

Determinants of Acceptability and Willingness to Receive the RTS, S/AS01 Malaria Vaccine Among Mothers of Under-Five Children in Abuja Municipal Area Council, Nigeria: A Mixed-Methods Study

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Abstract

Background

RTS, A/S01 is a malaria vaccine that is a major step forward in childhood malaria prevention in sub-Saharan Africa. Maternal awareness, acceptability and willingness to vaccinate, however, are found to be critical to the uptake of vaccines.

Methods

This study employed a convergent mixed methodology, it involved Quantitative (Cross-sectional survey) and Qualitative (Interviews). Structured questionnaires were used to conduct a survey with 421 mothers of under-five children who were attending immunization clinics. In-depth interviews with eight mothers, five healthcare workers and four community leaders were used to gather qualitative data. Association between the socio-demographic factors and vaccine acceptability were analyzed through chi-square analyses. Thematic analysis was used to identify the key determinants using NVivo software.

Results

Out of the mothers, 55% were not aware of the vaccine, and the acceptability was moderate to good, with 62% saying they were willing to vaccinate (50% agreed and 12% strongly agreed). 71% were willing to vaccinate if offered. Education ($\chi^2 = 256.434$, $p < 0.001$), religion ($\chi^2 = 268.140$, $p < 0.001$), employment status ($\chi^2 = 118.018$, $p < 0.001$), age ($\chi^2 = 98.521$, $p < 0.001$), and income ($\chi^2 = 121.610$, $p < 0.001$) were significantly associated with acceptability. Four determinants were determined with thematic analysis: (1) access and convenience, (2) information and social influence, (3) safety and efficacy concerns, and (4) trust in information sources.

Conclusions

Though there is enthusiasm, there are significant barriers to uptake including low awareness and safety concerns, and socioeconomic inequalities. Implementation strategies should include culturally-tailored communication to reduce awareness gaps, trusted voices in the community and healthcare sectors, minimize financial and logistical barriers, and communicate safety related concerns clearly and factually.

Background

Malaria is still a major cause of morbidity and mortality among children in sub-Saharan Africa with Nigeria having the largest burden of the disease in the world. The country accounts for approximately 27% of global malaria cases and 31% of global malaria deaths, despite malaria being both preventable and treatable [1]. The disease accounts for an estimated 60% of outpatient attendance and 30% of

hospital admissions in children under 5 years in Nigeria and is responsible for about 20% of the mortality of young children [2].

Malaria control efforts, such as the use of insecticide-treated nets (ITN), indoor residual spraying (IRS), intermittent preventive treatment (IPT), and the use of artemisinin-based combination therapies (ACT), have made some progress, but are not yet sufficient to reach the elimination goal [3]. The recent WHO recommendation for use of the new malaria vaccine (RTS, S/AS01) (Mosquirix™) in 2021 is a significant step forward [4, 19]. The efficacy of the vaccine in clinical trials was shown to reduce clinical malaria cases by 30–50%, including a significant decrease in severe malaria and hospitalisation, especially when vaccination was started in children aged 5–17 months [5, 20].

Promising safety, immunogenicity and feasibility outcomes have been reported for pilot implementation programs in Ghana, Kenya and Malawi [6]. But community awareness and acceptance of vaccines are critical to their success. Research in pilot countries and other vaccine introduction programmes in Africa suggests that low uptake of even highly effective vaccines may occur where there is poor awareness, cultural issues are not addressed, and low trust in health systems [7, 13].

Given Nigeria's consideration of introducing RTS, S/AS01 into its Expanded Programme on Immunization (EPI) it is important to understand how mothers view the vaccine. The awareness, attitudes, and willingness of mothers to vaccinate will have a significant impact on coverage at the population level, a fact that is influenced by their role as primary decision makers in child health [8]. This study is important because it fills a critical gap by providing context-specific evidence of factors that influence vaccine acceptability and willingness in the urban context in Nigeria.

Methods

Study design and setting

In order to triangulate quantitative and qualitative data, it was decided to use a convergent mixed-methods design. The study was carried out in selected Primary Healthcare Centres (PHCs) in Abuja Municipal Area Council (AMAC) of the Federal Capital Territory (FCT) Abuja, Nigeria. AMAC is a highly populated urban local government area with a population of about 1.4 million, a diverse socio-cultural population and reasonably developed health infrastructure. Choosing AMAC gave a glimpse into an urban landscape that is similar to both capital city and peri-urban settings.

