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Determinants of Full Vaccination Status Among Children Aged 12 to 23 Months in Calabar South, Cross River State, Nigeria

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Abstract

Background: Childhood immunization remains one of the most cost-effective preventive strategies against mortality and morbidity among children. The study sought to identify determinants of full vaccination status among children aged 12 to 23 months in Calabar South LGA, Cross River State. The study was a community-based cross-sectional study among 460 children in the 12 to 23 months age bracket, and information about them was obtained from their caregivers. The sample size of 460 was calculated using the Cochran formula. The study is a quantitative component of a bigger mixed-method study conducted from October to December 2023 among 5 wards selected from the 12 wards in Calabar South through a 2-stage cluster sampling. SPSS was used for data entry and analysis, and ethical approval was obtained from the CRS ethical committee (CRSMOH/RP/HREC/2023/401). The prevalence of full vaccination was presented as a pie chart. Bivariate analysis was carried out using Chi-square test statistics while significant variables at 5% were subjected to multivariable regression to identify independent determinants of full vaccination at a 95% confidence interval. The proportion with full vaccination status was 67%, factors associated with full vaccination included the child's sex/age, caregiver's age, education, occupation, relationship to the child, knowledge, and attitude towards vaccination. Independent determinants of full vaccination included caregivers' age, education, occupation, knowledge, attitude, and the occurrence of missed opportunities. Understanding these variations is crucial for policymakers and healthcare professionals to tailor interventions effectively, addressing region-specific challenges and enhancing overall vaccination coverage.

Keywords: *Childhood, Calabar South, Determinant, Full, Partial, Vaccination.*

Introduction

Childhood immunization is one of the most cost-effective preventive strategies against mortality and morbidity among children used all over the world [1], resulting in a drastic decline and elimination of many childhood infectious diseases [2]. Insufficient coverage with DTP and other recommended vaccines results in 1.5 million childhood deaths throughout the world from vaccine-preventable diseases each year [3].

Global efforts, initiated by WHO and UNICEF, led to the Global Immunization Vision and Strategy, aiming to reduce vaccine-preventable disease-related morbidity and mortality (WHO/UNICEF, 2005). Despite significant strides, an estimated 19.3 million children were not fully vaccinated, with approximately 50% residing in India, Nigeria, and the Democratic Republic of Congo (CDC, 2009). The 2011-2020 Global Action Plan set a target of achieving 90% coverage across all vaccines in national immunization programs by 2020 [4]. WHO's Immunization Agenda 2030

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(IA2030) aims to ensure increased and equitable access to routine vaccines, striving to halve the number of zero-dose children by 2030 [5,6]. The burden of incomplete immunization poses a significant public health challenge globally, with children aged 12 to 23 months being particularly vulnerable. In this context, understanding the predictors of full vaccination is crucial for developing targeted interventions and enhancing immunization coverage. This introduction aims to synthesize evidence from diverse studies to highlight the multifaceted nature of factors influencing full vaccination in this age group [7]. Despite the significant decline in the incidence of vaccine-preventable diseases as a result of increased vaccination coverage worldwide, there are many children with delayed vaccination and a marked heterogeneity in vaccination coverage [8]. The cross-sectional study by Eze et al. in Enugu state, Nigeria, identified maternal status, delivery conditions, postnatal care, maternal knowledge, socioeconomic factors, and proximity to vaccination facilities as significant factors linked to incomplete immunization [9]. Adedire et al. expanded on this by revealing determinants such as maternal antenatal care attendance, tetanus toxoid immunization, access to immunization information, and maternal knowledge [10]. The study conducted in Eastern Ethiopia further illuminated the scenario, associating partial immunization with various factors such as gender, maternal awareness, immunization counselling, and travel times to health facilities [11]. Additionally, global evidence from a systematic review by Oyo-Ita et al. highlighted the effectiveness of diverse intervention strategies, albeit with varying levels of certainty [12]. Recognizing the need to address the gaps in current research, studies have employed different methodologies and interventions. Adedire et al. utilized semi-structured questionnaires to comprehensively collect data on socio-demographic factors and maternal knowledge [10]. Muluye et al. focused on assessing prevalence and associated factors through a community-based cross-sectional study [11]. Oyo-Ita et al. conducted a systematic review to evaluate the effectiveness of intervention strategies [12]. Despite these efforts, challenges persist. Recall bias, identified in various studies [9,11,12], presents a notable deficit in accurately capturing vaccination history. The exclusive reliance on vaccination cards, as seen in the study by Mbegue et al. [13], may overlook essential data, impacting the precision of results. This study aimed to synthesize and critically assess existing research on predictors of full vaccination among children aged 12 to 23 months, identifying gaps and areas for improvement in understanding the complex dynamics influencing immunization status to contribute to the ongoing efforts to enhance vaccination practices at the subnational level and, consequently, improve child health outcomes.

