

# Factors Influencing Missed Opportunities in Infant Vaccination Among Children Aged 0-23 Months Within the Hohoe Municipality in The Volta Region, Ghana: A Facility-Based Study

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## Abstract

### Background

Immunization is a vital public health strategy to enhance child survival by addressing significant diseases that cause child mortality. Annually, over 31 million children under five in sub-Saharan Africa are affected by vaccine-preventable conditions, with more than half a million dying due to lack of access to necessary vaccines. This study explored the factors contributing to Missed Opportunities for Vaccination (MOV) among caregivers of children aged 0-23 months in the Hohoe municipality.

### Methods

The study employed a cross-sectional design. Structured questionnaires were administered to caregivers of children aged 0-23 months in selected health facilities in the Hohoe municipality. Three hundred seventy-eight caregivers aged 18 years and above participated in the study.

### Results

The prevalence of MOV was found to be 22.2%. Factors predicting MOV included respondent's age, marital status, parity status, knowledge and attitude. Younger mothers were more likely to have missed opportunities in infant vaccination [aOR=0.20(0.09,0.43)  $p<0.001$ ]. Being unmarried and having a large family size also contributed to missed opportunities in infant vaccination [aOR=2.0(1.12,3.44)  $p=0.019$ ] and [aOR=5.80(2.67,12.6)  $p<0.001$ ] respectively.

### Conclusion

MOV is prevalent in many settings and hinders immunization coverage. Age, number of children and family size were found predictors inhibiting infant vaccination. Furthermore, caregivers' knowledge and attitudes were associated with missed opportunities for vaccination, indicating a need for strategies to enhance their understanding and combat missed opportunities in the Hohoe municipality.

**Keywords:** Immunization, Missed Opportunities for Vaccination (MOV), Caregivers, Hohoe Municipality

## Abbreviations

MOV: Missed Opportunities for Vaccination  
SDGs: Sustainable Development Goals  
VPDs: Vaccine-Preventable Diseases  
CWC: Child Welfare Clinic  
AOR: Adjusted Odds Ratio  
COR: Crude Odds Ratio  
GHS: Ghana Health Service  
WHO: World Health Organization

UNICEF: United Nations Children's Fund

## 1. Introduction

Immunization is a cornerstone of public health, saving millions of lives globally each year by preventing various life-threatening infectious diseases [1]. It is one of the most cost-effective interventions in healthcare, with the potential to avert approximately 2–3 million deaths annually [2]. The impact of immunization extends beyond infancy, preventing

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an estimated 600,000 adult deaths and a staggering 2.5 million child deaths worldwide [3]. However, even in the face of such remarkable successes, the shadows of unmet potential loom large. Each year, over 31 million children under the age of five in sub-Saharan Africa fall victim to preventable diseases, with more than half a million succumbing to illnesses due to a lack of access to essential vaccines [4]. Within the diversity of vaccines administered today, the Expanded Program on Immunization (EPI) offers a full-spectrum defense against diseases such as Tuberculosis, Polio, Diphtheria, Pertussis, Tetanus, Hepatitis B, Hemophilus influenzae type B (Hib), Measles and Rubella, Yellow fever, Rotavirus, Pneumococcal infections, Meningococcal diseases, and Malaria infections not excluding Vitamin A supplementation [5]. In Ghana, the national EPI policy lays out a comprehensive vaccination schedule for children to provide a solid immunological shield from birth to the age of two years [6]. This schedule includes the administration of the Bacillus Calmette-Guerin (BCG) vaccine at birth; three doses of the pentavalent vaccine (DPT-Hep B- Hib) at 6, 10, and 14 weeks; four doses of oral polio vaccine (OPV) at birth; 6, 10, and 14 weeks; one dose of inactivated polio vaccine (IPV) at 14 weeks; two doses of measles-rubella vaccine (MR) at 9 and 18 months; three doses of pneumococcal conjugate vaccine (PCV) at 6,

10, and 14 weeks; one dose of yellow fever vaccine at the 9th month; and four doses of RTS, S at 6, 7, 9, and 24 months [5]. This meticulous schedule ensures vital protection against various debilitating and potentially fatal diseases when faithfully adhered to.

However, even within the ambit of structured immunization programs, Missed Opportunities for Vaccination (MOV) casts a lingering shadow over public health efforts. An MOV occurs when an eligible individual, be it a child or an adult, interacts with healthcare services but fails to receive one or more vaccine doses for which they qualify [5]. While it is paramount that healthcare services provide comprehensive care, a missed opportunity for vaccination underscores a significant gap in delivering essential preventive services. Consequently, MOVs pose a substantial challenge to achieving global health targets, including the Sustainable Development Goals (SDGs), specifically SDG 3, which strive to ensure healthy lives and promote well-being for all at all ages [2].

Remarkably, despite significant strides in vaccination and healthcare delivery, infant vaccine coverage rates in some regions of Ghana remain stagnant and dishearteningly low, persisting as a stubborn challenge to the progress of the national immunization program [7]. The reasons for MOVs are multi-faceted and intricate. Numerous studies across different contexts have implicated various factors, including but not limited to health workers' oversight in checking vaccination status, insufficient integration of vaccination services with other healthcare offerings, a scarcity of adequately trained personnel to administer vaccines, the complexities of administering multi-dose vaccines, poor retention of vaccination cards by

caregivers, and the periodic occurrence of vaccine stock-outs or shortages [8]. A prime example of this issue can be seen in the Hohoe Municipality, located in the Volta Region of Ghana. This area has experienced a concerning decrease in routine immunization coverage rates [9]. This decline suggests that the number of children receiving the recommended vaccines is significantly below the Global Vaccine Action Plan's target of 80% district coverage. These statistics serve as alarming indicators of a potential public health crisis. Despite the gravity of this situation, there is a paucity of detailed information on the underlying factors contributing to the decline in immunization coverage within Hohoe Municipality. Understanding these gaps and deciphering the intricate web of reasons behind MOVs is not merely an academic exercise but a crucial step towards formulating targeted and effective interventions. Addressing these challenges will undoubtedly pave the way for a renaissance in the municipality's timeliness and adherence to vaccination schedules. Moreover, it can unlock a broader transformation, improving the health and well-being of the infants in most vulnerable communities as well. With these imperatives in mind, this study was conceived and conducted with the dual objectives of illuminating the factors contributing to Missed Opportunities for Vaccination (MOV) among children aged 0-23 months in Hohoe Municipality and proposing evidence-based measures to elevate vaccination coverage rates. This study seeks to identify these challenges and provide actionable insights for policymakers, healthcare providers, and communities. By unravelling the complex web of MOVs, we aspire to guide the formulation of context-specific strategies to bolster the local immunization program. The implications of this research extend beyond the Hohoe Municipality, serving as a beacon for other regions grappling with similar issues. As we delve deeper into the multi-faceted dimensions of MOVs, we set forth a journey toward enhanced vaccination coverage, safeguarding the future of our children, and nurturing the promise of healthier generations.

