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Awareness, perception and Willingness to Accept Malaria Vaccination for Maternal and Child Protection among Pregnant Women Attending Antenatal Care: A Cross-Sectional Study

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Research Article

Keywords: Malaria vaccine, Vaccine acceptance, Awareness, Pregnant women, Maternal and child protection

Posted Date: April 14th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9204164/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Nigeria contributes substantially to the global burden of malaria, with pregnant women and young children among the most vulnerable groups. With the recent introduction of malaria vaccines in several African countries, community awareness and acceptance are critical for successful implementation. This study assessed awareness, perceptions, and willingness to accept the malaria vaccine among pregnant women attending antenatal care in a tertiary hospital in Nigeria.

Methods

A hospital-based cross-sectional study was conducted among 274 pregnant women attending antenatal clinics at a tertiary health facility. Data were collected using a structured interviewer-administered questionnaire covering sociodemographic characteristics, awareness of the malaria vaccine, perceptions about vaccination, and willingness to accept the vaccine. Descriptive statistics summarized participants' characteristics. Associations between explanatory variables and willingness to accept the vaccine were assessed using chi-square tests and logistic regression analysis. Statistical significance was set at $p < 0.05$.

Results

The majority of participants were aged 20–34 years (75.5%), married (85.3%), and had tertiary education (55.1%). Awareness of the malaria vaccine was relatively low (48.5%). However, perceptions toward vaccination were largely positive: 86.1% believed vaccines prevent disease and 87.2% believed a malaria vaccine could protect against malaria. Overall, 81.0% of respondents were willing to receive the vaccine if available, and 79.9% were willing to vaccinate their children. Factors significantly associated with vaccine acceptance included belief in vaccine protection ($p < 0.001$), healthcare provider recommendation ($p = 0.002$), vaccine availability ($p = 0.002$), provision of safety information ($p = 0.005$), and free vaccination ($p < 0.001$). In multivariable analysis, belief in vaccine protection and healthcare provider recommendation remained independent predictors of vaccine acceptance.

Conclusions

Despite limited awareness, pregnant women demonstrated favourable disposition and high willingness to accept the malaria vaccine. Strengthening antenatal health education and leveraging healthcare provider recommendations may improve vaccine uptake and support effective malaria vaccine implementation in high-burden settings.

Introduction

Malaria remains a major public health challenge in Nigeria, contributing to approximately 24.3% of global malaria cases and 30.3% of deaths, with pregnant women and children under five years old bearing the highest burden due to increased risks of severe complications such as anemia, low birth weight, and maternal mortality.[1,2] The recent introduction of malaria vaccines, including RTS,S/AS01 and R21/Matrix-M, marks a pivotal advancement in malaria control, with the World Health Organization (WHO) recommending their use in high-transmission settings since 2021 and 2023, respectively.[3,4] Nigeria commenced phased rollout of the R21/Matrix-M vaccine in November 2024, initially targeting children aged 5 months and older in high-burden states like Kebbi and Bayelsa, with plans for nationwide expansion by 2025–2026.[5,6] Although these vaccines are not yet routinely administered during pregnancy, pregnant women attending antenatal care clinic (ANC) play a crucial role as primary caregivers and decision-makers for child vaccination, influencing community acceptance and uptake.

However, vaccine hesitancy driven by low awareness, misinformation, concerns about side effects, and cultural factors has historically undermined immunization programs in Nigeria, as evidenced by challenges during the COVID-19 and polio vaccine rollouts.[7,8] Recent studies highlight a pattern of limited awareness but high potential willingness among Nigerian mothers and caregivers.[9,10,11] Despite these insights, significant gaps persist. Most existing research focuses on general caregivers or mothers of under-five children, with limited data specifically on pregnant women, who are uniquely positioned at ANC clinics, a key entry point for health education and immunization promotion.[12] Additionally, studies from Southwest Nigeria are scarce, despite the region's diverse urban-rural dynamics and ongoing malaria endemicity, leaving a void in localized evidence to guide tailored interventions during the national rollout.

