



# Factors influencing the role of healthcare providers in promoting acceptance of the malaria vaccine in the Bamenda and Bamenda III Health districts.

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## Abstract

**Background:** Malaria remains a major public health problem, with almost half of the world's population at risk of infection. To improve malaria control, on 22 of the January 2024, Cameroon introduced the malaria vaccine into its immunization program making it available for children under five. Acceptability faces challenges due to different perception of caregivers on the malaria vaccine. **Objective:** The study aims to examine the factors influencing the role of healthcare providers in promoting the acceptance of the malaria vaccine the Bamenda and bamenda III Health Districts. **Methods:** The research was a hospital based cross sectional study. Data was collected from the multistage sampling of the 18 health areas of the Bamenda and Bamenda III Health Districts. **Results:** A total of 458 respondents filled the survey with 73.4% females and 60.5% nurses. Educational level played a critical role in shaping healthcare providers' perceptions of caregiver attitudes towards vaccine acceptability, a significant association with perceptions of caregiver attitudes, evidenced by a  $X^2$  of 17.377 ( $p = 0.043$ ) with those of primary education having the highest percentage of good perceptions at 81.3%. With regards to impact of training and support, educational level demonstrates a significant relationship ( $X^2 = 28.154$ ,  $p = 0.001$ ); as educational attainment increases, the percentage of respondents rating the training and support as "Very Inadequate" rises, particularly among those with tertiary education (75.7%). The correlation analysis reveals that the frequency of discussions about the malaria vaccine with caregivers, their confidence in educating caregivers, and their personal willingness to recommend the vaccine positively influence the role of health care providers to promote acceptability as evidence by their values ( $r = 0.256$ ,  $p < 0.01$ ), ( $r = 0.241$ ,  $p < 0.01$ ) and ( $r = 0.336$ ,  $p < 0.01$ ), respectively. **Conclusion:** Frequent discussions about the malaria vaccine among healthcare providers, access to resources and training significantly improve their confidence in educating and willingness to promote vaccine acceptance among caregivers.

**Keywords:** Malaria vaccine, Acceptance, health care provider, factors,

## 1. Introduction

Malaria is a mosquito-borne parasitic disease common in tropical and subtropical regions, which continues to cause high rates of illness and death, significantly adding to the global burden of morbidity and mortality. [1]. Most severe and deadly cases of malaria are caused by *Plasmodium falciparum*, responsible for over 90% of malaria-related deaths worldwide. [2]. *P. falciparum* is the deadliest and the most prevalent in the African continent, it is transmitted by anopheles to cause malaria in humans [3]. In 2023, the global malaria burden was estimated at 263 million cases, corresponding to an incidence of 60.4 cases per 1,000 people at risk. This reflects an increase of 11 million cases compared to the previous year, with incidence rising from 58.6 per 1,000 at-risk individuals in 2022. [4]. There were 249 million malaria cases globally in 2022, leading to 608 000 deaths. Of these deaths, 77% were children under 5 years of age, mostly in Africa[5,6]. An estimated 86% of the deaths were among children younger than five years, with the

overwhelming majority occurring in sub-Saharan Africa[7]. Although overall childhood mortality is declining across Africa, deaths specifically caused by malaria remain a major public health challenge, especially in sub-Saharan Africa [8]. Also in other parts of Africa, malaria often affects children's mental and physical development and is a leading cause of school absenteeism [9]. Malaria is the most widespread endemic disease in Cameroon, annually responsible for greater than two million reported cases[10]. In Cameroon, malaria remains the main cause of hospital consultations with more than 5 million cases per year representing 2.9% of all the world cases [11]. However, since the disease remains a threat due to drug and insecticide resistance. Therefore, additional interventions like vaccines are needed to combine with the already existing interventions [12]. On October 6, 2021, the WHO officially endorsed the RTS,S malaria vaccine for young children in regions with moderate to high transmission, aiming to lessen the global malaria burden and strengthen existing prevention strategies. [13]. Cameroon has made the fight against malaria a priority and On 22 of January 2024, Cameroon introduced the RTS,S malaria vaccine into its Expanded Program on Immunization. The nation plans to vaccinate infants at six, seven, nine, and twenty-four months old with four vaccine doses across 42 health districts in the country's ten regions[14]. However, the availability of the vaccine does not necessarily mean it will be accepted by the public. Making malaria vaccine available for routine use will be a major achievement, but the level of its acceptability, by caregivers could pose a considerable challenge that need to be addressed in order to achieve a successful implementation of the program[15]. In Cameroon, few studies have been done on the introduction of the malaria vaccine and its acceptability[2,10,12,14,16], but no published research has been done on factors influencing the role of Health care provider in promoting malaria vaccine acceptance in the North-West Region of Cameroon. The purpose of this study was to investigate the factors that shape healthcare providers' role in encouraging the acceptance of the malaria vaccine in the Bamenda and Bamenda III Health Districts.

