

Determinants of Non-Vaccination and Under-Vaccination Among Children Aged 12–23 Months in Diema Health District

Daouda Traore^{1*}; Dr. Bakary Moro Traore²; Ousmane Sy³; Dr. Abdoul Salam Diarra⁴; Dr. Moussa Kone⁵; Dr. Mory Bengaly⁶; Lamine Doumbia⁷

¹Diema Reference Health Center

²Bamako Regional Health Department

³Professor, Private Higher Institute of Public Health

⁴Faculty of Medicine and Dentistry

⁵Diema Reference Health Center

⁶Independent Consultant

⁷Private Higher Institute of Public Health

Corresponding Author: Daouda Traore¹

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Abstract:

➤ Introduction:

Non-vaccination or under-vaccination remains a significant public health problem. This study aim is to identify determinants of non-vaccination or under-vaccination among children aged 12–23 months in Diema Health District during 2025.

➤ Methods:

This was an analytical observational case-control study conducted from March 1 to April 30, 2026, in Diema health district. It included mothers or caregivers of children aged 12–23 months who were unvaccinated or under-vaccinated (cases) and those whose children's vaccination status was up to date (controls). Data collection took place at community health centers and in the community using a standardized face-to-face questionnaire. Statistical analysis was performed using SPSS version 20.0.

➤ Results:

Determining factors for children's non-vaccination or under-vaccination were unacceptably long wait times during vaccination sessions (OR = 2.53, 95% CI = [1.23–5.23], p = 0.01), lack of information about vaccination (OR = 3.77, 95% CI = [1.28–11.11], p = 0.02), inadequate sources of information (OR = 2.14, 95% CI = [1.05–4.37], p = 0.04), and a lack of awareness of the importance of vaccination (OR = 2.02, 95% CI = [1.12–3.64], p = 0.02).

➤ Conclusion:

Incomplete vaccination coverage is a real public health problem because these children remain at risk of vaccine-preventable diseases.

Keywords: Children; Determining Factors; Vaccination, Diema.

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I. INTRODUCTION

Vaccination is considered the most effective public health intervention for preventing morbidity, complications, and mortality from infectious diseases in children [1,2,3]. It has been one of major components of primary health care for children since the 1978 Alma-Ata Conference [4].

According to the WHO and UNICEF, to ensure herd immunity and prevent disease outbreaks, it is necessary to achieve vaccination coverage of at least 90–95% for most antigens [1,5].

According to WHO estimates, nearly 3 million deaths are prevented annually worldwide through vaccination; and another 1.5 million deaths could be prevented simply by improving vaccination coverage [6]. Among children under 5 years of age, 30% of deaths are due to causes that can be prevented by vaccination [7].

However, vaccine effectiveness is only possible if the vast majority of the population is vaccinated [8]. In several health zones, vaccination rates remain well below this target, exposing children aged 0 to 59 months to preventable diseases such as measles, polio, diphtheria, and pertussis [5,9]. The scientific literature indicates that certain factors such as low educational attainment, lack of official documentation or irregular residency status, low or no awareness of vaccination, occupational activities, and parents' lack of understanding of the vaccination schedule—prevent certain segments of the population from being fully vaccinated [10–13].

In 2025 in Mali, according to DHIS2 data, 903,434 children were identified as under-vaccinated (813,490 with zero doses and 89,944 who dropped out between Penta1 and Penta3). In the Diema health district, 5,166 inadequately vaccinated children were recorded (1,333 with zero doses and 3,833 who dropped out between Penta1 and Penta3) [14].

Despite efforts of national health authorities and their partners, challenges remain in reaching all children of vaccination age. The significant number of under-vaccinated children raises questions about the reasons for non-vaccination or under-vaccination among these children, in order to develop appropriate solutions.

It is within this context that this study was initiated to identify the factors that may contribute to non-vaccination or

under-vaccination among children aged 12-23 months in the Diema health district during the year 2025.

II. METHODS

➤ Study Type, Location, and Time Period

This study was conducted in 12 of the 24 health zones in Diema Health District, where number of under-vaccinated children was high (20 or more children with zero doses and a dropout rate between Penta-1 and Penta-3 of 10% or higher). This was an observational, analytical case-control study conducted from March 1 to April 30, 2026.

➤ Study Population and Data Collection

The study included mothers or caregivers of children aged 12–23 months who were unvaccinated or under-vaccinated (cases) and those whose children's vaccination status was up to date (controls). Data collection took place at community health centers and in the community using a standardized face-to-face questionnaire.

➤ Statistical Analysis

The collected data were coded, then entered and processed using Microsoft Excel. Statistical analysis was performed using SPSS version 25.0. It consisted first of descriptive analysis of the variables, followed by bivariate analysis comparing means (Student's t-test) and percentages (chi-square test), and finally multivariate analysis using binary logistic regression to account for confounding factors and identify the main determinants likely to be involved in the non-vaccination or under-vaccination of children in Diema health district.

➤ Ethical Considerations

The study was approved by regional and district health authorities, as well as by community health associations (ASACO). Participation by mothers or caregivers of children was voluntary and based on verbal, informed consent. The anonymity of questionnaire ensured its confidentiality.

