Texila International Journal of Academic Research
ISSN: 2520-3088
DOI: 10.21522/TIJAR.2014.12.02.Art015

# Assessment of Zero Dose, Under-Immunized, and Dropout Children in Ifelodun Local Government Area, Kwara State Nigeria

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***Abstract***

*Immunization is a cost-effective strategy for reducing childhood morbidity and mortality, yet Nigeria faces challenges in achieving optimal vaccination coverage. This study assessed the prevalence and determinants of incomplete immunization among children aged 0–23 months in Ifelodun LGA through a cross-sectional survey of 383 caregivers selected via multistage random sampling. Data were collected using structured questionnaires and analyzed using descriptive statistics, chi-square tests, and logistic regression. While 93.5% of children received at least one vaccine, only 19.6% were fully immunized. Three immunization gaps were identified: zero-dose children (6.5%), under-immunized (50.4%), and dropouts (23.5%). Place of delivery significantly influenced coverage, with hospital-born children having higher full immunization rates (25.5%) compared to home births, which had higher dropout rates (29.6%). Key barriers included parental negligence (23.1%), lack of awareness (18.8%), fear of side effects (15.6%), and accessibility/financial constraints (12% and 11.4%). Multivariate analysis showed zero-dose status was predicted by lack of awareness (OR=3.96, p=0.053), unfamiliarity with vaccination sites (OR=11.44, p=0.014), and stockouts (OR=10.74, p=0.007). Under-immunization was strongly linked to older child age (OR=6.75, p=0.001), while learning about vaccines from friends was protective (OR=0.32, p=0.009). Dropout risk increased with older age (OR=3.93, p=0.002) but decreased with caregiver education from friends (OR=0.23, p=0.027). Despite the high initial uptake, dropout rates remain concerning. Targeted interventions addressing health system barriers, education, supply chains, and community engagement are critical to improving coverage.*

***Keywords:*** *Dropout, Immunization, Nigeria, Under-Immunized, Zero-Dose Children.*

## Introduction

Immunization remains one of the most cost-effective public health interventions, preventing an estimated 2–3 million childhood deaths annually [1]. However, vaccination coverage in many low- and middle-income countries (LMICs) falls below the World Health Organization's (WHO) target of 90% national coverage for three doses of diphtheria-tetanus-pertussis (DTP3) vaccines [2]. Globally, approximately 22.7 million children are either "zero-dose" (having received no vaccines) or under-immunized (incomplete vaccination), with about 3.1 million (14%) residing in Nigeria [3].

The Nigerian immunization schedule includes Bacillus Calmette-Guérin (BCG), oral polio vaccine (OPV), and hepatitis B at birth; three doses of OPV, pentavalent vaccine, and pneumococcal conjugate vaccine (PCV) at 6, 10, and 14 weeks; and measles-containing vaccine (MCV), meningococcal, and yellow fever vaccines at 9 months [4,1]. Despite these standardized protocols, Nigeria's DTP1 and

***Received: 02.04.2025*** ***Accepted: 18.04.2025*** ***Published on: 30.04.2025***
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DTP3 coverage rates were only 65% and 57% respectively in 2020 [5], with the number of zero-dose children increasing from 3.0 million in 2019 to 3.1 million in 2020 [2].

Nigeria's challenges are particularly acute, accounting for two-thirds of unvaccinated children worldwide in 2022 [6]. Vaccine-preventable diseases contribute to 22% of childhood mortality [7], with rural children being twice as likely to miss vaccinations compared to urban counterparts [8]. Multiple factors influence these gaps, including maternal education, geographic accessibility, and healthcare system limitations [9,10].

Globally, 87% of zero-dose children reside in LMICs, with Nigeria, India, and the Democratic Republic of Congo contributing the highest numbers [11]. Subnational disparities are stark; conflict-affected and rural regions exhibit coverage gaps exceeding 50% [12]. In Nigeria, factors such as maternal education, household income, and healthcare accessibility influence immunization status [13]. For instance, children of mothers with no formal education are 3.3 times more likely to be zero-dose [14], while home births correlate with higher dropout rates [15]. System-level challenges including vaccine stockouts, distance to health facilities, and caregiver misinformation further exacerbate disparities [16, 17].

In Ifelodun Local Government Area (LGA) of Kwara State, persistent immunization gaps are evident, with 15,642 zero-dose children recorded between 2021–2023 [18]. Geographic barriers, socioeconomic constraints, and healthcare service challenges contribute to these low coverage rates. This study examined the prevalence of zero-dose, under-immunized, and immunization dropout among children aged 0–23 months and determinants of immunization gaps in Ifelodun LGA, Kwara State, Nigeria.

## Materials and Methods

This section details the methodological framework, including research design, population sampling, instrumentation, data collection protocols, analytical approaches, and ethical considerations employed in investigating immunization coverage gaps among under-24-month children in Ifelodun LGA, Nigeria.

### Research Design

A cross-sectional survey design was adopted, combining quantitative methods with open-ended qualitative components. This mixed-methods approach enabled both statistical analysis of immunization patterns and nuanced understanding of contextual factors influencing vaccination uptake.