## 2. MATERIALS AND METHODS

### 2.1 Study design

This was a descriptive hospital based cross sectional study of health care providers who were currently working in the vaccination units/children wards of the different health facilities in Bamenda and Bamenda III health districts.

### 2.2 Study site

The study was conducted among health areas within the Bamenda and Bamenda III Health District. The Bamenda Health District with a total of 271390 inhabitants, covers a total surface area of 560 Km<sup>2</sup> consisting of 13 Health areas with 28 health facilities, while the Bamenda III Health District with its 178180 inhabitants, covers 5 Health areas with 10 health facilities, 3 of which are public, 4 confessional and 3 private health facilities. Both districts have an urban and rural community.

### 2.3 Study Population

The study population constituted health care providers (nurses, community health worker, Lab technicians, and medical doctors) from the 18 health areas of the Bamenda and Bamenda III health districts.

### 2.4 Sample inclusion and exclusion criteria:

These included health care providers who were currently serving at the health units and who gave their consent. Students on internship, temporary trainees, and those not willing to participate in the study were not included

### 2.5 Sample size calculation

The sample size for health care providers was calculated using the Cochran formula[17] as follows

$$N = \frac{Z^2 (p)(q)}{d^2}$$

Where N= minimum sample size

Z= Value corresponding to 95% confidence interval =1.96

P= Estimate of malaria prevalence. Prevalence of malaria in the Mezam division of the North West Region is 34.7[18]

q = 1 - p (1 - 0.347) = 0.653

d= Margin of error= 5%= 0.05

Given the prevalence of malaria data from a study by Ngum et al[18], a sample size of 345 healthcare providers was calculated.

To minimize the non-response errors, non-response rate was taken at 10% of the sample size (10/100)345 = 34.5.

Therefore, sample size was 345+35=380 health personnel to participate in the study. To improve the precision of the estimates, we opted to survey 458 health care providers, from Bamenda and Bamenda III health districts.

## 2.6 Sampling technique

Study sample consisted of 458 health care providers that were drawn from the various sampled health areas. All available healthcare workers were sampled. The study population was distributed into all the 18 health areas of the Bamenda and Bamenda III Health Districts and for each health area, all health units were selected, within which the health care providers were sampled by convenient sampling, until the required sample size was achieved.

## 2.7 Data collection tool and collection procedure

An interview guide (questionnaire) was divided into six sections; Socio-demographic, Experience and perception on malaria vaccine acceptability, Factors influencing provider role, communication, interaction and perception of care giver attitude, impact of training and support, factors influencing role of health care provider. In each of the selected health units, all health workers who consented to participate in the study were interviewed with the use of a questionnaire, by convenient sampling, method. To each health worker, a questionnaire was issued, which was filled by the health worker and returned to the trained data collector.

## 2.8 Validation of instrument

To be sure of the quality of data collected, the instrument Interview guide (questionnaire) was pretested on 50 participants in the Tubah health district.

## 2.9 Data management and analysis

Prior to data entry, a data coding guide was prepared with each variable assigned a specific code. Data was entered into excel and exported to SPSS. Data entry was done using unique identifiers and cross-checked for entry errors and range checks. Data analysis was done using the Statistical Package for Social Science (SPSS) for Windows version 25.0. Descriptive statistics was obtained for different variables. Frequency distribution tables were used to present results. Chi-square ( $\chi^2$ ) analyses were also conducted to test all research hypotheses to determine any existing relationship with the demographic and other variables. Statistical significance was set at  $P=0.05$  or 5% confidence level. Pearson correlation was used to determine the factors influencing the role of health care providers.

