

Factors Associated with Incomplete Childhood Immunization among Children Aged 12–36 Months in Burkina Faso

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Abstract Childhood immunization remains one of the most effective public health interventions to prevent vaccine-preventable diseases. In Burkina Faso, incomplete immunization schedules remain a challenge amid insecurity, population displacement, and health system disruptions. This study aimed to identify factors associated with incomplete immunization and the vaccination dropout rate in children aged 12 to 36 months. A secondary analysis of the 2021 Burkina Faso Demographic and Health Survey (2021-DHS-BF) data was performed. Incomplete immunization was defined as a child not receiving all recommended routine vaccine doses by 15 months of age. Factors associated with incomplete immunization were identified using modified Poisson regression with generalized estimating equations; adjusted prevalence ratios (aPR) with 95% confidence intervals were reported at a 5% significance threshold. Among the 2,375 children who met the eligibility criteria in the 2021-DHS-BF dataset, 1,482 (66.0%) had not completed their immunization schedule. The dropout rate between the first and third doses of the pentavalent vaccine was 11.0%. Maternal occupation (Saler: aPR = 0.89, 95% CI: 0.80–0.98 and farmer/self-employed: aPR = 0.93; 0.85, 95% CI: 0.78–0.94) and being treated with respect “sometimes” at health facilities (aPR = 1.14, 95% CI: 1.02–1.27) were associated with an incomplete immunization schedule. Strengthening person-centered care, improving post-first-dose follow-up, and expanding community-based outreach strategies could improve immunization schedule completion.

Keywords Burkina Faso, Children, Factors Associated, Immunization, Vaccine.

Introduction

Immunization of children starting at birth is universally recognized as one of the most effective and cost-effective public health strategies for reducing morbidity and mortality from vaccine-preventable diseases [1]. The World Health Organization (WHO) estimates that vaccination prevents 2 to 3 million deaths annually, a figure that could increase by an additional 1.5 million with improved global coverage. However, achieving this collective effectiveness relies on maintaining high and equitable vaccination coverage across populations [2]. Despite global progress in childhood immunization, major challenges persist. In 2021, nearly 25 million children were under-immunized. Furthermore, the number of "zero-dose children"—defined as those who have not received any doses of the pentavalent vaccine, serving as a key indicator of poor access to health services—increased from 13.6 million in 2019 to 18.2 million in 2021 [3].

In West Africa in 2015, 24,551 children were incompletely vaccinated in six countries, including 55.2% in Mali, 69.8% in Liberia, 26.2% in Ghana, 21.6% in Burkina Faso, 48.9% in Côte d'Ivoire, and 63.1% in Guinea [4].

In Burkina Faso, the Ministry of Health has made efforts that have led to major public health achievements, such as eliminating maternal and neonatal tetanus and eradicating wild poliovirus. Consequently, the percentage of fully vaccinated children in their first year of life reached 96.20% according to the 2020 vaccination coverage survey report [5]. Service delivery is supported by routine immunization in both public and private health facilities, where vaccines and healthcare supplies are provided free of charge [6].

However, vaccine-preventable diseases remain a complex challenge. The continued deterioration of the security situation since 2016 has led to mass population displacement, leaving many individuals without reliable access to immunization services and creating a pool of children who have not completed their

vaccination schedule. In addition, despite free access to vaccines, disparities persist: certain populations live far from health facilities, while others are disproportionately affected by insecurity. Missed opportunities for vaccination remain high [6] with various barriers, including insecurity, poverty, population displacement, and poor service quality, hindering adherence to the immunization schedule [7]. Beyond initial access to immunization, schedule completeness is a critical indicator of immunization program performance. Because receiving initial doses does not guarantee the completion of the recommended immunization schedule, dropouts between scheduled visits weaken individual child protection and compromise the herd immunity necessary for the sustainable control of vaccine-preventable diseases [8].

Burkina Faso's National Immunization Strategy 2022-2026 aims to achieve at least 95% coverage for all routine antigens nationally and to reduce the number of zero-dose children by 50% by 2026 [9]. To achieve these ambitious goals and mitigate emerging threats from vaccine-preventable infectious diseases, understanding the specific factors underlying non-adherence to immunization is imperative.

