bite of an infected female Anopheles mosquito. It occurs mainly in tropical and subtropical climates. The incubation period is 7-14 days, and systemic symptoms include fever, chills, abdominal pain, vomiting, muscle and joint pain, and malaise. If left untreated, malaria can cause severe illness and death within a few days.

In 2020, there were an estimated 241 million malaria cases and 627,000 malaria deaths globally, according to the World Malaria Report 2021. The African region accounted for 95% of all malaria cases and 96% of malaria deaths in 2020, with children under five years of age being the most vulnerable, accounting for almost 80% of all malaria-related deaths (World Health Organization, 2021).

The National Malaria Control Program (NMCP) recorded a total of 10,623,292 confirmed malaria cases in 2021, up from 953,957 in 2020. The proportion of confirmed malaria cases was 159.1 cases per thousand population in 2020 and 161 cases per thousand population in 2021.

Current tools for malaria prevention and elimination include reducing the risk of infection through indoor spraying (IRS) or the use of insecticide-treated bednets (ITNs), intermittent preventive treatment for pregnant women (IPTp), early treatment of malaria with artemisinin-based combination therapies (ACTs), new diagnostic tests, and revised malaria control delivery and evaluation systems.

Vaccination has proven to be one of the most cost-effective tools for infectious disease control in recent decades because it provides protection to vaccinated individuals. The search for an effective malaria vaccine has taken over 30 years. This is due to the genetic complexity of the *Plasmodium* parasite and its complicated multi-stage life cycle that occurs in.

After many years of research and clinical trials, RTS,S/AS01E (RTS,S,Mosquirix,) was approved as the first parasite vaccine by WHO. It is an injectable malaria vaccine developed by GlaxoSmithKline. It has been recommended for widespread use in children living in regions with moderate to high malaria transmission (WHO, 2022). RTS,S is a recombinant protein-based malaria vaccine that targets the circumsporozoite protein on the sporozoite surface of *Plasmodium falciparum.*

The recommendation is based on the results of pilot implementation of RTS,S as part of routine childhood vaccination in areas of Ghana, Kenya, and Malawi, which began in 2019. This first-generation malaria vaccine has shown modest efficacy of about 35% against malaria disease (Laurens, 2020). The vaccine has been shown to reduce malaria in children, including life-threatening severe malaria, associated hospitalizations, and the need for blood transfusions (World Malaria Report 2021, WHO).

In Ghana, the malaria vaccination program began in May 2019 in some selected districts in the Central, Brong Ahafo, Volta, and Upper East regions. Four doses are currently recommended for children. The first three doses are administered monthly at the ages 6, 7, and 9 months, with the fourth dose administered at the age of 24 months.

Abura-Asebu-Kwamankese (AAK) district is one of the selected districts participating in the current malaria vaccination program. The program is highly effective and efficient when the

majority of children are vaccinated. This study will examine the factors associated with the uptake of the malaria vaccine in this district. This will help policy makers find ways to improve uptake and vaccination coverage.

1.2 Problem statement

Vaccines continue to be one of the most efficient and cost-effective means of disease prevention. An estimated 2.5 million child deaths are prevented by vaccines worldwide each year. Approximately 23,000 malaria-related deaths in children can be prevented each year if all children in countries with high incidence of malaria receive the full series of vaccines (Hogan et al., 2020). However, coverage for many vaccines remains low in many low-income countries. WHO estimates that by 2021, approximately 25 million children under the age of one, will have not received essential life-saving immunizations.

In Ghana, childhood immunization under the Expanded Immunization Program (EPI) has helped reduce infant mortality and morbidity. Yet many children living in Ghana's inner cities and densely populated urban areas are not reached and are exposed to vaccine-preventable diseases at a young age. In 2015, 63 of Ghana's 216 districts failed to meet the 80% immunization coverage target for Penta 3 (Yawson et al., 2017).

RTS,S 1 (first dose) coverage in AAK was 39.2% in 2019 and improved to 59.6% and 68.8% in 2020 and 2021, respectively, but there was a decline in coverage rates for the three subsequent doses (DHIMS2, 2021). These coverage rates are well below the 90% target set by WHO for all childhood vaccines. Despite the District Health Directorate's measures such as booster campaigns, child health promotion, and home visits, vaccine coverage rates have not improved considerably.

The expected impact of the malaria vaccination program is unlikely to occur in Ghana if vaccine uptake is not optimal. Factors such as educational level, poverty, knowledge of vaccines and adverse effects following immunization are known to influence vaccine uptake and compliance. This study aims to investigate the factors associated with malaria vaccine uptake in AAK district in the Central Region of Ghana.

1.3 Justification

Given the high burden of malaria, there is a strong need for an effective vaccine to prevent the disease. Vaccines work by stimulating the body's immune system to recognize and fight off the pathogen that causes the disease. A malaria vaccine would reduce the number of cases and deaths, as well as the economic burden associated with the disease, which primarily affects low- and middle-income countries. A malaria vaccine is justified by the high burden of the disease, the need to reduce the number of cases and deaths, and the potential economic benefits that could be achieved through prevention of the disease. The program will be more effective and efficient when majority of children are vaccinated. This study examined the factors associated with the uptake of the malaria vaccine in AAK district. This will assist policymakers in determining methods to improve uptake and vaccination coverage.

1.4 Conceptual Framework

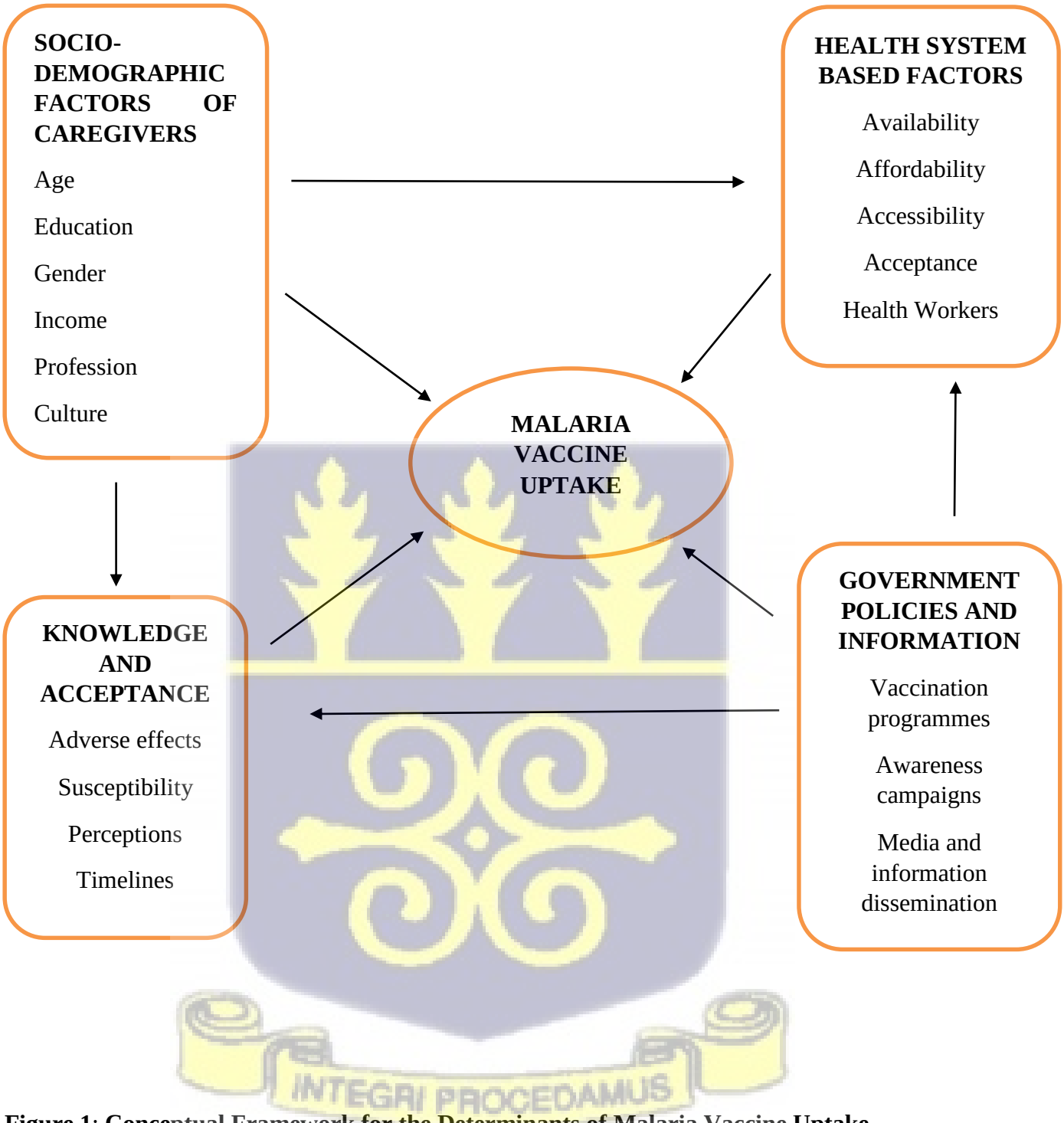

Figure 1: **Conceptual Framework for the Determinants of Malaria Vaccine Uptake**

1.4.1 Narration of Conceptual Framework

Figure 1 illustrates the interactions between various factors that may influence malaria vaccine uptake. Sociodemographic factors such as age, gender, income, occupation, education level, and others play an important role in understanding and accepting childhood vaccines. The less educated and those with lower income or economic status are more likely to be hesitant. They are likely to live in places where access to health facilities is difficult and tend to have less knowledge and poor perceptions of childhood immunization, which are rooted primarily in their cultural practices. The presence of health facilities facilitates caregivers' access to vaccines and schedule information and also reduces direct and indirect costs. Government policies through education, ensuring availability of vaccines, campaigns, and dissemination of information about vaccines are positively related to increasing vaccination rates.