## 2. Methods

### 2.1 Study Site and Context

The research was conducted in the Hohoe Municipality, Ghana's Volta Region. This region is divided into eighteen municipalities, with Hohoe being one of them. The Hohoe Municipality consists of a diverse population of approximately 210,620 individuals. This population is almost evenly split between females, 50.2% (106,978 individuals), and males, 49.8% (103,642 individuals). The municipality experiences a growth rate of 2.4% (10). For administrative purposes, the Hohoe Municipality is divided into four sub-municipalities: Alavanyo, Agumatsa, Gbi-South, and Hohoe-sub. Each sub-municipality contributes to the region's rich cultural diversity, housing various tribes, including the Ewes, Likpes, Akpafus, Lolobi, and Santrokofi. The study focused on eight healthcare facilities within the Hohoe-sub and Agumatsa sub-municipalities. These included four hospitals and four Community-based Health Planning and Services (CHPS) compounds. These facilities are crucial in providing healthcare services to the local population

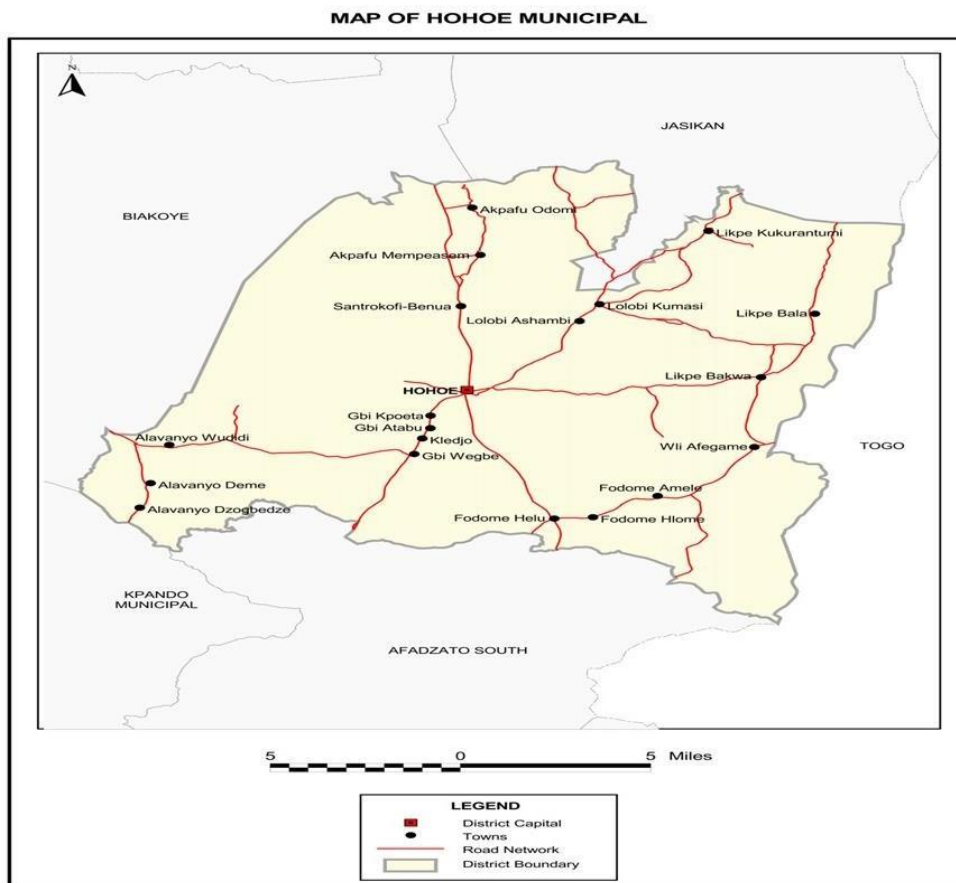


Figure 1: Map of Hohoe Municipal Source: Ghana Statistical Service, 2014.

## 2.2 Study Design, Population and Sample Size

This study, conducted from March to April 2021, utilized a quantitative approach and a cross-sectional design. The participants were caregivers who were at least 18 years old. The study's sample was selected using all Child Welfare Clinic (CWC) registries available at the selected healthcare facilities. This comprehensive approach ensured a diverse and representative sample, contributing to the depth and clarity of the study's findings. The study aimed to provide an in-depth understanding of the subject matter, and the chosen methodology was instrumental in achieving this objective using a cross-sectional design, which allowed for a snapshot of the situation during the specified period, providing valuable insights into the experiences and perspectives of the caregivers involved.

A minimum sample size of 378 was obtained from the formula.

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

$$n = \frac{2 \cdot 0.442(1-0.442)}{0.05^2}$$

Where;

n= Estimated sample size.

$z^2 a$ = Test Statistics (1.96).

2

p=44.2% from an annual report from the Hohoe Municipal

Health Directorate, 2020 (11) e= 0.05 (5%) non-response rate.

$$n = \frac{(1.96)^2 \times 0.442(1-0.442)}{(0.05)^2}$$

$$n = 379$$

$$n = 379$$

A final sample size of 397 caregivers was chosen for this study, considering a non-response rate of 5%.