This study aimed to identify the factors associated with incomplete immunization among children aged 12 to 36 months and evaluate vaccination dropout rates in Burkina Faso using data from the 2021 Demographic and Health Survey (2021 DHS-BF).

Methods

Design Study and Period

This was a secondary analysis of nationally representative data from the 2021 Burkina Faso Demographic and Health Survey [10]. Data were collected between July and November 2021 [11].

Study Site

In 2021, Burkina Faso had an estimated population of 21,510,181, with a slight female (51.79%) and predominantly young demographic, of whom 45.29% were under 15 years of age [12]. The annual population growth rate was 2.9% in 2019. The population remains largely rural (73.7% in 2019) with low literacy levels, as only 23% of women and 38% of men considered literate. The total fertility rate declined from 6.2 children per woman in 2003 to 5.4 in 2019 [12].

The health system is organized according to a three-tiered pyramidal structure. Healthcare services are structured across three levels: the first level comprises Health and Social Promotion Centers, Medical Centers and Medical Centers with Surgical facilities; the second level consists of Regional Hospital Centers and Regional University Teaching Hospitals; and the third level includes National University Teaching Hospitals. In addition to the public sector, the country has an extensive network of private healthcare facilities, pharmacies, drug dispensaries, as well as a community-based health network operated by Community-Based Health Workers (CBHWs), at a rate of two agents per village. Immunization is central to national health policy due to its crucial role in reducing infant and child morbidity and mortality [13]. In 2020, zero-dose cases accounted for 3.5% of children aged 0-11 months [7].

Study Population

The target population for this study comprised all children aged 12 to 36 months residing in Burkina Faso at the time of the 2021 DHS-BF survey.

Inclusion and Exclusion Criteria

Children alive and aged 12 to 36 months at the time of the 2021 DHS-BF survey were included in the study. Children with incomplete or missing key information regarding vaccination status or study variables was excluded.

Variables

Dependent Variable

The dependent variable was incomplete immunization schedule among children aged 12 to 36. A child was classified as having an incomplete immunization schedule (coded 1) if he or she has not received all the recommended routine vaccines doses by the age of 15 months. Conversely, a child who received all required doses by 15 months of age was classified as having a complete immunization schedule (coded 0).

Independent Variables

Independent variables were selected based on sociodemographic, contextual and individual determinants of immunization schedule completeness (Table 1).

Table 1. Independent Variables

Variables	Categories
Mother/Caregiver	
Age in years	<20, 20–29, 30–39, ≥40
Marital status	Single/Divorced/Widowed, Married/Cohabiting
Level of education	No Education, Primary, Secondary, Tertiary
Occupation	Unemployed, Professional/Technical/Manager, Sales, Farmer/Self-employed, Manual worker
Wealth Index	Poorest, Poorer, Middle, Richer, Richest
Distance a big problem	No, yes
Treated with respect at facility	All the time, sometimes, no at all

Place of residence	Rural, Urban
Region of residence	Boucle du Mouhoun
	Cascades
	Centre
	Centre Est
	Centre Nord
	Centre Ouest
	Centre Sud
	Est
	Hauts-bassins
	Nord
	Plateau central
	Sahel
	Sud-Ouest
Husband/Partner	
Gender of household head	Men, Women
Husband/Partner's education level	No education, Primary, Secondary, Tertiary
Husband/Partner occupation	Unemployed, Professional/Technical/Manager, Saler, Farmer/Self-employed, Manual worker
Child	
Age in months	12-23 months, 24-36 months
Gender	Male, Female
Twin	No, yes

Data Source

The data were from the 2021 Burkina Faso Demographic and Health Survey (Phase VI of the DHS program). Information was primarily extracted from the Individual Questionnaire for Women [14].

Sampling

The 2021 DHS-BF used a two-stage stratified cluster sampling design to ensure representative results at the national, regional, and urban/rural levels. The sampling was conducted across consecutive stages [11].

The first step involved stratifying the population to ensure adequate representation across the country's different subpopulations. Stratification was based on Burkina Faso's 13 administrative regions and place of residence, distinguishing between urban and rural areas.

This stratification improved estimate precision and ensured reliable comparisons across regions and places of residence.