## 2.10 Ethical considerations

Ethical clearance was obtained from the University of Bamenda No 2024/0009H/UBa/IRB, Faculty of Health Sciences Institutional Review Board. Administrative clearance was obtained from the Regional Delegate of Public Health for the North-West Region. Absolute confidentiality was guaranteed by not including the subject's names on the data collection tool. Instead, codes were used. All information obtained was kept confidential and anonymous.

## 3. Results

### 3.1 Socio-demography information

A total of 458 Health care providers took part in this survey. Following the inclusion criteria, majority of participants are aged 20-30 years (68.3%), with a significant representation of females (73.4%) compared to males (26.6%). Educationally, a high percentage (75.3%) possesses tertiary qualifications, indicating a well-educated population. In terms of marital status, nearly half (48.9%) are single, while 43.7% are married. The religious affiliations show a predominant Christian representation (82.5%), which may influence community dynamics. Professionally, nursing is the leading occupation, with 60.5% of participants identifying as nurses, followed by various health-related roles (Table 1).

**Table I: Distribution of socio-demography information of participants**

Variable(n=458)	Frequency	Percentage
<b>Age Group (Years)</b>		
20-30	313	68.3
31-40	81	17.7
41-50	49	10.7
51-60	15	3.3
<b>Gender</b>		
Male	122	26.6
Female	336	73.4
<b>Educational Level</b>		
No response	2	0.4
Primary	32	7.0
Secondary	79	17.2
Tertiary	345	75.3

### Marital Status

Widow(er)	26	5.7
Divorced	8	1.7
Married	200	43.7
Single	224	48.9
<b>Religion</b>		
Others	5	1.1
Muslim	75	16.4
Christian	378	82.5
<b>Profession</b>		
Community health worker	13	2.8
Health Technician	48	10.5
Medical Doctor	18	3.9
Midwife	51	11.1
Nurse	277	60.5
Nurse Assistant	51	11.1
<b>Educational Certificate</b>		
PhD	3	0.6
MSc	22	4.8
BSc	126	27.5
Nurse assistant	89	19.4
1 year Diploma	75	16.4
HND/SRN	143	31.6

### 3.2 Experience and Perception

Table II outlines the distribution of participants' experiences and perceptions regarding the acceptability of the malaria vaccine. A significant portion of participants (43.2%) have been in their current roles for 1-3 years. When asked about their knowledge on the malaria vaccine, most participants felt knowledgeable, with 45.9% rating themselves as "knowledgeable" and 27.5% as "very knowledgeable." Regarding the perceived effectiveness of the malaria vaccine, 50.4% considered it "very effective." In terms of acceptance, a substantial majority (67.0%) reported being "accepting" of the malaria vaccine, with only a small fraction (7.2%) expressing rejection. Furthermore, an overwhelming 82.5% agreed that malaria illness leads to a loss of economic productivity. Additionally, an impressive 96.9% of health care providers agreed that the malaria vaccine is a valuable addition to malaria control strategies.

**Table II: Distribution of participant's experience and perception on acceptability of malaria vaccine**

Variable(n=458)	Frequency	Percentage
<b>How long you have been working in your current role</b>		
<1 year	123	26.9
1-3 years	198	43.2
4-6 years	59	12.9
7-10 years	54	11.8
Over 10 years	24	5.2
<b>How knowledgeable you feel about malaria vaccine</b>		
Very knowledgeable	126	27.5
Knowledgeable	210	45.9
Somewhat knowledgeable	73	15.9
Not knowledgeable	49	10.7
<b>Perception of the effectiveness of the malaria vaccine</b>		
Very effective	92	20.1
Effective	77	16.8
ineffective	58	12.7
Very effective	231	50.4
<b>How you specifically perceive the malaria vaccine</b>		
Very accepting	100	21.8
Accepting	307	67.0
Rejecting	33	7.2
Very rejecting	18	3.9

**Malaria illness leads to loss of economic productivity**

No, I disagree	80	17.5
Yes, I agree	378	82.5

**Malaria vaccine is a good addition to the control of malaria.**

No, I disagree	14	3.1
Yes, I agree	444	96.9

**3.3 Relationship between demography and perception on Malaria vaccine acceptability**

The data presented in Table III examines the relationship between various demographic characteristics and participants' experiences and perceptions of vaccine acceptability by caregivers. Overall, none of the characteristics show statistically significant associations with perceptions, as all p-values exceed the 0.05 threshold for significance. For example, the  $X^2$  value for gender is 5.820 ( $p = 0.121$ ), indicating that perceptions of vaccine acceptability are similar for males (66.4% good perception) and females (67.3% good perception). Similarly, age groups and educational levels also reflect no significant differences, with chi-square values of 8.375 ( $p = 0.497$ ) for age and 14.094 ( $p = 0.119$ ) for education.