Study population and sampling

Quantitative component

It was conducted with 421 mothers/guardians of children aged below 5 years attending immunization clinics in the selected PHCs. The sample size was calculated using Cochran's formula: $n = (1.96^2 \times 0.5 \times$

$0.5) / 0.05^2 = 384$, increased by 10% for non-response to 421 participants. A two-stage sampling was used, with purposive sampling of PHCs with high immunization attendance and simple random sampling of eligible mothers from the PHCs (with random number tables) to be representative and reduce sampling bias.

Inclusion criteria were: mothers/guardians aged 18 years or more and with one or more children under five years who were willing to give informed consent. The exclusion criteria were: trained health workers, guardians of ill children in critical condition, and non-consent.

Qualitative component

Eight mothers were recruited from immunization clinics and the community via purposive sampling, five from immunization clinics and community, and four community leaders (religious leaders, traditional rulers, health advocates). The participants were chosen according to their knowledge about prevention of malaria and issues related to vaccines.

Data collection

Quantitative data

The instrument used was adapted from a previously validated questionnaire developed by Andrew (2025) [21], originally used to assess knowledge, perception, and willingness to accept the malaria vaccine among mothers in Ondo State, Nigeria, and modified to suit the study's Health Belief Model (HBM) framework and the Abuja, FCT context. The questionnaire consisted of five sections: socio-demographic characteristics, awareness, perceptions (perceived susceptibility, severity, benefits, barriers, cues to action, self-efficacy), willingness, and acceptability. Likert scale items had a range from 1 (strongly disagree) to 5 (strongly agree). A pilot test was conducted with 12 mothers from a non-study PHC with questionnaires. The Cronbach's alpha for the scales based on HBM was in the range of 0.72–0.81, thus having acceptable reliability. The questionnaire was developed specifically for this study and is provided in full as a supplementary file (Additional File 1)

Qualitative data

In-depth interviews have been conducted with participants lasting between 30 and 45 minutes to understand attitudes and beliefs about vaccine awareness, safety concerns, barriers and enablers. The interview guide was semi-structured to give consistency and yet be flexible. Interviews were conducted in English and local language and audio recorded and transcribed word for word.

Data analysis

Quantitative analysis

The data were analyzed by SPSS version 25. Socio-demographic characteristics and important study variables were summarized using descriptive statistics (frequencies/percentages). Chi-square (χ^2) tests were used to determine if there were association between acceptability and socio-demographic factors. A p-value < 0.05 was considered to be statistically significant.

Qualitative analysis

Transcripts were analysed thematically through an NVivo software, which was adopted in the six-step process suggested by Braun and Clarke. Initial codes were inductively generated from the data, grouped into themes, compared to the data and further developed by comparison between participants. Deductive Coding was guided by the HBM and Social Ecological Model.

Triangulation

Both quantitative and qualitative results were analysed and combined so as to gain a holistic understanding. Convergence, divergence and complementary information across data streams were discussed.

Ethical considerations

The Federal Capital Territory Health Research Ethics Committee (Approval #FHREC/2025/01/213/21-07-25) granted ethical approval. Informed written consent was obtained for all participants. Data was kept in a confidential manner and presented as aggregates. There was complete voluntary participation.

Results

Socio-demographic characteristics

The 421 respondents were predominantly aged 26–35 years (39.7%, n = 167) and 36–45 years (35.6%, n = 150). Most were married (78.6%, n = 331) and had tertiary education (81.9%, n = 345). Employment was varied with 49.9% of self-employed, 21.6% in the private sector and 21.4% as civil servants. Monthly household income exceeded ₦100,000 for 81.9% (n = 345). Most practiced Christianity (78.6%, n = 331). More than half (226, 53.7%) had suffered from malaria in the last six months. More than 60.7% (n = 256) of them resided more than 5 km away from the nearest PHC. Full socio-demographic information is reported in Table 1.