Methods

The research was conducted within Calabar South Local Government Area, situated in the Southern Senatorial District of Cross River State, Nigeria. Encompassing 264 km², this region recorded a population of 191,630 individuals during the 2006 census (NPC, 2006). Calabar South LGA is characterized by diverse demographics, accommodating individuals from various parts of both the state and Nigeria as a whole. The area comprises 11 local government wards, exhibiting a mix of urban and slum-like environments. This study adopts a cross-sectional community-based approach, forming part of a larger mixed-method study from October to December 2023. A household survey serves as the primary data collection method for the quantitative component, while qualitative insights are derived from caregivers and healthcare providers. The quantitative study focuses on children aged 12 to 23 months, with proxy caregivers providing information through

interviews. For the qualitative aspect, caregivers and healthcare providers are included in the study population. The sample size was determined using the Cochran sample size formula for a single proportion, $n = \frac{z^2PQ}{d^2}$ (where: n is the minimum sample size, Z is the standard normal deviate corresponding to a 2-sided level of significance of 5% = 1.96, P is the proportion of coverage from previous study = 69% [14]. Q = 1-P, d is the desired level of precision (usually at 5% for single proportions). To adapt this formula for cluster sampling with the design effect size of 1.25, the sample was rounded off to 460. A two-stage cluster sampling method was employed. In the first stage, five wards (4, 5, 8, 11, and 12) were randomly selected from the 12 wards in Calabar South LGA, considering each ward as a primary sampling unit. In the second stage, within each selected ward, specific communities were purposively chosen, with each community regarded as a secondary sampling unit. The selection involved the random allocation of caregivers for interviews (25 from Ward 4, 25 from Ward 5, 51 from Ward 8, 193 from Ward 11, and 166 from Ward 12) to ensure proportional representation in the sample. A semi-structured pre-tested interviewer-administered questionnaire, designed through the Kobo toolbox, was used. The questionnaire comprised four sections covering socio-demographic characteristics, knowledge of childhood vaccination, vaccine coverage, and missed opportunities for vaccination and reasons. A small-scale trial in Calabar Municipality involving 50 caregivers helped identify and rectify any issues in the measurement tool. Five trained healthcare workers served as research assistants, undergoing a 2-day training period to enhance their understanding of the study tool, including vaccination history documentation and addressing potential challenges during data collection. The questionnaire was pretested in Calabar Municipality under the supervision of the Principal Investigator. Quantitative data analysis was performed using SPSS version 25.0 software. Descriptive statistics, including frequency, percentage, and charts, were used to present socio-demographic characteristics and vaccination-related information. Chi-square test statistics assessed factors associated with full vaccination. Independent variables significantly associated with full vaccination underwent multivariate binary logistic regression to identify predictors. Multivariable analyses were conducted at a 95% confidence interval, and a p-value of < 0.05 was considered statistically significant.

Results

The total number of study participants was 460. The study had 190 male children (41.3%) and 275 female children (58.7%). The age group of 12-15 months (55.2%) represents the largest category. The category of 1 to 2 birth order (60.9%) is the most prevalent. Female caregivers (85.9%) form the largest category. The age group of 30-39 years among caregivers (42.8%) is the most prominent. Caregivers with secondary education (61.3%) constitute the highest category. Those involved in business (60.4%) represent the most significant category. Mothers (92.0%) hold the highest proportion in caregiving relationships.

Prevalence of Full Vaccination

Figure 1 shows that the prevalence of full vaccination among children aged 12 to 23 months was 67%. On the other hand, 21.3% did not receive all the vaccines while 11.7% did not receive any vaccination.