In the first stage, enumeration areas (EAs) were selected within each defined stratum. EAs are geographical units delineated during the 2019 General Population and Housing Census [15], each consisting of a defined number of households.

EAs were selected using systematic sampling with probability proportional to size, where size was defined as the number of households enumerated in each EA during the census. This sampling strategy ensured that more populated areas had a higher probability of selection, while maintaining overall randomness. At the end of this stage, a final list of selected EAs was generated for each stratum.

In the second stage, ordinary households were selected within each sampled EA. Prior to selection, a complete household listing was conducted in each selected EA to update the sampling frame. A fixed number of households was then selected from this updated list using equal probability systematic sampling.

All households within the same cluster had an equal probability of selection, thereby minimizing selection bias.

In each sampled household, the survey included all individuals meeting the eligibility criteria defined by standard DHS protocols. These included all women aged 15 to 49 who were usual resident in the household, as well as children under 5 years of age (for whom data were collected via maternal reports). Additionally, all men aged 15 to 59 were interviewed in a designated subsample of households.

Finally, sampling weights were applied to the data to adjust for unequal selection probabilities across households and individuals, complex survey stratification and clustering, and potential non-response.

Applying these weights ensured that the resulting estimates were nationally, regionally, and environmentally (urban/rural) representative.

Sample Size

A total of 2,375 children aged 12-36 months were extracted from the 2021 DHS-BF survey dataset and included in the analysis.

Statistical Analyses

Statistical analyses were performed using Stata version 15.0 (StataCorp, College Station, TX, USA). We first described the sociodemographic characteristics of the children and their parents/caregivers, as well as the clinical characteristics of children who had information on their immunization status, along with specific vaccines received by the children.

Pearson's chi-square test was used to compare the proportion of reported health events (fever, cough, diarrhea and anemia) during the two weeks preceding the survey between children with complete and incomplete immunization schedules. All descriptive analyses incorporated sampling weighted, stratification, and clustering to account for the complex survey design, in accordance with DHS program guidelines [11]. To identify independent factors associated with incomplete immunization schedule in children aged 12 to 36 months, we used a modified Poisson regression model with generalized estimating equations (GEE) with a robust variance estimator in an adjusted model. Variables associated with incomplete immunization schedule at p-value <0.20 in the unadjusted model were included in the adjusted model. Adjusted prevalence ratios (aPR) and their corresponding 95% confidence intervals (CI) were estimated. Statistical significance was set at a two-sided p-value < 0.05.

Ethical Considerations

The 2021 DHS-BF protocol received ethical approval from the Health Research Ethics Committee (CERS) of Burkina Faso. All participants provided informed consent prior to data collection. For minors, informed consent was obtained from parents or legal guardians, alongside participant assent where applicable. The dataset used in this study was anonymized and publicly available with formal authorization from the DHS Program [11].

Results

The 2021 DHS-BF dataset involved 5,907 children with recoded age data. Among these, 2,375 were aged 12 to 36 months and met the inclusion criteria for this study. Within this target population, 66% had an incomplete immunization schedule (Figure 1).