Table 1
Socio-demographic characteristics of respondents (N = 421)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
18–25	85	20.2
26–35	167	39.7
36–45	150	35.6
>45	19	4.5
Marital status		
Married	331	78.6
Single/Other	90	21.4
Education level		
Primary/None	42	10.0
Secondary	34	8.1
Tertiary	345	81.9
Employment status		
Self-employed	210	49.9
Private sector	91	21.6
Civil servant	90	21.4
Unemployed	30	7.1
Religion		
Christianity	331	78.6
Islam/Other	90	21.4
Monthly income (₦)		
≤50,000	42	10.0
50,001–100,000	34	8.1
>100,000	345	81.9
Distance to PHC		
≤5 km	165	39.3

Variable	Frequency (n)	Percentage (%)
>5 km	256	60.7

Vaccine awareness

There was a polarized distribution in vaccine awareness. Forty percent reported being aware (20% strongly, 20% agree), 55% were unaware (30% strongly, 25% agree), and 15% were neutral (Fig. 1). This shows a high level of awareness deficit in the face of the immense burden of malaria in Nigeria.

Vaccine acceptability

Overall acceptability was moderate to high: 62% of mothers agreed or strongly agreed to vaccinate (50% agree, 12% strongly agree). About 27% disagreed (15% disagreed; 12% strongly disagreed) and 15% were neutral (Fig. 2). This suggests overall openness with a significant minority holding back.

Willingness to vaccinate

Of those who were asked about behavioral intention, 71% (n = 299) answered that they would consider vaccinating their child if RTS, S/AS01 was available. However, 14% (n = 59) reported unwillingness, and 14% (n = 57) were uncertain (Fig. 3).

Socio-demographic relationships to acceptability.

The results of the chi-square analysis showed that there were significant relationships between acceptability and all the socio-demographic factors tested except distance to the nearest PHC (Table 2):

- Age: $\chi^2 (3) = 98.521$, $p < 0.001$
- Education level: $\chi^2 (2) = 256.434$, $p < 0.001$
- Employment status: $\chi^2 (3) = 118.018$, $p < 0.001$
- Religion: $\chi^2 (2) = 268.140$, $p < 0.001$
- Monthly household income: $\chi^2 (2) = 121.610$, $p < 0.001$
- Distance to nearest PHC: $\chi^2 (3) = 39.925$, $p = 0.429$ (not significant)

Table 2
Chi-square test of independence results: associations between socio-demographic characteristics and vaccine acceptability

Variable	χ^2 value	df	p-value
Age	98.521	3	< 0.001*
Education level	256.434	2	< 0.001*
Employment status	118.018	3	< 0.001*
Religion	268.140	2	< 0.001*
Monthly household income	121.610	2	< 0.001*
Distance to nearest PHC	39.925	3	0.429
*Statistically significant at $p < 0.05$. PHC = Primary Healthcare Centre.			

The strongest associations were with education and religion, which indicate that there may be significant roles of these factors in vaccine decision-making.

Qualitative results: factors affecting vaccine acceptance

Using thematic analysis, four cross-cutting themes were identified:

Theme 1: Accessibility and usability.

Availability of vaccine and consistency of vaccine supply were highlighted as key enablers, as were affordability. Mothers said: "I would vaccinate my child, if it was free and available at the clinic at all times. Transport barriers were raised by community leaders: "If transportation to the health facility is easier, if outreach services are able to go to our village, more mothers would come." Healthcare workers highlighted integration: "Administering the malaria vaccine along with other routine vaccines will make it easier for mothers and less visits."

Theme 2: Information and social influence.

There was a need for clear, reiterated communication. Mothers appreciated health education and reminders: "If I receive the right information and reminders about the schedule I would not miss it." Peer modelling had a strong influence: "If others in the community are vaccinating their children then so will they." Healthcare workers emphasized the importance of communication: "Parents will be more accepting if healthcare workers are patient and explain them well."

Theme 3: Safety and efficacy issues

The barriers were high were safety concerns and skepticism over effectiveness. Side effects concern was expressed by mothers: "I worry about side effects, particularly, fever in small kids." They also asked about long-term protection: "I am concerned if the vaccine will indeed protect kids long-term." Parents'

questions included whether vaccine testing was adequate: “Many parents ask whether the vaccine has been tested enough.”

Theme 4: Reliance on information sources.