## 2.3 Sampling Procedure

The study utilized a three-stage probability sampling technique to ensure a comprehensive and representative data collection. In the first stage, a simple random method was employed to select two sub-districts from four. This was achieved by writing the names of all four sub-districts on individual sheets of paper, which were then folded and placed into a box. The box was thoroughly shaken, and two neutral individuals were asked to each draw one sheet from the box without looking. The second stage involved the selection of health facilities within the chosen sub-districts. A list of all facilities in these sub-districts was compiled for balloting, and two facilities from each sub-district were selected using a simple random technique. In the final stage, systematic random sampling was used to select mothers or caregivers with children between 0 and 23 months from each chosen facility. The population of eligible mothers was determined using the Child Welfare Clinic (CWC) register at each facility. This population data was then used to proportionally determine the number of mothers or caregivers interviewed at each facility until the desired sample size was reached. The study recruited 378 caregivers, achieving a response rate of 100%. This

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rigorous sampling ensured that the study's findings were based on a representative and diverse sample, thereby enhancing the validity and reliability of the results.

#### **2.4 Inclusion and Exclusion Criteria**

This study included all mothers /caregivers with children aged 0-23 months who have received at least a vaccine dose and were present with the child at the child welfare clinic (CWC) at the time of the study and gave their consent to participate in the survey within the Hohoe municipality. Furthermore, the study excluded mothers who were sick and present during the data collection period and those who declined consent to participation.

#### **2.5 Data Collection Instrument and Procedure**

Based on the researched literature, a structured, closed-ended questionnaire was created. The questionnaire was altered to include demographic characteristics such as sex, age, marital status, and level of education, as well as attitudes and knowledge of caregivers about immunization, infant characteristics and immunization status. Research assistants who had previously worked on facility-based studies were trained, supervised and used. Proper data collection methods were ensured in adherence to the study's protocol. The data collection tool was pretested, and all identified errors were rectified before the survey. The study covered a period from June 2021 to August 2021.

#### **2.6 Definition of Variables**

##### **2.6.1 Outcome Variable**

Experiencing a MOV was the outcome variable for this study. A missed opportunity was considered any contact with a health facility by a child eligible for vaccination during an immunization session, but they do not receive the vaccine doses for which they qualify. The outcome variable was collected as a categorized variable with a Yes or No response. A "Yes" for experiencing a MOV and "No" for not experiencing MOV.

##### **2.6.2 Exposure Variables**

The primary exposure variables for this study were the caregiver's socio-demographic characteristics, as well as their knowledge and attitudes towards infant immunization. These variables are crucial in assessing the caregiver's understanding and approach to infant immunization [8]. The socio-demographic characteristics of the caregiver play a significant role in this study. These characteristics include factors such as age, education level, occupation, and socioeconomic status. They provide context to the caregiver's environment and circumstances, which may influence their knowledge and attitudes towards infant immunization. The caregiver's knowledge and attitudes towards

infant immunization were assessed through a series of questions. These questions aim to gauge the caregiver's understanding of the importance of immunization, the process involved, and any potential risks or benefits. A composite variable was generated from the responses to these knowledge and attitude questions. This composite variable provides a comprehensive overview of the caregiver's overall understanding and perspective on infant immunization. To quantify the caregiver's knowledge and attitudes, a mean score was developed from their responses. This score serves as a benchmark to categories the caregiver's knowledge and attitude levels. A knowledge score above the average mean was categorized as 'good knowledge', while a score below the average mean was considered 'poor knowledge'. The same scoring procedure was applied to assess maternal attitude. This allowed for a consistent and objective evaluation of both knowledge and attitude levels in relation to infant immunization.

##### **2.6.3 Data Management and Statistical Analysis**

The data collection process employed Kobo Collect, and subsequent data cleaning, validation, and analysis were conducted using Stata Corp version 17.0. Descriptive statistics using frequencies, percentages, and means were utilized to present key findings. To identify factors predicting Missed Opportunities for Vaccination (MOV), a Chi-square test was performed. Variables deemed significant at a 95% confidence level were subsequently incorporated into a logistic model for further analysis. The assessment of the association strength between independent variables and the outcome variable (missed opportunity) was accomplished through a multiple logistic regression model. A 5% alpha level served as the criterion for determining statistical significance.

### **3. Results**

#### **3.1 Socio-demographic Characteristics**

In the study, it was observed that a significant portion of caregivers attending infant immunization for vaccination were female (96.0%). Interestingly, a minority of males (4.0%)

were also noted to be involved in ensuring their infants received immunization. Most (60.9%) caregivers were over 26 years with an average age of 28 years a standard deviation of  $\pm 6.0$ . Around half of them (53.2%) were married, and a significant majority (85.2%) identified as Christians. The Ewe ethnic group was the most represented (66.7%), and most caregivers were employed (69.1%). Approximately 35.2% had completed education up to the Junior High School level, and over half (57.1%) had given birth once or twice. Many caregivers (73.3%) lived near immunization centers (Table 1).

Variable	Frequency(n)	Percentage (%)
<b>Sex</b>		
Male	15	4.0
Female	363	96.0
Mean age of caregivers (SD)[Years]	28± (6.0)	
<b>Age (years)</b>		
18-25 years	145	38.3
26+	233	61.4
<b>Marital status</b>		
Married	201	53.2
Not married	177	46.8
<b>Religion</b>		
Christianity	323	85.5
Islamic	55	14.5
<b>Ethnicity</b>		
Ewe	252	66.7
Akan	26	6.9
Kotokoli	38	10.1
Guan	17	4.5
Kokomba	23	6.1
Others	22	5.8
<b>Occupational status</b>		
Not working	117	31.0
Working	261	69.1
<b>Educational status</b>		
None	72	19.1
Primary	57	15.1
JHS	133	35.2
SHS	82	21.2
Tertiary	34	9.0
<b>Parity (Mean)[S.D]</b>		
1-2	216	57.1
3-5	140	37.0
5+	22	5.8
<b>Long distance to immunisation site [≤ 30 minutes]</b>		
Yes	101	26.7
No	277	73.3

JHS: Junior High School, SHS: Senior High School

**Table 1: Distribution of socio-demographic Characteristics of Respondents (n=378)**

### 3.2 Socio-demographic Characteristics of Infants.

The mean age of the infants in the study is approximately 22.51 months, with a standard deviation of ±13.54 months. When broken down into age groups, 55.3% of the infants are between 0-11 months, while the remaining 44.7% are within the 12–23-month age bracket. Regarding gender distribution,

males comprise 56.1% of the group, with females accounting for the remaining 43.9%. Most of these infants were born in a health facility (98.4%), with a small percentage (1.6%) delivered at home. Importantly, all the children in this study have an immunization card (Table 2).