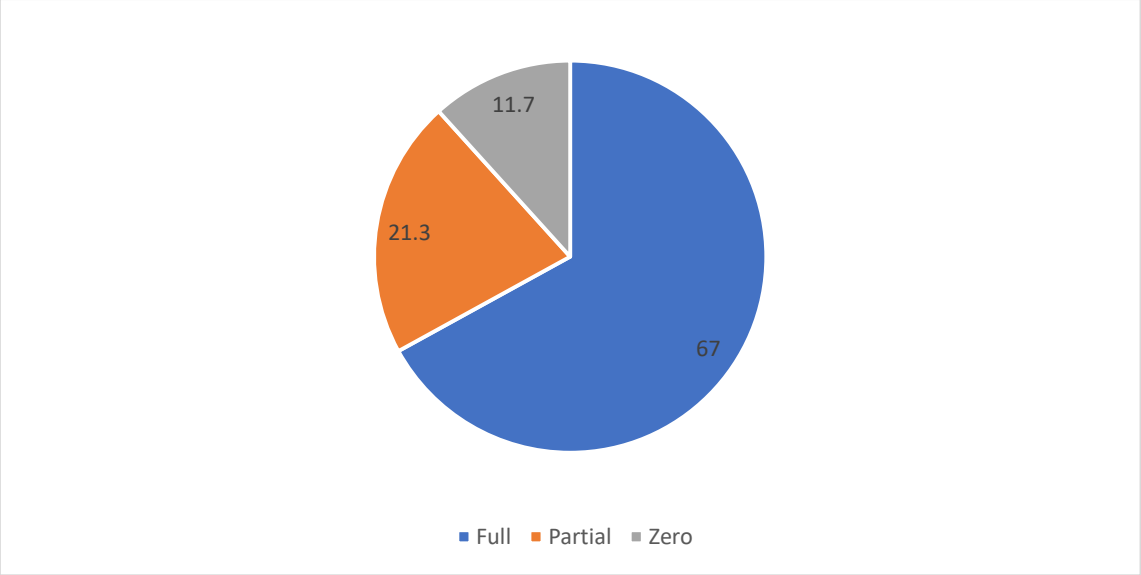

Figure 1. Prevalence of full vaccination among children aged 12 to 23 months

Relationship between Full Vaccination and Socio-demographic Characteristics

As shown in Table 1, male children accounted for a higher proportion of children who were fully vaccinated in comparison with females (72.6% versus 58.9%), and the difference was statistically significant (p=0.002). Furthermore, other socio-demographic variables that were significantly associated with full vaccination among children aged 12 to 23 months were the child's age (p<0.001), caregiver's age (p<0.001), relationship of caregiver to child (p<0001), highest level of education of caregivers (p<0.001), and occupation of caregiver (p=0.001). However, there was no statistically significant relationship between full vaccination and the birth order of the child (p=0.195), and caregiver's sex (p=0.132).

Table 1. Relationship Between Full Vaccination and Socio-demographic Characteristics

Variable	**Fully vaccinated**			**Chi-square test**	**p-value**
	Yes n=308(67%)	**No n=152(33%)**	**Total N=460(100%)**		
Sex					
Female	112(58.9)	78(41.1)	190(100.0)	9.385	0.002*
Male	196(72.6)	74(27.4)	270(100.0)		
Child's age/months					
12-15	158(62.2)	96(37.8)	254(100.0)	19.723	<0.001*
16-19	127(79.4)	33(20.6)	160(100.0)		
20-23	23(50.0)	23(50.0)	46(100.0)		
Birth order					
1-2	181(64.6)	99(35.4)	280(100.0)	3.271	0.195
3-4	100(73.0)	37(27.0)	137(100.0)		
5-6	27(62.8)	16(37.2)	43(100.0)		
Caregiver' sex					
Female	278(68.1)	130(31.9)	408(100.0)	2.274	0.132
Male	30(57.7)	22(42.3)	52(100.0)		
Caregiver' age/years					
<20	17(34.7)	32(65.3)	49(100.0)	41.243	<0.001*