Trust was there on several levels. Mothers always believed in the nurses and regular health care providers: “I trust the nurses who see my children regularly.” Community leaders emphasized culturally-respected voices: “If community leaders are involved in giving information, more people will accept.” Healthcare workers drew attention to messages coming from multiple sources, and how these messages have synergistic effects: “When messages reach people from the Ministry of Health and trusted community members, the people listen.”

The quantitative and qualitative data were triangulated.

Data stream integration showed that there is convergence in the barriers of structure and cognition. Low awareness (55% unaware) was correlated with participants' more focus on inadequate health communication. Qualitative results revealed significant associations between education and acceptability, which were described by more educated mothers having greater health literacy and ability to assess vaccine information. Geographic access was not associated with acceptability, with qualitative results suggesting that cognitive and social factors (trust, information, safety concerns) are more important than geographic access in this relatively well-served urban setting, AMAC.

Discussion

Principal findings

This study offers important baseline data on the acceptability and willingness of mothers to vaccinate their children with RTS,S/AS01 in an urban context in Nigeria. This level of unawareness, at 55%, is alarming in a country like Nigeria with a malaria burden and constitutes an important challenge at the first step of the adoption pathway. This demonstrates low signals to action and unequal information sharing, similar to findings from other vaccine rollout in Africa [7, 17].

The acceptance rate of 62% is promising and indicates that informing mothers is a step that convinces many that malaria is a serious condition and that prevention is important. But the 27 percent who disagreed shows that the lack of trust, safety fears and cultural beliefs remain a problem. The difference in acceptability (62%) and willingness (71%) shows a behavioural intention that could be influenced by situational factors and depends on the need for practical measures.

High links with education and religion, and income, indicate that acceptability is not even across the population. The patterns show that there are indications for potential widening of health inequalities unless uptake strategies are designed with a clear focus on disadvantaged groups. This is because the

non-significant relationship with physical distance occurred in this urban setting, which has a relatively good healthcare coverage, as provided by AMAC.

Theoretical contextualization

Perceived susceptibility and perceived severity are high (from the Health Belief Model perspective, because individuals have experienced malaria in the past), while perceived benefits are low (due to perceived barriers such as safety concerns, logistical issues and mistrust). Healthcare worker endorsement, peer modelling and reminders were identified as critical but under utilised cues to action [9].

The Social Ecological Model emphasizes that vaccine acceptability can be manifested at various levels: personal cognition/health literacy; interpersonal level/social influence; community norms/trust networks; and the systems level (health worker capacity, vaccine supply, policy environment) [10]. Taking up will need multi-level intervention.

Comparison with existing literature

The results of the pilot countries (Ghana, Kenya, Malawi) of RTS, S/AS01 have also been moderate-to-high following the engagement of communities and addressing community concerns [6, 11, 14]. This Nigeria study provides important additional context though: Nigeria has even higher awareness gaps, and the notion of a stronger role of religion in influencing perceptions of vaccines seems particularly pronounced, which was less reported from pilot country studies [12, 15].

Implications for practice

Health communication strategies should include trusted voices (nurses, religious leader, community leader) and culturally appropriate, evidence-based messages concerning safety concerns. The normalisation of uptake and reduction of burden on mothers will be achieved through integration of RTS,S/AS01 into existing EPI programmes [16]. To stop inequalities in health, deliberate attempts must be made to reach out to mothers with lower socio-economic status, lower educational levels and rural backgrounds. Free vaccinations and transportation may be required to minimize structural barriers.

Limitations

This study was conducted in an urban area and may not be representative of rural and remote groups. The sample was weighted by education and income of mother, which may not reflect the most disadvantaged. There is a risk of social desirability bias with self-reported data. With cross-sectional design, causality is limited. These restrictions should be taken into account when interpreting and for future studies.

Conclusions

This mixed-methods study shows that the overall acceptance of malaria vaccination is positive (71%) but there are significant barriers. The combination of low awareness (55% unaware) and safety concerns with socio-demographic stratification, highlights the complexity of vaccine uptake. The following are required to implement RTS, S/AS01 successfully in Nigeria: (1) Awareness building campaign to address gaps in knowledge; (2) transparent communication with the aim of building trust in safety and efficacy; (3) service integration and accessibility improvements; (4) targeted outreach to marginalized groups; and (5) ongoing trust building through institutional and community channels. If well implemented, with attention to these factors, the RTS,S/AS01 vaccine has real promise to decrease morbidity and mortality due to malaria in Nigeria's under-fives.