This study addresses these gaps by assessing awareness, perceptions, and willingness to accept the malaria vaccine among pregnant women in Southwest Nigeria's ANC settings. The findings aim to inform policymakers, healthcare providers, and community stakeholders on strategies to bridge awareness deficits and leverage high latent demand for sustainable malaria control.

Methods

Study design

This was a facility-based descriptive cross-sectional study conducted from April 2025 to July 2025.

Study area

The study was conducted at the antenatal care (ANC) clinic of Olabisi Onabanjo University Teaching Hospital (OOUTH) in Sagamu, Ogun State, Southwest Nigeria. Olabisi Onabanjo University Teaching Hospital is a major tertiary referral facility serving Ogun and Lagos states), with high patient volumes for

maternal and child health services, including routine ANC, immunization integration, and malaria prevention counselling.

Study population

The study population comprised 274 pregnant women attending routine ANC visits at OOUTH. Inclusion criteria were: women confirmed pregnant (any trimester), aged 18 years or older, and willing to provide informed consent. Exclusion criteria included: women with acute illness preventing participation, non-pregnant attendees, or those declining consent.

Sampling technique and sample size determination

Consecutive sampling of eligible participants was done. The sample size was determined using a standard formula for cross-sectional studies (Cochran's Formula), considering the prevalence of malaria vaccination acceptance among women of 97.7% from a study by Alagbe*et al*[10], with the assumptions of 95% confidence interval (CI) and margin of error of 2%. Considering a 15% non-response rate, the total minimum sample size calculated was 253. However, 274 pregnant women were recruited for the study.

Data collection instrument

A structured, interviewer-based administered questionnaire was developed, adapted from validated WHO Knowledge, Attitudes, and Practices (KAP) tools for malaria vaccines and similar studies in Nigeria.[10,13,14] (supplementary file). The tool consisted of four sections. Section A: sociodemographic and obstetric characteristics (e.g., age, education, employment, marital status, socioeconomic status using the Oyedeji classification system,[15] ethnicity, parity, trimester). Section B: Awareness of malaria vaccine (yes/no, sources via multiple choices). Section C: Perceptions (e.g., belief in vaccination as prevention, vaccine protection against malaria, and necessity for pregnancy/children. Section D: Willingness and motivators (e.g., willingness to accept for self/child, recommend to others; motivators like free access, convenient location, healthcare provider (HCP) recommendation, and safety/effectiveness information). Content validity was ensured through expert review by a public health specialist and an infectious disease expert, achieving a content validity index (CVI) of 0.85. Reliability was assessed via Cronbach's alpha ($\alpha = 0.78$ for perception scale, $\alpha = 0.82$ for willingness items). The questionnaire was pretested on 15 non-study ANC attendees, following which minor refinements for clarity and cultural appropriateness was made. Completion time averaged 10–15 minutes.

Data collection procedure

A trained research assistant administered the questionnaire during ANC waiting periods to minimize disruption after obtaining an informed consent. Questionnaires were checked for completeness on-site. Data were collected anonymously, with unique identifiers for quality control.

Data Management and Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics summarized sociodemographics, awareness, perceptions, and willingness using frequencies and percentages. Bivariate associations between independent variables (sociodemographics, perceptions, motivators) and malaria vaccine acceptance (dichotomized: yes vs. no/undecided) were tested using chi-square tests. Variables with p value < 0.05 in bivariate analysis were entered into multivariable binary logistic regression to identify independent predictors, reporting adjusted odds ratios (Exp(B)) with 95% confidence intervals (CI). Level of significance was set at $p < 0.05$. Bar chart for sources of information was generated using Excel for visualization.

Results

A total of 274 pregnant women were recruited for the study. They were predominantly aged 20–34 years (75.5%), with 55.1% having tertiary education (Table 1). Less than half of the respondents (48.5%) were aware of the malaria vaccine, with healthcare workers being the primary source of information (Fig. 1).