### Study Area

The study was conducted across all 18 wards of Ifelodun LGA, Kwara State (population: 350,773; NPC 2024), with particular focus on its 63,210-under-five population. Ward-level demographic data informed stratified sampling to ensure geographic representation of the target 0-23 month cohort.

### Target Population

The study population comprised mother-child dyads (children 0-23 months) residing ≥12 months in Ifelodun LGA. This selection criterion ensured participants had sufficient exposure to local immunization services while capturing the critical vaccination window under EPI schedules.

### Sampling Strategy

Fisher's formula was used to determine the sample of 384, with proportional allocation across wards based on under-five populations. A multi-stage random sampling approach was employed:

1. Ward-level proportional allocation.
2. Settlement randomization via balloting.

3. Household selection using modified spin-the-bottle technique with systematic skipping.

## Instrumentation

A validated semi-structured questionnaire captured:

1. Section A: Sociodemographics
2. Section B: Immunization status (verified by card/recall)
3. Section C: Barriers to vaccination
4. Section D: Improvement strategies

Incorporated both closed-ended and open-response items to balance quantitative precision with qualitative depth.

## Validity & Reliability

Robust psychometric testing included:

1. *Content validity*: Expert panel review (5 public health specialists)
2. *Face validity*: Pilot testing (n=38; 10% sample)
3. *Reliability*: Cronbach's $\alpha \geq 0.7$ for all retained scales

Pretesting in Ilorin South LGA confirmed the instrument appropriateness, clarity and non-ambiguity.

## Data Collection

Trained enumerators administered electronic questionnaires (KoBoCollect) in local languages after rigorous competency testing. Standardized protocols ensured:

1. Consistent question interpretation
2. Privacy protections
3. Data quality checks (real-time completeness validation)

## Analytical Approach. Data were analysed using SPSS v26

The following analytical methods were employed

1. *Descriptive analyses*: Frequencies/proportions for coverage rates
2. *Bivariate analyses*: $\chi^2$ tests for association detection
3. *Multivariate modeling*: Logistic regression to identify predictors of:
    - Zero-dose status
    - Under-immunization
    - Dropout rates

All analytical tests employed were at $\alpha=0.05$ with 95% CIs.

## Ethical Compliance

The Ethics and Research Committee (ERC/MOH/2024/10/351) of Kwara State Ministry of Health, Nigeria, approved the study's conduct, with protocols ensuring voluntary participation, informed consent, data anonymity, and community benefit. The study adhered to research ethical principles of autonomy, beneficence, non-maleficence, and justice throughout implementation.

# Results

**Table 1.** Sociodemographic Characteristics

| **Sociodemographic Characteristics** | | **Frequency (N=383)** | **Percentage (%)** |
|---|---|---|---|
| Age of mother | 15-25 | 94 | 24.5 |
| | 26-35 | 235 | 61.4 |
| | 36-42 | 54 | 14.1 |
| | Mean±SD | 29.6±5.6 | |
| Education Level of mother | No education | 142 | 37.1 |
| | Primary | 90 | 23.5 |
| | Secondary | 124 | 32.4 |
| | Higher | 27 | 7 |
| Education Level of father | No education | 118 | 30.8 |
| | Primary | 52 | 13.6 |

| | | | |
|---|---|---|---|
| | Secondary | 149 | 38.9 |
| | Higher | 64 | 16.7 |
| Child age | Less than 6 weeks | 55 | 14.4 |
| | 6weeks-10weeks | 48 | 12.5 |
| | 10weeks-14weeks | 50 | 13.1 |
| | 14weeks-6months | 46 | 12 |
| | 6months-9months | 31 | 8.1 |
| | 9months-12months | 44 | 11.5 |
| | 12months-15months | 44 | 11.5 |
| | 15months-24months | 65 | 17 |
| Gender of Child | Male | 195 | 50.9 |
| | Female | 188 | 49.1 |
| Number of siblings | None | 54 | 14.1 |
| | 1-3 | 283 | 73.9 |
| | 4-7 | 46 | 12 |
| | Mean±SD | 1.34±2.01 | |
| Place of delivery | Hospital | 243 | 63.4 |
| | Home | 135 | 35.2 |
| | Others | 5 | 1.3 |

The data presented in Table 1 indicates that the average age of mothers is 29.6 years, with a standard deviation of 5.6. A significant portion, specifically 142 mothers (37.1%), lack formal education. In contrast, a larger proportion of fathers, amounting to 149 (38.9%), possess a secondary school education, while 118 fathers (30.8%) have no formal education in the Ifelodun local government area. Additionally, it is noted that 195 children (50.9%) are male. Most of the children, 283 (73.9%), have between one to three siblings, and nearly two-thirds, 243 (63.4%), were delivered in a hospital setting.