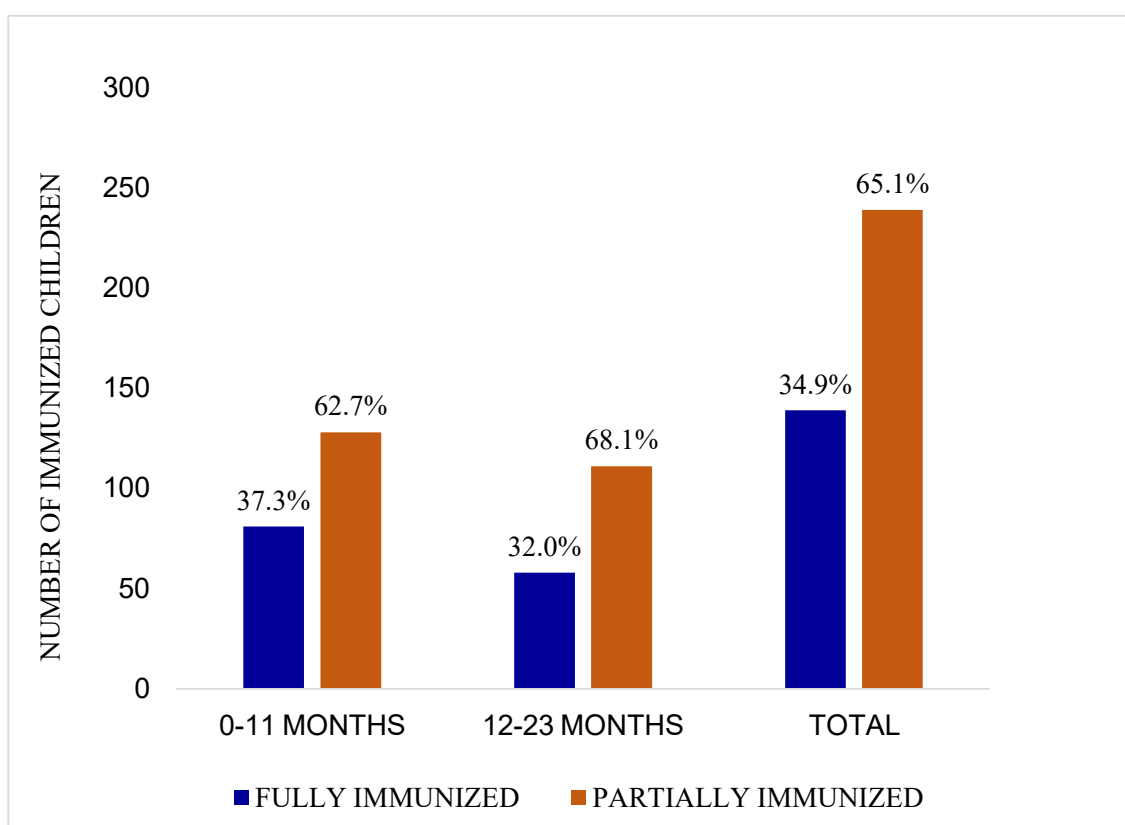
Variables	Frequency(n)	Percentage (%)
The mean age of the child (SD)[Months]	22.51(±13.54)	
<b>The age group of children (Months)</b>		
0-11	209	55.3
12-23	169	44.7
<b>Sex</b>		
Male	212	56.1
Female	166	43.9
<b>Place of birth</b>		
Health Facility	372	98.4
Home	6	1.6
<b>Immunisation card</b>		
Yes	378	100
No	0	0

**Table 2: Demographic characteristics of infants in the Hohoe Municipality (n=378)**

### 3.3 Infant Immunization Status

The majority (65.1%) of 378 children with valid vaccination records were partially immunized and had missed or not received all the recommended vaccines by WHO. However, only 34.9% were fully immunized and had received all the vaccine doses considered to protect them from vaccine-preventable diseases as

recommended by WHO. Out of the fully vaccinated children, (37.3%) were less than one year, while (32.0%) were above one year of age. More than half (62.7%) and (68.1%) of the partially immunized children were less than a year and above one year respectively (Figure 2).



**Figure 2: Percentage Distribution of Infant Immunization Status in the Hohoe Municipality**

### 3.4 Prevalence of MOV

The study found that in the 0-11 months age group, 22.5% missed opportunities in infant vaccination, while 78% did not. The

percentages in the 12-23 months age group are similar, with 22% missing opportunities and 77.5% not missing any. Regarding gender, 25.5% of males missed opportunities compared to

74.5% who did not. For females, the percentages are 18.1% and 81.9%, respectively. Regarding place of birth, 22% of those born in a health facility missed opportunities, compared to 78% who did not. The percentages for those born at home are slightly

higher, with 33.3% missing opportunities and 67% not missing any. Finally, when considering immunization status, 82.1% of non-immunized children missed infant vaccination compared to 17.7% of fully immunized children (Table 3).

Variable	Missed opportunity (n=84)	
	Yes n(%)	No n(%)
Mean Age of Child (SD)[Months]	22.51(±13.54)	
<b>The age group of children (Months)</b>		
0-11	46(22.5)	163(78.0)
12-23	38(22.0)	131(77.5)
<b>Sex</b>		
Male	54(25.5)	158(74.5)
Female	30(18.1)	136(81.9)
<b>Place of birth</b>		
Health Facility	82(22.0)	290(78.0)
Home	2(33.3)	4(67.0)
<b>Fully immunised</b>		
No	69(82.1)	177(60.2)
Yes	15(17.7)	117(39.8)