III. RESULTS

The study included a total of 264 mothers of children (132 in the case group children who were under-vaccinated and 132 in the control group children with up-to-date vaccination status).

Sociodemographic characteristics of children and mothers are summarized in Table 1.

Table 1 Sociodemographic Characteristics of Mothers and Children

Variables	Case, n (%)	Control n(%)
Average age of children (age ± standard deviation in months)	132 (19.15±/-3.7)	132 (19.92±/-2.5)
Does the child have a vaccination card or record book?		
Yes	72 (54.5)	127 (96.2)
No	60 (45.5)	5 (04.8)
Age of mother or caregiver		
< 20 years	24 (18.2)	26 (19.7)
≥ 20 years	108(81.8)	106(80.3)
Marital Status		

Monogamy	70 (53.8)	60 (46.9)
Polygamy	60 (46.2)	68 (53.1)
Level of Education		
Not in school	112 (84.8)	116 (87.9)
In school	20 (15.2)	16 (12.1)
Occupation		
Housewife	132 (100.0)	131 (99.2)
Other occupations*	0 (00.0)	1 (00.8)
Parity		
Primiparity	57 ((43.2)	48 (36.4)
Multiparity	75 (56.8)	84 (63.6)

*Other Occupations: Civil Servants, Students, Shopkeepers

Table 2 summarizes factors related to supply, demand, and knowledge about vaccination.

Table 2 Factors Related to Supply, Demand, and Knowledge About Vaccination

Variables	Case, n (%)	Control n (%)
Are the wait times at vaccination clinics acceptable?		
Yes	94 (71.2)	117 (88.6)
No	38 (28.8)	15 (11.4)
Is the healthcare facility easily accessible from your home?		
Yes	119 (90.2)	123 (93.2)
No	13 (9.8)	09 (06.8)
Does the schedule (days/times) for the vaccination sessions work for you?		
Yes	122 (92.4)	129 (97.7)
No	10 (07.6)	03 (02.3)
Availability and a warm welcome from the vaccination provider		
Yes	121 (91.7)	127(96.2)
No	11 (08.3)	5 (03.8)
Is the cost of the vaccination card affordable for you?		
Yes	107 (81.7)	117 (88.6)
No	25 (18.3)	15 (11.4)
Have you already received information about childhood vaccinations?		
Yes	88 (66.7)	126 (95.5)
No	44 (33.4)	6 (04.5)
Main Source of Information		
Health Worker/Community Liaison	86 (65.2)	109 (82.6)
Other sources (media, friends and family)	46 (34.8)	23(17.4)
Connaissez-vous l'importance de la vaccination ?		
Yes	92 (69.7)	123 (93.2)
No	40 (30.3)	9 (06.8)
Do you know of at least one disease that can be prevented by vaccination?		
Yes	66 (50.0)	101 (76.5)
No	66 (50.0)	31 (23.5)
Are you aware of any possible side effects of vaccines?		
Yes	104 (78.8)	127 (96.2)
No	28 (21.2)	5 (03.8)
Do you have the authority to make decisions on your own?		
Yes	100 (75.8)	114 (86.4)
No	32 (24.2)	18 (13.6)
Do you trust the vaccines your child receives?		
Yes	119 (90.2)	129 (97.7)
No	13 (09.8)	3(02.3)

The analysis of potential associations between case and control status (the variable to be explained) and the explanatory variables is summarized in Table 3.

Table 3 Relationships Between Vaccination Status and Explanatory Variables

Variables	Status n (%)		p Value
	Case	Control	
Does the child have a vaccination card or record book?			<0,01
Yes	72 (54.5)	127 (96.2)	
No	60 (45.5)	5 (04.8)	
Does the schedule (days/times) for the vaccination sessions work for you?			0,04
Yes	122 (92.4)	129 (97.7)	
No	10 (7.6)	03 (02.3)	
Are the wait times at vaccination clinics acceptable?			<0,01
Yes	94 (71.2)	117 (88.6)	
No	38 (28.8)	15 (11.4)	
Have you already received information about childhood vaccinations?			<0,01
Yes	88 (66.7)	126 (95.5)	
No	44 (32.6)	6 (04.5)	
Main Source of Information			<0,01
Health Workers/Community Liaison Officers	66 (48.5)	104 (78.8)	
Other sources*	66 (51.5)	28 (21.2)	
Do you know how important vaccination is?			<0,01
Yes	92 (69.7)	123 (93.2)	
No	40 (30.3)	9 (06.8)	
Do you know of at least one disease that can be prevented by vaccination?			<0,01
Yes	66 (50.0)	101 (76.5)	
No	66 (50.0)	31 (23.5)	
Are you aware of any possible side effects of vaccines?			<0,01
Yes	104 (78,8)	127 (96,2)	
No	28 (21,2)	5 (03,8)	
Do you have the autonomy to make decisions on your own (such as taking the child to the health center for a vaccination without asking anyone for permission)?			0,03
Yes	100 (75.8)	114 (86.4)	
No	32 (24.2)	18 (13.6)	
Do you trust the vaccines your child receives?			0,01
Yes	119 (90.2)	129 (97.7)	
No	13 (09.8)	3 (02.3)	

* Other Sources: Media, Associates, No Response

By accounting for confounding factors, we were able to identify the main factors associated with children not being vaccinated or not being fully vaccinated in the Diema health district (Table 4).