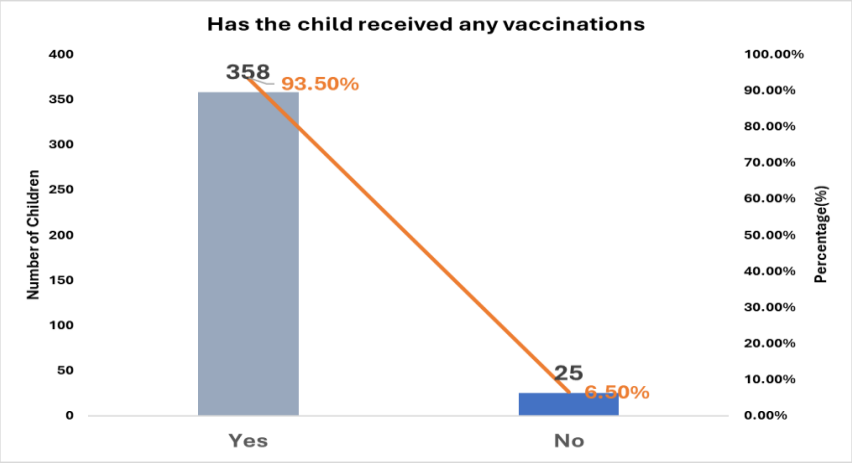


**Figure 1.** Status of Routine Immunization Among Children

The data in Figure 1 show that 358 respondents (93.5%) reported their child had received at least one vaccination, while 25 respondents (6.5%) indicated their child had not been vaccinated. This high initial vaccine uptake rate of 93.5% in Ifelodun Local Government, Kwara State, represents a significant achievement.

**Table 2.** Type of Vaccines Ever Received by Children

| Type of Vaccines | Frequency (N=383) | Percentage (%) |
|---|---|---|
| BCG | 332 | 84.1 |
| OPV | 333 | 86.9 |
| HepB | 144 | 37.6 |
| Penta | 234 | 61.1 |
| PCV | 229 | 59.8 |
| IPV | 185 | 48.3 |
| ROTA | 198 | 51.7 |
| Measles | 50 | 13.1 |
| Vitamin A | 64 | 16.7 |
| Yellow fever | 38 | 9.9 |
| Meningitis | 31 | 8.1 |
| No vaccination | 25 | 6.5 |

The findings presented in Table 2 indicate that the Oral Polio Vaccine (OPV) is the most frequently administered vaccine, with 333 children (86.9%) having received it, highlighting the significant impact of the polio eradication initiative in the region. Following closely is the Bacillus Calmette-Guérin (BCG) vaccine, which has been administered to 332 children (84.1%). Additionally, the data in Table 2 reveals that the Penta, Rota, Pneumococcal Conjugate Vaccine (PCV), and Inactivated Polio Vaccine (IPV) are also among the most received vaccinations in Ifelodun Local Government, Kwara State.

**Table 3.** Number of Children who Received Penta Vaccines

| | | Frequency | Percentage (%) |
|---|---|---|---|
| Has your child ever received an injection in their left upper thigh to protect against tetanus, whooping cough, or Diphtheria | Yes | 234 | 61.1 |
| | No | 149 | 38.9 |
| | **Total** | **383** | **100** |
| Number of times child received Penta vaccine | One time | 85 | 36.3 |
| | Two times | 66 | 28.2 |
| | Three times | 83 | 35.5 |
| | **Total** | **234** | **100** |

The study findings demonstrate that 234 children (61.1%) received an intramuscular injection in the left upper thigh for protection against tetanus, pertussis (whooping cough), diphtheria, hepatitis B, and Haemophilus influenzae type b (Hib). In contrast, 149 children (38.9%) did not receive this vaccination.

**Table 4.** Number of Fully Eligible Children who Received Complete PENTA Vaccines Dosages

| | | Frequency | Percentage (%) |
|---|---|---|---|
| Has your child ever received an injection in their left upper thigh to protect against tetanus, whooping cough, or Diphtheria | Yes | 181 | 78.7 |
| | No | 49 | 21.3 |
| | **Total** | **230** | **100** |
| Number of times child received Penta vaccine | One time | 43 | 23.8 |
| | Two times | 55 | 30.3 |
| | Three times | 83 | 45.9 |
| | **Total** | **181** | **100** |

The research indicates that among children eligible for the complete dosage of the Penta vaccine, 181 (78.7%) have received at least one dose. However, of these 181 children who commenced the vaccination series, only 83 (45.9%) completed all three doses, resulting in a dropout of 54.1% within the Ifelodun Local Government Area of Kwara State.

**Table 5.** Category of Child Routine Immunization Status (Under-Immunized, Zero-Dose, Dropout)

| **Child Immunization Status** | **Frequency** | **Percentage (%)** |
|---|---|---|
| Fully Immunized | 75 | 19.6 |
| Under-immunized | 193 | 50.4 |
| Zero-dose | 25 | 6.5 |
| Immunization Dropout | 90 | 23.5 |
| **Total** | **383** | **100** |

According to the Nigeria Expanded Programme on Immunization (EPI) schedule - which includes BCG, oral polio vaccine (OPV), pentavalent vaccine (diphtheria-tetanus-pertussis-hepatitis B-Haemophilus influenzae type b), measles, yellow fever, and other routine vaccines - Table 5 data indicate that 193 children (50.4%) were under-immunized. Furthermore, 25 children (6.5%) had received no vaccinations (zero-dose), while 90 children (23.5%) were immunization dropouts.