**Table 3: Prevalence of MOV**

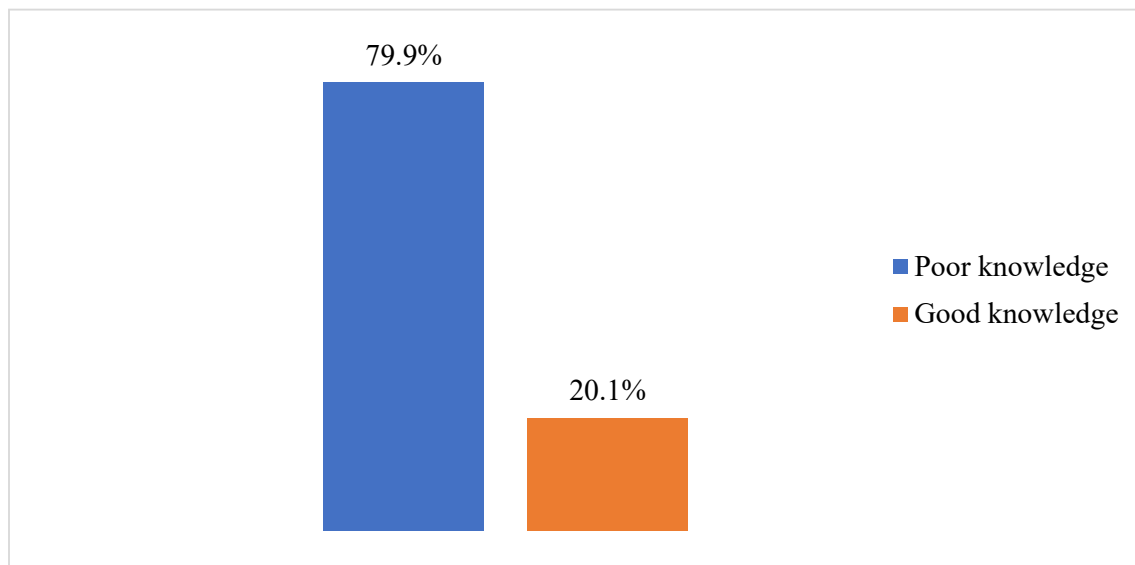
### 3.5 Respondent's Knowledge of Infant Immunization

The survey revealed that health professionals were the primary source of information on infant immunization for a significant majority (79.8%) of respondents. Friends were cited by a smaller group (17.7%), while a mere 2.5% relied on television and radio for this information. Regarding understanding the commencement of the infant vaccination programmed, only 34.4% correctly identified that it begins immediately after birth. A substantial portion (65.6%) confessed their lack of knowledge about the programmer's start, and 21.7% mistakenly believed it started after one month. The purpose of vaccines elicited

varied responses. A large group (44.7%) were uncertain about why vaccines are administered. However, 37.3% correctly identified that vaccines are intended to prevent diseases. A smaller percentage (14.6%) believed that vaccines ensure children grow up healthy, and a minimal group (3.4%) thought vaccines are meant to cure or heal diseases (Table 4). Upon assessing the respondents' knowledge level, it was found that approximately 80% had poor knowledge about immunization, its commencement, and the purpose of vaccines for their wards. Conversely, about 20% understood these topics well (Figure 3).

Variables	Frequency(n=378)	Percent (%)
<b>Sources of information</b>		
Health professionals	301	79.8
Television & Radio	10	2.5
Friends	67	17.7
<b>The infant vaccination programme starts.</b>		
Just after birth	130	34.4
After one month	82	21.7
Don't know	166	65.6
<b>Vaccine's purpose</b>		
Not sure what they are for	169	44.7
So children would grow up healthy	55	14.6
To cure/heal diseases	13	3.4
To prevent diseases	141	37.3

**Table 4: Distribution of Respondents Knowledge on Infant Immunization**



**Figure 3:** Knowledge Level of Respondents in Infant Immunization

### 3.6 The attitude of Respondents towards Infant Immunization.

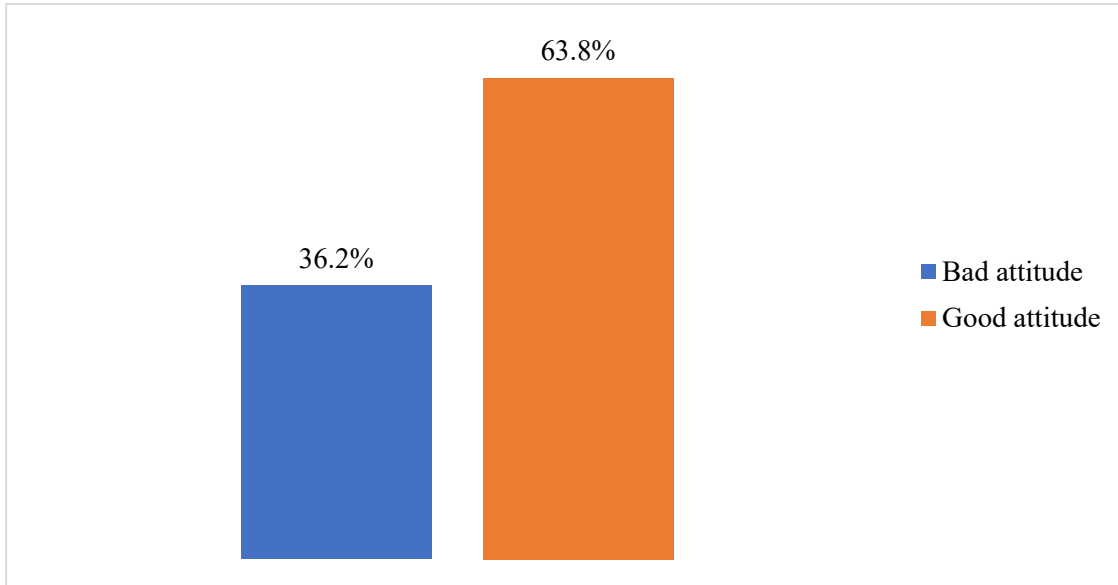
The study assessed caregivers' attitudes towards immunization, revealing that a significant majority of 79.4% (300 out of 378 respondents) regularly attend immunization sessions, while 20.6% (78 respondents) do not. Despite the high attendance rate, a considerable level of concern about the side effects of vaccines was noted, with 60.1% (227 respondents) expressing fear of side effects after vaccination and 40.0% (151 respondents) not sharing this concern. Regarding accessibility, most did not consider distance or cost as barriers to reaching the immunization center. Specifically, 90.7% (343 respondents) did not view distance as a

barrier; similarly, 86.8% (282 respondents) did not see the cost of transportation as a problem (Table 5). However, the results were less positive when evaluating overall attitudes towards immunization. Only 36.2% (241 respondents) demonstrated good attitudes towards immunization, while a concerning 63.8% (137 respondents) exhibited poor attitudes (Figure 3). These findings highlight the importance of addressing concerns about vaccine side effects and improving overall attitudes towards immunization to maintain high attendance rates at immunization sessions.