1.5 Research Questions

1. What is the malaria vaccine coverage rate among children in the Abura Asebu Kwamankese district?

2. What are the challenges in implementing the malaria vaccination program in the Abura Asebu Kwamankese district?

3. Which factors influence compliance to the malaria vaccination schedule?

1.6 Main Objective

To determine the factors influencing the uptake of the malaria RTSS vaccine among children in the Abura Asebu Kwamankese district

1.7 Specific Objectives

1. To determine the vaccine coverage rate among children in the Abura Asebu Kwamankese district.

2. To assess the challenges in implementing the malaria vaccination program in the Abura Dunkwa district.

3. To determine factors influencing compliance to the malaria vaccination schedule.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

Malaria is a parasitic disease that is transmitted through the bites of infective female Anopheles mosquitoes. It affects over 200 million people annually and leads to an estimated 400,000 deaths each year, primarily in children under the age of five in sub-Saharan Africa. Malaria symptoms typically include fever, chills, headache, and muscle aches, which can appear between 7 to 30 days after a person is bitten by an infected mosquito. Without early interventions and treatment, malaria can progress rapidly and lead to severe complications, including organ failure, coma, and death.

Malaria is caused by parasites of the *Plasmodium spp*. There are several different species of Plasmodium (*Plasmodium sp*.) that cause malaria in humans, including: *P. falciparum, P .vivax, P. malariae, P. ovale, P. knowlesi* .

P. falciparum is primarily found in Sub-Saharan Africa and is the most lethal *Plasmodium sp*, accounting for the majority of malaria-related deaths globally.

2.2 Vaccination/Immunization

Vaccination and immunization are related terms that are often used interchangeably, but they have slightly different meanings. Vaccination refers to the process of administering a vaccine, which is a substance that contains a weakened or dead pathogen or a piece of it. The vaccination stimulates the body's immune system to create a reaction, which can help protect the person from future pathogen infections.

Immunization, on the other hand, is the process by which a person becomes immune to a particular pathogen. This can occur naturally when the person is exposed to the pathogen and their immune system produces a response that protects them from future infections.

Immunization/vaccination coverage measures the proportion of children who have been vaccinated against a specific antigen to the number of children who are expected to be vaccinated. It is an important indicator of the health system's performance and output.

2.3 Malaria vaccine

RTSS/AS01 is the first malaria vaccine shown to have a significant impact on reducing the burden of malaria in children (WHO, 2019). GlaxoSmithKline (GSK), a British pharmaceutical company, began developing the vaccine in 1987. The vaccine was developed by GlaxoSmithKline in collaboration with the PATH Malaria Vaccine Initiative. RTS,S/AS01 is a monovalent recombinant protein that contains a portion of the *Plasmodium falciparum* circumsporozoite protein, which is the target of the immune response. The vaccine is adjuvanted with AS01, which is a proprietary adjuvant system developed by GSK. In clinical trials, RTS,S/AS01 has been shown to provide partial protection against malaria, with an efficacy of around 50% in children aged 5-17 months and 30-40% in infants aged 6-12 weeks. After years of testing and development, the vaccine was shown to be effective in 2014 (PATH, 2019). In 2019, WHO initiated a malaria vaccine pilot trial in Ghana, Malawi, and Kenya. It is expected that the RTSS malaria vaccine will contribute to malaria prevention.

2.4 Factors that influence uptake of vaccines

Vaccine hesitancy is a delayed acceptance or rejection of vaccines despite their availability, usually due to low levels of confidence in the efficacy and/or safety of a vaccine, the health system,

the government and vaccine manufacturers. Factors that can influence the uptake of vaccines include; sociodemographic and socioeconomic factors, knowledge and perceptions about the vaccine, cultural and religious beliefs, history and experience with vaccines and health service associated factors.

2.4.1 Sociodemographic and economic factors

Sociodemographic and economic factors including age, gender, education level, income, race, ethnicity, religion, occupation, income, and geographic location a significant role in vaccine uptake. A study conducted in Nigeria found that several socioeconomic factors including the parents' education level, age, and occupation, household wealth, and place of residence were associated with childhood immunization coverage (Oleribe et al. 2017).

Similarly, in the Democratic Republic of Congo(DRC), factors such as maternal education, maternal age, household wealth, and maternal knowledge about vaccines were found to be significant predictors of child immunization (Acharya et al. 2017). In the Sunyani municipality, Tabiri et al. found that children whose parents had higher levels of education were more likely to receive all recommended doses of the malaria vaccine in the Sunyani Municipality (Tabiri et al., 2021). Ofosu et al also found that mothers' age, occupation, knowledge, and education level were major drivers of vaccine uptake in Assin North Municipality, Ghana (Ofosu, 2017).

2.4.2 Knowledge and perceptions of vaccination

Knowledge can be defined as facts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject. It also defines it as awareness or familiarity gained by experience of a fact or situation.

Gaining knowledge and becoming aware of the vaccine one is giving to her child can enhance demand and uptake. Similarly, individuals who have a good understanding of vaccines and their role in preventing diseases are more likely to take up a vaccine when it becomes available.

Owais et al. found that maternal knowledge about vaccines improved significantly in the intervention group compared to the control group. There was also a significant increase in the proportion of fully immunized infants in the intervention group compared to the control group (Owais et al., 2011).

Febir et al. discovered that most mothers in Kintampo had a widespread knowledge of childhood immunizations and were willing to vaccinate their children against malaria (Febir et al., 2013)

2.4.3 Health service related factors

According to studies, access to healthcare services, affordability of healthcare, and vaccine availability and attitudes and competency of health care providers are all major factors that can influence vaccination coverage and acceptability. Lack of access to specific vaccines due to shortages or distribution challenges may result in decreased immunization rates among children in these areas.

A study in the Kassena Nankana Municipality revealed a strong association between health service factors and malaria vaccine uptake (Yeboah et al,. 2022).

Ekouevi et al. also found that distance and access to vaccination centers was a significant predictor of incomplete immunization (Ekouevi et al., 2018)

A good attitude by healthcare workers towards vaccination can have a significant impact on vaccine coverage. It can help to build trust and confidence in the vaccine, educate patients about

its importance, and serve as a positive influence on patients' decision-making regarding vaccination.

The likelihood of receiving a future malaria vaccine for one's child was substantially correlated with having a moderate level of satisfaction with the services provided in a health facility (Ojakaa et al, 2017).

A multilevel logistic regression study conducted by Abadura et al. found that ANC accessibility and utilization by mothers and were positively associated with full immunization coverage whilst distance to health facilities were negatively associated with full immunization coverage (Abadura et al, 2015).

2.4.4 Previous experiences with vaccinations

There is evidence to suggest that previous experiences with vaccinations can impact a person's decision to get vaccinated again in the future, but the exact nature of this association may depend on various factors, including the specific vaccine, the person's past experiences, and their current beliefs and attitudes. Research has shown that individuals who have had positive experiences with vaccines in the past are more likely to get vaccinated again in the future, while those who have had negative experiences such as AEFIs, may be more hesitant.

CHAPTER THREE

3.0 RESEARCH METHODS

3.1 Research Approach

The study approach used a quantitative method.

3.2 Study Design

This study was conducted using an analytical-cross sectional research design. The collection of data was done at a single point in time for both independent and dependent variables. The study population included parents/caregivers of children who were eligible to have taken all four doses of the vaccine in the AAK district. Structured questionnaires were used to collect data from parents/caregivers on factors influencing vaccine uptake. Maternal and Child Health record books and cards were used to collect data on the level of vaccine uptake, pregnancy and delivery-related factors.