Table 4 Determinants of Non-Vaccination or Under-Vaccination Among Children Aged 12–23 Months.

Variables	OR	95%CI	p Value
Unacceptable wait times during appointments	2,53	[1,23 -5,23]	0,01
Lack of information about vaccination	3,77	[1,28-11,11]	0,02
Inadéquate sources of information	2,14	[1,05-4,37]	0,04
Lack of awareness of the importance of vaccination	2,02	[1,12-3,64]	0,02

IV. DISCUSSION

This study enabled us to identify the factors that may influence childhood vaccination in Diema health district.

The lack of or incomplete vaccination of children in our study area was linked to various factors. In fact, a lack of awareness of the importance of vaccination and a lack of information about vaccination each doubled the risk, respectively (OR = 2.02, 95% CI = [1.12–3.64], p = 0.02) and nearly fourfold (OR = 3.77, 95% CI = [1.28–11.11], p = 0.02), respectively, the risk of not vaccinating or vaccinating children incorrectly. This may be explained by the fact that

educational discussions during vaccination sessions—both before and during vaccination—are not conducted properly. Furthermore, during prenatal consultations, maternity ward staff provide very little information to women about childhood vaccination. Our results are consistent with those found in the study conducted by L. Nath and al. in India [15], where a lack of knowledge about the benefits of vaccination emerged as a modifiable risk factor associated with a child's vaccination status. However, in a study conducted in Morocco, Serge Esako Toirambe and al.[16] reported that having children who were incompletely or unvaccinated was not linked to mothers' lack of knowledge about the benefits of vaccination.

According to the authors [16], mothers' limited knowledge of the immunization schedule had a negative impact on their children's immunization status. A similar study conducted in Cameroon highlighted the association between mothers' and infants' lack of understanding of the immunization schedule and incomplete immunization among children aged 12 to 23 months [17].

The lack of or incomplete vaccination of children was associated with inadequate sources of information (OR = 2.14, 95% CI = [1.05–4.37], $p = 0.04$). Our study found that 34.8% of mothers in the case group received vaccination information from their social circle and the media, compared with 17.4% in the control group. The main sources of information were vaccination workers and community health workers (65.2% among cases and 82.6% among controls). This may be explained by the fact that mothers and caregivers trusted information provided by vaccination workers and community health workers more than information from other sources. Efforts must be made to help them understand that anyone—whether a health worker or not—can convey accurate health messages, particularly regarding vaccination. Vaccination workers and community health workers must also encourage mothers who come for vaccinations to properly educate others about the benefits of vaccination once they return home.

Our study found that long wait times during vaccination sessions (OR = 2.53, 95% CI = [1.23–5.23], $p = 0.01$) increased the risk of incomplete vaccination among children by 2.5 times. Long wait times may be attributed to mothers arriving sporadically with their children on vaccination days, the need for proper vaccine management—particularly of lyophilized vaccines—the vaccination worker performing other tasks on vaccination days, and the lack of support for the vaccination worker on days with high turnout. Our findings are consistent with those of the authors [16,17], who reported in their study that waiting time at the vaccination clinic was significantly associated with incomplete vaccination among children. Indeed, women who spent more than one hour at the vaccination clinic were more likely to have children who were incompletely vaccinated or unvaccinated.

However, our study found no association between educational level, occupation, gender, and incomplete childhood vaccination, as this research was conducted in a rural setting where nearly all mothers—both in the case and control groups—were homemakers, had given birth to multiple children, and had no formal education. Serge Esako Toirambe and al. [16] and J. V. Jani and al. [18] found that a low level of education or lack of schooling had a negative impact on children's vaccination status. However, these results contrast with those reported by the authors [19,20], who showed that having a mother with a higher level of education was a significant demographic factor in delaying or missing vaccinations.

This study inevitably has certain limitations, notably the inability to extrapolate the results to other health districts, since conducting the same study in other districts might

reveal factors different from those found in our area; there are also potential recall biases arising from mothers' reports when certain information about their children's vaccinations was not available in the immunization records. Despite these limitations, the study has major methodological strengths, such as the availability of children's immunization records, from which information regarding their vaccination status was extracted, ensuring the reliability of the data used.

V. CONCLUSION

Based on our findings, improving children's vaccination status in the Diema health district remains a challenge. Addressing the identified barriers—such as unacceptably long wait times during vaccination sessions, a lack of information about vaccination, inadequate sources of information, and a lack of awareness regarding the importance of vaccination—would help improve children's vaccination status. Incomplete vaccination is a real public health problem because these children remain exposed to vaccine-preventable diseases.

- Conflicts of Interest: No conflicts of interest were reported by the authors.

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