Variable	Frequency(n=378)	Percent (%)
<b>Regular immunization attendance</b>		
Yes	300	79.4
No	78	20.6
<b>Distance as a barrier to immunization center</b>		
Yes	35	9.3
No	343	90.7
<b>Cost of transportation as a barrier to immunization center</b>		
Yes	43	13.2
No	282	86.8
<b>Fear of side effects of vaccines after vaccination</b>		
Yes	227	60.1
No	151	40.0

**Table 5:** Distribution of Respondents Attitudes towards Infant Immunization





**Figure 3:** Attitude Level Respondents Towards Infant Immunisation

### 3.7 Factors Influencing Missed Opportunity in Infant Vaccination.

A bivariate analysis was performed to identify all significant variables impeding infant vaccination. A significant association was found between socio-demographic characteristics (age, marital status and parity status), their knowledge and attitude and missed opportunities. A backward stepwise regression approach (model) to investigate their joint effects. The summary of the results is presented in (Table 6).

The age group of 26 years and above had a lower chance of missing the opportunity for vaccination compared to the 18-25 age group. The odds ratio was 0.53, indicating that the older age group were less likely to miss infant vaccination and this was statistically significant ( $p=0.011$ ). Marital status also played a role. Those unmarried were twice as likely to miss the chance of infant vaccination compared to those who were married, with

an odds ratio of 2.20 ( $p=0.002$ ). Religion, ethnicity, education and occupation did not show any significant influence on missed opportunities for vaccination. The number of children is also influenced by missed opportunities with infant vaccination. Larger family size increases the likelihood of missed infant vaccination. Those with 3-5 children were 6 times more likely to miss infant vaccination compared to those with 1-2 children (odds ratio 5.80,  $p<0.001$ ). Those with more than five

children were even 14 times more likely to miss the opportunity (odds ratio 13.90,  $p<0.001$ ). Respondents with poor knowledge about vaccination were twice as likely to miss the chance as those with good knowledge (odds ratio 2.14,  $p=0.037$ ). Similarly, respondents with poor attitudes towards vaccination were three times more likely to miss the opportunity than those with good attitudes (odds ratio 3.23,  $p<0.001$ ).

Variable	Missed Opportunity					
	Yes n= [84] n (%)	No n= [294] n (%)	cOR (95%CI)	p-value	aOR (95%CI)	p-value
<b>Age group (Years)</b>						
18-25	43(51.2)	105(37.7)	Ref		Ref	
26+	48(48.8)	189(64.3)	0.53(0.32,0.84)	0.011	0.20(0.08,0.42)	<0.001
<b>Marital Status</b>						
Married	32(38.1)	169(57.5)	Ref		Ref	
Not Married	52(61.9)	125(42.5)	2.20(1.34,3.61)	0.002	2.0(1.12,3.44)	0.019
<b>Religion</b>						
Christianity	71(84.5)	252(85.7)	Ref			
Islamic	12(14.3)	40(13.6)	1.06(0.53,2.14)	0.860		
Traditional	1(1.2)	2(0.7)	1.77(0.16,19.86)	0.642		
<b>Ethnicity</b>						

Ewe	52(62.0)	200(68.0)	Ref			
Akan	5(6.0)	21(7.1)	0.92(0.33, 2.54)	0.866		
Kotokoli	7(8.3)	31(10.5)	0.87(0.36, 2.08)	0.752		
Guan	5(6.0)	12(4.1)	1.60(0.54, 4.75)	0.395		
Kokomba	7(8.3)	16(5.4)	1.68(0.66, 4.30)	0.277		
Others	8(9.5)	14(4.8)	2.19(0.88,5.52)	0.094		
<b>Occupation</b>						
Not Working	26(31.0)	91(31.0)	Ref			
Working	203(69.1)	58(69.1)	1(0.59,1.69)	1.000		
<b>Education</b>						
None	18(21.4)	54(18.4)	Ref			
Primary	20(23.8)	37(12.6)	1.62(0.76,3.47)	0.214		
JHS	27(32.1)	106(36.1)	0.76(0.39,1.51)	0.438		
SHS	16(19.1)	66(22.5)	0.72(0.34,1.56)	0.414		
Tertiary	3(3.6)	31(10.5)	0.29(0.08,1.06)	0.062		
<b>Number of children</b>						
1-2	36(42.9)	180(61.2)	Ref		Ref	
3-5	39(46.4)	101(34.4)	1.93(1.15,3.23)	0.012	5.80(2.67,12.6)	<0.001
5+	9(10.7)	13(4.4)	0.35(1.38,8.70)	0.008	13.90(4.34,44.45)	<0.001
<b>Respondents Knowledge</b>						
Good	10(11.9)	66(22.5)	Ref		Ref	
Poor	74(88.1)	228(77.6)	2.14(1.05,4.38)	0.037*	1.98(0.95,4.09)	0.098
<b>Respondents Attitude</b>						
Good	52(61.9)	247(84.0)	Ref		Ref	
Poor	32(8.1)	47(16.0)	3.23(1.89,5.55)	<0.001*	3.12(1.81,5.37)	0.59

\*Statistically significant p-value <0.05 aOR: adjusted odds ratio, cOR: crude odds ratio, Ref: Reference