Table 1
Sociodemographic and Obstetric Characteristics of Participants (n = 274)

Variable	Frequency (n)	Percentage (%)
Age (years)		
< 20	3	1.1
20–34	207	75.5
35 and above	64	23.4
Level of education		
No formal	4	1.5
Primary	7	2.6
Secondary	112	40.9
Tertiary	151	55.1
Employment status		
Self-employed	189	69.0
Private employed	59	21.5
Civil servant	16	5.8
Unemployed	10	3.6
Marital status		
Single	13	4.7
Married	261	85.3
Socioeconomic status		
Upper	150	54.7
Middle	101	36.9
Lower	23	8.4
Ethnicity		
Yoruba	218	79.6
Igbo	36	13.1
Hausa	7	2.6
Others	13	4.7

Variable	Frequency (n)	Percentage (%)
Age (years)		
Parity		
0	87	31.8
1–2	138	50.4
3–4	45	16.4
5 and above	4	1.5
Trimester		
1st	60	21.9
2nd	123	44.9
3rd	91	33.2

Despite limited awareness, perceptions toward the malaria vaccine were predominantly positive. A large proportion (86.1%) believed vaccination is an effective means of disease prevention, 87.2% believed the malaria vaccine can protect against malaria, and 77.7% considered malaria vaccination necessary during pregnancy and for children (Table 2). Willingness to accept the vaccine was correspondingly high: 81.0% would be willing to receive the vaccine themselves if available today, 79.9% would vaccinate their child if introduced into the National Programme on Immunization (NPI) schedule, and 78.5% would recommend it to others (Table 2). The key motivators for malaria vaccine acceptance included recommendation by a healthcare provider (60.2%) and information on vaccine safety and effectiveness (53.3%), Table 3.

Table 2
Perception and readiness to accept the malaria vaccine among respondents

Variable	Frequency, n = 274	Percentage (%)
Do you believe in vaccination as a means of disease prevention?		
Yes	236	86.1
No	22	8.0
I don't know	16	5.8
Do you believe the malaria vaccine can protect against malaria?		
Yes	239	87.2
No	21	7.7
I don't know	14	5.1
Do you think malaria vaccination during pregnancy and for children is necessary?		
Yes	213	77.7
No	35	12.8
I don't know	26	9.5
Would you recommend the malaria vaccine to others?		
Yes	215	78.5
No	34	12.4
I don't know	25	9.1
If malaria vaccination were available today, would you be willing to get vaccinated?		
Yes	222	81.0
No	26	9.5
Undecided	26	9.5
If introduced in the NPI schedule, would you be willing to vaccinate your child?		
Yes	219	79.9
No	32	11.7
Undecided	23	8.4

Table 3
Motivators of vaccination acceptance among the respondence

Variable	Frequency, n = 274	Percentage (%)
What would motivate you to accept the malaria vaccine for yourself and your child?		
Free vaccination		
Yes	130	47.4
No	144	52.6
Convenient vaccination location		
Yes	111	40.5
No	163	59.5
Recommendation by healthcare provider		
Yes	165	60.2
No	109	39.8
Information about vaccine safety and effectiveness		
Yes	146	53.3
No	128	46.7

Bivariate analysis revealed no significant associations between sociodemographic or obstetric characteristics (age, education, employment, marital status, parity, trimester) and vaccine acceptance ($p > 0.05$) (Table 4). However, strong positive associations were observed with perceptual and motivational factors, including belief that the vaccine protects against malaria ($\chi^2 = 49.252$, $p < 0.001$), free vaccination ($\chi^2 = 11.230$, $p < 0.001$), convenient location ($\chi^2 = 9.977$, $p = 0.002$), healthcare provider recommendation ($\chi^2 = 9.726$, $p = 0.002$), and information on safety/effectiveness ($\chi^2 = 7.915$, $p = 0.005$) (Table 4).

Table 4
Association between Sociodemographic and health system related factors, and malaria vaccination acceptance for mothers and their children.