20-29	92(61.7)	57(38.3)	149(100.0)		
30-39	154(78.2)	43(21.8)	197(100.0)		
40-49	20(57.1)	15(42.9)	35(100.0)		
≥50	25(83.3)	5(16.7)	30(100.0)		
Relationship of caregiver to child					
Father	0(0.0)	7(100.0)	7(100.0)	69.290	<0.001*
Grandparent	21(80.8)	5(19.2)	26(100.0)		
Mother	287(67.8)	136(32.2)	423(100.0)		
Uncle/aunt	0(0.0)	4(100.0)	4(100.0)		
Highest education of caregiver					
No formal education	29(34.1)	56(65.9)	85(100.0)	51.212	<0.001*
Primary	53(72.6)	20(27.4)	73(100.0)		
Secondary	210(74.5)	72(25.5)	282(100.0)		
Tertiary	16(80.0)	4(20.0)	20(100.0)		
Occupation of caregiver					
Business	195(70.1)	83(29.9)	278(100.0)	17.678	0.001*
Civil servant	12(75.0)	4(25.0)	16(100.0)		
Farming	19(55.9)	15(44.1)	34(100.0)		
Housewife	65(56.5)	50(43.5)	115(100.0)		
Unemployed	17(100.0)	0(0.0)	17(100.0)		

*=statistically significant

Relationship between Full Vaccination and Vaccination-Related Characteristics

Table 2 shows that there was a statistically significant between full vaccination and usual means of transport to HCF (p<0.001), as well as with components of attitude towards vaccination such as knowledge of vaccines child needs (p<0.001), immunization is important (p<0.001), had recommended immunization for others (p<0.001), immunization benefit children (p<0.001), disagreement that infants take too many vaccines (p=0.004). Furthermore, a statistically significant association was found between full vaccination and attitude towards vaccination (p<0.001).

Table 2. Relationship between full vaccination and vaccination-related characteristics

Variable	**Fully vaccinated**			**Chi-square**	**p-value**
	Yes n=308	**No n=152**	**Total n=460**		
Usually means of transport to HCF					
Car or Bus	3(100.0)	0(0.0)	(0.0)	88.190	<0.001*
Motorcycle/tricycle	124(84.9)	22(15.1)	146(100.0)		
Other, please, specify	0(0.0)	32(100.0)	32(100.0)		
Walk	181(64.9)	98(35.1)	279(100.0)		
Ever had MOV					
No	288(54.1)	135(31.9)	423(100.0)	3.028	0.082
Yes	20(54.1)	17(45.9)	37(100.0)		
Immunization schedule is important					
Disagree	0(0.0)	68(100.0)	68(100.0)	161.692	<0.001*
Agree	308(67.0)	84(21.4)	392(100.0)		
Immunization S/E are dangerous**					
Agree	12(54.5)	10(45.5)	22(100.0)	1.609	0.205
Disagree	296(67.6)	142(32.4)	438(100.0)		
Immunization is for unserious diseases					
Disagree	287(66.0)	148(34.0)	435(100.0)	3.471	0.062
Agree	21(84.0)	4(16.0)	25(100.0)		

Immunization makes infant sick					
Disagree	286(67.5)	138(32.5)	424(100.0)	0.603	0.437
Agree	22(61.1)	14(38.9)	36(100.0)		
All children should be vaccinated					
Disagree	0(0.0)	79(100.0)	79(100.0)	193.271	<0.001*
Agree	308(80.8)	73(19.2)	381(100.0)		
Immunization kills					
Disagree	300(67.3)	146(32.7)	446(100.0)	0.629	0.428
Agree	8(57.1)	6(42.9)	14(100.0)		
Had recommended it for others					
Disagree	16(16.0)	84(84.0)	100(100.0)	149.960	<0.001*
Agree	292(81.1)	68(18.9)	360(100.0)		
Immunization benefit children					
Disagree	5(5.7)	83(94.3)	88(100.0)	184.664	<0.001*
Agree	303(81.5)	69(18.5)	372(100.0)		
Infants takes too many vaccines					
Disagree	262(68.6)	120(31.4)	382(100.0)	11.109	0.004*
Agree	46(59.0)	32(41.0)	78(100.0)		
Attitude towards child's vaccination					
Good	304(81.5)	69(18.5)	373(100.0)	FET, 19.3	<0.001*
Fair	0(0.0)	74(100.0)	74(100.0)		
Poor	4(30.8)	9(69.2)	13(100.0)		

