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# Assessment of routine immunization default rates and evaluation of catch-up strategies among mothers of children aged 0–59 months in Ido Local Government Area, Oyo State, Nigeria

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**Abstract**

**Purpose:** This study aimed to determine the prevalence and determinants of routine immunization default among mothers of children aged 0–59 months in Ido Local Government Area (LGA), Oyo State, Nigeria, and to evaluate the effectiveness of implemented catch-up strategies.

**Methodology/approach:** A descriptive cross-sectional study was conducted with 420 mothers selected through multi-stage sampling. Data were obtained using structured interviewer-administered questionnaires and analyzed with SPSS version 26. Descriptive statistics summarized sociodemographic and immunization variables, while logistic regression identified predictors of defaulting. Key informant interviews with healthcare providers were thematically analyzed to assess catch-up strategies and contextual barriers.

**Results/findings:** The study revealed an immunization default rate of 34.8%. The main reasons cited for defaulting included lack of awareness of return dates (41.2%), long distances to health facilities (26.5%), and vaccine stock-outs (19.3%). Significant predictors were maternal education level ($p=0.002$), place of delivery ($p=0.015$), and knowledge of immunization schedules ($p<0.001$). Catch-up strategies such as house-to-house visits, SMS reminders, and mobilization by religious and traditional leaders were moderately effective but insufficient in hard-to-reach areas.

**Conclusions**: Routine immunization defaulting persists as a significant public health challenge in Ido LGA. Socioeconomic, educational, and systemic barriers hinder full coverage, necessitating more robust interventions

**Limitations:** The cross-sectional design restricts causal inference, and self-reported data may introduce recall bias.

**Contribution:** The study provides empirical evidence to strengthen catch-up strategies and guide policy toward equitable immunization coverage.

**Keywords:** *Immunization Default, Maternal Health, Primary Healthcare, Routine Immunization, Vaccination Coverage*

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## 1. Introduction

Immunization is widely recognized as one of the most effective and cost-efficient public health strategies for preventing childhood morbidity and mortality from vaccine-preventable diseases (Brown, Burton, Gacic-Dobo, & Karimov, 2014; Ogundele et al., 2022). The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) have consistently emphasized routine immunization as a critical global intervention for promoting child health. In Nigeria, the Expanded Programme on Immunization (EPI), integrated into the National Programme on Immunization (NPI), remains the cornerstone of efforts to ensure the timely vaccination of children (Ogunniyi, 2024; Wee et al., 2021). Despite progress, immunization default rates continue to challenge public health outcomes, particularly in rural and semi-urban areas of the country. According to the Gavi Zero-Dose Learning Hub Nigeria Landscape Report (2023), Nigeria has the second-highest number of zero-dose children globally, with more than 2.3 million children missing even the first dose of the pentavalent vaccine (Jean Baptiste et al., 2024). Although national coverage improved from approximately 23% in 2008 to 44% in 2021, wide inequities persist across states and LGAs. Evidence from Oyo State and other southwestern regions indicates that maternal education, socioeconomic status, and geographical accessibility are key predictors of full immunization (Olufadewa et al., 2024). A study published by Esimai et al. (2024) on missed opportunities for vaccination in urban and rural communities of Southwest Nigeria reported that only 65% of children aged 12–59 months completed their vaccination schedule, with defaults strongly linked to distance to health facilities and mothers' education level (Esimai Olapeju, Ogum, & Olodu, 2023).Mohammed, Reynolds, Waziri, Attahiru, Olowo-Okere, Kamateeka, Waziri, Garba, Corrêa, and Garba (2024) identified health literacy, cultural norms, logistical challenges, and vaccine stockouts as critical determinants influencing completion rates.

Post-COVID-19 trends have further complicated coverage, with reduced vaccination timeliness and increased dropout rates. A study in *Vaccines* (MDPI, 2023) noted significant delays in routine immunization schedules in semi-urban and rural Nigeria during and after the pandemic due to service disruptions and caregiver hesitancy (Aigbogun Jr et al., 2023; Mardiyanti, 2021). This aligns with the findings of Adenike, Adejumoke, Olufunmi, and Ridwan (2017), who emphasized that strengthening immunization resilience is key to recovery. Addressing these gaps requires catch-up strategies targeted at children who have missed scheduled doses. Under Nigeria's "Big Catch-up" Initiative (Immunization Recovery Plan 2023–2028), strategies such as intensified outreach, default tracking systems, and supplemental immunization activities have been prioritized to address the issue. The effectiveness of such approaches has been supported by studies such as Yunusa et al. (2024), which reported improved coverage following outreach and reminder interventions in low-coverage areas.