Malaria vaccination acceptance				
Variable	**Yes**	**No/undecided**	**χ^2**	**p value**
Age of mothers				
< 20	2 (66.7)	1 (33.3)	0.672[Y]	0.715
20–34	163 (78.7)	44 (21.3)		
35 and above	54 (84.4)	10 (15.6)		
Marital status				
Single	8 (61.5)	5 (38.5)	1.799[Y]	0.180
Married	211 (80.8)	50 (19.2)		
Mothers' level of education				
No formal education	4 (100)	0 (0)	0.153[Y]	0.985
Primary	5 (71.4)	2 (28.6)		
Secondary	90 (80.4)	22 (19.6)		
Tertiary	120 (79.5)	31 (20.5)		
Mothers' employment status				
Civil servants	11 (68.8)	5 (31.2)	0.879[Y]	0.830
Self-employed	153 (81.0)	36 (19.0)		
Private employed	48 (81.4)	11 (18.6)		
Unemployed	7 (70.0)	3 (30.0)		
Parity				
Nulliparous	72 (82.8)	15 (17.2)	0.637	0.425
Primi/multiparous	147 (78.6)	40 (21.4)		
Trimester				

Malaria vaccination acceptance				
Variable	**Yes**	**No/undecided**	**χ^2**	**p value**
Age of mothers				
First Trimester	47 (78.3)	13 (21.7)	0.210	0.900
Second Trimester	98 (79.7)	25 (20.3)		
Third Trimester	74 (81.3)	17 (18.7)		
Believe that the malaria vaccine can protect against malaria				
Yes	204 (86.4)	32 (13.6)	49.252^{Y}	**< 0.001**
No	5 (22.7)	17 (77.3)		
I don't know	10 (62.5)	6 (37.5)		
Free vaccination				
Yes	115 (88.5)	15 (11.5)	11.230	**< 0.001**
No	104 (72.2)	40 (27.8)		
Convenient vaccination location				
Yes	99 (89.2)	12 (10.8)	9.977	**0.002**
No	120 (73.6)	43 (26.4)		
Recommendation by healthcare provider				
Yes	142 (86.1)	23 (13.9)	9.726	**0.002**
No	77 (70.6)	32 (29.4)		
Information about vaccine safety and effectiveness				
Yes	126 (86.3)	20 (13.7)	7.915	**0.005**
No	93 (72.7)	35 (27.3)		

χ^2: Chi square; Y: Yates' correction.

Multivariable binary logistic regression confirmed two independent predictors of acceptance: belief in the vaccine's protective efficacy (adjusted OR = 0.303, 95% CI 0.174–0.528, p < 0.001) and healthcare provider recommendation (adjusted OR = 0.476, 95% CI 0.245–0.927, p = 0.029) (Table 5).

Table 5
Predictors of malaria vaccination acceptance for self and child

Variables	B	Wald	p value	Exp (B)	95% CI for Exp (B)	
					Lower	Upper
Free vaccination	− .762	3.684	0.055	0.466	0.214	1.016
Convenient vaccination location	− .374	.725	0.395	0.688	0.291	1.627
Healthcare provider information	− .742	4.764	**0.029**	**0.476**	0.245	0.927
Safety and effectiveness	− .592	2.991	0.084	0.553	0.283	1.082
Believe that the mv can protect against malaria	-1.193	17.729	**0.000**	**0.303**	0.174	0.528
Constant	6.736	38.500	0.000	841.841		

B: regression coefficient, Exp (B): Exponentiated B, CI: confidence interval.