*=statistically significant; S/E**=Side Effects

Relationship between Full Vaccination and Vaccination Knowledge among Caregivers

Table 3 shows that those who had heard about vaccination accounted for a higher proportion of caregivers whose children were fully vaccinated compared with those who had not heard (79.0% versus 31.6%), and the difference was statistically significant (p<0.001). Similarly, knowledge of vaccine child need was significantly associated with full vaccination (p<0.001), and caregivers who knew constituted a higher proportion of those whose children had full vaccination compared with those who did not know (78.6% versus 38.3%). Furthermore, knowledge of the age for a second dose of routine childhood vaccination has significantly increased the likelihood of full childhood vaccination (p<0.001), and caregivers who knew also accounted for a higher proportion of those whose children were fully vaccinated, so also was knowledge of the total number of doses required for full vaccination in childhood significantly associated with full vaccination (p<0.001).

Table 3. Relationship Between Full Vaccination and Vaccination Knowledge among Caregivers

	Fully vaccinated			**Chi-square**	**p-value**
Variable	**Yes n=308**	**No n=152**	**Total n=460**		
Heard of vaccination					
No	37(31.6)	80(68.4)	117(100.0)	88.536	0<.001*
Yes	271(79.0)	72(21.0)	343(100.0)		
Knows vaccines child needs					
No	51(38.3)	82(61.7)	133(100.0)	69.221	<0.001*
Yes	257(78.6)	70(21.4)	327(100.0)		
Knowledge of age for second vaccine dose					
Correct	292(83.9)	56(16.1)	348(100.0)	185.634	<0.001*
Not correct	16(14.3)	96(85.7)	112(100.0)		
Knowledge of age for last vaccine dose					
Correct	253(84.1)	48(15.9)	301(100.0)	115.046	<0.001*
Not correct	55(34.6)	104(65.4)	159(100.0)		

Knowledge of total number of doses for complete routine vaccination					
Correct	223(83.5)	44(16.5)	267(100.0)	78.916	<0.001*
Not correct	85(44.0)	108(56.0)	193(100.0)		

***=statistically significant**

Multivariate Binary Logistic Regression of Factors Associated with Full Vaccination of Children Aged 12 to 23 Months

As shown in Table 4, independent predictors of full childhood vaccination among study the participants were the caregiver's age, the highest level of education, knowledge of vaccine child needs, ever missed opportunity, occupation and hearing about vaccination. Increasing age of caregivers (AOR: 1.13; 95% CI: 1.092-1.173), level of education is primary (AOR: 10.12; 95% CI: 3.934-26.056), secondary (AOR: 11.77; 95% CI: 5.169-26.813) or tertiary (AOR: 15.69; 95% CI: 3.436-71.697), as well as absence of missed opportunity ((AOR: 2.64; 95% CI: 1.055-6.623) were positive predictors of full vaccination. On the other hand, not knowing the vaccine a child needs (AOR: 0.16; 95% CI: 0.092-0.278), farming occupation (AOR: 0.22; 95% CI: 0.081-0.605), and having not heard of vaccination (AOR: 0.12; 95% CI: 0.077-0.197) were negative predictors of full vaccination. Other variables presented in Table 7 were not predictors of full childhood vaccination.

Table 4. Multivariable Binary Logistic Regression of Predictors of Full Vaccination of Children Aged 12 to 23 Months

Variable	AOR	95% Confidence Interval		p-value
		Lower	Upper	
Child's age/months	1.02	0.933	1.109	0.702
Sex of child	1.70	0.829	3.499	0.147
Age of caregiver/years	1.13	1.092	1.173	<0.001*
Highest level of education				
Primary	10.12	3.934	26.056	<0.001*
Secondary	11.77	5.169	26.813	<0.001*
Tertiary	15.69	3.436	71.697	<0.001*
No formal education	Reference category			
Know the Vaccine a child needs				
No	0.16	0.092	0.278	<0.001*
Yes	1			
Ever had MOV				
No	2.64	1.055	6.623	0.038*
Yes	Reference category			
Occupation				
Civil servant	5.80	0.441	76.304	0.181
Farming	0.22	0.081	0.605	0.003*
Housewife	2.90	1.501	5.609	0.002*
Unemployed	0.83	0.000		0.998
Business	Reference category			
Heard of vaccination				
No	0.12	0.077	0.197	<0.001*