3.3 Study Area

3.3.1 Location

The study was conducted in the AAK district. The district consists of 262 communities with Abura Dunkwa as the capital. The population of the district is estimated at 124,465 in the 2021 Population and Housing Census. The district consists of three traditional areas namely; Asebu in the south, Abura further inland in the north and northwest and Kwamankese in the northeast

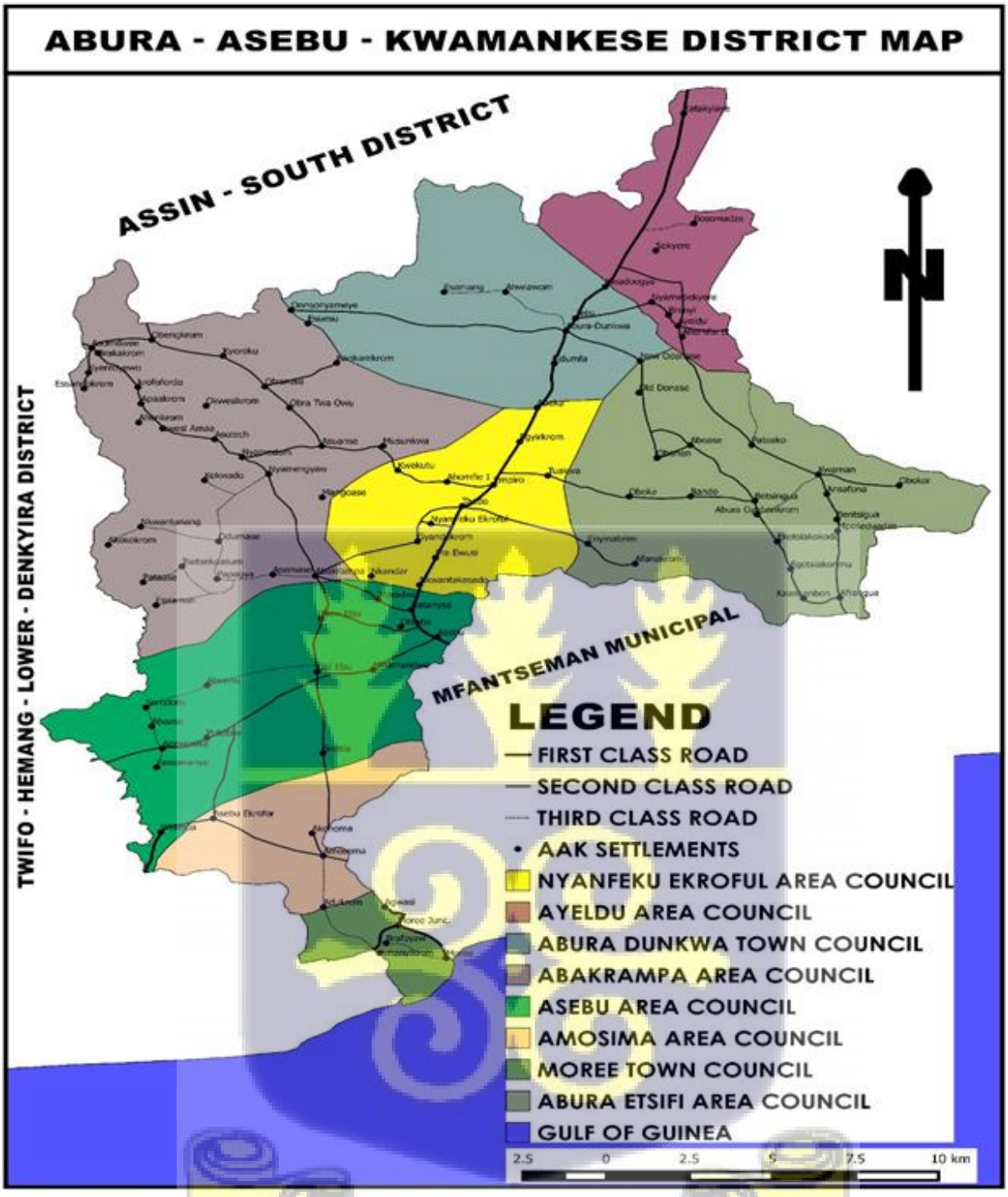

Figure 2: A map of Abura Asebu Kwamankese District (Source AAK District Directorate, 2021)

3.3.2 District Health System

Health services in the district are provided by different sectors: traditional (orthodox), spiritual, governmental and private health institutions. The District hosts the largest number of prayer camps in the central region, where people come to seek spiritual healing and guidance. Many of these spiritual healing centers, popularly known as GARDEN or AWOYO, seem to be the first point of call for most people suffering from one illness or another.

The health services are structured to provide both preventive and curative services. While curative services are usually provided in facilities, preventive services are usually provided at the community level and during home visits by health officials.

The introduction of the National Health Insurance Scheme (NHIS) has contributed to increased utilization of government health facilities The following services are provided: Child health services, school health services, nutrition services, and reproductive health services.

3.3.3 Sub-district Level:

The District is divided into six (6) sub-districts, each with a management team known as the Sub-District Health Management Team (SDHMT). The six sub-districts are:

- Asuansi Sub-district
- Moree Sub-district
- Abakrampa Sub-district
- Abura Dunkwa Sub-district
- Asebu sub-district
- Gyabankrom Sub-district

3.3.4 Health facilities

Table 1: Health Facilities located in the district

Type of Health Facility	Number of facilities
District Hospital	1
Health Centers (Moree, Abakrampa)	2
Rural Clinics (Asuansi)	1
Reproductive and Child Health Center	1
CHPS Compounds Gyabankrom, *Ayeldo, Kwadoegya *Kwamankese *Korado *Mpeseduadze, Obohen, Obokor, Batanyaa, New Ebu *Old Ebu *Nkwantanan *Papagya, Amosima, *Asebu, Asebu Ekroful *Putubiw, Brafoyaw Moree Sorodofo/Abaasa, Asomdwee *Asuansi, Musumkwa *Okyiriku Srafa Enyinabrim New Odonase Tuakwa, Abaka, Obengkrom, Nyanfeku Ekroful, Abuenu	32
Infirmiries (Aburaman Snr High, Aggrey Mem. Snr High, Asuansi Tech/Snr. High, Abakrampa Snr. High)	4
Ambulance Services (GAS)	1

3.3.5 Human Resources

In 2022, there were four (4) physicians, five (5) medical assistants, and two hundred and seventeen (217) nurses in the District. In addition, there are three (3) Public Health Nurses, three (3) technical

staff (disease control) and seventy-five (75) community health nurses (AAK Health Directorate, 2022). Thus, the physician to population ratio is 1:31770 (WHO standard 1:5000) and the nurse to population ratio is 1:479 (standard 1:1000).

3.4 Variables

Variables that were considered in the study are subsequently discussed.

3.4.1 Dependent Variables

In this particular study, uptake of the malaria vaccine (RTS,S) was the dependent variable. The uptake rate of the malaria vaccine was determined according to whether a child received one or all doses of the vaccine (i.e., RTS,S 1, RTS,S 2, RTS,S 3, and RTS,S 4).

The first dose of malaria vaccine, designated RTS,S 1, should be given to children 6 months of age. The second dose (RTS,S 2) is to be administered at 7 months of age. RTS,S 3, the third dose, is to be given to children at 9 months of age. The final dose of malaria vaccine, RTS,S 4, is given to children at 24 months of age.

A full vaccine uptake is considered when a child has received all four doses. No uptake is considered when a child receives none of the vaccines.

3.4.2 Independent Variables

The following factors were considered as independent variables: sociodemographic characteristics of the parents or caregiver (such as age, educational level of both parents or caregivers, marital status, occupation and religion; knowledge and acceptance of the parents or of the caregiver regarding vaccines (such as knowledge, awareness, and timing); history or experience of the parent

or caregiver with the vaccine; social media and public opinion about the vaccine; religious and personal beliefs about the vaccine; health care system factors (e.g., attitude and competency of health workers, accessibility to health care, availability of vaccines). The operational definitions for the independent variables have been provided in Table 2.

Table 2: Definition of independent variables and scale of measurement

Variables	**Operational Definition**	**Type of Variable**	**Measurement**
Socio-Demographics	During period of vaccination of index child		
Age	Parent/caregiver's age in completed years at time of delivery	Ordinal	1= 15-19 years 2= 20-24 years 3= 25-29 years 4= 30-34 years 5= 35-39 years 6= 40 and above
Sex	Being a male or female	Nominal	1= Female 2= Male
Educational Status	Highest level of education attained	Ordinal	1= No formal education 2= Basic 3=Secondary 4=Tertiary
Marital Status	Legally defined marital relationship with partner	Nominal	1= Co-habiting 2= Married 3= Single (, Separated, Widowed, Divorced)
Occupational status	What the person does for a living	Nominal	1= Apprentice 2= Student 3= Unemployed 4= Employed
Religion	Religious denomination	Nominal	1= Christian 2= Muslim 3= Others (Atheist , Traditionalists etc)
Subdistrict	Subdistrict where immunization center of attendance is located	Nominal	1= Abakrampa 2= Abura Dunkwa 3= Asebu 4= Asuansi 5= Gyabakrom 6= Moree

Pregnancy and Delivery related			
Place of delivery	Where child was delivered	Nominal	1= Health facility 2= Home (Any other place outside a health facility)
Antenatal (ANC) attendance	How many ANC visits made	Ordinal	1= 0-4 times 2= 5-9 times 3= 10 and above
Post-natal attendance	Was the child taken for PNC visits	Binary	1= No 2= Yes
First child	Is the index child the first child	Binary	1= No 2= Yes
Knowledge and Perception			
Knowledge on vaccine	Having heard of the malaria vaccine	Binary	1= No 2= Yes
Knowledge on number of doses needed	Being able to correctly determine number of doses given	Binary	1= No 2= Yes
Time for first dose	Being able to correctly determine month where first dose is given	Binary	1= No 2= Yes
Time for last dose	Being able to correctly determine month where last dose is given	Binary	1= No 2= Yes
Heard of negative rumors	Having heard of the any negative rumors concerning the malaria vaccine	Binary	1= No 2= Yes
History of vaccine adverse effect	Whether any of respondent's child has ever suffered an adverse reaction from any vaccine	Binary	1= No 2= Yes
Health care related factors			
Attitude of HCW	Describing the attitude and competency of health care workers at immunization centers	Ordinal	1= Bad 2= Fair 3= Good
Distance to Immunization center	Rating how far centers are from their homes	Ordinal	1= Close 2= Very Close 3= Far 4= Very Far

Openness of Immunization center	Is the center in an enclosed place or an open space	Nominal	1= Enclosed 2= Open

3.5 Study population

The study population were parents and caregivers of children between the ages of 2-3 years by January 2023 and currently living in the district. The RTS,S vaccine is administered at ages 6, 7, 9, and 24 months. This indicates that during the time of this study, children who would have been eligible for a full uptake would be between the ages of 2-3 years. Table 3 outlines the population per sub-district.