Abbreviations

AMAC

Abuja Municipal Area Council

EPI

Expanded Programme on Immunization

HBM

Health Belief Model

ITN

Insecticide-treated net

IRS

Indoor residual spraying

PHC

Primary Healthcare Centre

WHO

World Health Organization

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Federal Capital Territory Health Research Ethics Committee (Approval No. FHREC/2025/01/213/21-07-25). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to participation. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without penalty. Confidentiality and anonymity were maintained throughout the study.

Human Ethics and Consent to Participate

Ethical approval was obtained from the Federal Capital Territory Health Research Ethics Committee (Approval No. FHREC/2025/01/213/21-07-25). All procedures involving human participants were performed in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all participants.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

C.E.O., S.A.O., O.C.O., O.E.O., and O.T.A. designed the research. H.A.A., supervised the research, C.E.O., S.A.O., and O.C.O. conducted fieldwork and data collection. All authors contributed to data analysis and interpretation. C.E.O. drafted the manuscript. All authors reviewed and approved the final version.

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Data Availability

The quantitative datasets generated and analysed during the current study are not publicly available in order to protect the privacy of research participants, but are available from the corresponding author

(C.E.O.) on reasonable request. Qualitative data (interview transcripts) are not publicly available as they contain information that could compromise the privacy and confidentiality of research participants, in accordance with the terms of ethical approval granted by the Federal Capital Territory Health Research Ethics Committee (Approval #FHREC/2025/01/213/21-07-25).

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Figures

I have heard about the RTS,S/AS01 malaria vaccine.

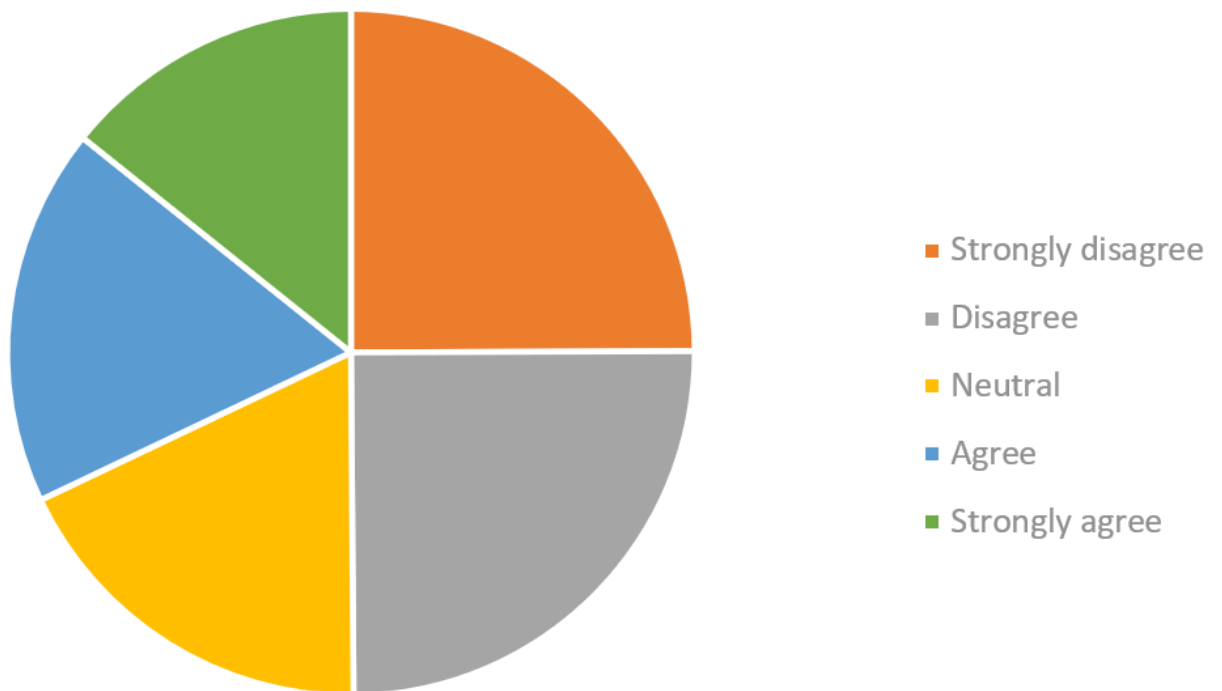


Figure 1

The proportion of respondents' awareness of RTS, S/AS01 malaria vaccine (N = 421).