Yes	Reference category			
Relationship with child	1.41	0.562	3.558	0.462
Means transport to health facility	1.07	0.676	1.685	0.778
Attitude	2.12	1.172	1.193	<0.001*

*=statistically significant

Discussion

The current study aimed to identify the prevalence and predictors of full vaccination among children aged 12 to 23 months. Our findings revealed that approximately 67% of the children in the study area were fully vaccinated. This prevalence aligns with the results reported by Mbengue et al. (2017), who found a similar rate of 62.8% for complete immunization coverage among boys and girls based on both vaccination card information and mothers' recall [17]. However, our findings differ notably from those reported in studies conducted in Ibadan, South-Western Nigeria, and urban and rural districts of southwest Nigeria. In Ibadan, only 40.7% of children achieved full immunization by both card and history [15]. Similarly, another study in southwest Nigeria reported prevalence rates of 40.2% and 41.3% for full vaccination in urban and rural districts, respectively [16]. Possible Reasons for differences in Findings could be due to geographical differences, including healthcare infrastructure, accessibility, and regional healthcare policies [15], variations in socioeconomic status between study populations can influence access to healthcare services, awareness, and overall health-seeking behaviour, impacting vaccination rates [16], differences in the effectiveness of local health systems, including the implementation of vaccination programs and outreach efforts, may contribute to disparities in vaccination coverage [15] [16], changes in vaccination programs and policies over time could influence vaccination coverage rates. Mbengue et al.'s study, conducted at a different time, might reflect variations in immunization practices [17] and discrepancies in study methodologies, such as sampling methods, survey tools, and data collection techniques, could contribute to differences in reported prevalence rates across studies [15-17]. The current study delves into various predictors associated with full vaccination among children, highlighting multiple socio-demographic factors and caregiver-related attributes. Interestingly, male children exhibited notably higher rates of full vaccination compared to females, and several other socio-demographic factors like the caregiver's age, education level, occupation, and means of transport were linked with full vaccination. Moreover, attitudes and knowledge towards vaccination significantly influenced vaccination rates, with caregivers holding positive attitudes and possessing comprehensive vaccination knowledge demonstrating higher rates of full vaccination. Binary logistic regression unveiled key independent predictors of full childhood vaccination, including caregiver age, education level, knowledge of vaccination needs, and absence of missed vaccination opportunities. Conversely, lack of vaccination knowledge, farming occupation, and unfamiliarity with vaccination emerged as negative predictors. In contrast, previous studies have identified various determinants associated with full immunization uptake [9-12,18]. These encompass factors like community leader involvement, provider interventions, maternal status, delivery conditions, postnatal care, maternal knowledge, access to immunization information, patient-physician communication, and socioeconomic factors. Discrepancies in findings across these studies could be attributed to contextual differences in healthcare systems,