Marital status and religious affiliation further demonstrate the lack of statistically significant findings. For instance, the chi-square value for marital status is 7.073 ( $p = 0.630$ ), showing that perceptions of acceptability do not significantly differ among widowed (73.1% good perception), divorced (50%), married (69.5%), and single individuals (64.7%). Religious groups also exhibit similar trends, with Muslims (62.7%) and Christians (67.7%) showing comparable perceptions ( $X^2 = 2.344$ ,  $p = 0.885$ ).

**Table III: Distribution of the relationship between experience/perception and demography**

Characteristics	Variable (n=458)	Experience and perception on vaccine acceptability		$X^2$	P* Value
		Good Perception N (%)	Bad Perception N (%)		
Gender	Male	81 (66.4%)	4 (3.3%)	5.820	0.121
	Female	226 (67.3%)	29 (8.6%)		
Age Group	20-30	208 (66.5%)	22 (7.0%)	8.375	0.497
	31-40	52 (64.2%)	8 (9.9%)		
	41-50	38 (77.6%)	2 (4.1%)		
	51-60	9 (60%)	1(6.7%)		
Educational level	No Response	1 (50%)	0 (0.0%)	14.094	0.119
	Primary	20 (62.5%)	3 (9.4%)		
	Secondary	45 (57%)	9 (11.4%)		
	Tertiary	241 (69.9%)	21 (6.1%)		
Marital Status	Widow(er)	19 (73.1%)	1(3.8%)	7.073	0.630
	Divorced	4 (50%)	1 (12.5%)		
	Married	139 (69.5%)	15 (7.5%)		
	Single	145 (64.7%)	16 (7.1%)		
	Others	4 (80%)	0 (0.0%)		
Religion	Muslim	47 (62.7%)	6 (8%)	2.344	0.885
	Christian	256 (67.7%)	27 (7.1%)		

$X^2$  : Chi square test

**3.4 Factors influencing provider role**

Table IV highlights the factors influencing healthcare providers' roles in promoting the acceptability of the malaria vaccine. A significant majority of providers (65.3%) report that they discussing malaria vaccine with caregivers on a monthly basis, while 25.5% do so daily. In terms of confidence in educating caregivers, 52.0% of providers feel "confident," and 26.6% feel "very confident". Willingness to promote vaccine acceptance is also high, with 67.5% of providers indicating they are "very willing" to encourage caregivers. Regarding the resources used to stay informed, medical journals (30.6%) and peer discussions (30.1%) are the most common sources of information, followed by workshops and seminars (19.7%) and online courses (18.1%).

**Table IV: Distribution of factors influencing provider role in vaccine acceptability**

Variable(n=458)	Frequency	Percentage
<b>How often you discuss the malaria vaccine with caregivers</b>		
Daily	117	25.5
Monthly	299	65.3
Monthly	20	4.4

Rarely	22	4.8
<b>Confident in your ability to educate caregivers about the malaria vaccine</b>		
Very confident	122	26.6
Confident	238	52.0
Somewhat confident	68	14.8
Not confident	30	6.6
<b>Your willingness to promote malaria vaccine acceptance for caregivers</b>		
Very willing	309	67.5
Somewhat willing	119	25.9
Reluctant	25	5.5
Not willing	5	1.1
<b>Resources you use to stay informed about malaria vaccines</b>		
Peer discussions	138	30.1
Medical journals	140	30.6
Online courses	83	18.1
Workshops/seminars	97	21.2

### 3.5 Communication and interaction and perceptions of caregiver attitudes

According to Table V, most providers feel comfortable discussing vaccine-related concerns, with 54.4% reporting they are "comfortable" and 40.8% "very comfortable." When it comes to effective communication methods, face-to-face conversations are overwhelmingly preferred by 76.0% of providers. Regarding caregiver receptiveness, a significant 64.2% of providers perceive caregivers as "receptive" to malaria vaccine information, while 21.8% view them as "very receptive." However, barriers to acceptance persist, with misinformation identified by 48.0% of providers as a major obstacle, followed by cultural beliefs (31.9%). Accessibility to vaccines and trust in healthcare providers are less frequently cited as barriers.