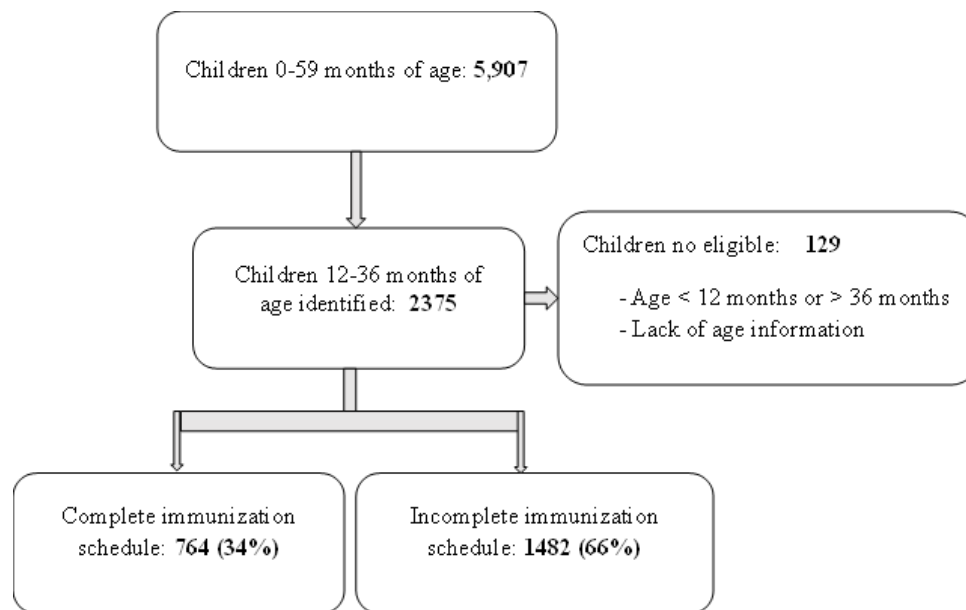


Figure 1. Flow Diagram for the Selection of the Study Population

The majority of mothers/caregivers were aged 20 and 29, and more than 95% were married or cohabiting. More than two-thirds had no formal education and resided in rural areas. The distribution of maternal/caregiver occupations was comparable between children with incomplete and complete immunization schedules, with unemployed mothers/caregivers accounting for 36% and farmer/self-employed accounting for 45% of

participants. More than 85% of mothers/caregivers reported being treated with respect at health facilities. Among partners, over 68% had no formal education and were predominantly farmer/self-employed. The mean age of children was similar between those with incomplete (1.49 years; SD = 0.5) and complete immunization schedules (1.43 years; SD = 0.5) (Table 2).

Table 2. Sociodemographic Characteristics of Children Aged 12 to 36 Months and their Parents in Burkina Faso in 2021

Characteristics	Incomplete Immunization Schedule	Complete Immunization Schedule	Total
Mother	n (%)	n (%)	
Age in years (mean, SD)	28.95 (6.95)	28.72 (6.78)	
<20	91 (6.44)	49 (6.86)	140
20–29	727 (48.87)	377 (51.02)	1104
30–39	536 (36.35)	281 (35.17)	817
≥40	128 (8.34)	57 (6.95)	185
Marital status			
Single/divorced/widowed	72 (4.34)	26 (2.95)	98
Married/cohabiting	1410 (95.66)	738 (97.05)	2148
Education			
No education	1017 (68.76)	528 (69.44)	1545
Primary	198 (13.31)	95 (12.34)	293
Secondary	253 (16.58)	130 (16.04)	383

Higher	14 (1.36)	11 (2.18)	25
Place of residence			
Rural	1037 (73.50)	577 (79.08)	1614
Urban	445 (26.50)	187 (20.92)	632
Region of residence			
Boucle du Mouhoun	85 (6.33)	89 (14.87)	174
Cascades	57 (2.31)	55 (4.04)	112
Centre	146 (15.60)	58 (12.63)	204
Centre Est	138 (10.25)	89 (13.42)	227
Centre Nord	110 (10.03)	43 (8.15)	153
Centre Ouest	132 (11.02)	61 (9.03)	193
Centre Sud	113 (5.14)	28 (2.61)	141
Est	98 (8.75)	53 (9.01)	151
Hauts-Bassins	184 (11.81)	41 (4.89)	225
Nord	115 (5.88)	74 (7.19)	189
Plateau central	110 (5.31)	95 (9.44)	205
Sahel	83 (3.91)	11 (1.10)	94
South-Ouest	111 (3.66)	67 (3.62)	178
Occupation			
Unemployed	524 (36.24)	194 (27.74)	718
Professional/Technical/Managerial	55 (3.77)	26 (3.61)	81
Sales	295 (18.78)	151 (18.27)	446
Farmer/self-employed	512 (33.95)	349 (45.27)	861
Manual Laborer	94 (7.26)	41 (5.10)	135
Wealth Index			
The poorest	299 (22.07)	148 (21.40)	447
Poorer	291 (20.98)	154 (19.97)	445
Midfield	320 (19.85)	199 (25.36)	519
Richer	320 (19.29)	157 (18.53)	477
The richest	352 (17.80)	106 (14.74)	458
Distance is a big problem			
No	901 (58.92)	455 (60.67)	1356
Yes	541 (41.08)	309 (39.33)	850
Treated with respect at facility			
All the time	1069 (85.24)	617 (88.51)	1686
Sometimes	116 (9.98)	49 (7.79)	165
No at all	62 (4.78)	27 (3.70)	89
Husband/Partner			
Head of household Sex			
Male	1319 (88.64)	693 (90.56)	2012
Female	163 (11.36)	71 (9.44)	234
Education			
No education	1017 (68.76)	528(69.44)	1545
Primary	198 (13.31)	95 (12.34)	293