**Table 6.** Reason for Incomplete Vaccination

| **Reason for incomplete the vaccination** | **Frequency** | **Percentage (%)** |
|---|---|---|
| Accessibility Issues | 37 | 12.0 |
| Because I did not give birth in the health facility | 1 | 0.3 |
| Child is sick | 13 | 4.2 |
| Cultural Beliefs | 17 | 5.5 |
| Fear of Side Effects | 48 | 15.6 |
| Financial Constraints | 35 | 11.4 |
| Health Worker were absent | 2 | 0.6 |
| I do not have time (parental negligence) | 71 | 23.1 |
| Lack of Awareness | 58 | 18.8 |
| Lack of Trust in Healthcare System | 1 | 0.3 |
| Previous Bad Experience | 14 | 4.5 |
| Rumour (Misconception) | 6 | 1.9 |
| Vaccine was not available | 5 | 1.6 |
| **Total** | **308** | **100** |

The data presented in Table 6 identifies the primary factors contributing to incomplete vaccination among children as reported by their caregivers. The most common reason was caregivers' lack of time to facilitate vaccination (23.1%), followed by lack of awareness about immunization (18.8%). Concerns about potential vaccine side effects were reported by 15.6% of caregivers, while 12% cited difficulties accessing vaccination services. Financial constraints were reported by 11.4% of caregivers.

**Table 7.** Association between the Child Vaccination Status and the Sociodemographic Characteristics of Respondents

| | **Child Immunization Status (N=383)** | | | | **Pearson Chi-square Tests** | |
|---|---|---|---|---|---|---|
| | **Fully Immunized N (%)** | **Under-immunized N (%)** | **Zero-dose N (%)** | **Immunization Dropout N (%)** | ***X*** | **p-value** |
| **Age of mother** | | | | | | |
| 15-25 | 21 (22.3) | 45 (47.9) | 3 (3.2) | 25 (26.6) | 11.604 | 0.071 |
| 26-35 | 48 (20.4) | 123 (52.3) | 14 (6) | 50 (21.3) | | |
| 36-42 | 6 (11.1) | 25 (46.3) | 8 (14.8) | 15 (27.8) | | |
| **Education Level of mother** | | | | | | |
| No education | 24 (16.9) | 67 (47.2) | 13 (9.2) | 38 (26.8) | 6.553 | 0.684 |
| Primary | 20 (22.2) | 49 (54.4) | 4 (4.4) | 17 (18.9) | | |
| Secondary | 27 (21.8) | 61 (49.2) | 7 (5.6) | 29 (23.4) | | |
| Higher | 4 (14.8) | 16 (59.3) | 1 (3.7) | 6 (22.2) | | |
| **Education Level of father** | | | | | | |
| No education | 23 (19.5) | 58 (49.2) | 10 (8.5) | 27 (22.9) | 14.224 | 0.115 |
| Primary | 5 (9.6) | 31 (59.6) | 5 (9.6) | 11 (21.2) | | |
| Secondary | 28 (18.8) | 77 (51.7) | 10 (6.7) | 34 (22.8) | | |
| Higher | 19 (29.7) | 27 (42.2) | 0 (0) | 18 (28.1) | | |
| **Age of child** | | | | | | |
| Less than 6 weeks | 31 (56.4) | 17 (30.9) | 7 (12.7) | 0 (0) | **146.83** | **<0.0001** |
| 6w-10w | 12 (25) | 34 (70.8) | 2 (4.2) | 0 (0) | | |
| 10w-14w | 11 (22) | 38 (76) | 1 (2) | 0 (0) | | |
| 14w-6m | 7 (15.2) | 15 (32.6) | 2 (4.3) | 22 (47.8) | | |
| 6m-9m | 5 (16.1) | 12 (38.7) | 4 (12.9) | 10 (32.3) | | |
| 9m-12m | 3 (6.8) | 20 (45.5) | 5 (11.4) | 16 (36.4) | | |
| 12m-15m | 4 (9.1) | 20 (45.5) | 2 (4.5) | 18 (40.9) | | |
| 15m-24m | 2 (3.1) | 37 (56.9) | 2 (3.1) | 24 (36.9) | | |
| **Gender of child** | | | | | | |
| Male | 38 (19.5) | 100 (51.3) | 16 (8.2) | 41 (21) | 2.811 | 0.422 |
| Female | 37 (19.7) | 93 (49.5) | 9 (4.8) | 49 (26.1) | | |
| **Number of siblings** | | | | | | |
| None | 7 (13) | 30 (55.6) | 5 (9.3) | 12 (22.2) | 4.57 | 0.600 |
| 1-3. | 55 (19.4) | 143 (50.5) | 17 (6) | 68 (24) | | |
| 4-7. | 13 (28.3) | 20 (43.5) | 3 (6.5) | 10 (21.7) | | |
| **Place of delivery** | | | | | | |
| Hospital | 62 (25.5) | 125 (51.4) | 7 (2.9) | 49 (20.2) | **30.722** | **<0.001** |
| Home | 12 (8.9) | 65 (48.1) | 18 (13.3) | 40 (29.6) | | |
| Others | 1 (20) | 3 (60) | 0 (0) | 1 (20) | | |

The findings presented in Table 7 from the Pearson's Chi-square test indicate a significant association (p-value <0.0001) between the age of the child with immunization status (p <

0.0001). Younger children (<6 weeks) had the highest full immunization rate (31, 56.4%), while dropout rates peaked at 14 weeks to 6 months (22, 47.8%). Furthermore, there was a significant association (p-value <0.001) between the location of their delivery with the child's immunization status, children born in hospitals had higher full immunization rates (62, 25.5%) and lower zero-dose rates (7, 2.9%) compared to home deliveries, where dropout was higher (40, 29.6%). However, maternal and paternal education, maternal age, child gender, and the number of siblings showed no statistically significant associations.