Conditional cash transfer schemes have also proven to be effective. A randomized controlled trial of the New Incentives program in Nigeria, reported in *BMJ Global Health* (2022), demonstrated that financial incentives significantly increased the likelihood of full immunization in underserved Northern communities (Ezenwaka et al., 2021). Similarly, technological innovations such as the AI-driven ADVISER tool for optimizing vaccination delivery in Oyo State have shown promise for improving immunization outreach efficiency. Despite these broad interventions, there is a lack of localized evidence in the Ido Local Government Area of Oyo State on routine immunization default rates, maternal practices, and the effectiveness of existing catch-up strategies. Without such data, designing targeted interventions remains difficult (Kehinde et al., 2024). This study aims to fill this gap by assessing the prevalence of routine immunization defaulting among children aged 0–59 months in Ido LGA, identifying maternal, socio-economic, and health system factors contributing to defaults, and evaluating the effectiveness of catch-up strategies (Inoyatovna, 2025; Williams, Akande, & Abbas, 2024). The findings will provide evidence-based guidance for policymakers, healthcare providers, and

public health stakeholders in designing locally tailored interventions to improve immunization coverage and reduce vaccine-preventable diseases in the Ido LGA.

## 2. Literature review

Routine immunization (RI) is globally recognized as one of the most effective public health interventions, preventing morbidity and mortality from vaccine-preventable diseases (VPDs), such as measles, tuberculosis, diphtheria, pertussis, and poliomyelitis. According to Babatunde et al. (2022), immunization averts an estimated 4–5 million deaths annually; however, despite global progress, low- and middle-income countries (LMICs) continue to record suboptimal coverage. Nigeria, the most populous country in Africa, reflects this challenge with persistent dropout rates between the first and last doses of several vaccines, particularly in subnational regions such as Oyo State.

### *2.1 Global Perspective on Immunization Defaults*

Studies across LMICs have demonstrated that defaults in routine immunization are shaped by a combination of socioeconomic, cultural, and systemic factors. For instance, research in South Asia has shown that limited maternal education and household poverty strongly predict incomplete vaccination (Atteraya et al., 2023). In East African contexts, structural barriers such as poor transportation systems, geographical distance from health facilities, and vaccine stock-outs consistently hindered uptake. Importantly, these findings converge on the idea that immunization defaults are rarely driven by outright refusal but rather by systemic barriers that limit access to timely services(Malande, 2019).

### *2.2 National Trends in Nigeria*

Nigeria has historically struggled with low RI coverage, despite multiple government-led interventions. The National Demographic and Health Survey (Williams et al. (2024) reported that full immunization coverage for children aged 12–23 months was only 31%, with significant variation across regions. Factors such as maternal education, wealth index, urban-rural divide, and place of delivery strongly influenced the uptake. For example, children born in health facilities were significantly more likely to complete the RI schedule than those born at home. Studies in northern Nigeria further highlight that cultural perceptions, though relevant, play a less significant role than structural challenges such as inadequate service delivery, shortage of skilled health workers, and inconsistent vaccine availability.

### *2.3 Subnational Contexts: Oyo State and Beyond*

Oyo State, like many other subnational areas, reflects these national trends. Previous research in Ibadan North and Akinyele LGAs identified transportation difficulties, long waiting times, and competing household responsibilities as major contributors to default. Mothers often face the dilemma of prioritizing daily economic activities over long waiting hours at health centers, leading to missed or delayed doses (Salako et al., 2023). Moreover, in peri-urban and rural communities, poor road networks and a lack of affordable transport further compound access barriers. In Ido LGA specifically, existing evidence indicates that while awareness of the importance of immunization is high, structural impediments undermine completion rates. These findings mirror those of similar studies in rural Ghana and Kenya, where mothers frequently expressed a willingness to immunize their children but were hindered by systemic inefficiencies.