Table 3: Population of the Sub-district

Sub-district	Population
Asuansi Sub-district	17791
Moree Sub-district	25416
Abakrampa Sub-district	22874
Abura Dunkwa Sub-district	26941
Gyabankrom Sub-district	18172
Asebu Sub-district	15885
Total	127079

3.5.1 Inclusion criteria

1. All parents or caregivers with children between ages of 2-3 years who were registered in Child Welfare Clinic (CWC) in the Abura Asebu Kwamankese district.

3.5.2 Exclusion criteria

1. All parents or caregivers in Abura Asebu Kwamankese district whose children were exempted from malaria vaccination based on medical reasons and age.
2. Parents or caregivers who were below 18 years as of time of the study.

3.6 Sample size calculation

The minimum sample size for this study was calculated with Cochran's Formula

$$n = \frac{z^2_{1-\alpha/2} P(1-P)}{d^2}$$

Where

n = the minimum sample size,

p = the proportion of children who take RTSS vaccine

$z^2_{1-\alpha/2}$ = statistic corresponding to the level of confidence.

d =is the error of margin allowed.

A confidence level of 95% and an error margin of 5% were used. The malaria vaccine annual coverage for full RTSS 1-4 in 2021 was 39%. Thus

p = 0.39

$z^2_{1-\alpha/2}$ = 1.96

d = 0.05

$$n = \frac{1.96^2 \times 0.39(1-0.39)}{0.05^2}$$

n = 365.57

n = 366

To adjust for a possible 10% non-response rate, we calculate as:

n = 365.57 + (0.1 x 365.57)

n = 365.57 + 36.55 = 42.22

n = 402.13

n = 403

3.6.1 Sampling technique

A proportionate stratified sampling technique was used to select the right portion of the population per sub-district. The total population was divided into sub-districts where a proportional fraction was used to allocate the sample to be derived from each sub-district. At the sub-district level, a sampling frame was constructed which included all the names of children who met the eligibility criteria in alphabetical order. This information was gathered from CWC registration books across the sub-district from the various Community-Community Health Planning and Services (CHPS). A computer-generated random sampling was used to select the children per the required number of participants in the sub- district. First, a list of names of the children per each sub-district was entered into Excel. A range of numbers corresponding to the number of children was generated. Names were randomly selected using the RANDBETWEEN function command. The parents/caregivers of the selected children were contacted via mobile phone or traced using their home addresses. Those who volunteered to participate were interviewed at a place of their convenience including market places, CWC centers and their homes.

3.6.2 Sample size distribution

The proportionate stratified random sample was obtained using this formula: **(sample size/population size) x stratum size**. Details provided in Table 4

Table 4: Distribution of sample size per sub-district

Sub-district	Stratum size	Sample proportion	Stratum sample size (whole number)
Asuansi Sub-district	17791	(403/127079)x17791 = 56.42	56
Moree Sub-district	25416	(403/127079)x25416 =80.6	81
Abakrampa Sub-district	22874	(403/127079)x22874 = 72.54	73
Abura Dunkwa Sub-district	26941	(403/127079)x26941 = 85.4	85
Gyabankrom Sub-district	18172	(403/127079)x18172 = 57.62	58
Asebu Sub-district	15885	(403/127079)x15885 = 50.3	50
Total	127079		403

3.7 Data collection technique

Respondents were given questionnaires to complete. Questions were based on socio-demographic characteristics, perceptions and knowledge of the malaria vaccine, past experience with vaccination, information on social media, health system factors and accessibility of vaccines, and religious/traditional beliefs about the malaria vaccine in AAK District.

A google form link of the questionnaire was generated and provided via WhatsApp to respondents who were educated and desired to respond online. In-person interviews were done for respondents who were illiterate, to assist in answering questionnaires. Translation of questionnaires into a local

dialect of respondent choice was provided. Maternal and Child Health record books and cards were used to gather data on the level of vaccine uptake, compliance to the schedule, and pregnancy and delivery-related characteristics

Research assistants, which also included Community Health Nurses (CHN) were trained in the collection exercise.

3.8 Quality control

To avoid errors in data collection, all research assistants were trained. All necessary ethical considerations such as informed consent, confidentiality, the potential for harm, voluntary participation, and communication of results were duly addressed. When necessary, questions were translated into local languages for participants to ensure correct responses. Data entered were checked for errors to ensure that no values were missing or incorrectly reported

3.9 Data processing and analysis

Data collected from the Google forms and printed questionnaires were entered into Microsoft Excel for data cleaning and then imported into Stata 17 for further analysis. Descriptive statistics were performed for the independent variables. Ordinal logistic regression was performed to calculate the odds ratio at the univariate level. Statistically significant variables ($p < 0.05$) were included in a multivariate ordered logistic regression model to determine the factors contributing to complete vaccination (adjusted odds ratio and 95% confidence intervals) The results obtained were presented in tables and graphs with odds ratios, p-values, and percentages, and discussed using the relevant literature.

3.10 Ethical Considerations

Ethical approval was sought from the Ghana Health Service Ethics Review Board. Approval was given on 28th November 2022 with reference number: GHS-ERC 060/09/22. In addition, permission was obtained from the regional health directorate, district health directorate and various health facility heads before the commencement of data extraction.

Informed consent was sought from all respondents after the purpose, objectives, and benefits of the study had been explained to them They were made to know that they were free to withdraw from the study even after giving their consent. Contact numbers of the principal investigator, supervisor and the administrator of the Ethics Review Committee were made available to all respondents to enable them to contact, in case they have concerns.

Data collected and entered was stored under lock with only the investigators having access to it. Data from google forms was made only available to the principle investigator.

To ensure confidentiality, there were no identifying information about the participants taken.

All possible social or psychological risks associated with the study were kept to an absolute minimum by ensuring the confidentiality and privacy of participants' responses.

Respondents were not compensated for partaking in this study.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic characteristics of parents/caregivers and their children

A total of 403 respondents from the Abura Asebu Kwamankese district successfully participated in this study. Respondents were aged between 18-57 years, with a mean age of 28 ± 6 years. 98% of these were parents. The majority of respondents (98%) were parents and females (97%). Most of the respondents were Christians (89%). More than half (59%) were engaged in an occupation. Among the respondents, 56% were married with 27% of them co-habiting. The majority of them (66%) had received only a primary level of education.

The Socio-demographic characteristics of respondents have been captured in Table 5

Table 5: Socio-demographic characteristics of parents/caregivers and their children

Participants n=403		
Variables	**Frequency**	**Percentages(%)**
Subdistrict of Abode		
Abakrampa	73	18.11
Abura Dunkwa	85	21.09
Asuansi	50	12.41
Gyabankrom	56	13.90
Moree	58	14.39
Total	403	100
Sex of parent/caregiver (years)		
Female	392	97.27
Male	11	2.73
Age of parent/caregiver (years)		
Mean age ± SD	27.92 ± 6.33	
15-19	28	6.95

20-24	100	24.81
25-29	114	28.39
30-34	108	26.80
35-39	34	8.44
40 and above	19	4.71
Parent or Caregiver		
Parent	401	98.61
Caregiver	2	1.39
Religion of Parent		
Christian	362	89.82
Muslim	39	9.68
Others	2	0.50
Religion of Partner		
Christian	348	86.35
Muslim	43	10.67
Others	12	2.98
Marital Status		
Co-habiting	111	27.54
Married	225	55.84
Single	67	16.62
Occupational Status of Parent		
Apprentice	36	8.93
Student	24	5.96
Unemployed	106	26.30
Employed	237	58.81
Occupational Status of Partner		
Apprentice	16	3.97
Student	8	1.99
Unemployed	25	6.20
Employed	354	87.84
Educational Status of Parent		
No formal education	34	8.44
Basic	264	65.51
Secondary	74	18.36
Tertiary	31	7.69

Educational Status of Partner		
No formal education	33	8.19
Basic	199	49.38
Secondary	106	26.30
Tertiary	65	16.13
Sex of Child		
Male	226	56.08
Female	177	43.02

4.2 Pregnancy and delivery related characteristics

The mean number of ANC attendance among participants was 6 ± 2 times and 97% of the respondent attended post-natal care (PNC) after delivery. The majority of respondents delivered the child in a health facility (85%) and only 27% of the children were the first child of their parents.

Details of these characteristics are provided in Table 6

Table 6: Pregnancy and delivery related characteristics

Participants n=403		
Variables	**Frequency**	**Percentages(%)**
No. of ANC attendance		
Mean ± SD	6.15 ± 2.35	
0-4	94	23.33
5-9	277	68.73
10 and above	32	7.94
Place Of Delivery		
Home	61	15.14
Health Facility	342	84.86
Attended PNC		
No	13	3.23
Yes	390	96.77

First Child		
No	293	72.70
Yes	110	27.30

4.3 Level of uptake of RTSS vaccine and associated factors

Nine children received none of the malaria vaccines. Two parents of these children cited personal reasons for not accepting to vaccinate their children whilst seven claimed the decision was made by their partners.