**Table 8.** Predictors of Zero-Dose Immunization Status among Children

| | | **p-value** | **OR** | **95% C.I. for OR** | |
|---|---|---|---|---|---|
| | | | | **Lower** | **Upper** |
| Age of child | Less than 6 weeks | 0.031 | **Ref** | | |
| | 6w-10w | 0.079 | 0.189 | 0.029 | 1.212 |
| | 10w-14w | 0.079 | 0.04 | 0.001 | 1.455 |
| | 14w-6m | 0.096 | 0.144 | 0.015 | 1.41 |
| | 6m-9m | 0.455 | 0.516 | 0.091 | 2.921 |
| | 9m-12m | 0.101 | 0.239 | 0.043 | 1.32 |
| | 12m-15m | 0.009 | 0.022 | 0.001 | 0.385 |
| | 15m-24m | 0.001 | 0.008 | 0 | 0.13 |
| Place of delivery | Hospital | | **Ref** | | |
| | Home/Others | 0.302 | 1.868 | 0.57 | 6.121 |
| Are you aware of the importance of childhood immunizations | Yes | | **Ref** | | |
| | No | 0.053 | 3.958 | 0.98 | 15.993 |
| How did you learn about immunizations | Health worker | 0.729 | **Ref** | | |
| | Family | 0.482 | 0.365 | 0.022 | 6.071 |
| | Friend | 0.649 | 0.644 | 0.097 | 4.272 |
| | Media | 0.905 | 1.192 | 0.067 | 21.211 |
| | Others | 0.388 | 2.628 | 0.293 | 23.572 |
| Do you know where to get your child vaccinated | Yes | | **Ref** | | |
| | No | 0.014 | 11.438 | 1.627 | 80.421 |
| Are vaccines always available when you visit the health facility | Yes | | **Ref** | | |
| | No | 0.007 | 10.738 | 1.929 | 59.781 |
| Do you receive reminders for your child’s next vaccination appointment | Yes | | **Ref** | | |
| | No | 0.925 | 0.921 | 0.165 | 5.146 |
| Are there any cultural beliefs or practices that influence your decision on child immunization | Yes | | **Ref** | | |
| | No | 0.158 | 0.337 | 0.075 | 1.525 |
| Do you face any social pressure regarding immunizing your child | Yes | | **Ref** | | |
| | No | 0.778 | 1.259 | 0.254 | 6.242 |
| Constant | | 0.178 | 0.186 | | |

The logistic regression analysis presented in Table 8 indicates that children older than 6 weeks are less likely to exhibit a zero-dose immunization status compared to those younger than 6 weeks, with an odds ratio of less than 1. Additionally, the findings reveal that children born at home are 87% more likely to have a zero-dose status than their

counterparts born in a hospital (OR=1.868). Furthermore, children whose caregivers lack awareness regarding the significance of childhood immunization are four times more likely to have a zero-dose immunization status compared to those who are informed (OR=3.958). Moreover, children of caregivers who acquire knowledge about immunization from family and friends are 63% and 36% less likely to have a zero-dose immunization status than those who receive this information from healthcare professionals (OR=0.365, OR=0.644). Conversely, those who learn about immunization through media and other sources are 19% and 2.6 times more likely, respectively, to have a zero-dose status compared to those who learn from health workers (OR=1.192, OR=2.628).

Additionally, children of caregivers who are unaware of where to obtain immunizations are 11.4 times more likely to have a zero-dose status than those who know (OR=11.438). The data in Table 8 also indicates that children of caregivers who report that vaccines are not consistently available at health facilities are 10.7 times more likely to have a zero-dose immunization status compared to those who report vaccine availability (OR=10.738).

Furthermore, children of caregivers who do not receive reminders for their child's upcoming vaccination appointments are 7% less likely to have a zero-dose immunization status than those who do receive reminders (OR=0.925). Lastly, children of caregivers who do not hold any cultural beliefs or practices that affect their immunization decisions are 66% less likely to have a zero-dose immunization status compared to those who do (OR=0.337), while children of caregivers who do not experience social pressure regarding immunization are 26% more likely to have a zero-dose status than those who do (OR=1.148).