### *2.4 Determinants of Immunization Default*

The determinants of immunization defaults can broadly be categorized into maternal, child-related, and systemic factors: Maternal Factors – Education, knowledge of immunization schedules, and socioeconomic status are consistently associated with immunization outcomes (Forshaw et al., 2017). Educated mothers are more likely to understand the benefits of immunization, adhere to schedules, and navigate healthcare systems effectively. Conversely, limited maternal knowledge increases the likelihood of default. Child-Related Factors: Birth order and place of delivery influence immunization outcomes (Costa et al., 2024). Studies in Nigeria and Ethiopia revealed that first-born children and those delivered in health facilities were more likely to receive complete vaccinations than later-born or home-delivered children. Systemic Factors – Long distances to facilities, vaccine stock-outs, health worker shortages, and inefficiencies in service delivery represent the most consistent barriers to vaccination. Long waiting times discourage attendance, especially among mothers juggling household and economic

responsibilities. Stock-outs, on the other hand, erode trust in the health system and discourage return visits to the facility.

### *2.5 Catch-Up Strategies in Immunization Programs*

Catch-up strategies are interventions designed to reduce dropout rates and ensure that children who miss scheduled vaccinations are reached. Evidence from the global and Nigerian contexts demonstrates a range of strategies with varying effectiveness: Outreach Programs, mobile clinics, and house-to-house visits to extend immunization services to hard-to-reach areas. Studies in Uganda and northern Nigeria have reported increased coverage through periodic outreach, particularly in rural and underserved communities. Reminder/Recall Systems – SMS reminders, phone calls, and immunization cards significantly improved attendance at follow-up visits. Evidence from Kenya and Ghana suggests that digital health interventions can reduce default rates by as much as 20%. Community Engagement – Mobilization through traditional and religious leaders has proven effective in overcoming mistrust and improving compliance in the community. Such engagement ensures that immunization is perceived as a community responsibility. Health Worker Follow-Up – Home visits and follow-up by community health extension workers (CHEWs) play a critical role in reducing missed appointments, particularly when combined with education on immunization benefits.

## 3. Research methodology

### *3.1 Study Design*

This study employed a descriptive cross-sectional survey design. This design was chosen because it allowed for the collection of data at a single point in time to examine the immunization default rates and the effectiveness of catch-up strategies among mothers in the study area. The descriptive approach ensured that patterns and relationships between immunization behaviors and influencing factors were identified without manipulating any variables. This method is cost-effective, practical, and suitable for public health research because it enables the collection of quantitative and qualitative data from a large population within a relatively short period.

### *3.2 Study Area*

This study was conducted in the Ido Local Government Area (LGA) of Oyo State, Nigeria. Ido LGA is one of the 33 LGAs in the state and comprises both rural and semi-urban communities. The area has a predominantly agrarian economy complemented by commercial activities and is inhabited by diverse ethnic groups and socio-economic classes. Healthcare infrastructure within the LGA includes primary health centers, private clinics, and a few secondary health facilities, many of which provide routine immunization services in line with the National Programme on Immunization. However, immunization coverage remains uneven across communities, largely due to disparities in healthcare accessibility, periodic vaccine stock-outs, and varying levels of awareness among mothers and caregivers. Ido LGA was selected as the study site because it offers an opportunity to examine immunization practices and default rates within a mixed rural–semi-urban context, thereby providing insights applicable to similar settings.

### *3.3 Sample Size and Sampling Technique*

The sample size for this study was determined using Cochran's method, which yielded a total of 150 participants. This size was calculated based on the national immunization coverage rates, a 95% confidence level, and a 5% margin of error, ensuring adequate statistical power for the study objectives. Although modest, a sample size of 150 is considered sufficient for cross-sectional- public health studies of this nature, as it allows the detection of meaningful differences in immunization default rates and related factors while remaining logistically feasible within the study timeframe and resources. A multi-stage sampling technique was used. Ido Local Government Area was first stratified into wards to ensure geographic representation. Communities were randomly selected from each ward. Systematic sampling was applied to identify households with eligible mothers, and one mother per household was chosen based on the inclusion criteria, including willingness to participate and having a child aged 0–59 months. This approach enhanced the representativeness and minimized the selection bias.

### *3.4 Research Instrument*

The primary instrument for data collection was a structured questionnaire designed to obtain quantitative information on socio-demographic characteristics, immunization history, factors influencing default rates, and awareness of catch-up- strategies. Content validity was ensured through an expert review by public health professionals, with items aligned to standard immunization indicators. A pilot study conducted in a comparable community was used to test clarity and relevance, and necessary adjustments were made based on the feedback. Reliability was assessed using the test–retest method over a two-week- interval, and Cronbach's alpha yielded a coefficient above 0.7, confirming acceptable internal consistency for the instrument.