A majority (98%) of the children had received the first dose. The percentage of children who took both the first and second doses declined to 97. % and further declined to 95. % for those who took the first, second and third doses. Only 68% of children from the survey received the full required dose of the vaccine.

Out of the 130 participants whose children had not taken all four doses, most respondents (42%) had no knowledge on when to send the child for vaccination. Thirty-two percent (32%) claimed they were not in an implementing district when the next dose was due, whilst others cited various reasons.

Details of the level of uptake of RTSS and associated factors are provided in Table 7

Table 7: Level of uptake of RTSS vaccine and associated factors

Participants n=403		
Variables	**Frequency**	**Percentages(%)**
None	9	2.23
RTSS 1	394	97.77
RTSS 2	388	96.27
RTSS 3	383	95.03
RTSS 4	273	67.73

Reason for None Taken (n=9)		
Partner's decision	2	0.50
Personal decision	7	1.74
Reason for failed completion (n=130)		
Child/parent wasn't around	41	31.54
Did not know next one	54	41.54
Not comfortable with side effects of vaccination	9	6.92
Fear of issues related to the vaccine	8	6.15
I was busy/no time	8	6.15
Not needed/necessary	6	4.62
Vaccines not available	4	3.08

4.4 Knowledge and Perception of RTSS Vaccine

Most of the participants (72%) had heard about the malaria vaccine and 88% heard about it in a health facility. Only 20% of participants could rightly determine the number of doses needed for full vaccination.

A few of the participants who knew about the malaria vaccine had heard negative reports about the vaccine. These included reports such as vaccines being new and dangerous, Africans being used as guinea pigs in the clinical trial phase and others.

Details on knowledge and perception of the RTSS vaccine are given in Table 8

Table 8: Knowledge and perception of the RTSS vaccine

Participants n=403		
Variables	**Frequency**	**Percentages(%)**
Heard of the RTSS vaccine		
Yes	292	72.46
No	111	27.54
Medium through which information was heard (n=292)		
Health Facility/Personnel	258	88.36
Mass/Social Media	31	10.62
Other People	3	1.02
Able to correctly determine number of doses needed		
Yes	79	19.60
No	324	80.40
Able to correctly determine time for first dose of vaccine		
Yes	71	17.62
No	332	82.38
Able to correctly determine time for last dose of vaccine		
Yes	100	24.81
No	303	75.19
Heard of negative rumors on RTSS vaccine		
Yes	15	3.72
No	388	96.28
Medium through which rumor was heard (n=15)		
Other People	8	53.33
Health Personnel/Health facility	2	13.33
Mass/Social Media	5	33.34
History of a vaccine adverse effect		
Yes	67	16.63
No	336	83.37
Type of Adverse Effect (n=67)		
Swelling/Abscess	24	35.82
Gastroenteritis	2	2.99
Pyrexia	41	61.19

4.5 Health care related factors

Most of the participants (93%) rated the attitude of health personals at immunization centers as good, whilst 95% stated that the nurse who administered the vaccine did a good job. Most of the immunization centers were judged to be very close (45%) and 22% were close to the place of dwelling of participants, with 26% acknowledging the distance to be far and 7% of them staying very far from the centers. The majority of these centers (61%) were held in an open space. Details on health care related factors are shown in Table 8

Table 9: Health care related factors

Participants n=403		
Variables	**Frequency**	**Percentages(%)**
Attitude of HCW at RCH		
Bad	5	1.24
Fair	25	6.20
Good	373	92.56
Distance to Immunization center		
Very Close	90	22.34
Close	182	45.16
Far	105	26.05
Very Far	26	6.45
Openness of Immunization center		
Enclosed Space	158	39.21
Open Space	245	60.79

4.6 Association between socio-demographic factors and level of uptake

There were no statistically significant association between socio-demographic factors and a full vaccine uptake ($p<0.05$)

Table 10 provides details of the association between socio-demographic factors and the level of uptake of malaria RTSS vaccine. Details of the association between socio-demographic factors and level of uptake are shown in table 10.

Table 10: Association between socio-demographic factors and level of uptake

Variables	Odds ratio	P-value	95% CI
Age of parent/caregiver at delivery (years)	**1.16**	**0.08**	**0.98-1.38**
15-19	1 (base)		
20-24	1.75	0.21	0.73-4.19
25-29	1.18	0.70	0.51-2.77
30-34	1.52	0.34	0.65-3.40
35-39	2.85	0.07	0.92-8.78
40 and above	4.03	0.06	0.94-17.10
Sex of parent/caregiver	**0.79**	**0.71**	**0.23-2.73**
Female	1 (base)		
Male	0.79	0.71	0.23-2.73
Educational Level of Parent	**0.97**	**0.78**	**0.79-1.20**
Basic	1 (base)		
No formal education	0.45	0.03	0.22-0.92
Secondary	2.22	0.02	1.16-2.24
Tertiary	0.40	0.02	0.19-0.85
Educational Level of Partner	**0.97**	**0.77**	**0.82-1.16**
Basic	1 (base)		
No formal education	0.57	0.14	0.27-1.20
Secondary	1.17	0.55	0.70-1.95
Tertiary	0.78	0.40	0.43-1.40
Occupational Status of Parent	**1.04**	**0.69**	**0.85-1.29**
Apprentice	1 (base)		
Student	0.74	0.60	0.25-2.23
Unemployed	0.98	0.96	0.44-2.20
Employed	0.82	0.59	0.39-1.72

Occupation Status of Partner	**1.11**	**0.60**	**0.75-1.63**
Apprentice	1 (base)		
Student	0.48	0.43	0.08-2.97
Unemployed	1.05	0.94	0.25-4.46
Employed	0.64	0.45	0.21-2.01
Marital status	**1.02**	**0.88**	**0.75-1.41**
Cohabiting	1 (base)		
Married	1.06	0.824	0.65-1.70
Single	1.03	0.91	0.54-1.98
Religion Of Parent	**0.83**	**0.56**	**0.43-1.59**
Others	1 (base)		
Christian	1.82	0.65	0.14-24.47
Muslim	1.44	0.79	0.10-20.6
Religion Of Partner	0.82	0.51	0.47-1.45
Others	1		
Christian	0.76	0.69	0.20-2.90
Muslim	0.64	0.55	0.15-2.73
Sub-district of Abode	**0.78**	**<0.001**	**0.70-0.88**
Abakrampa	1 (base)		
Abura Dunkwa	0.71	0.36	0.34-1.49
Asebu	0.77	0.54	0.33-1.80
Asuansi	0.45	0.05	0.21-0.99
Gyabankrom	0.50	0.09	0.23-1.10
Moree	0.25	<0.001	0.13-0.52
Sex Of Child	**1.24**	**0.31**	**0.82-1.87**
Female	1 (base)		
Male	1.24	0.31	0.82-1.88

4.7 Association between pregnancy and delivery-related characteristics and level of Uptake

There were no significant association between pregnancy and delivery related characteristics and vaccine uptake (P<0.05). Details of the association between pregnancy and delivery-related characteristics and level of uptake are shown in table 11.

Table 11: Association between pregnancy and delivery related characteristics and level of uptake

Variables	Odds ratio	P-value	95% CI
No. of ANC attendance	**1.22**	**0.30**	**0.83-1.80**
0-4	1 (base)		
5-9	1.04	0.86	0.64-1.70
10 and above	1.91	0.18	0.75-4.84
Place Of Delivery	**0.68**	**0.17**	**0.39-1.18**
Health Facility	1 (base)		
Home	0.68	0.17	**0.39-1.18**
Attended PNC	**1.08**	**0.90**	**0.32-3.62**
No	1 (base)		
Yes	1.08	0.90	**0.32-3.62**
First Child	0.96	0.86	0.60-1.53
No	1 (base)		
Yes	0.96	0.86	` 0.60-1.53

4.8 Association between knowledge and perception on level of RTSS vaccine uptake

There was a statistically significant association between knowledge of the malaria RTSS vaccine and the level of uptake.

Parents who had heard of the malaria vaccine were 1.81 times more likely to fully vaccinate their children as compared to parents who had no knowledge of the vaccine [COR=1.81 (95%CI 1.16-2.84) p<0.05]

Children with parents who had heard of negative reports on malaria vaccines had a 92% reduced odds of full vaccine uptake.

Parents with experience of an AEFI were 46% times less likely to fully vaccinate their children as compared to those with no experience with an AEFI. Details of the association knowledge and perception on level of RTSS vaccine uptake are shown in table 11.

Table 12: Association between Knowledge and Perception on Level of RTSS vaccine uptake

Variables	Odds ratio	P-value	95% CI
Heard of RTSS vaccine	**1.81**	**0.01**	**1.16-2.84**
No	1 (base)		
Yes	1.81	0.01	**1.16-2.84**
Able to correctly determine number of doses needed	**3.53**	**<0.001**	**1.80-6.93**
No	1 (base)		
Yes	3.53	<0.001	1.80-6.93
Able to correctly determine time for first dose of vaccine	**5.24**	**<0.001**	**2.33-11.79**
No	1 (base)		
Yes	5.24	<0.001	2.33-11.79
Able to correctly determine time for last dose of vaccine	**4.62**	**<0.001**	**2.42-8.80**
No	1 (base)		
Yes	4.62	<0.001	2.42-8.80
Heard of negative rumors on RTSS vaccine	**0.08**	**<0.001**	**0.02-0.29**
No	1 (base)		
Yes	0.08	<0.001	0.02-0.29
History of a vaccine adverse effect on a child	**0.54**	**0.02**	**0.32-0.92**
No	1 (base)		
Yes	0.54	0.02	0.32-0.92

4.9 Association between health care-related factors and level of uptake

There was a strong association between the attitude of `health workers at immunization centers and the uptake of the vaccine. There was increased odds of 5.5 times and 7.35 times of a full vaccine uptake for children whose parents rated the attitude of health care workers at immunization centers as "fair" and "good" respectively when compared to "bad".