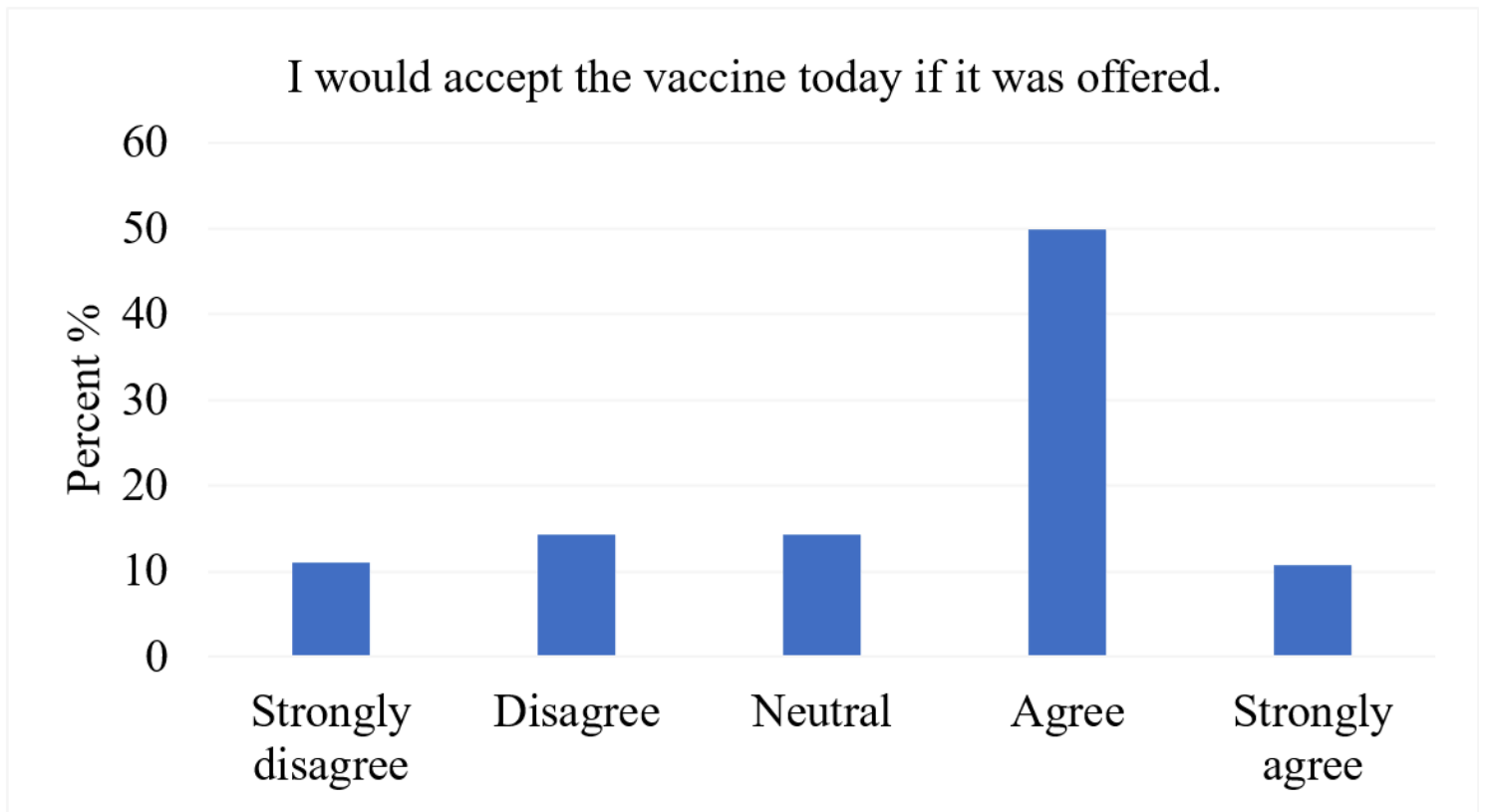


Figure 2

The acceptability of the RTS, S/AS01 malaria vaccine among respondents (N = 421).