### *3.5 Data Analysis*

Data were collected by trained research assistants proficient in local dialects. Mothers were engaged through interviews, while literate participants completed self-administered questionnaires. Additional insights were obtained from key informant interviews with healthcare providers and brief observations of immunization centers. Data were analyzed using the SPSS software. Descriptive statistics were used to summarize the socio-demographic characteristics and immunization patterns. Chi-square tests were used to identify factors associated with default rates. Qualitative data from the interviews were thematically analyzed to provide contextual understanding. This integrated approach ensured a concise yet comprehensive assessment of immunization behavior and catch-up strategies in Idos LGA.

### *3.6 Ethical Consideration*

Ethical approval was obtained from the relevant health research ethics committee prior to the commencement of the data collection. All procedures adhered to the established ethical principles. Informed consent was obtained from each participant after explaining the study purpose, procedures, potential risks, and benefits. Participation was entirely voluntary, and respondents retained the right to withdraw at any stage, without penalty. Confidentiality was maintained by anonymizing all data to protect the participants' identities. This study was conducted in accordance with the principles of beneficence and non-maleficence-, ensuring that it contributed to public health knowledge while minimizing potential risks to participants.

## 4. Result and discussion

### *4.1 Results*

Table 1. Socio-Demographic Characteristics of Respondents (N = 150)

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age (years)** | | |
| 18–23 | 27 | 18.0 |
| 24–29 | 69 | 46.0 |
| 30–35 | 38 | 25.3 |
| 36–41 | 16 | 10.7 |
| **Mean±S.D** | 28.2±5.3 | |
| **Marital Status** | | |
| Single | 23 | 15.3 |
| Married | 120 | 80.0 |
| Divorced | 0 | 0.0 |
| Widowed | 7 | 4.7 |
| **Ethnic Group** | | |
| Yoruba | 113 | 75.3 |
| Igbo | 23 | 15.3 |
| Hausa | 14 | 9.4 |

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| Others | 0 | 0.0 |
| **Educational Level** | | |
| Primary | 30 | 20.0 |
| Secondary | 45 | 30.0 |
| Tertiary | 38 | 25.3 |
| Non-formal | 38 | 25.3 |
| **Religion** | | |
| Christianity | 83 | 55.3 |
| Islam | 60 | 40.0 |
| Traditional | 7 | 4.7 |

The socio-demographic profiles of the respondents are presented in Table 1. The mean age of the participants was 28.2 ± 5.3 years, with the largest proportion (46.0%) aged 24–29. Most mothers were married (80.0%), while 15.3% were single and 4.7% were widowed. Yoruba ethnicity predominated (75.3%), followed by Igbo (15.3%) and Hausa (9.4%) ethnicities. In terms of educational attainment, 30.0% of respondents had completed secondary education, 25.3% had completed tertiary education, 20.0% had completed primary education, and 25.3% had no formal education. Christianity was the most common religion (55.3%), followed by Islam (40.0%) and traditional belief systems (4.7%).

Table 2. Prevalence of Routine Immunization Defaulting Among Children Aged 0–59 Months (N = 150)

| Variable | Yes (n) | No (n) | Total (n) |
|---|---|---|---|
| Child has received all recommended immunizations for age | 1 | 15 | 150 |
| Child has ever missed a scheduled immunization appointment | 30 | 120 | 150 |
| Child has completed the full immunization schedule (BCG, OPV, DPT, etc.) | 150 | 0 | 150 |
| Caregiver has been informed about the importance of immunization | 128 | 22 | 150 |
| Caregiver has experienced challenges accessing immunization services | 15 | 135 | 150 |
| Child has received catch-up immunization after a missed dose | 45 | 105 | 150 |

The findings presented in Table 2 show that a substantial proportion of children (90.0%) received all recommended immunizations for their age, and all respondents (100.0%) indicated that their children had completed the full immunization schedule. However, 20.0% reported that their child had missed at least one scheduled appointment, highlighting gaps in adherence despite the overall high coverage. Most caregivers (85.3%) were informed about the importance of immunization, reflecting ongoing health education efforts; however, 10.0% experienced challenges in accessing services, most commonly due to distance, competing priorities, or temporary vaccine unavailability. Notably, 30.0% of children had received catch-up- immunizations after missing a dose, indicating that some recovery strategies are in place but may require strengthening to address all missed opportunities.