Secondary	253 (16.58)	130 (16.04)	383
Higher	14 (1.36)	11 (2.18)	25
Profession			
Unemployed	166 (13.05)	45 (7.42)	211
Professional/Technical/Managerial	102 (7.64)	63 (9.93)	165
Saler	194 (14.21)	105 (14.20)	299
Farmer/self-employed	597 (41.81)	359 (48.61)	956
Manual laborer	319 (23.29)	157 (19.83)	476
Children			
Age in months (sort of, SD)	1.49 (0.50)	1.43 (0.50)	
12–23	965 (49.59)	223 (46.31)	1188
24–36	942 (50.41)	245 (53.69)	1187
Gender			
Male	771 (50.76)	384 (52.12)	1155
Female	711 (49.24)	380 (47.88)	1091
Twins			
No	1437 (97.30)	729 (95.17)	2166
Yes	45 (2.70)	35 (4.83)	80

Across the 19 routine vaccine doses scheduled between 0 and 23 months, coverage patterns among children aged 12 to 36 months varied substantially. Over 90% of children received five vaccines (BCG, OPV0, OPV1,

Pentavalent 1 and 2), over 80% received ten vaccines and fewer than 80% received four vaccines (IPV, Rotavirus 3, Measles 2 and Meningitis) (Table 3).

Table 3. Vaccination Coverage Among Children Aged 12 to 36 Months in Burkina Faso in 2021

Vaccines	n (%)
BCG (Bacillus Calmette–Guérin)	
No	70 (3.14)
Yes	2159 (96.86)
Oral polio vaccine (OPV) 0	
No	138 (6.20)
Yes	2090 (93.8)
OPV 1	
No	152 (6.81)
Yes	2076 (93.19)
OPV 2	
No	224 (10.06)
Yes	2004 (89.94)
OPV 3	
No	445 (19.99)
Yes	1782 (80.01)
Inactivated Poliovirus Vaccine (IPV)	
No	946 (42.91)
Yes	1258 (57.09)

Pentavalent 1	
No	120 (5.39)
Yes	2103 (94.61)
Pentavalent 2	
No	167 (7.52)
Yes	2055 (92.48)
Pentavalent 3	
No	230 (10.36)
Yes	1992 (89.64)
Pneumococcal 1	
No	269 (12.10)
Yes	1954 (87.90)
Pneumococcal 2	
No	326 (14.66)
Yes	1897 (85.34)
Pneumococcal 3	
No	324 (16.87)
Yes	1598 (83.13)
Rotavirus 1	
No	310 (13.99)
Yes	1909 (86.01)
Rotavirus 2	
No	369 (16.61)
Yes	1851 (83.39)
Rotavirus 3	
No	468 (21.09)
Yes	1752 (78.91)
Measles 1	
No	286 (12.91)
Yes	1929 (87.09)
Measles 2	
No	716 (37.33)
Yes	1201 (62.67)
Meningitis	
No	719 (37.67)
Yes	1191 (62.33)
Yellow fever	
No	396 (17.91)
Yes	1815 (82.09)

Among children aged 12 to 36 months, the prevalence of health conditions reported in the two weeks preceding the survey was similar regardless of the immunization completion status. Fever was reported in 28.80% of

children with an incomplete immunization schedule compared to 29.73% of those with a complete immunization schedule. Similarly, comparable distributions were observed between the two groups for cough (12.87% vs.

11.73%), diarrhea (21.89% vs. 21.22%) and moderate anemia (49.76% vs. 51.92%) (Table 4).