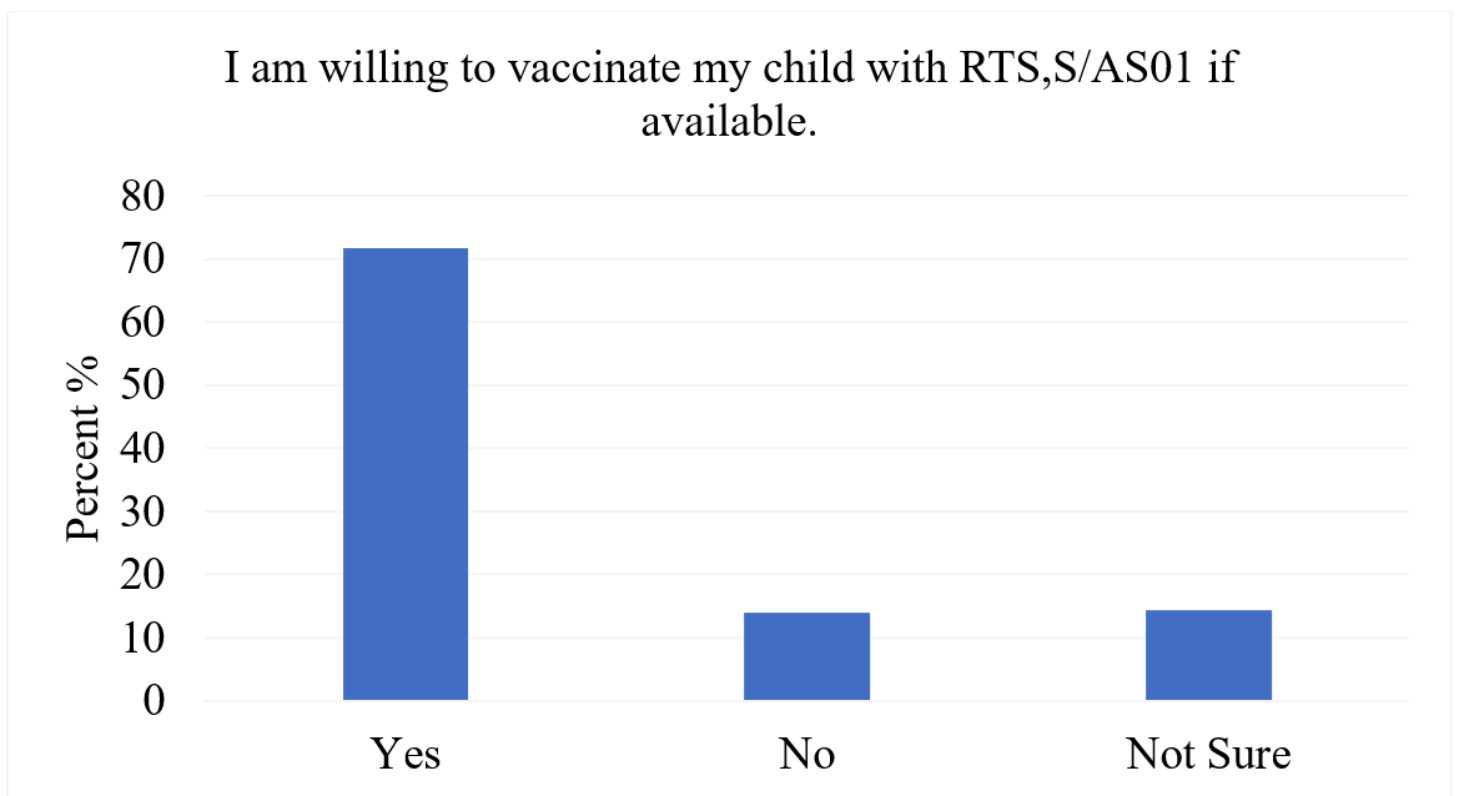


Figure 3

Willingness to vaccinate children with RTS,S/AS01 malaria vaccine if available (N = 421).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1Studyquestionnaire.docx](#)