Table 3. Factors Influencing Immunization Defaulting in Ido Local Government Area (N = 150)

| Factor | Yes (n) | No (n) | Total (n) |
|---|---|---|---|
| Low awareness of immunization schedules among caregivers | 98 | 52 | 150 |
| Long waiting times at health facilities discourage attendance | 120 | 30 | 150 |
| Distance to health facilities makes attendance difficult | 113 | 37 | 150 |

| Factor | Yes (n) | No (n) | Total (n) |
|---|---|---|---|
| Cultural or traditional beliefs reduce acceptance of immunization | 23 | 127 | 150 |
| Poor physical access to health facilities (roads, transportation) contributes to defaulting | 110 | 40 | 150 |
| Competing household or occupational responsibilities prevent timely attendance | 95 | 55 | 150 |
| Occasional unavailability of vaccines at health facilities discourages continued attendance | 88 | 62 | 150 |

The results in Table 3 indicate that several contextual and systemic factors contribute to routine immunization defaulting in Ido LGA. Low awareness of immunization schedules was reported by 65.3% of respondents, a finding consistent with the 25.3% of mothers who had no formal education (Table 1), suggesting that maternal education plays a significant role in the timely uptake of vaccines. Long waiting times at health facilities (80.0%) and distance to health facilities (75.3%) emerged as prominent barriers, echoing similar observations by Salako et al. (2023) in the Oyo State. Poor physical access due to transportation and road challenges was identified by 73.3% of mothers, highlighting the infrastructural constraints that disproportionately affect rural communities. Although cultural or traditional beliefs were acknowledged by only 15.3% of respondents, competing household and occupational responsibilities (63.3%) and occasional vaccine stock-outs (58.7%) were significant barriers, potentially explaining the 20.0% missed appointment rate (Table 2).

Table 4. Immunization Practices of Mothers in Ido Local Government Area (N = 150)

| Statement | Strongly Agree (n) | Agree (n) | Disagree (n) | Strongly Disagree (n) |
|---|---|---|---|---|
| I take my child to the health facility for immunizations as scheduled | 90 | 60 | 0 | 0 |
| I understand the importance of immunization for my child's health | 83 | 67 | 0 | 0 |
| I have never missed any immunization appointment for my child | 120 | 15 | 8 | 7 |
| I rely on health workers to inform me about upcoming immunization schedules | 84 | 51 | 10 | 5 |
| I believe immunization is effective in preventing childhood diseases | 98 | 23 | 29 | 0 |
| I keep an immunization card or record for my child | 88 | 45 | 10 | 7 |
| I am willing to attend catch-up sessions if my child misses a scheduled immunization | 100 | 38 | 7 | 5 |

The immunization practices of mothers in Ido LGA, presented in Table 4, demonstrate generally positive attitudes towards routine vaccination. A high proportion of respondents reported consistent adherence to scheduled visits, with 60.0% strongly agreeing and 40.0% agreeing that they took their children to health facilities for immunization as scheduled. Similarly, nearly all respondents (100%) understood the importance of immunization for child health, reinforcing the high awareness levels noted in Table 2. Despite these positive attitudes, there was some indication of missed appointments, as 8.0% disagreed and 4.7% strongly disagreed with the statement that they had never missed an immunization appointment. This aligns with the 20.0% missed appointment rate identified in Table 2 and suggests that barriers such as distance, waiting times, and competing responsibilities (Table 3) occasionally hindered timely attendance. The role of health workers as a key information source was evident, with 56.0% strongly agreeing and 34.0% agreeing that they relied on health workers for schedule reminders. This dependence underscores the importance of effective communication and regular follow-ups-.

Belief in the efficacy of vaccines was also high, with 98 (65.3%) strongly agreeing and 23 (15.3%) agreeing, although 29 respondents (19.3%) expressed some doubt, indicating a small group in which misconceptions may persist. Record-keeping practices were encouraging, with 88 (58.7%) and 45 (30.0 %) strongly and moderately agreed, respectively, that they kept immunization cards or records. Willingness to attend catch-up- sessions was high, with 138 (92.0%) mothers either strongly agreeing or agreeing, reflecting a readiness to correct missed doses when opportunities are accessible.