Further details of the association between health care related factors and level of uptake have been provided in Table 13

Table 13: Association between health care-related factors and level of uptake

Variables	Odds Ratio	P-value	95% CI
Attitude of HCW at RCH	**1.85**	**0.04**	**1.04-3.31**
Bad	1 (base)		
Fair	5.55	0.07	0.89-34.72
Good	7.35	0.02	1.37-39.38
Distance to Immunization center	**1.08**	**0.44**	**0.88-1.35**
Close	1 (base)		
Very Close	1.52	0.15	0.86-2.68
Far	0.78	0.32	0.47-1.28
Very Far	0.93	0.87	0.40-2.19
Openness of Immunization center	**0.92**	**0.70**	**0.60-1.41**
Enclosed Space	1 (base)		
Open Space	**0.92**	**0.70**	**0.60-1.41**

4.10 Multivariate Analysis between level of uptake of the RTSS vaccine and independent variables.

Knowledge of malaria vaccination and its scheduled timing was not significantly associated with the level of uptake at the multivariate level

Health care workers' attitude at the immunization centers was significantly associated with a full vaccine uptake [(aOR = 2.31; 1.22-4.38) ($p<0.05$)] in a multivariate analysis. Parents who rated attitude as "good" were 13.43 times more likely to fully vaccinate their children as compared to those who rated attitude as "poor".

Parents who had heard of negative issues concerning the vaccine were 94% times less likely to fully vaccinate their children.

Details of multivariate analysis has been provided in Table 14

Table 14: Multivariate Analysis between level of uptake of the RTSS vaccine and independent variables.

Variables	**cOR (95%CI)**	**p-value**	**aOR (95%CI)**	**p-value**
Heard of RTSS vaccine	**1.81 (1.16-3.84)**	**0.01**	**1.23 (0.75-2.04)**	**0.41**
No	1 (base)		1 (base)	
Yes	1.81 (1.16-3.84)	0.01	1.23 (0.75-2.04)	0.41
Able to correctly determine number of doses needed	**3.53 (1.80-6.93)**	**<0.001**	**2.00 (0.82-4.87)**	**0.13**
No	1 (base)		1 (base)	
Yes	3.53 (1.80-6.93)	<0.001	2.00 (0.82-4.87)	0.13

Able to correctly determine time for first dose of vaccine	**5.24 (2.33-11.79)**	**<0.001**	**2.62 (0.91-7.57)**	0.08
No	1 (base)		1 (base)	
Yes	**5.24 (2.33-11.79)**	<0.001	**2.62 (0.91-7.57)**	0.08
Heard of negative rumors on RTSS vaccine	**0.08 (0.02-0.29)**	**<0.001**	**0.06 (0.02-0.20)**	**<0.001**
No	1 (base)		1 (base)	
Yes	0.08 (0.02-0.29)	<0.001	**0.06 (0.02-0.20)**	<0.001
History of a vaccine adverse effect on a child	**0.54 (0.32-0.92)**	**0.02**	**0.65 (0.36-1.16)**	**0.14**
No	1 (base)		1 (base)	
Yes	0.54 (0.32-0.92)	0.02	0.65 (0.36-1.16)	0.14
Attitude of HCW at RCH	**1.85 (1.04-3.31)**	**0.04**	**2.31 (1.22-4.38)**	**0.01**
Bad	1 (base)		1 (base)	
Fair	5.55 (0.89-34.72)	0.07	10.04 (1.43-70.71)	0.02
Good	7.35 (1.37-39.38)	0.02	13.83 (2.33-82.06)	0.04
Sub-district of Abode	**0.78 (0.70-0.88)**	**<0.001**	0.79 (0.70-0.90)	**<0.001**
Abakrampa	1 (base)		1 (base)	
Abura Dunkwa	0.71 (0.34-1.49)	0.36	0.88 (0.39-1.94)	0.74
Asebu	0.77 (0.33-1.80)	0.54	0.70 (0.29-1.70)	0.43
Asuansi	0.45 (0.21-0.99)	0.05	0.33 (0.14-0.77)	0.01
Gyabankrom	0.50 (0.23-1.10)	0.09	0.48 (0.14-1.01)	0.08
Moree	0.25 (0.13-0.52)	<0.001	0.30 (0.21-0.63)	<0.001

cOR-crude odds ratio, aOR-adjusted odds ratio, 95% CI – 95% confidence interval

CHAPTER FIVE

5.0 DISCUSSION

This study aimed to identify factors influencing the level of uptake of the RTSS malaria vaccine among a sample population residing in the AAK district.

5.1 Level of RTSS vaccine uptake

5.1.1 Coverage for RTSS 1 2 and 3

The study showed a high vaccine coverage for the first three doses of the RTSS vaccine: 97.77% for RTSS 1, 96.27% for RTSS 2, and 95.03% for RTSS 3. These values were consistent with the required vaccine coverage target of the Global Vaccine Action Plan (GVAP), which calls for > 80% coverage in a district These results indicate that the malaria vaccine was well received in the district. This positive attitude towards the malaria vaccine is also evident in similar studies conducted in other districts in Ghana (Febir et al., 2013), (Yeboah et al., 2022) and (Tabiri et al., 2021).

5.1.2 Full vaccine uptake

However, the coverage rate for RTSS 4 (67.73%) was below the target. This rapid decline in uptake of the RTSS 4 vaccine was also observed in a similar study conducted in the Kassena Nankana Municipality (Yeboah et al., 2022).

The fourth dose is administered when the child is 24 months old. Most (42%) of the respondents whose children did not receive the fourth dose reported not knowing about the fourth dose. Respondents generally felt that the EPI schedule in Ghana ends at 18 months and that many parents

do not actively attend CWC after that point. By 2 years of age, most children are already enrolled in school and parents do not bother to send them to clinics for growth monitoring and further immunization.

During the course of vaccination, 32% of respondents whose children had not taken the fourth dose reported that they had not been in the MVIP district and therefore could not complete the full vaccination

5.1.3 No Uptake

According to the results of the study, about 2% of the sample population had refused to vaccinate their children. In a number of studies, the reasons for vaccination refusal were classified into 4 main categories: personal beliefs, religious beliefs, safety concerns, and lack of adequate information. All respondents who refused the vaccine in this study cited either personal beliefs or safety concerns as the reason for their refusal. Most of them (89%) reported hearing negative rumors about the vaccine, including "The vaccine is new and dangerous," "Africans are being used as guinea pigs in the clinical trial phase," and others.

5.2 Factors influencing vaccine uptake

Thomson et al. (2016) found that all factors influencing vaccine uptake could be grouped into five areas; accessibility, acceptability, affordability, awareness, and activation.

The results of the study indicate that the majority of respondents (68%) lived either very close or close to vaccination centers. The numerous CHPS zones (34) established in the district have directly contributed to increasing community access to vaccines through education, home visits, contact tracing, outreaches and the presence of immunization centers in each community. Woods

et al. (2019) found that people living near the CHPS zone had better access to care, not only through accessibility, but also through affordability and health promotion.

Acceptance of the malaria vaccine was generally high among respondents. Only 2% rightly refused to have their children vaccinated against malaria. This result is similar to a study conducted at the national scale in Ghana by Adjei et al. (2021). The study found that most respondents (73%) were aware of the malaria vaccination program. This result is consistent with the studies by Tabiri et al. and Yeboah et al. which showed high awareness of the malaria vaccine in Ghanaian communities. However, few (20%) were able to correctly identify the vaccination schedule

5.2.1 Factors that positively influence vaccine uptake

Statistical analysis using odds ratio calculations to determine which factors were significantly associated with the level of vaccine uptake in a univariate analysis showed that; 'knowledge of the malaria vaccine', 'correct determination of vaccination schedule', 'attitude of health care workers' and "parents who had heard of negative rumors" had significant associations with an increased malaria vaccine uptake.

Having a parent with knowledge of the malaria vaccination program was associated with an eighty-one percent increased likelihood of full vaccine uptake in univariate analysis compared with having a parent with no knowledge of the vaccine. This finding is consistent with studies by Yeboah et al in the Kassena Nankena Municipality and Adedire et al.

Similarly, children of parents who were able to correctly determine the number of doses needed for full vaccination and the timeline for the first dose (RTSS 1) were at a higher odds of a full vaccination. This supports Mukungwa et al. (2015) findings that caregivers' and parents'

knowledge of vaccination schedules significantly increases the probability of children being fully immunized.