**Table V: Distribution of interaction and perceptions of caregiver attitudes**

Variable(n=458)	Frequency	Percentage
<b>Your comfort in discussing malaria vaccine-related concerns with caregivers</b>		
Very comfortable	187	40.8
Comfortable	249	54.4
Uncomfortable	12	2.6
Very uncomfortable	10	2.2
<b>Communication methods do you find most effective when discussing the malaria vaccine with caregivers</b>		
Face-to-face conversations	348	76.0
Printed materials (brochures, flyers)	31	6.8
Group presentations	49	10.7
Social media	25	5.5
Radio/TV	5	1.0
<b>Receptiveness of caregivers to information about the malaria vaccine</b>		
Very receptive	100	21.8
Receptive	294	64.2
Unreceptive	54	11.8
Very unreceptive	10	2.2
<b>Barriers you observe that may affect caregivers' acceptance of the malaria vaccine</b>		
Misinformation	220	48.0
Cultural beliefs	146	31.9
Accessibility to vaccines	55	12.0
Trust in healthcare providers	37	8.1

### 3.6 Perceptions on the receptiveness of caregivers to information about the malaria vaccine acceptability and demography

The data from Table VI reveals insights into the perceptions of healthcare providers regarding caregiver attitudes towards vaccine acceptability across various characteristics. Gender appears not to significantly influence these perceptions, ( $X^2 = 0.553$ ;  $p = 0.907$ ). Age groups also show no significant differences, ( $X^2 = 6.878$ ;  $p = 0.650$ ). Conversely, educational level presents a significant association with perceptions of caregiver attitudes, evidenced by a  $X^2$  of 17.377 ( $p = 0.043$ ). Those with primary education showed

the highest percentage of good perceptions at 81.3%, while those with secondary education had a much lower rate at 50.6%. Marital status and religion did not significantly affect perceptions either, with p-values of 0.758 and 0.474, respectively.

**Table VI: Distribution of Perceptions of healthcare providers on caregiver attitudes towards vaccine acceptability and demography**

Characteristics	Variable (n=458)	Perceptions of caregiver attitudes on vaccine acceptability information		$X^2$	P* Value
		Good Perception N (%)	Bad Perception N (%)		
Gender	Male	81 (66.4%)	13 (10.7%)	0.553	0.907
	Female	213 (63.4%)	41 (12.2%)		
Age Group	20-30	203 (64.9%)	36 (11.5%)	6.878	0.650
	31-40	49 (60.5%)	13 (16%)		
	41-50	33 (67.3%)	2 (4.1%)		
	51-60	9 (60%)	3 (20%)		
Educational level	No Response	1 (50%)	0 (0.0%)	17.377	<b>0.043*</b>
	Primary	26 (81.3%)	1 (3.1%)		
	Secondary	40 (50.6%)	13 (16.5%)		
	Tertiary	227 (65.8%)	40 (11.6%)		
Marital Status	Widow(er)	19 (73.1%)	3 (11.5%)	5.814	0.758
	Divorced	6 (75%)	0 (0.0%)		
	Married	135 (67.5%)	21 (10.5%)		
	Single	134 (59.8%)	30 (13.4%)		
Religion	Others	4 (80%)	0 (0.0%)	5.565	0.474
	Muslim	45 (60%)	8 (10.7%)		
	Christian	245 (64.8%)	46 (12.2%)		

$X^2$  : Chi square test

### 3.7 Impact of training and support

Table VII highlight significant gaps in training and support related to malaria vaccine acceptability among participants. A striking 71.0% reported not having received specific training on promoting the vaccine, and among those who did, an overwhelming 83.8% found the training inadequate. Additionally, a large majority (72.7%) of participants emphasized the crucial role that healthcare providers play in encouraging vaccination, indicating that improving training could have a positive impact on vaccine uptake. Barriers to vaccine acceptance were also identified, with misinformation being the most commonly cited issue (30.1%), followed by lack of training (24.9%) and cultural beliefs (20.5%). To address these challenges, participants proposed several strategies, with the most favoured being the dissemination of accurate information about the vaccine (34.3%) and training healthcare staff in health units (32.8%).