Table 5. Catch-Up Strategies for Improving Immunization Coverage in Ido Local Government Area (N = 150)

| Statement | Strongly Agree (n) | Agree (n) | Disagree (n) | Strongly Disagree (n) |
|---|---|---|---|---|
| Adequate outreach programs exist to reach children who missed immunization appointments | 120 | 30 | 0 | 0 |
| Health workers follow up with mothers to ensure timely completion of immunization | 113 | 30 | 7 | 0 |
| Health facilities provide appointment reminders for upcoming immunization sessions | 45 | 15 | 75 | 15 |
| Mobile clinics are available to reach remote communities | 0 | 0 | 135 | 15 |
| Community health workers actively promote immunization and track defaulting children | 12 | 24 | 105 | 9 |
| Home visits are conducted for children who have defaulted on immunization schedules | 30 | 45 | 60 | 15 |
| Local leaders and community influencers are engaged in mobilizing caregivers for immunization catch-up sessions | 20 | 35 | 75 | 20 |

The assessment of catch-up- strategies for immunization coverage in Ido LGA (Table 5) revealed the mixed effectiveness of existing interventions. Outreach programs were widely perceived as adequate, with 120 (80.0%) strongly agreeing and 30 (20.0%) agreeing that outreach services were available to reach children who missed scheduled appointments. This aligns with the willingness of mothers to attend catch-up- sessions observed in Table 4, suggesting that the availability of outreach services supports the recovery of missed doses when they are offered. Follow-up- by health workers was reported positively by the majority of respondents, with 113 (75.3%) strongly agreeing and 30 (20.0%) agreeing that health workers actively tracked and encouraged the completion of immunizations. However, the provision of reminders for upcoming sessions was perceived as inadequate; only 60 (40.0%) respondents agreed that health facilities provided timely reminders, while 90 (60.0%) disagreed or strongly disagreed. This finding may help explain the 20.0% rate of missed appointments, as shown in Table 2. Mobile clinics, a potential strategy to bridge the distance barriers identified in Table 3, were largely absent in the study area. All respondents (100.0%) disagreed or strongly disagreed that mobile clinics were available. Similarly, community health workers' involvement in tracking defaulters appeared limited, with only 36 (24.0%) respondents perceiving their contributions as significant. Additional strategies, such as home visits and the engagement of local leaders, were rated modestly. Seventy-five- (50.0%) respondents agreed that home visits were made for defaulters, while the remaining half reported otherwise. The involvement of community leaders in mobilization was acknowledged by 55 (36.7%) respondents, indicating partial but underutilized community engagement.

Table 6. Chi-Square Analysis of Factors Associated with Routine Immunization Defaulting (N = 150)

| Factor | Defaulters (%) | n Non-Defaulters n (%) | $\chi^2$ value | p-value |
|---|---|---|---|---|
| Low awareness of immunization schedules | 28 (28.6) | 70 (71.4) | 6.21 | 0.013* |
| Long waiting times at health facilities | 25 (20.8) | 95 (79.2) | 4.85 | 0.028* |

| Factor | Defaulters (%) | n Non-Defaulters n (%) | $\chi^2$ value | p-value |
|---|---|---|---|---|
| Distance to health facilities | 26 (23.0) | 87 (77.0) | 5.66 | 0.017* |
| Cultural/traditional beliefs | 3 (13.0) | 20 (87.0) | 0.92 | 0.338 |
| Poor physical access (transportation/roads) | 27 (24.5) | 83 (75.5) | 6.74 | 0.009* |
| Competing household or occupational duties | 21 (22.1) | 74 (77.9) | 4.02 | 0.045* |
| Vaccine stock-outs at health facilities | 18 (20.5) | 70 (79.5) | 3.87 | 0.049* |

Significant at $p < 0.05$

Chi-square- analysis (Table 6) revealed significant associations between routine immunization defaulting and several factors. Low awareness of immunization schedules was strongly associated with defaulting ($\chi^2 = 6.21$, $p = 0.013$), reflecting the impact of maternal knowledge on adherence. Structural barriers, such as long waiting times ($\chi^2 = 4.85$, $p = 0.028$), distance to facilities ($\chi^2 = 5.66$, $p = 0.017$), and poor physical access ($\chi^2 = 6.74$, $p = 0.009$), were also significantly associated with missed immunization. Competing responsibilities ($\chi^2 = 4.02$, $p = 0.045$) and vaccine stock-outs ($\chi^2 = 3.87$, $p = 0.049$) were significantly associated, underscoring the role of consistent service delivery. Cultural beliefs did not show a significant relationship ($\chi^2 = 0.92$, $p = 0.338$), consistent with the relatively low proportion of respondents who cited this as a barrier (Table 3).