The attitude of health workers in immunization centers was a significant predictor of full uptake. Most respondents (93%) had a positive experience during immunization sessions and rated the attitude of health workers as "good". In the multivariate analysis, children whose parents rated attitudes as "good" had almost 13-fold higher odds of being fully vaccinated than children whose parents had rated attitudes as "bad". This shows that a good and healthy relationship with clients is key to improving vaccination coverage. This supports the findings of Ojakaa et al. (2017), who indicated that the likelihood of one's child being vaccinated against malaria was associated with moderate satisfaction with the services provided at a particular health facility and by health workers

5.2.2 Factors that negatively influence vaccine uptake

Studies have found strong evidence of an association between the perception and experience of adverse effects after vaccination (AEFI) and vaccination hesitancy. These included fever, diarrhoea and vomiting, and abscesses at the injection site. In the study by Tabiri et al, it was found that respondents who had experienced AEFI in the Sunyani community were less likely to vaccinate their children. This is consistent with the results of this study, which found a 46% reduced odds of full vaccine uptake among respondents who had experience with an AEFI in the univariate analysis. The costs associated with treating AEFI may serve as a deterrent factor for

continuing to vaccinate their children as well as the emotional and physical involved in caring for the sick child.

Children of respondents who had heard negative rumors about the malaria vaccine were significantly less likely to be fully vaccinated against malaria in both univariate and multivariate analyses (aOR 0.06, 95%CI;(0.02-0.20) than children of respondents who had no negative information. It was found that most (89%) of the children who did not get vaccinated had parents who refused to vaccinate their children because of these negative rumors. As Menaca et al. (2014) noted, misinformation and rumors spread about malaria vaccines need to be addressed through planned education and communication strategies.

5.4 Strengths of the study

At the time of this study, it was one of the few studies to include the fourth dose of malaria vaccine (RTSS 4) in its evaluation. This study will help to increase knowledge about the existing factors that prevent high malaria vaccination coverage in the central region and the country.

5.5 Limitations of the study

A limitation of this study is that only respondents from children who were registered in a CWC were included in the analysis. There are children who are delivered at home and never sent for immunization. It would be beneficial to capture the opinions, perceptions and experiences of these parents to provide policy makers with information to improve uptake of malaria vaccination among them.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The uptake showed a high vaccine coverage rate for the first three doses of the RTSS vaccine: 97.77% for RTSS 1, 96.27% for RTSS 2, and 95.03% for RTSS 3. However, the number of children who were fully vaccinated decreased (67.73%).

Knowledge of the vaccination program was a positive predictor of a full uptake. Having a parent with knowledge of the malaria vaccination program and schedule was associated with increased odds of a full malaria vaccine uptake in both univariate and multivariate analysis.

Children of parents who had a positive experience with health workers during immunization sessions were 7.35 times more likely to be fully vaccinated.

AEFI in children and misinformation about the malaria vaccines were significantly associated with reduced odds of a full vaccine uptake. Children of parents who had witnessed an AEFI had a 46% reduced odds of a full uptake. Parents who had heard negative rumors about vaccines were 94% times less likely to fully vaccinate their children.

6.2 Recommendations

Based on the factors influencing malaria vaccine uptake discussed in this article, the following recommendations are suggested to the Abura Asebu Kwamankese District Health Directorate.

1. Increase awareness: It is important to raise awareness of malaria vaccination through public health campaigns, community engagement, and targeted messages to health workers. This

will help dispel myths, misinformation, and misconceptions about the vaccine and improve knowledge about the vaccination program and schedules, as well as increase vaccine uptake.

2. Improve access: Access to vaccines is a key factor that influences vaccine uptake. Therefore, it is important to ensure that vaccines are readily available and accessible throughout the country. There is a need to expand the vaccination program to all districts in Ghana to ensure continuity in uptake even when parents travel to other districts.
3. Strengthen trust in the health system: Professional conduct of health workers influences public perception of the healthcare system. Ethical and professional behavior by health workers can help build a positive perception of the healthcare system and helps establish and maintain trust and confidence between health workers and patients, which is essential for effective communication, informed consent, and patient engagement.
4. Monitor and evaluate: To ensure that vaccination programs are effective and sustainable, it is important to monitor and evaluate vaccine uptake rates and identify gaps or barriers to uptake. This can help to inform targeted interventions and improve vaccine coverage.

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APPENDICES

Appendix I: Participant Information Sheet

Title Of Study : Factors influencing malaria vaccine uptake in the Abura Asebu Kwamankese district

Institution of Affiliation: School of Public Health, University of Ghana, Legon.

Background of Interviewer: I, Budu-Acquah Papa Obeng, am a masters student at the School of Public Health, University of Ghana, who is here to collect data on the factors influencing malaria immunisation in Abura Asebu Kwamankese district. You are invited to participate in this data collection as a parent/caregiver of a child aged 2 to 3 years enrolled for immunisation in Abura Asebu Kwamankese district. This study is currently only taking place in Abura Asebu Kwamankese district. The data collected will help me to determine the factors that influence the adherence to the malaria vaccination program among children in the district. A copy of the final results of this study will be provided to the administration of this facility to keep all staff informed of the results of this study. Please answer the questions as honestly as possible and to the best of your knowledge.

Procedure: A simple structured questionnaire will be used to gather data about your background characteristics and factors influencing your adherence to the malaria vaccination program. This data collection forms are concise and should take less than 15 minutes of your time to complete.

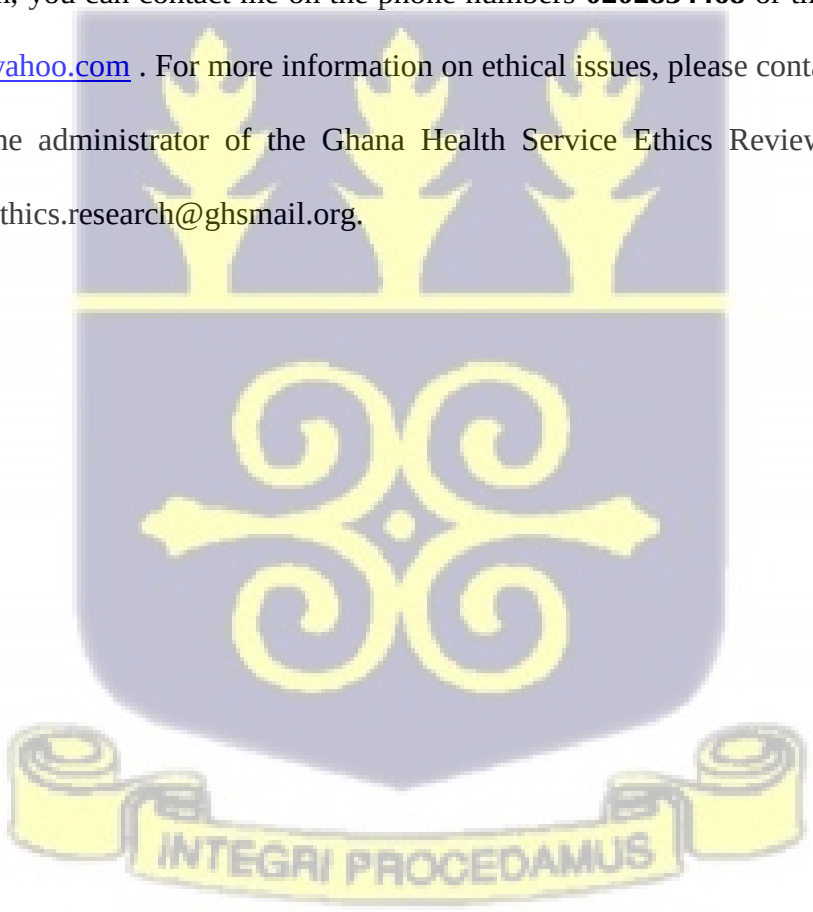
Risks involved in participating in this study: There are no foreseeable risks to your health and well-being should you decide to take part in this study. The Principal Investigator and his research assistants will approach you in face masks and with their hands sanitized to ensure the full observance of COVID-19 public health protocols.

Compensation for Participation : Your participation in this study is fully free without any cost or compensation for participation

Freedom to Withdraw: You are free at any time to withdraw from the study and will not be questioned for doing so.

Anonymity and Confidentiality: Your name will be excluded from the findings of this study to ensure absolute anonymity and confidentiality. Data collected from study participants will be stored safely and made only accessible to the principal investigator.

C**ontact details of the principal investigator:** In case of any difficulty or if there is a need for extra clarification, you can contact me on the phone numbers **0202834468** or the E-mail address obeng.acquah@yahoo.com . For more information on ethical issues, please contact Madam Nana Abena Apatu, the administrator of the Ghana Health Service Ethics Review Committee, at 0503539896 or ethics.research@ghsmail.org.



APPENDIX II: CONSENT FORM

STUDY TITLE:

FACTORS INFLUENCING MALARIA VACCINE UPTAKE IN THE ABURA ASEBU KWAMANKESE DISTRICT

PARTICIPANTS' STATEMENT

I agree that I have read the contents of the Participants' Information Sheet and that all questions have been adequately answered in a language that I understand (English, Twi, other(specify).....). I am fully aware of the contents and any potential repercussions, as well as my right to change my mind (i.e. withdraw from the research) even after signing this form.

Name of Participant…….. Name of Child **……**

Participants' Signature …….. Thumb Print……

Date of interview:……

INTERPRETERS' STATEMENT

I explained the aim and contents of the Participants' Information Sheet to the aforementioned participant to the best of my ability in the (English, Twi, other(specify).....) language.

All questions, suitable clarifications, and answers were sorted by the participant and duly interpreted to his/her satisfaction

Name of Interpreter……

Signature of Interpreter…….. Thumb Print …….....