cultural beliefs, and geographical disparities. The varying methodologies employed, such as sampling methods, sample sizes, and survey techniques, might also contribute to diverse findings. For instance, studies incorporating robust sampling methods, larger sample sizes, and diverse geographic representations tend to provide a broader perspective and potentially more generalizable findings. However, the convergence of findings on certain determinants, such as maternal knowledge, attitudes toward vaccination, and accessibility to vaccination information, suggests their pivotal roles in influencing vaccination practices across different settings. Moreover, the consistent identification of education level as a predictor emphasizes the significance of education in shaping vaccination decisions. A previous study in urban and rural districts of southwest Nigeria found that Maternal age ≥30 years, retention of vaccination card, completion of tertiary education, or secondary education, hospital birth and first-order birth were significant predictors of complete childhood vaccination [16]. In another study among children of female traders in Ibadan, South-Western Nigeria Full immunization by both card and history was recorded in only 40.7% while 8.4% of children had never been immunized. The highest vaccine coverage was seen with BCG (91.4%) while Hepatitis B (1%) had the lowest coverage. DPT1 to DPT3 vaccine dropout rate was 32.1%. All the immunizations were received in health facilities. The immunization coverage rate among children of female traders was low. Routine immunization sites should be made available in the markets [15]. Among children aged 12-23 months in Atakumosa-west district, Osun State Nigeria, it was found that mothers antenatal care attendance (aOR = 3.3, 95 % CI = 1.1-8.3), maternal tetanus toxoid vaccination (aOR = 3.2, 95 % CI = 1.1-10.0) access to vaccination information (aOR = 1.8, 95 % CI = 1.1-2.5) and mothers having good knowledge of vaccination (aOR = 2.4, 95 % CI = 1.6-3.8) were significant determinants of full vaccination [19]. In Ethiopia, full vaccination coverage noticeably varied across some of the demographic characteristics. Housewives had children with higher coverage of full immunization status (63%) than certain other occupations such as merchants (51%) or public/private employees (56%). Families with farmland also had greater coverage of full immunization status (70%) than those without (57%). There was a strong gradient between ANC visits and vaccination status; only 15% of children whose mothers had had no ANC visits were fully vaccinated, compared to 77% of those whose mothers had at least four visits. Lastly, families whose home was at least an hour from the vaccination site were less likely to be fully vaccinated (56%) than families whose home was between 30 and 59 min away (67%); there was no significant difference between living 30–59 min away and <30 min away. The mother's occupation and ownership of farmland were also significantly linked to the child's full vaccination status. Farmland, a measure of wealth, could be a better indicator of socioeconomic status, than other variables we included, like education or income. Housewives could have been more likely to have fully vaccinated children because they have more flexibility in their schedule to attend vaccination clinics or may have had more potential contact with Health Extension Workers. Mothers with a full-time occupation outside of the household may face more barriers, for example, "lack of time", which may prevent them from bringing their child to a vaccine clinic [20]. Mbengue and fellow researchers in Senegal found that mothers who could show a vaccination card attended at least secondary education level, attended four antenatal visits [AOR 3.10 95% CI (1.69 – 5.63)], or delivered at a health facility [AOR 1.27 95% CI (1 – 1.74)] were the predictors of full childhood immunization. Additionally, children living in the eastern administrative regions of the country were less likely to be

fully vaccinated [7]. A systematic review highlighted that higher birth order was frequently cited as a factor affecting vaccination coverage [21]. Similarly, findings from the current study support this observation, as family dynamics and competing responsibilities could impact the prioritization of vaccinations for later-born children. Both the current study and the systematic review identified low maternal education and socioeconomic status as significant factors influencing full vaccination. Economic barriers, educational disparities, and limited access to healthcare resources may contribute to these consistent findings. Although our study did not explicitly focus on HDI, it provides a local perspective, and factors like maternal employment and lack of reminders may resonate with our findings. Understanding the convergence and divergence of findings between our study and the systematic review is crucial for tailoring effective vaccination programs. The consistency in identifying socioeconomic factors and birth order emphasizes the universality of these challenges. However, the variations highlight the need for context-specific interventions. For instance, addressing the challenges posed by out-of-hospital births and maternal employment in regions with lower HDI may require targeted strategies to improve accessibility and awareness. Barrow et al., in a study on uuptake and determinants of childhood vaccination status among children aged 0-12 months in three West African countries found that children whose mothers attended postnatal care visits had higher odds of being fully vaccinated [22]. This finding underscores the importance of postnatal healthcare interactions in promoting comprehensive child health, likely facilitating better access to vaccination services and awareness. Children whose fathers had primary education had lower odds of being fully vaccinated. This suggests a potential influence of parental education on vaccination decisions, emphasizing the need for targeted education campaigns to address misconceptions and enhance awareness. Children in households that never watched TV had lower odds of full vaccination. This association might indicate a correlation between media exposure and health-seeking behaviour. Utilizing television as a medium for health education and promotion could be explored to improve vaccination awareness. In comparing the findings of the current study, which reported a prevalence of 67% for complete vaccination, with the previous study conducted in East Africa (prevalence of 69.21%) [23], it's essential to note the close alignment in the reported rates. Both studies demonstrate a substantial proportion of children receiving complete basic childhood vaccinations. However, the nuanced differences in the associated predictors warrant attention. Both studies identified the education level of caregivers as a significant predictor of complete childhood vaccination. This consistency highlights the universal importance of caregiver education in positively influencing vaccination outcomes. While the overall prevalence rates are close, the slight variation (67% in the current study and 69.2% in the East Africa study) may be attributed to differences in sample sizes, geographical locations, or variations in vaccination programs and policies across regions. In Nepal, a significant majority (78.2%) of the children in the study were reported as fully immunized. This is a positive indication of relatively high immunization coverage within the sampled population. Mothers with a formal education above the secondary school level had increased odds of having their children fully immunized [24]. This suggests that higher maternal education is associated with better awareness, understanding, and adherence to immunization schedules. Maternal employment was also linked to increased odds of full immunization. This association could be attributed to the potential access to healthcare information and resources that working mothers may have. In another previous study by Deressa et al.,