Table 4. Prevalence of Reported Childhood Health Conditions During the Two Weeks Preceding the Survey, by Immunization Status in Burkina Faso in 2021

Health Conditions	Incomplete Immunization Schedule	Complete Immunization Schedule	P-Value
Fever in the last two weeks prior to the survey			0.68
No	1063 (71.20)	538 (70.27)	
Yes	417 (28.80)	225 (29.73)	
Cough these last two weeks before the investigation			0.51
No	1298 (87.13)	672 (88.27)	
Yes	182 (12.87)	92 (11.73)	
Diarrhea in the last two weeks prior to the survey			0.74
No	1165 (78.11)	610 (78.78)	
Yes	315 (21.89)	154 (21.22)	
Anemia			0.60
Severe	51 (3.60)	21 (2.57)	
Moderate	706 (49.76)	388 (51.92)	
Mild	389 (26.32)	202 (25.58)	
No anemia	305 (20.33)	145 (19.93)	

After adjusting for potential confounders, maternal occupation/caregiver (Saler: aPR = 0.89, 95% CI: 0.80–0.98 and farmer/self-employed: aPR = 0.93; 0.85, 95% CI: 0.78–0.94) and reporting treatment

sometimes with respect at health facilities (aPR = 1.14, 95% CI: 1.02–1.27) remained significantly associated with incomplete immunization schedules in children aged 12 to 36 months (Table 5).

Table 5. Factors Associated with Incomplete Immunization Schedule Among Children Aged 12 to 36 Months in Burkina Faso: Evidence from the 2021 Demographic and Health Survey.

Factors	Unadjusted			Adjusted		
	PR*	95% CI	p-value	PR	95% CI	p-value
Mothers						
Age in years			0.54			
<20	1					
20 - 29	1.01	[0.90 – 1.13]				
30 - 39	1.01	[0.90 – 1.13]				
≥40	1.08	[0.94 – 1.23]				
Marital status			0.09			
Single/divorced/widowed	1					
Married/living with partner	0.90	[0.79 – 1.01]				
Education			0.95			
No education	1					
Primary	1.00	[0.91 – 1.10]				
Secondary	0.98	0.90 – 1.07]				

Higher	0.92	[0.66 – 1.29]				
Place of residence			0.05			0.18
Rural	1			1		
Urban	0.92	[0.85 – 1.00]		0.93	[0.85 – 1.03]	
Occupation			<0.001			0.01
unemployed	1			1		
Professional/Technical/Managerial	0.93	[0.80 – 1.09]		0.91	[0.75 – 1.10]	
Saler	0.90	[0.83 – 0.98]		0.89	[0.80 – 0.98]	
Farmer/self-employed	0.84	[0.77 – 0.90]		0.85	[0.78 – 0.94]	
Manual Laborer	0.91	[0.79 – 1.04]		0.92	[0.79 – 1.07]	
Wealth Index			0.74			
The poorest	1					
Poorer	0.98	[0.90 – 1.08]				
Midfield	0.95	[0.86 – 1.05]				
Richer	0.99	[0.90 – 1.09]				
The richest	1.02	[0.62 – 0.72]				
Distance is a big problem			0.63			
No	1					
Yes	1.01	[0.94 – 1.09]				
Treated with respect at facility			0.02			0.04
All the time	1			1		
Sometimes	1.14	[1.03 – 1.27]		1.14	[1.02 – 1.27]	
No at all	1.09	[0.94 – 1.25]		1.07	[0.93 – 1.25]	
Husband/Partner						
Head of household Sex			0.51			
Male	1					
Female	1.03	[0.93 – 1.14]				
Education			0.95			
No education	1					
Primary	1.00	[0.91 – 1.10]				
Secondary	0.98	[0.90 – 1.07]				
Higher	0.92	[0.66 – 1.29]				
Occupation			<0.01			0.08
unemployed	1			1		
Professional/Technical/Managerial	0.83	[0.72 – 0.95]		0.88	[0.75 – 1.03]	
Saler	0.83	[0.74 – 0.93]		0.85	[0.74 – 0.97]	
Farmer/self-employed	0.84	[0.77 – 0.93]		0.94	[0.83 – 1.05]	
Manual laborer	0.88	[0.80 – 0.97]		0.94	[0.83 – 1.06]	
Age in months			0.01			0.05
12–23	1			1		
24–36	1.09	[1.01 – 1.14]		1.07	[0.99 – 1.15]	
Gender			0.72			
Male	1					
Female	0.98	[0.93 – 1.04]				