Date of interview:……

Witness Statement

I was there when the purpose and contents of the Participant Information Sheet were read and satisfactorily presented to the participant in the language he/she understood (English, Twi, other(specify...).....).

I confirm that he/she was given the opportunity to ask questions/seek clarifications, and that those questions/clarifications were promptly answered to his/her satisfaction before freely choosing to participate in the research.

Name:……

Signature…….. Thumb Print ……

Date:……

Investigator Statement

I confirm that the participant was given adequate time to read and understand about the study. All issues and clarifications raised by the participant have been answered.

Researcher's name…….

Signature …….

Date……

Appendix III: Study Questionnaire

UNIVERSITY OF GHANA, LEGON

My name is Dr Budu-Acquah Papa Obeng. I am a postgraduate student at the University of Ghana, Legon, conducting research on "**factors that influence malaria vaccine uptake in the Abura Asebu Kwamankese district**" as part of my Masters of Public Health degree requirements.

All information you provide will be treated confidentially and will not be shared with anyone other than the researchers conducting the study. Confidential information will be kept in closed files that only the study personnel will have access to. You are free to skip any question on the form or interrupt the interview/procedure at any time. Please answer the following questions by filling in the blanks or checking (√) where applicable. This will take approximately 15 minutes. Thank you for consenting to take part in this vital research project.

Participants Code……

Contact information of interviewer ……

Name of interviewer……

Date of interview……

Place of interview……

SECTION A: Background characteristics of parent/caregivers and child

1. Sex of Parent/caregiver: a. Male [ ] b. Female [ ]
2. Age: a. Below 20 [ ] b. 20-29 [ ] c. 30-39 [ ] d. 40 and above [ ]

3. Religion: a. Christian [ ] b. Muslim [ ] c. Traditionalist [ ] d. Atheist e. Other …….
4. Religion affiliation of partner: a. Christian [ ] b. Muslim [ ] c. Traditionalist [ ] d. Atheist [ ] e. Other …….
5. Marital status: a. Married [ ] b. Divorced/Separated [ ] c. Single [ ] d. Widowed [ ] e. Co-habiting [ ]
6. Are you a parent or caregiver? a. Parent [ ] b. Caregiver [ ]
7. Educational status: No formal education [ ] b. Basic Education [ ] c. Secondary education [ ] d. Tertiary [ ]
8. Occupational status as at time period of after delivery of the child under review)
   a. Unemployed [ ] b. Student [ ] c. Apprentice[ ] d. Èmployed [ ]
9. Educational status of partner: a. No formal education [ ] b. Basic Education [ ] c. Secondary education [ ] d. Tertiary [ ]
10. Occupational status: a. Unemployed [ ] b. Student [ ] c. Apprentice[ ] d. Èmployed [ ]
11. Number of ANC visits attended when pregnant with child under review?.....
12. Where was the child delivered? a. Home [ ] b. Traditional Birth attendant [ ] c. In a health facility [ ] d. Other …..
13. Did you go for post natal care (after delivery of the child under review)? a. Yes [ ] b. No [ ]
14. Is this child your first child a. Yes [ ] b. No [ ]
15. Sex of child a. Male [ ] b. Female
16 Where did child attend CWC ?
17 Doses of RTS, S child has received

    [ ] None

    [ ] RTS, S 1 only

    [ ] RTS, S 1 & RTS, S 2

    [ ] RTS, S 1, RTS, S 2 & RTS, S 3

    [ ] RTS, S 1, RTS, S 2, RTS, S 3 & RTS, S 4

18 Child's date of birth:

SECTION B: Knowledge and Acceptance

19 . Do you believe that children should be vaccinated? a. Yes [ ] b. No [ ]

20. Have you heard about malaria vaccine before? a. Yes [ ] b. No [ ]

21. *If yes, where did you first hear about it? a. Health facility [ ] Information centers/social media [ ] c. Family/friends [ ] e. Religious institution [ ] g. Not applicable [ ]

22. How many times should a child takes a malaria vaccine?

1 [ ] b. 2 [ ] c. 3 [ ] d. 4 [ ] e. Don't know [ ]

23. What specific ages (in months) should a child take the first malaria vaccine?

1 month [ ] b. 3 months [ ] c. 6 months [ ] d. 12 months [ ] e. Don't know [ ]

24. What specific ages (in months) should a child take the last malaria vaccine?

15 month [ ] b. 18 months [ ] c. 21 months [ ] d. 24 months [ ] e. Don't know [ ]

25. How do you know when your child's malaria vaccination period is due?

a. Family/friends [ ] b. Check child's CWC card [ ] c. Health personnel informs me [ ] d. others …..specify

SECTION C: Negative Rumors and Experience With AEFI

26. Have you heard about any negative report concerning the malaria vaccine? a. Yes [ ] b. No [ ]

27 If yes, where did you hear it from

a. Social media [ ] b. Family/friends [ ] c. Health personnel [ ] d. Not applicable [ ] Others specify: ……

28. Did it prevent/delay your decision to vaccinate your child/ward? a. Yes [ ] b. No [ ]

29. Has any of your children suffered an adverse reaction following the administration of any vaccine? a. Yes [ ] b. No [ ]

30.* If yes, what was it?

a. Fever [ ] b. Diarrhea/vomiting [ ] c. Abscess [ ] d Not applicable [ ] Other specify ……

SECTION D: Public Opinions And Personal Beliefs

31. Did information or circulars on the social media influence your decision on whether to vaccinate your child/ward or not . Yes [ ] b. No [ ]

32. Do many parents complain bitterly about malaria vaccine. a. Yes [ ] b. No [ ]

33. Do your religious beliefs/religious leader frown on vaccination? a. Yes [ ] b. No [ ]

34. Do your personal beliefs prevent you from vaccinating your child/ward? a. Yes [ ] b. No [ ]

35. Does your community/family restrict you from vaccinating your child/ward? a. Yes [ ] b. No [ ]

SECTION F: Health System Factors

36. How will you describe the attitude of nurses who attend to you during CWC for child under review? a. Bad [ ] b. Fair [ ] c. Good [ ]

37. How will you describe the attitude of nurses who administer malaria vaccination to children? a. Bad [ ] b. Fair [ ] c. Good [ ]

38. How far is the health facility where malaria vaccination is administered? a. Far [ ] b. very far [ ] c. Close [ ] d. Very close [ ]

39. How open is the place of vaccination in the community? Enclosed place[ ] b.Open space [ ]

SECTION G: Challenges

40. What is the reason why your child has not taken any of the four doses of the malaria vaccine?

[ ] Personal decision to refuse vaccine
[ ] Partner's decision to refuse vaccine
[ ] Did not know child is eligible
[ ] Other specify:……..

41. What is the reason why your child has not taken all of the four doses of the malaria vaccine?

[ ] Did not know when next one was
[ ] Did not take previous dose on time
[ ] Not comfortable with side effects
[ ] Not comfortable with issues surrounding the vaccine
[ ] Money charged for previous dose
[ ] I was not around
[ ] Other specify: ……..……..…….

42.Will you recommend the malaria vaccine to other parents? a. Yes [ ] b. No [ ]

THANK YOU

Appendix IV : Ethical Approval Letter

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

My Ref. GHS/RDD/ERC/Admin/App 022540
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-681109
Email: ethics.research@ghs.gov.gh
28th November, 2022

Papa Obeng Budu-Acquah
P.O. Box 55
Abura Dunkwa

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	GHS-ERC: 060/09/22
Study Title	Factors Influencing Malaria Vaccine Uptake in the Abura Asebu Kwamankese District.
Approval Date	28th November, 2022
Expiry Date	27th November, 2023
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. Naa-Korkor Allotey
(Ag. Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

Approval Letter To Conduct Research

In case of the reply, the number and the date of this letter should be quoted.

GHS Core values
PEOPLE CENTRED
PROFESSIONALISM
TEAMWORK
INNOVATION/EXCELLENCE
DISCIPLINE
INTEGRITY

GHANA HEALTH SERVICE
REGIONAL HEALTH
DIRECTORATE
P. O. BOX 63
CAPE COAST,
CENTRAL REGION,
GHANA
Tel: 042 32281/2
Fax: 042 34785
rdhs.central@ghsmail.org

My Ref. No.CR/G- 263/46
Your Ref. No...

6th February, 2023

PAPA OBENG BUDU-ACQUAH
P. O. Box 55
Abura Dunkwa

APPROVAL TO CONDUCT RESEARCH

Reference a permission letter dated 17th January 2023 and ethical clearance from the *Ghana Health* Service Ethics Review Committee No *GHS-ERC:060/09/22* Ref. No. *GHS/RDD/ERC/Admin/App/22/540* dated 28th November, 2022 seeking permission to conduct research on "Factors influencing Malaria Vaccine uptake in the Abura Asebu Kwamankese district".

I write to grant you the approval to conduct the research.

A copy of the **final report** of the studies in full should be lodged with the Research and Development Unit of the Central Regional Health Directorate.

By copy of this letter, the District Director of Abura Asebu Kwamankese is kindly requested to provide the researcher with the necessary support to make the study a success.

Thank you.

DR. MRS. AKOSUA AGYEIWAA OWUSU-SARPONG
REGIONAL DIRECTOR OF HEALTH SERVICES
CENTRAL REGION

CC: - DDHS, Abura Asebu Kwamankese