Discussion

The findings of this study demonstrate a notable disparity between the relatively low awareness of the malaria vaccine and the high levels of positive perceptions and willingness to accept it among pregnant women attending antenatal care clinic. Although less than half of the participants had prior knowledge of the malaria vaccine, the majority expressed readiness to receive the vaccine themselves and to allow their children to be vaccinated if it were incorporated into the National Programme on Immunization (NPI). This observation suggests the presence of a latent demand for malaria vaccination that could be effectively harnessed through improved public health communication and health system engagement. Such a pattern is consistent with emerging evidence from other parts of Nigeria where awareness of the malaria vaccine remains limited, yet willingness to accept it becomes substantial once basic information is provided. For instance, a study conducted in North-central Nigeria among mothers of under-five children reported that although awareness was only 23.7%, willingness to accept the vaccine was as high as 97.3%, with positive perceptions, particularly the belief that the vaccine provides protection against malaria, serving as a major determinant of acceptance.[10] Similarly, research conducted in Enugu State in Southeast Nigeria found a high level of initial unawareness among pregnant and nursing mothers; however, acceptability rose dramatically to 94.2% following health education, underscoring the transformative role of targeted information dissemination in improving vaccine acceptance.[11] In contrast, a national cross-sectional survey among mothers of under-five children reported relatively

lower acceptance levels, largely attributed to concerns regarding vaccine safety and potential costs, highlighting the persistent influence of perceived risks and financial barriers in vaccination decision-making.[16]

The channels through which participants obtained information about the malaria vaccine in the present study were predominantly healthcare providers, mass media platforms, and informal discussions within families and communities. This distribution of information sources mirrors findings from similar studies conducted in Nigeria and other malaria-endemic settings, emphasizing the importance of multiple communication channels in disseminating health information effectively. Ajayi *et al*[17] and Dim *et al*[11] reported that healthcare providers were the most trusted and frequently cited sources of malaria vaccine information in Northeast and Southeast Nigeria respectively, reinforcing the central role of frontline health workers in shaping vaccination attitudes and decisions. In addition, mass media, particularly radio, television, and social media, has increasingly emerged as an influential source of health information in urban populations, complementing the messaging delivered within clinical settings. However, the reliance on informal community discussions as a source of information may also expose populations to misinformation or incomplete knowledge regarding new vaccines. This underscores the need to strengthen structured, provider-led communication strategies within antenatal care clinics and other maternal health platforms. Notably, the low overall awareness observed in this study, despite being conducted in a tertiary healthcare facility located in an urban setting, reflects broader national trends in Nigeria where awareness levels of the malaria vaccine have ranged between 9% and 28% in recent studies.[9–11] This finding highlights a significant gap in pre-implementation public health communication, particularly in Southwest Nigeria where malaria transmission remains stable but vaccine education efforts have not been as prominent as in northern pilot regions.

The sociodemographic profile of participants in this study may have contributed to the favourable perceptions observed. A substantial proportion of respondents had tertiary education and belonged to middle or upper socioeconomic groups, characteristics that are often associated with greater access to health information and healthcare services. Nevertheless, no statistically significant associations between sociodemographic variables and willingness to accept the malaria vaccine were observed in the bivariate analysis. This finding differs from some previous studies that identified educational attainment as a key predictor of vaccine acceptance and uptake.[10,17,18] For example, studies conducted among caregivers in other Nigerian regions have shown that higher educational levels were positively associated with improved vaccine knowledge and acceptance. Similarly, research conducted in Enugu suggested that higher social class was linked to greater acceptability of the malaria vaccine, implying that socioeconomic advantages may enhance access to reliable health information and strengthen trust in health interventions.14 The absence of a significant association in our study suggests that while education and social class may shape baseline knowledge levels, perceptual factors—such as trust in vaccine effectiveness and confidence in healthcare systems—may play a more decisive role in influencing vaccine acceptance among pregnant women in clinical settings.