**Table 6: Factors Influencing Missed Opportunity in Infant Vaccination**

## 4. Discussion

### 4.1 Prevalence of MOV

This cross-sectional study primarily focused on assessing the prevalence of Missed Opportunities for Vaccination (MOV) within the Hohoe Municipality. The study revealed that most MOV cases in this area stood at 22.2%. This prevalence figure, although significant, was notably lower than what previous studies in Ethiopia and Ondo State, Nigeria, as well as a systematic review encompassing children across Africa, had reported. Those studies documented MOV rates of 74.9%, 33%, and 27.3%, respectively [8,12,15]. One intriguing factor potentially contributing to these disparities in MOV prevalence is client satisfaction among caregivers who received immunization services within the Hohoe Municipality. The higher satisfaction levels here may account for the comparatively lower MOV rates [16]. This suggests that caregivers in this region may have access to well-organized and efficient immunization services, reducing missed opportunities for vaccination. However, it's worth noting that the MOV rate of 22.2% in this study was higher than the

rate observed in South Africa, which stood at 4.6% [8]. This divergence in MOV rates could be attributed to socio-cultural differences in health-seeking behaviors among caregivers in these regions. The intricate interplay of cultural factors, perceptions of healthcare, and access to immunization services may contribute to the varying prevalence rates observed. Further research and in-depth analysis are required to grasp the underlying causes of these disparities fully and to develop targeted interventions aimed at reducing MOV and improving overall child vaccination rates in the Hohoe Municipality and beyond.

### 4.2 Factors Influencing MOV in Infant Immunization

The study's findings shed light on several crucial factors impacting infant vaccination, emphasizing the disparities young mothers face compared to their older counterparts. Young mothers or caregivers were identified as a group more prone to missed opportunities in vaccination, a trend supported by a similar study conducted in Ethiopia [17]. This heightened vulnerability among young mothers may be attributed to various

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factors, including their limited knowledge about immunization, emotional instability, and a potential lack of understanding of healthcare services. These factors, in turn, contribute to their children missing out on vital immunizations. Furthermore, the study revealed that children born to unmarried mothers or caregivers were twice as likely to experience missed opportunities in infant vaccination than their counterparts. This finding aligns with the conclusions drawn in these studies [14,15,18]. It suggests that married women receive more support from their husbands regarding infant vaccination, which may lead to better immunization rates among their children.

Another significant factor affecting missed opportunities in immunization was the size of the caregiver's family. Children of respondents with more prominent families were at a higher risk of missing immunizations. This was consistent with a study in Ethiopia [15]. This correlation may be due to the challenges posed by larger families in terms of time, resources, and attention allocation, particularly in certain economic circumstances. Moreover, these constraints may make caregivers in larger families more likely to attend immunization sessions later. The study identified respondent's knowledge about infant immunization as a predictor of missed opportunities in vaccination. Strikingly, health workers served as the primary source of immunization information for 80% of the caregivers, mirroring findings from a study conducted in Nigeria [19]. However, despite this reliance on health workers for information, approximately 80% of caregivers displayed poor knowledge of immunization, with only a minority (20%) possessing a good understanding. This pattern echoed similar findings from studies in Kenya and Nigeria [19,20]. This suggests a gap in the knowledge and health education programs, indicating the need for comprehensive education tailored to enhance caregivers' understanding of immunization's importance. Moreover, the study revealed that respondents' attitudes towards infant immunization were pivotal in predicting missed opportunities. Infants of caregivers with poor attitudes were at a higher risk of experiencing missed opportunities, aligning with findings from studies conducted in India, Khartoum, and Ethiopia [12,20,22]. Interestingly, even though knowledge of immunization was notably low, the respondents had a positive attitude towards the immunization program.

This suggests that, in this context, knowledge does not necessarily influence attitudes toward immunization. This divergence could be attributed to immunization services being offered free in Ghana, and health workers often conduct outreach services, ensuring that vaccination is accessible even at residents' doorsteps [18]. In conclusion, the study underscores the complex interplay of factors affecting infant immunization rates, with young mothers, marital status, family size, knowledge, and attitudes all playing critical roles. These findings highlight the importance of targeted health education programs to bridge knowledge gaps and promote a positive attitude towards immunization, ultimately reducing missed opportunities and improving child health outcomes in Ghana.

### 4.3 Implication for Practice

The study highlights the need for CWC nurses to prioritize health education messages on vaccination and emphasize the significance of vaccines for infants. This approach aims to enhance caregivers' understanding beyond mere attendance, ultimately contributing to increased awareness about the essential nature of vaccination. A similar positive impact on infant vaccination coverage was observed in several studies [23,24]. Also, the findings on younger mothers experiencing missed opportunities call for education on family involvement in supporting these younger mothers in seeking immunization sessions. These nurses could also factor in such messages during their health education campaigns. Partner support emerged as a significant factor in minimizing missed opportunities for infant vaccination. This study advocates for an intensified focus on messages promoting male involvement. Collaborative efforts between the Ghana Health Service (GHS) and the media are recommended to amplify the importance of infant immunization and advocate for increased male participation in healthcare. Such initiatives not only contribute to enhancing infant immunization rates but also align with the country's pursuit of achieving SDG 3.2, aiming to eliminate preventable deaths among newborns and children under 5 by 2030 [25].

### 4.4 Limitations and opportunities

The study acknowledges the opportunities and limitations of the assessment approach used. A cause-and-effect relationship could not be established because the study employed a cross-sectional survey and might not have been able to capture all MOV [26]. Again, because the study was located in a healthcare institution, only caregivers present on the data collection day were included. Additionally, since just two of the municipality's subdistricts were represented in the findings, conclusions from this study cannot be applied to the entire study population. Therefore, considering MOV from a larger perspective is crucial for future research.

**Prior to Publication** A preprint of this manuscript has been published on Research Square [27].

### 5. Conclusion

Immunization has been one of the health interventions that has attained significant effectiveness over the years. However, there are still grounds to cover to ensure all eligible children access and utilize immunization. A missed opportunity has been a significant challenge to attaining this immunization goal. The study found (22.2%) prevalence of MOV. Caregiver's attitude and knowledge were significantly associated with missed opportunities in this study. The study's findings revealed that many caregivers had little information about vaccinations yet had a favorable attitude regarding immunization. Despite the low proportion of missed opportunities for immunization among children of caregivers in the municipality, infant immunization is paramount to their survival, and as such, there is a need to intensify strategies to curb these barriers. This is crucial for achieving SDG 3 Goal 2, which aims to eliminate the preventable deaths of infants and children under five by 2030.