Fever in the last two weeks prior to the survey			0.44			
No	1					
Yes	0.97	[0.91 – 1.04]				
cough these last two weeks before the investigation			0.80			
No	1					
Yes	1.01	[0.92 – 1.10]				
Diarrhea in the last two weeks prior to the survey			0.71			
No	1					
Yes	1.01	[0.94 – 1.08]				
Anemia			0.46			
No anemia	1					
Severe	1.04	[0.88 – 1.22]				
Moderate	0.96	[0.89 – 1.04]				
Mild	1.01	[0.93 – 1.09]				

*PR: prevalence Ratio

Vaccine Dropout Rate

Using the pentavalent vaccine as a proxy for program retention, 11.02% of children aged 12

to 36 months dropped out between the first and third doses (Pentavalent 1 to 3). The overall dropout rate across the complete immunization schedule was 5.19% (Figure 2).

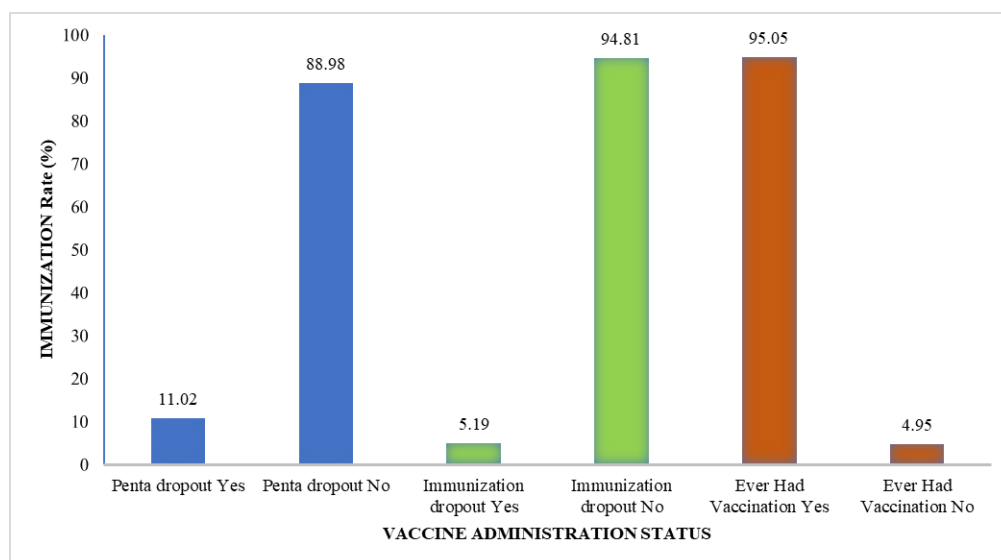


Figure 2. Pentavalent and overall Vaccination Dropout Rates Children Aged 12 to 36 Months in Burkina Faso in 2021

Discussion

Our study highlights that immunization completeness remains insufficient among Burkinabè children aged 12 to 36 months, driven by dropouts after the second doses of the measles-rubella, meningitis, and inactivated poliomyelitis vaccines. Key factors independently associated with an incomplete

immunization schedule included maternal occupation (salaried and farmers/self-employed) and inconsistent (sometimes) respectful treatment at the facility.

This study highlights a high prevalence of incomplete immunization schedules among children aged 12 to 36 months in Burkina Faso. The prevalence of incomplete immunization schedules in our study is higher than rates

reported in several sub-Saharan African countries, such as Ghana and Nigeria, where incomplete immunization estimates generally range between 25% and 50% [17, 18]. This difference could be explained by the specific context in Burkina Faso, which has been marked by persistent insecurity challenges, internal population displacements, disruptions in healthcare delivery, and the lingering effect of the COVID-19 pandemic—all of which hinder adherence to the immunization schedule and compromise healthcare continuity [16].

Our results show that vaccination coverage remains high for the initial doses administered during the first year of life, reflecting strong initial adherence to EPI services. However, this performance gradually wanes as children age, with a marked decline in coverage for vaccines scheduled during the second year of life, particularly the second dose of measles-rubella vaccine and meningitis [17]. This gap poses a major challenge for the Expanded Programmed on Immunization (EPI), as it reflects a breakdown in service continuity despite high coverage for vaccines administered in early infancy. This progressive drop suggests that the main challenge for the EPI in Burkina Faso has shifted from initial access to ensuring service continuity and retaining children in the health system through completion of the schedule. Strengthening community health worker networks for active tracking and home-based follow-up could offer an effective strategy to reduce incomplete immunization schedules. A similar progressive decline in immunization completeness has also been reported in several countries in sub-Saharan Africa, where they decrease with the number of visits [18, 19].