Importantly, the key motivators for malaria vaccine acceptance identified in this study were healthcare provider recommendation and access to clear information regarding vaccine safety and effectiveness. These findings highlight the critical role of modifiable health system factors in promoting vaccine uptake. Multivariable analysis confirmed that belief in the protective efficacy of the malaria vaccine and endorsement by healthcare providers were independent predictors of willingness to accept the vaccine. This observation is consistent with established models of vaccine hesitancy, which show that individuals are more likely to accept vaccines when they perceive clear health benefits, trust healthcare professionals, and receive information through trusted interpersonal communication.[19] In many settings, healthcare providers remain the most trusted source of vaccine information and play a pivotal role in addressing concerns related to safety, efficacy, and potential adverse effects. Comparable findings were reported in a study conducted in Ibadan Nigeria, among caregivers of under-five children, where willingness to accept the malaria vaccine, reported by approximately 87% of respondents, was strongly associated with trust in healthcare providers and recommendations from health professionals.[20] Our findings extend this evidence to pregnant women, suggesting that antenatal care clinics provide a valuable opportunity for integrating malaria vaccine education, particularly as the introduction of newer vaccines such as the R21/Matrix-M expands across malaria-endemic countries.

These findings carry important policy and programmatic implications for malaria control strategies in Nigeria. As the country continues the phased introduction of malaria vaccines, initially prioritizing under-five children in Kebbi and Bayelsa states, with plans for nationwide scale-up in the year 2026, there is a clear need to strengthen community engagement and public awareness campaigns.[21] Integrating structured malaria vaccine education into routine antenatal care services could serve as a strategic approach to improving maternal knowledge and fostering positive attitudes toward vaccination. Pregnant women often function as key health decision-makers within households and can therefore play an important role in advocating for childhood immunization. Strengthening provider-led counseling on vaccine safety, benefits, and availability during ANC visits may help bridge the existing awareness gap while reinforcing public confidence in malaria vaccination programmes. Overall, the findings of this study indicate that pregnant women in Sagamu, Southwest Nigeria demonstrate substantial readiness to accept malaria vaccination for themselves and their children despite limited baseline awareness. Harnessing this favourable disposition through targeted health education and trusted healthcare provider engagement may significantly enhance vaccine uptake and contribute to the successful implementation of malaria vaccination programmes in high-burden settings.

Strengths and limitations of the study

This study's strengths include its focus on pregnant women in an ANC setting, a novel angle in malaria vaccine literature; providing actionable insights for integration into maternal-child health programs. The adequate sample size and multivariable analysis enhance internal validity and generalizability to similar urban-referral setting in Southwest Nigeria. The single-site focus in an urban setting limits

generalizability to rural or primary care settings, potentially over-representing educated, health-seeking women and underestimating barriers in underserved areas.

Abbreviations

ANC: Antenatal Care

NPI: National Programme on Immunization

AOR: Adjusted Odds Ratio

CI: Confidence Interval

CVI: Content Validity Index

B: Regression coefficient.

Exp(B): Exponentiated Beta (Odds Ratio from logistic regression)

HCP: Health Care Provider

KAP: Knowledge, Attitude and Practice

OOUTH: Olabisi Onabanjo University Teaching Hospital

SPSS: Statistical Package for the Social Sciences

WHO: World Health Organization

RTS,S: RTS,S/AS01 Malaria Vaccine

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Health Research Ethics Committee of Olabisi Onabanjo University Teaching Hospital, Sagamu, with the protocol approval number OOUTH/HREC/04/017/E269/2026AP. Informed consent was obtained from participants and participation was voluntary.

Consent for publication

Not applicable

Availability of data and materials

The datasets analysed during the current study are available from the corresponding author on reasonable request. The questionnaire used has been supplied as anadditional file.

Competing interest

The authors declare no competing interest

Funding

No funding was received for this study.

Acknowledgement

We are grateful to the nurses at the antenatal care clinic who assisted us with the recruitment of the pregnant women for data collection.

Authors' contributions

SOA, OEJ and KO conceived the idea and design. SOA, OEJ, KO and EO were involved in the data collection process. SOA and KVO performed the data analysis and interpreted the findings. SOA drafted the manuscript. TAO and AVA shared in the study ideology and did a critical appraisal of the manuscript. All authors read and approved the final manuscript for submission.