**Table VII: Distribution of participant's responses on impact of training and support**

Variable(n=458)	Frequency	Percentage
<b>Have received specific training on promoting malaria vaccine acceptability</b>		
Not at all	325	71.0
Yes, I did	133	29.0
<b>If yes, how adequate you find the training you have received regarding malaria vaccines</b>		
Not adequate	384	83.8
Yes, adequate	72	15.7
No Response	2	.4
<b>How important is the role of healthcare providers in influencing vaccine acceptance</b>		
Very important	333	72.7
Important	111	24.2
Unimportant	1	.2
Very unimportant	13	2.8
<b>How often caregivers accept the malaria vaccine</b>		
Always	96	21.0
Most of the time	245	53.5
Rarely	110	24.0
Never	7	1.5
<b>Barriers you observe that may affect health care provider from promoting acceptance</b>		
Misinformation	138	30.1

Cultural beliefs	94	20.5
vaccine perception	65	14.2
Vaccine stock outs	42	9.2
Lack of training	119	26.0

#### Strategies that can be put in place to promote acceptance and uptake of the malaria vaccine by caregivers

Train and provide staff in every health unit	150	32.8
Providing the vaccine freely	112	24.5
Availability of the vaccine	33	7.2
Ensure the flow of correct of information on the vaccine	163	35.5

### 3.8 Relationship between impact of training and support on vaccine acceptability and demography

Table VIII presents, the analysis, conducted using Chi-square tests, this reveals that gender and age do not significantly influence perceptions of training and support, with a high percentage of respondents from both groups rating the training and support as "Very Inadequate." In contrast, educational level demonstrates a significant relationship ( $X^2 = 28.154$ ,  $p = 0.001$ ). Furthermore, marital status and religion show no significant relationships with vaccine acceptability, as most respondents across these categories also reported "Very Inadequate" training and support.

**Table VIII: Distribution of the relationship between impact of training and support on vaccine acceptability and demography**

Characteristics	Variable (n=458)	Impact of training and support				$X^2$	P Value
		Very Adequate N (%)	Adequate N (%)	Inadequate N (%)	Very inadequate N (%)		
Gender	Male	24 (19.7)	11 (9)	0 (0.0)	87 (71.3)	5.628	0.131
	Female	44 (13.1)	48 (14.3)	3 (0.9)	241 (71.7)		
Age Group	20-30	48 (15.3)	47 (15)	3 (1)	215 (68.7)	8.701	0.465
	31-40	10 (12.3)	5 (6.2)	0 (0.0)	66 (81.5)		
	41-50	9 (18.4)	5 (10.2)	0 (0.0)	35 (71.4)		
	51-60	1 (6.7)	2 (13.2)	0 (0.0)	12 (80)		
Educational level	No Response	2 (100)	0 (0.0)	0 (0.0)	0 (0.0)	28.154	<b>0.001</b>
	Primary	7 (21.9)	3 (9.4)	0 (0.0)	22 (68.8)		
	Secondary	18 (22.8)	14 (17.7)	2 (2.5)	45 (57)		
	Tertiary	41 (11.9)	42 (12.2)	1 (0.3)	261 (75.7)		
Marital Status	Widow(er)	3 (11.5)	3 (11.5)	0 (0.0)	20 (76.9)	7.457	0.590
	Divorced	2 (25)	3 (37.5)	0 (0.0)	3 (37.5)		
	Married	31 (15.5)	28 (14)	1 (0.5)	140 (70)		
	Single	32 (14.3)	25 (11.2)	2 (0.9)	165 (73.7)		
Religion	Others	1 (20)	0 (0.0)	0 (0.0)	4 (80)	1.961	0.923
	Muslim	9 (12)	10 (13.3)	1 (1.3)	55 (73.3)		
	Christian	58 (15.3)	49 (13)	2 (0.5)	269 (71.2)		