**Table 9.** Predictors of Under-Immunized STATUS among Children

| | | **p-value** | **OR** | **95% C.I. for OR** | |
|---|---|---|---|---|---|
| | | | | **Lower** | **Upper** |
| Age of child | Less than 6 weeks | <0.001 | **Ref** | | |
| | 6w-10w | <0.001 | 5.547 | 2.321 | 13.26 |
| | 10w-14w | <0.001 | 6.748 | 2.755 | 16.53 |
| | 14w-6m | 0.982 | 0.99 | 0.417 | 2.351 |
| | 6m-9m | 0.712 | 1.197 | 0.46 | 3.114 |
| | 9m-12m | 0.141 | 1.903 | 0.808 | 4.481 |
| | 12m-15m | 0.106 | 2.047 | 0.86 | 4.876 |
| | 15m-24m | 0.003 | 3.453 | 1.54 | 7.742 |
| Place of delivery | Hospital | | **Ref** | | |
| | Home/Others | 0.84 | 1.052 | 0.641 | 1.728 |
| Are you aware of the importance of childhood immunizations | Yes | | **Ref** | | |
| | No | 0.451 | 1.371 | 0.603 | 3.12 |
| How did you learn about immunizations | Health worker | 0.082 | **Ref** | | |
| | Family | 0.188 | 0.509 | 0.187 | 1.39 |
| | Friend | 0.009 | 0.316 | 0.133 | 0.75 |
| | Media | 0.615 | 0.749 | 0.243 | 2.311 |
| | Others | 0.56 | 0.598 | 0.106 | 3.366 |
| Do you know where to get your child vaccinated | Yes | | **Ref** | | |
| | No | 0.042 | 0.206 | 0.045 | 0.946 |
| Are vaccines always available when | Yes | | **Ref** | | |

| | | | | | |
|---|---|---|---|---|---|
| you visit the health facility | No | 0.043 | 0.395 | 0.161 | 0.97 |
| Do you receive reminders for your child's next vaccination appointment | Yes | | **Ref** | | |
| | No | 0.515 | 1.269 | 0.619 | 2.601 |
| Are there any cultural beliefs or practices that influence your decision on child immunization | Yes | | **Ref** | | |
| | No | 0.334 | 0.637 | 0.255 | 1.59 |
| Do you face any social pressure regarding immunizing your child | Yes | | **Ref** | | |
| | No | 0.747 | 1.148 | 0.497 | 2.649 |
| Constant | | 0.643 | 0.732 | | |

The logistic regression analysis presented in Table 9 indicates that children older than 6 weeks are significantly more likely to be under-immunized compared to those younger than 6 weeks, with an odds ratio exceeding 1. Additionally, the findings reveal that children born at home have a 5% higher likelihood of being under-immunized than their hospital-born counterparts (OR=1.052). Furthermore, children whose caregivers lack awareness regarding the significance of childhood immunization are 37% more likely to be under-immunized compared to those whose caregivers are informed (OR=1.371). Moreover, children of caregivers who acquire knowledge about immunization from family, friends, media, and other sources are less likely to be under-immunized by 49%, 68%, 25%, and 40%, respectively, when compared to those who receive this information from health workers (OR=0.509, OR=0.316, OR=0.749, OR=0.598). Interestingly, children of caregivers who are unaware of where to obtain immunizations are 79% less likely to be under-immunized than those who know (OR=0.206).

The data in Table 9 further illustrates that children of caregivers who report that vaccines are not consistently available at health facilities are 60% less likely to be under-immunized compared to those who confirm vaccine availability (OR=0.395). Additionally, children of caregivers who do not receive reminders for their child's upcoming vaccination appointments are 27% more likely to be under-immunized than those who do receive such reminders (OR=1.268). Lastly, children of caregivers who do not hold any cultural beliefs or practices that affect their immunization decisions are 36% less likely to be under-immunized than those who do (OR=0.337), while children of caregivers who do not experience social pressure regarding immunization are 15% more likely to be under-immunized compared to those who do face such pressure (OR=1.148).

**Table 10.** Predictors of Immunization Drop-Out Status among Children

| | | **p-value** | **OR** | **95% C.I. for OR** | |
|---|---|---|---|---|---|
| | | | | **Lower** | **Upper** |
| Age of child | 14w-6m | 0.025 | **Ref** | | |
| | 6m-9m | 0.549 | 1.36 | 0.498 | 3.717 |
| | 9m-12m | 0.065 | 2.365 | 0.947 | 5.903 |
| | 12m-15m | 0.1 | 2.146 | 0.865 | 5.325 |
| | 15m-24m | 0.002 | 3.925 | 1.674 | 9.198 |
| Place of delivery | Hospital | | **Ref** | | |
| | Home/Others | 0.179 | 0.641 | 0.336 | 1.226 |
| Are you aware of the importance of childhood immunizations | Yes | | **Ref** | | |
| | No | 0.465 | 1.422 | 0.553 | 3.66 |

| | | | | | |
|---|---|---|---|---|---|
| How did you learn about immunizations | Health worker | 0.188 | **Ref** | | |
| | Family | 0.584 | 0.717 | 0.218 | 2.36 |
| | Friend | 0.027 | 0.225 | 0.06 | 0.843 |
| | Media | 0.368 | 2.065 | 0.426 | 10.021 |
| | Others | 0.958 | 1.065 | 0.102 | 11.071 |
| Do you know where to get your child vaccinated | Yes | | **Ref** | | |
| | No | 0.042 | 0.138 | 0.02 | 0.931 |
| Are vaccines always available when you visit the health facility | Yes | | **Ref** | | |
| | No | 0.137 | 0.451 | 0.158 | 1.287 |
| Do you receive reminders for your child's next vaccination appointment | Yes | | **Ref** | | |
| | No | 0.753 | 0.862 | 0.342 | 2.173 |
| Are there any cultural beliefs or practices that influence your decision on child immunization | Yes | | **Ref** | | |
| | No | 0.247 | 0.55 | 0.2 | 1.514 |
| Do you face any social pressure regarding immunizing your child | Yes | | **Ref** | | |
| | No | 0.772 | 1.155 | 0.435 | 3.068 |
| Constant | | 0.869 | 0.884 | | |