younger mothers (≤20 years old) and those who gave birth at home had lower odds of vaccinating their children [25]. While the current study provides a broader perspective on immunization coverage among a general population of children aged 12-23 months, the street children study sheds light on the challenges faced by a specific and vulnerable group. Both studies contribute valuable insights, emphasizing the importance of targeted interventions, contextual understanding, and age-specific strategies in promoting immunization. Yadita and Ayehubizu found that not knowing to come back for next visits 197(55.8%) were the major reason for dropout. Residing in urban (AOR = 2.0, 95%CI: 1.0, 3.9), primary educated mothers (AOR = 2.2, 95%CI: 1.0, 5.0), married mothers (AOR = 4.2, 95%CI:1.0, 18), higher average monthly income (AOR = 2.5, 95%CI 1.1, 5.2) and delivered at health facilities (AOR = 3.8, 95%CI 1.9, 7.3) were significantly associated with full-immunization [26]. Another previous study by Etana and Deressa, using multivariate logistic regression models, found factors associated with complete immunization. These factors include antenatal care follow-up, being born in a health facility, and mothers' knowledge about the age at which vaccination begins and is completed [27]. Both studies underscore the importance of caregiver knowledge in influencing full vaccination coverage. Understanding the need for vaccines, the timing of doses, and the total number required contributes to improved vaccination outcomes. The current study and the previous study align in identifying knowledge-related factors as significant predictors of complete immunization. In both cases, awareness of vaccination-related information positively correlates with higher rates of full vaccination (27). Another investigation discovered that a significant majority (76.8%) of children aged 12 to 23 months were fully vaccinated based on both vaccination cards and historical records. The study identified significant associations between full immunization and factors such as maternal occupation as a farmer and mothers possessing adequate knowledge about immunization [28]. The analysis of another previous study demonstrated compelling associations between the mother's level of education and full vaccination, showcasing significant odds ratios for primary education (OR = 3.59, p = 0.0200), high school education (OR = 3.68, p = 0.0400*), and higher education (OR = 8.25, p = 0.0018) [29]. A multivariate logistic regression analysis of yet another study also identified maternal literacy as a significant factor associated with full immunization [30]. These, in comparison with the current study involving Calabar South caregivers both shed light on factors associated with childhood immunization but have distinct demographic contexts. Both studies identify the mother's level of education as a significant factor associated with full vaccination. In the Calabar South study, higher maternal education levels were associated with increased odds of full vaccination, aligning with the current study's findings. Both studies report on the prevalence of full immunization, providing insights into the current state of childhood vaccination coverage.

Conclusion

Several predictors significantly associated with full vaccination emerged, including caregiver demographics, knowledge, and healthcare accessibility. Conversely, barriers such as missed appointments, cultural beliefs, and healthcare access limitations hindered vaccination uptake.

Recommendations

Intervention Studies: Implement and evaluate targeted interventions aimed at improving vaccination rates in these communities. Assess the effectiveness of community-based interventions, educational campaigns, or incentives on vaccination uptake.

Conflict of Interest

The authors declare that there is no conflict of interest. No funding was received for the work

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