This study also highlights a substantial dropout rate between the first and third doses of the pentavalent vaccine, alongside a notable dropout rate across the complete immunization schedule. These results indicate that, despite generally satisfactory performance by the EPI, a significant proportion of children discontinue their vaccination series before receiving all

recommended doses [19]. The observed dropouts predominantly affect vaccines scheduled late in the immunization timeline, confirming that service continuity remains a major challenge to overcome and achieve full protection for children [20]. To address this challenge, expanding outreach and mobile strategy in hard-to-reach areas, alongside routine catch-up campaigns for children who have missed one or more doses, is essential. These programmatic needs align with findings from similar settings across West Africa [19, 21, 22].

Two factors were independently associated with incomplete immunization schedules. The first was the inconsistent (sometimes) respectful treatment at health facilities. Mothers who reported being treated with respect only occasionally (sometimes) at health facilities were at significantly higher risk of having children with incomplete immunization schedules. This was also reported by Esako et al. in Morocco [22]. These findings underscore that immunization retention relies heavily on positive interpersonal interactions between caregivers and healthcare providers [23]. This aligns with evidence from Togo and Nigeria, where supportive health worker attitudes, respectful engagement, and reduced waiting times were key determinants of sustained caregiver adherence to vaccination schedules [18, 24].

Additionally, children whose mothers/caregivers were Salers or farmers/self-employed had a significantly lower risk of incomplete immunization schedules compared with those whose mothers/caregivers were unemployed. This association may be explained by the greater financial autonomy of working mothers, which enables them to better absorb indirect immunization costs, such as transportation expenses and opportunity costs from clinic waiting times. Furthermore, women engaged in commercial or agricultural activities frequently participate in community networks or occupational groups, which serve

as crucial conduits for health information. These results align with those of several studies conducted in sub-Saharan Africa. A meta-analysis by Bangura et al. demonstrated that low household socio-economic status is associated with lower uptake of routine pediatric immunization services [24]. Similarly, Sambala et al. highlighted women's economic empowerment as a key driver of completion of the childhood immunization schedule [25].

This study has several limitations to consider when interpreting the findings. First, because the 2021 DHS-BF is cross-sectional, causal inferences cannot be established. Second, immunization status was determined in part through maternal recall when vaccination cards were unavailable, introducing potential recall bias. Finally, several key structural and behavioral determinants—such as health facility stockouts of vaccines and related consumables, local staffing levels, geopolitical insecurity, and parental vaccine hesitancy—are not captured in DHS datasets and could not be controlled for in our models [10]. Despite these limitations, this study has notable strengths. It utilizes a nationally representative sample and applies appropriate analytical methods that account for the complex DHS sampling design and clustering, thereby enhancing the precision and external validity of our findings.

Conclusion

This study reveals a high prevalence of incomplete immunization among children aged 12–36 months in Burkina Faso. Although initial coverage was high for vaccines administered early in infancy, marked coverage drops and high dropout rates were observed for

subsequent doses scheduled in the second year of life. Incomplete immunization was associated with maternal/caregiver occupation (Sales and farmers/self-employed) and the perceived quality of interpersonal interactions at health facilities, specifically inconsistent (sometimes) respectful treatment. Strengthening child tracking systems following immunization initiation, fostering respectful, person-centered care, and institutionalizing targeted catch-up strategies for children who miss scheduled may contribute to improving immunization completion.

Conflict of Interest

The authors declare no competing interests.

Data Availability

The dataset analyzed in this study is publicly available upon request from the Demographic and Health Surveys (DHS) Program repository (<https://dhsprogram.com>).

Author Contributions

L.C.B. conceptualized the study. J.D.B. accessed and extracted the datasets from the DHS program website and analyzed the data.

L.C.B. and J.D.B. wrote the initial manuscript with contributions from M.D.

The I.T.T. supervised the work. All co-authors reviewed and consent to publication.

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