$X^2$  : Chi square test

### 3.9 Factors influencing the role of healthcare providers in promoting malaria vaccine

The correlation analysis reveals important relationships among healthcare providers' discussions about the malaria vaccine, their confidence in educating caregivers, their willingness to promote vaccine acceptance, and the resources they use to stay informed. A significant positive correlation exists between the frequency of discussions and providers' confidence in their educational abilities ( $r = 0.241$ ,  $p < 0.01$ ). Similarly, there is a notable correlation between discussion frequency and willingness to advocate for vaccine acceptance ( $r = 0.256$ ,  $p < 0.01$ ), indicating that those who engage in discussions are more likely to promote the vaccine. The strongest correlation is observed between confidence and willingness to promote acceptance ( $r = 0.336$ ,  $p < 0.01$ ), highlighting that greater

confidence enhances advocacy efforts. Access to resources is positively correlated with both confidence ( $r = 0.235$ ,  $p < 0.01$ ) and willingness ( $r = 0.158$ ,  $p < 0.01$ ), though these relationships are weaker. Notably, the correlation between discussion frequency and resource use is not significant ( $r = 0.080$ ,  $p = 0.088$ ), suggesting that the frequency of discussions may not be directly influenced by available resources. Overall, the findings indicate that frequent discussions about the malaria vaccine are linked to increased confidence and willingness to promote acceptance, underscoring the need for strategies that enhance healthcare providers' roles in vaccination advocacy (Table IX).

**Table IX: Factors influencing the role of healthcare providers in promoting malaria vaccine acceptance.**

		Frequency of discussion on malaria vaccine with caregivers	Confident in the ability to educate caregivers on malaria vaccine	Willingness to promote malaria vaccine acceptance for caregivers	Resources use to stay informed about malaria vaccines
Frequency of discussion on malaria vaccine with caregivers	Pearson Correlation	1	.241**	.256**	.080
	Sig. (2-tailed)		.000	.000	.088
	N	458	458	458	458
Confident in the ability to educate caregivers on malaria vaccine	Pearson Correlation	.241**	1	.336**	.235**
	Sig. (2-tailed)	.000		.000	.000
	N	458	458	458	458
Willingness to promote malaria vaccine acceptance for caregivers	Pearson Correlation	.256**	.336**	1	.158**
	Sig. (2-tailed)	.000	.000		.001
	N	458	458	458	458
Resources use to stay informed about malaria vaccines	Pearson Correlation	.080	.235**	.158**	1
	Sig. (2-tailed)	.088	.000	.001	
	N	458	458	458	458

\*\* . Correlation is significant at the 0.01 level (2-tailed).

#### 4. Discussion:

To the best of our knowledge the present study is the first survey on factors influencing the role of healthcare providers in promoting acceptance of the malaria vaccine in the Bamenda and Bamenda III Health districts of the Northwest region in Cameroon. Healthcare providers play a pivotal role in shaping community attitudes and behaviors toward vaccination, particularly in low resource settings where caregivers often usually rely on frontline health workers for trusted health information[19]. Statistical analysis demonstrates a significant association between educational level and perceptions of caregiver attitudes, evidenced by a chi-square value ( $\chi^2$ ) of 17.377 and a p-value of 0.043. These results suggest that caregivers' level of education influences how they are perceived in terms of their openness and responsiveness to malaria vaccination interventions. Notably, caregivers with primary education exhibited the highest percentage (81.3%) of good perceptions among healthcare providers, while those with secondary education were perceived less positively, with only 50.6% showing good perceptions. This inverse trend challenges the commonly held assumption that higher educational attainment correlates with improved health-seeking behaviors and vaccine acceptability[20]. Several factors may explain this counterintuitive result. Caregivers with primary education may rely more on local health workers and traditional community means for information, which are often perceived as trustworthy and culturally congruent [21]. In contrast, individuals with secondary education may have increased exposure to diverse information sources, including social media, where misinformation around vaccines can proliferate, particularly in contexts experiencing infodemics[22]. The significant association ( $X^2 = 28.154$ ,  $p = 0.001$ ) between educational level and perception of training and support presents a paradoxical yet revealing trend. Respondents with no formal education rated the training as "Very Adequate," while those with tertiary education (75.7%) rated it as "Very Inadequate." Highly educated individuals often have higher expectations regarding the structure, content, and delivery of training, and may quickly

identify gaps in evidence-based content, and practical applicability[23]. Meanwhile, less-educated participants may perceive any form of training as adequate, due to lower expectations. This emphasizes the need for stratified training modules tailored to different education levels which aligns with WHO recommendations on differentiated training strategies to optimize learning outcomes and healthcare worker performance [24].