The logistic regression analysis presented in Table10 indicates that children older than 6 months exhibit a higher likelihood of experiencing immunization dropout status compared to those younger than 6 months, with an odds ratio exceeding 1. Additionally, the findings reveal that children born at home are 36% less likely to have immunization dropout status than their counterparts born in hospitals (OR=0.641). Furthermore, children whose caregivers lack awareness regarding the significance of childhood immunization are 42% more likely to experience immunization dropout status compared to those whose caregivers are informed (OR=1.422). Moreover, children of caregivers who acquire knowledge about the importance of immunization from family and friends are 28% and 77% less likely, respectively, to have immunization dropout status compared to those who receive this information from healthcare professionals (OR=0.717, OR=0.225). Conversely, those who learn about immunization through media and other sources are twice as likely and 6% more likely, respectively, to have immunization dropout status compared to those informed by health workers (OR=2.065, OR=1.065).

Additionally, children of caregivers who are unaware of where to obtain immunizations are 86% less likely to have immunization dropout status than those who know (OR=0.138). The data in Table 10 further indicates that children of caregivers who report that vaccines are not consistently available at health facilities are 55% less likely to experience immunization dropout status compared to those who report vaccine availability (OR=0.451). Furthermore, children of caregivers who do not receive reminders for their child's upcoming vaccination appointments are 14% less likely to have immunization dropout status than those who do receive such reminders (OR=0.862).

Lastly, children of caregivers who do not adhere to any cultural beliefs or practices that affect their immunization decisions are 45% less likely to have immunization dropout status compared to those who do (OR=0.55). Additionally, children of caregivers who do not encounter social pressure regarding immunization are 16% more likely to have a

zero-dose immunization status than those who do face such pressure (OR=1.155).

## Discussion

The study provides critical insights into the sociodemographic factors influencing childhood immunization in Ifelodun LGA, Nigeria. The findings of this study align with previous research on childhood immunization in Nigeria and other low- and middle-income countries (LMICs). The findings reveal significant gaps in immunization coverage, with only 19.6% of children fully immunized, while 50.4% were under-immunized, 23.5% experienced immunization dropout, and 6.5% were zero-dose. These figures are consistent with Nigeria's national trends, where full immunization coverage remains low reported 31% full immunization coverage in Nigeria, indicating regional disparities, with rural areas like Ifelodun LGA lagging behind [19]. Similarly, a study in Kano State, Nigeria, found only 22.5% full immunization coverage, reinforcing systemic challenges [20].

However, some studies report higher coverage. For instance, Oyo State, Nigeria, recorded 43.7% full immunization [21]. suggesting that regional healthcare infrastructure and program implementation influence outcomes. The higher dropout rates (23.5%) in this study mirror findings from Ethiopia, where 20-30% of children fail to complete the immunization schedule [22]. highlighting persistent systemic barriers in LMICs.These statistics highlight substantial challenges in achieving universal immunization coverage, necessitating targeted interventions.

The study reveals that maternal and paternal education levels do not significantly influence immunization status (p=0.684 for mothers, p=0.115 for fathers). 37.1% of mothers and 30.8% of fathers had no formal education, which may contribute to low awareness and vaccine hesitancy. However, the place of delivery emerges as a crucial factor—children born in hospitals have higher full immunization rates (25.5%) and lower zero-dose rates (2.9%) compared to home deliveries, where dropout rates are higher (29.6%). This suggests that institutional deliveries facilitate early immunization engagement, possibly due to immediate postnatal vaccination and health education, aligning with global evidence. A study in India [23]. found institutional deliveries increased early vaccination by 40%, attributing this to immediate postnatal vaccination and health worker engagement. Similarly, a Kenyan study [24]. reported home births doubled dropout risks, reinforcing the need for facility-based interventions.

Child age is another significant predictor, with younger infants (<6 weeks) having the highest full immunization rates (56.4%), while dropout rates increase as children grow older (peaking at 14 weeks–6 months). This aligns with global trends where immunization adherence declines with age, often due to logistical barriers, parental forgetfulness, or competing priorities. A study in Pakistan [25]. found similar age-related declines, attributing them to competing family priorities and logistical barriers. However, a Ugandan study [26]. reported better retention through mobile reminders, suggesting interventions like SMS alerts could mitigate dropout.

BCG (84.1%) and OPV (86.9%) had high coverage, likely due to their administration at birth. However, Penta (61.1%), PCV (59.8%), and ROTA (51.7%) saw lower rates, suggesting systemic dropouts as the immunization schedule progresses. Only 45.9% of eligible children completed all three Penta doses, reinforcing the need for reminder systems and community engagement to improve retention. Mirroring findings from DRC [27]. This "front-loading" phenomenon—where birth doses succeed but later doses fail is common in LMICs due to weak follow-up systems. A study in

Bangladesh [28]. found community health workers improved Penta3 completion by 25%, suggesting similar interventions could help in Ifelodun LGA.