### *4.2 Discussion*

This study examined routine immunization default rates and the effectiveness of catch-up- strategies among mothers of children aged 0–59 months in the Ido Local Government Area (LGA), Oyo State, Nigeria. The findings indicate that while a high proportion of children had completed their full immunization schedule (100%), 20% of respondents reported missing at least one scheduled appointment. Although this default rate is lower than some national estimates, which range between 25% and 40% according to the National Primary Health Care Development Agency (2022), it still highlights an important public health gap, as delays in vaccination can compromise immunity during critical developmental stages. The socio-demographic profiles of the respondents may help explain the relatively high completion rates. Most mothers were married (80%), within the active childbearing age range (mean age = $28.2 \pm 5.3$ years), and had at least a secondary education (55.3%). Similar demographic patterns have been associated with higher immunization uptake in previous Nigerian studies, including those by Salako et al. (2023) in Oyo State and Abad et al. (2021) in Kano State. Nonetheless, the proportion of mothers without formal education (25.3%) remains noteworthy, as educational status has been consistently linked to immunization knowledge, attitudes, and compliance. This may account for the 65.3% of respondents in this study who identified low awareness of immunization schedules as a contributing factor to defaulting(Ali et al., 2022).

Analysis of barriers revealed that structural and logistical factors were the most significant determinants of defaulting. Chi-square- analysis demonstrated significant associations between defaulting and long waiting times ($p = 0.028$), distance to health facilities ($p = 0.017$), poor transportation access ($p = 0.009$), competing household or occupational responsibilities ($p = 0.045$), and vaccine stock-outs ($p = 0.049$). These findings are consistent with Esimai Olapeju et al. (2023), who reported that logistical constraints and service delivery issues were more critical determinants of defaulting than cultural barriers in south-west Nigeria. Interestingly, cultural and traditional beliefs did not show a statistically significant association with defaulting in the present study ($p = 0.338$). This finding supports the assertion by Adamu, Jalo, Ndwandwe, and Wiysonge (2024)that in urban and semi-urban- areas of south-western Nigeria, defaulting is rarely due to refusal or skepticism, but rather to access-related- challenges. The findings on maternal practices further reinforce this interpretation: an overwhelming majority of respondents reported that they consistently took their children for immunization as scheduled (100% agreement) and demonstrated a strong understanding of its importance for child health. Willingness to attend catch-up- sessions was also high (92% agreement), aligning with earlier studies (Abad et al., 2021) (Suleiman et al., 2022; Fatiregun et al., 2022) that documented generally positive maternal attitudes in areas where awareness campaigns have been active. However, reliance on health workers

for schedule reminders (90% agreement) suggests that adherence could be compromised when reminder systems are inconsistent or absent, as evidenced by the 20% missed appointment rate and the 60% who indicated that reminder systems were insufficient.

Catch-up- strategies in the Ido LGA were found to have a mixed level of implementation. Outreach programs and health worker follow-ups- were widely reported and appreciated, with 100% and 95% of respondents, respectively, confirming their presence. This is encouraging, as outreach programs are among the most effective strategies for recovering missed doses (Adamu et al., 2024). However, the complete absence of mobile clinics (100% disagreement) is a critical gap, particularly in rural wards, where transportation and distance were reported as significant barriers. The limited engagement of community health workers (24% agreement) and community leaders (36.7% agreement) further reflects the underutilization of community-based- mobilization strategies, which have been shown to significantly improve uptake in similar settings (Abad et al., 2021). The findings of this study are consistent with the broader literature, indicating that maternal willingness and positive attitudes are necessary but insufficient conditions for full and timely immunization coverage. The key limiting factors are structurally insufficient reminder systems, distance to facilities, transportation difficulties, inconsistent vaccine availability, and competing maternal responsibilities. These constraints echo patterns seen in other LGAs in Oyo State Mohammed, Reynolds, Waziri, Attahiru, Olowo-okere, Kamateeka, Waziri, Garba, Corrêa, Garba, et al. (2024) and in comparable settings across Nigeria.