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Figures

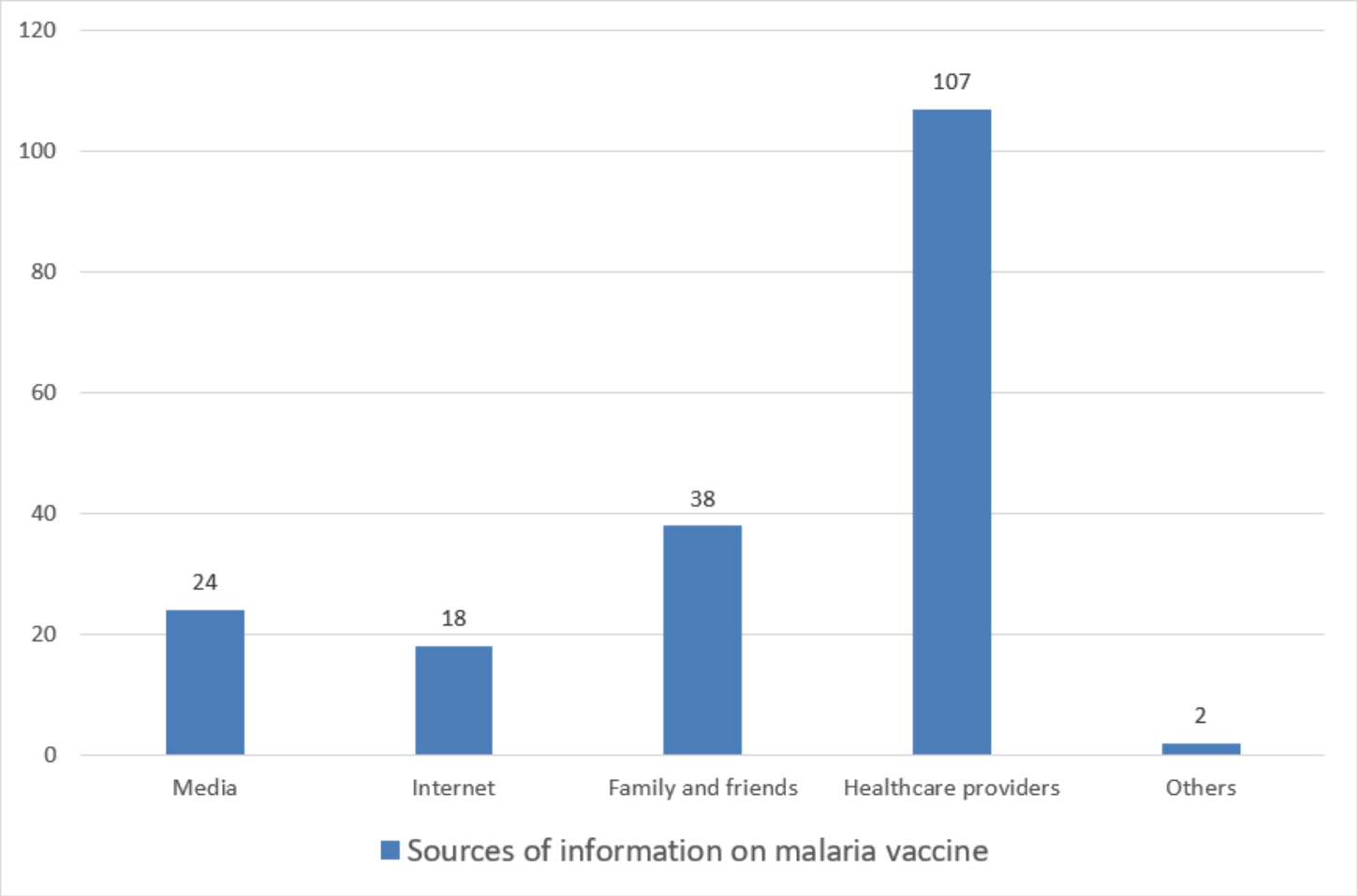


Figure 1

Sources of information

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