The study found that 61.1% (234 children) received at least one dose of the Penta vaccine (protecting against tetanus, whooping cough, diphtheria, Hepatitis B, and Hib), while 38.9% (149 children) were unvaccinated. Among eligible children, 78.7% (181/230) initiated vaccination, but only 45.9% (83/181) completed all three doses, resulting in a 54.1% dropout rate in Ifelodun LGA, Kwara State. These findings align with previous studies in Nigeria that have documented suboptimal Penta vaccine coverage and high dropout rates, often attributed to factors such as inadequate health education, logistical challenges in vaccine supply, and missed immunization opportunities during outreach sessions [29,30]. The observed dropout rate of 54.1% is particularly concerning, as it exceeds the national average and mirrors trends seen in other rural settings where access to healthcare facilities and caregiver compliance remain persistent barriers [31]. Similar to findings by Okoli et al [32]. in neighboring states, this study underscores the need for targeted interventions such as community engagement, reminder systems, and strengthened immunization tracking to improve both vaccine initiation and completion rates in underserved regions.

This study identified Parental negligence (23.1%) – Lack of time to visit health facilities suggests a need for more flexible immunization schedules or community outreach programs. Lack of awareness (18.8%) – Misinformation or insufficient knowledge about vaccine schedules contributes to under-immunization. Fear of side effects (15.6%) – Vaccine hesitancy persists due to misconceptions, requiring community sensitization. Accessibility and financial constraints (12% and 11.4%, respectively) – Geographic and economic barriers hinder consistent immunization access. Vaccine stockouts (1.6%) – Health system weaknesses, such as inconsistent vaccine supply, further exacerbate dropout rates. These align with WHO's "3Cs" model (Confidence, Complacency, Convenience) for vaccine hesitancy [33]. A Nigerian study [34]. similarly found fear of side effects and misinformation as major deterrents, while a Ghanaian study [35]. emphasized financial and transport barriers.

However, stockouts were less prominent (1.6%) in this study compared to a study in Malawi (15% stockout-related dropouts) [36]., suggesting Ifelodun's supply chain may be relatively better, but awareness and access remain critical gaps.

Zero-dose children were strongly associated with caregivers lack awareness of immunization importance (OR=3.96, 95% CI:0.98 – 15.993, p=0.053), do not know where to access vaccines (OR=11.44, 95% CI: 1.627 – 80.421, p=0.014), and vaccine stockouts (OR=10.74, 95%CI: 1.929 – 59.781, p=0.007). This matches a study in India [37], where zero-dose children were 8 times more likely to have mothers unaware of immunization schedules.

Under-immunization is strongly associated with older child age (OR=6.75, 95% CI:2.755 – 16.53, p=0.001), suggesting that sustaining immunization adherence beyond infancy remains a challenge. consistent with a Zambian study [38]. that found compliance dropped after infancy.

Immunization dropout increases with child age (OR=3.93, 95% CI: 1.674 – 9.198, p=0.002 for 15-24 months), indicating that follow-up mechanisms weaken over time. Lack of knowledge on vaccination sites (OR=0.138, 95% CI:0.02 – 0.931, p=0.042).

Peer influence (learning about immunization from friends) reduced under-immunization (OR=0.32, 95% CI:0.133 – 0.75, p=0.009) and dropout (OR=0.23, 95% CI:0.06 – 0.843, p=0.027), contrasting with a

Kenyan study [39]. where health workers were more influential, suggesting context-dependent communication strategies.

## Conclusion and Recommendations

This study highlights significant gaps in immunization coverage in Ifelodun LGA, with 50.4% of children under-immunized, 23.5% experiencing dropout and 6.5% were Zero dose. These challenges stem from multifactorial barriers, including Health system inefficiencies (e.g., vaccine stockouts, inconsistent access), Parental knowledge gaps (misinformation, lack of awareness), Sociodemographic disparities (education, place of delivery), Behavioral factors (vaccine hesitancy, competing priorities) and Logistical challenges (geographic and financial barriers).

While initial vaccine uptake is relatively high, sustaining coverage remains a critical challenge. A multi-sectoral approach integrating community engagement, health system strengthening, and policy enforcement is essential to improve immunization rates and reduce preventable childhood diseases.

Key recommendations based on study findings are categorized by responsible as follows:

**Government**

1. Implement community sensitization programs to dispel myths and emphasize vaccine safety.
2. Strengthening Health Education Programmes on Immunization.
3. Engage religious and community leaders as advocates for immunization.
4. Improve Health System Readiness to ensure consistent vaccine supply to prevent stockouts.
5. Enhance Accessibility through expansion of mobile vaccination units to reach remote populations.
6. Integrate immunization services with maternal and child health programs.
7. Address financial barriers through subsidized or free transport to clinics.

**Primary Health Directors, Heads of Department (HODs), and Routine Immunization (RI) Providers**

1. Implement SMS reminders and follow-up visits to reduce dropout rates.
2. Target High-Risk Groups by prioritizing immunization interventions for home-deliveries, older children and defaulters to prevent or reduce dropouts.

By addressing these systemic and behavioral barriers, Ifelodun LGA can significantly improve immunization coverage and protect children from vaccine-preventable diseases.


## Acknowledgements

The authors would like to appreciate the research assistants who contributed to data collection during this study.


## Conflict of Interest

The Authors declare no conflict of interest.


## Source of Funding

None declared.


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