The present study's correlation analysis reveals several critical relationships that influence the ability and willingness of Health care providers to advocate for malaria vaccine acceptance in the Bamenda and Bamenda III health districts. A significant positive correlation was found between the frequency of discussions about the malaria vaccine and providers' confidence in their ability to educate caregivers ( $r = 0.241$ ,  $p < 0.01$ ). This indicates that Health care providers who engage more frequently in vaccine-related dialogues with clients or colleagues tend to feel more self-assured in delivering accurate, persuasive, and contextually relevant health education. This finding aligns with existing research suggesting that practice and engagement improve communication competence, particularly for new or evolving public health interventions like the malaria vaccine [25]. Moreover, discussion frequency also correlates positively with willingness to promote vaccine acceptance ( $r = 0.256$ ,  $p < 0.01$ ). This implies that the more often providers discuss the vaccine; the more likely they are to actively encourage its uptake. Similar relationships have been observed in immunization programs for other vaccines such as HPV and COVID-19, where provider engagement and frequent patient conversations are strong predictors of advocacy behavior [25][26]. The strongest observed relationship is between confidence and willingness to promote vaccine acceptance ( $r = 0.336$ ,  $p < 0.01$ ), reinforcing the idea that self-efficacy is a key driver of proactive vaccine promotion. When providers feel competent and informed, they are more likely to act as vaccine champions within their communities. This finding resonates with the theory of planned behavior, which emphasizes that perceived behavioral control (i.e., confidence) significantly influences intentions and actual behaviors[27]. Access to information resources—such as training materials, updated clinical guidelines, and evidence-based content—also shows a positive correlation with both confidence ( $r = 0.235$ ,  $p < 0.01$ ) and willingness ( $r = 0.158$ ,  $p < 0.01$ ), though these are relatively weaker associations. This suggests that while resources are beneficial, they may not be the primary driver of provider engagement. However, their importance should not be understated, especially in under-resourced districts like Bamenda, where access to up-to-date information remains a barrier to effective health communication[28]. For operational feasibility, interventions such as capacity-building workshops, structured peer discussions, and locally tailored communication tools are likely to be effective. Importantly, such strategies must not only deliver knowledge but also foster confidence, trust, and professional empowerment, ensuring that healthcare providers become credible, motivated, and consistent advocates for malaria vaccination in their communities [29]. Operational feasibility depends not only on infrastructure and logistics but also on the capacity and readiness of human resource.

### Study Limitation

There were some important limitations to consider: Because it's a cross-sectional study, it can only show the factors influencing Health care provider's role, not cause-and-effect over time. We also focused on just two districts in the North West Region of Cameroon, so the findings may not fully be reflected in other parts of the country where local health systems and cultural factors could differ. Lastly, since the data is self-reported, there's a chance that participants may have overstated their willingness to promote vaccine acceptance, especially if they felt pressure to give socially desirable answers. This could lead to an inflated view of promotion of vaccine acceptance.

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### Conflicts of Interests

The authors declare no conflict of interest.

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### 5. Conclusion

Healthcare providers are central to vaccine promotion and education. The study reveals that their confidence in educating caregivers, the frequency of discussions about the malaria vaccine, and their personal willingness to recommend the malaria vaccine positively influence acceptability. Providers who are well-informed and supported by continuous training are more effective in communicating the malaria vaccine's value and addressing caregiver concerns, thereby improving public confidence.

## Recommendation

- Capacity Building and Training: Provide regular training to equip providers with updated knowledge and communication skills on malaria vaccine safety, efficacy, and handling.
- Improve Provider–Caregiver Communication: Encourage open, empathetic, and respectful dialogue with caregivers to boost confidence and reduce hesitancy.
- Champion Vaccine Promotion: Motivate providers to serve as advocates by consistently recommending the malaria vaccine during routine visits and outreach activities.
- Monitor and Address Challenges: Use feedback tools (e.g., brief caregiver satisfaction surveys) to identify barriers and improve service delivery quality.

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