## References

1. United Nations Children's Fund. (2023). *The state of the World's children 2023: For every child, vaccination*. United Nations Research Institute for Social Development.
2. WHO. Immunization Agenda 2030 [Internet].
3. World Health Organization. (2014). Meeting of the Strategic Advisory Group of Experts on immunization, October 2014—conclusions and recommendations. *Weekly Epidemiological Record= Relevé épidémiologique hebdomadaire*, 89(50), 561-576.
4. World Health Organization (WHO). (2019). Experts caution against stagnation of immunization coverage in Africa. *WHO Regional Office for Africa*, available at: [www.afro.who.int/news/experts-caution-against-stagnation-immunizationcoverage-africa](http://www.afro.who.int/news/experts-caution-against-stagnation-immunizationcoverage-africa) (accessed 27 September 2021).
5. Food and Drugs Board (2018). National Immunization Schedule. *Handb Med Pharm*.
6. Nyaku, M., Wardle, M., Eng, J. V., Ametewee, L., Bonsu, G., Opare, J. K. L., & Conklin, L. (2017). Immunization delivery in the second year of life in Ghana: the need for a multi-faceted approach. *The Pan African Medical Journal*, 27(Suppl 3).
7. World Health Organisation Regional Office for Africa (2023). Ghana steps up drive to revamp routine immunization | WHO | Regional Office for Africa.
8. Nnaji, C. A., Wiysonge, C. S., Adamu, A. A., Lesosky, M., Mahomed, H., & Ndwanwe, D. (2022). Missed opportunities for vaccination and associated factors among children attending primary health care facilities in Cape Town, South Africa: a pre-intervention multilevel analysis. *Vaccines*, 10(5), 785.
9. Hohoe Annual Immunisation Coverage Report (2016). Annual Immunisation Coverage Report. Ghana.
10. Ghana, G. S. S. (2021). Population and Housing Census: Population of Regions and Districts. *Ghana Statistical Service*.
11. Hohoe Municipal Health Directorate 2017 (2018). Annual Report. Hohoe.
12. Elizabeth, K., George, K., Raphael, N., & Moses, E. (2015). Factors influencing low immunization coverage among children between 12–23 months in East Pokot, Baringo Country, Kenya. *Int J Vaccines*, 1(2), 00012.
13. Olorunsaiye, C. Z., Langhamer, M. S., Wallace, A. S., & Watkins, M. L. (2017). Missed opportunities and barriers for vaccination: a descriptive analysis of private and public health facilities in four African countries. *The Pan African medical journal*, 27(Suppl 3).
14. Abdulraheem, I. S., Onajole, A. T., Jimoh, A. A. G., & Oladipo, A. R. (2011). Reasons for incomplete vaccination and factors for missed opportunities among rural Nigerian children. *J Public Health Epidemiol*, 3(4), 194-203.
15. Kidanne, L., Solomon, M., Bisrat, F., Asres, M., Tadesse, T., Asress, A., ... & Tessema, F. (2019). Child vaccination timing, intervals and missed opportunities in pastoral and semi-pastoral areas in Ethiopia. *Ethiopian Journal of Health Development*, 33.
16. Magadzire, B. P., Joao, G., Bechtel, R., Matsinhe, G., Lochlainn, L. N., & Ogbuanu, I. U. (2021). Reducing missed opportunities for vaccination in Mozambique: findings from a cross-sectional assessment conducted in 2017. *BMJ Open*, 11(12), e047297.
17. Budu, E., Darteh, E. K. M., Ahinkorah, B. O., Seidu, A. A., & Dickson, K. S. (2020). Trend and determinants of complete vaccination coverage among children aged 12-23 months in Ghana: analysis of data from the 1998 to 2014 Ghana demographic and health surveys. *Plos one*, 15(10), e0239754.
18. Adokiya, M. N., Bague, B., & Ndago, J. A. (2017). Evaluation of immunization coverage and its associated factors among children 12–23 months of age in Techiman Municipality, Ghana, 2016. *Archives of public health*, 75, 1-10.
19. Kehinde, O. A., Kuyinu, Y. A., & Odusanya, O. O. (2020). Factors associated with Missed Opportunities for Vaccination among children in the first year of life at a tertiary health facility in Lagos. *Annals of Health Research*, 6(3), 287-297.
20. Muluneh, F., Wubetu, M., & Abate, A. (2020). Missed opportunity for routine immunization and its associated factors in Gozamen District Health Centers, Northwestern Ethiopia. *Global Pediatric Health*, 7, 2333794X20981306.
21. Mahalingam, S., Soori, A., Ram, P., Achappa, B., Chowta, M., & Madi, D. (2014). Knowledge, attitude and perceptions of mothers with children under five years of age about vaccination in Mangalore, India. *Asian Journal of Medical Sciences*, 5(4), 52-57.
22. Negussie, A., Kassahun, W., Assegid, S., & Hagan, A. K. (2015). Factors associated with incomplete childhood immunization in Arbegona district, southern Ethiopia: a case-control study. *BMC public health*, 16, 1-9.
23. Owais, A., Hanif, B., Siddiqui, A. R., Agha, A., & Zaidi, A. K. (2011). Does improving maternal knowledge of vaccines impact infant immunization rates? A community-based randomized-controlled trial in Karachi, Pakistan. *BMC public health*, 11, 1-8.
24. GebreEyesus, F. A., Tarekegn, T. T., Amlak, B. T., Shiferaw, B. Z., Emeria, M. S., Geleta, O. T., ... & Chanie, E. S. (2021). Knowledge, attitude, and practices of parents about immunization of infants and its associated factors in Wadla Woreda, North East Ethiopia, 2019. *Pediatric Health, Medicine and Therapeutics*, 223-238.
25. Fong, B. Y., Law, V. T., Leung, T. C., Lo, M. F., Ng, T. K., & Yee, H. H. (2022). *Sustainable development goal 3: Health and well-being of ageing in Hong Kong* (p. 104). Taylor & Francis.
26. Wang, X., & Cheng, Z. (2020). Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest*, 158(1), S65-S71.
27. Otoo, D. M., & Ahaibor, S. Y. (2023). Factors influencing missed opportunities for vaccination among children aged 0-23 months within the Hohoe Municipality: A facility-based study.

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