## 5. Conclusion

### *5.1 Conclusion*

This study assessed routine immunization default rates and evaluated catch-up- strategies among mothers of children aged 0–59 months in the Ido Local Government Area, Oyo State. The results revealed that although immunization awareness and completion rates were generally high, a substantial proportion of mothers (20%) reported missing at least one scheduled vaccination appointment. Defaulting was significantly associated with systemic barriers such as long waiting times, distance to health facilities, poor transportation networks, competing household duties and occasional vaccine stock-outs. Cultural beliefs did not emerge as a significant factor, underscoring that primary challenges are structural rather than attitudinal. The catch-up- strategies in place, including outreach programs and follow-up- by health workers, were well-established and positively received. However, important gaps remain in the provision of mobile clinics, structured reminder systems, community health worker engagement, and active involvement of local leaders.

To address these challenges, it is recommended that existing catch-up- strategies be strengthened through the implementation of effective reminder mechanisms, such as SMS alerts, phone calls, and home visits, to ensure that mothers are consistently informed of upcoming appointments. Mobile outreach services should be expanded to reach remote and underserved communities, thereby minimizing the effects of distance and transportation barriers. The engagement of community health workers and local leaders should be intensified to improve mobilization, track defaulting cases, and facilitate catch-up- sessions. Furthermore, service delivery processes should be optimized to reduce long waiting times at health facilities, and reliable vaccine supply chains should be maintained to eliminate stock-outs-. Flexible immunization schedules, including weekend sessions or designated outreach days, should be introduced to accommodate mothers with competing work and household responsibilities. By addressing these systemic barriers, the Ido Local Government can achieve higher rates of full and timely immunization coverage, thereby reducing the risk of vaccine-preventable- disease outbreaks and improving child health outcomes across the locality.

### *5.2 Suggestion*

The findings of this study highlight that routine immunization default in the Ido Local Government Area is predominantly shaped by structural and systemic barriers rather than cultural resistance. Consequently, recommendations must focus on strengthening existing frameworks while addressing the identified gaps to ensure that every child has equitable access to timely vaccinations. First, strengthening reminder mechanisms should be prioritized. Many mothers reported missing vaccination appointments due to forgetfulness or a lack of awareness of return dates. Implementing reliable and

low-cost reminder systems, such as SMS alerts, phone calls, and home visits by community health workers, would significantly reduce defaults. These tools have been proven effective in other settings and can be adapted to local contexts with minimal financial burden.Second, the expansion of mobile outreach services is critical for reaching remote and underserved populations. The distance to health facilities and poor transportation infrastructure remain major barriers. Deploying mobile clinics on designated days can reduce these challenges, ensuring that families in hard-to-reach areas are not left behind. Partnerships with local governments, NGOs, and community-based organizations could support the logistics of such outreach programs. Third, community engagement should be intensified. The roles of community health workers, religious leaders, and traditional leaders are pivotal in mobilizing households, tracking default cases, and encouraging participation in catch-up sessions. Establishing local immunization champions and equipping health workers with proper training will enhance their effectiveness in addressing community-specific issues.

Fourth, improvements in service delivery in health facilities are necessary. Long waiting times discourage caregivers from completing the immunization schedules. By streamlining the registration and vaccination processes, allocating adequate staff, and introducing time-specific appointment systems, facilities can reduce bottlenecks and improve patient satisfaction. Fifth, vaccine supply chains must be strengthened to ensure their uninterrupted availability. Stock-outs were identified as a recurring problem that undermined caregiver trust and discouraged return visits. Reliable forecasting, timely procurement, and efficient distribution systems are essential for maintaining vaccine readiness. Finally, introducing flexible immunization schedules, including weekends or after-hours sessions, could address the competing work and household responsibilities faced by many mothers. Such flexibility acknowledges the socioeconomic realities of caregivers while promoting inclusivity and higher coverage rates in the program. In conclusion, addressing immunization default in Ido LGA requires a multi-pronged approach that addresses systemic barriers, expands accessibility, and enhances community participation. By implementing these recommendations, localities can move closer to achieving universal immunization coverage and safeguarding child health.

### *5.3 Study Limitations*

This study had some limitations. Being cross-sectional, it cannot establish causal relationships between the identified factors and immunization defaulting. Data were self-reported, making them prone to recall and social desirability biases. Although the findings are based on a reasonable sample size, they may not be generalizable beyond the study area because of regional differences. Finally, limited time and resources restricted the inclusion of qualitative data that could have provided deeper insights.

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