

Evaluation of Routine Immunization Coverage using Lot Quality Assurances Sampling (LQAs) of Jalingo LGA, Taraba State, Nigeria

Sani H, Abubakar

National Surveillance Officer, Taraba State, Nigeria

Abstract

Routine immunization remains an effective public health intervention in controlling morbidity and mortality among children. However, most areas in Nigeria have continued to perform below optimal levels, and thus it becomes essential to investigate its effectiveness using Lot Quality Assurance Sampling in Jalingo Local Government Area, Taraba State, Nigeria, and also address issues concerning non-vaccinated children who are supposed to be immunized. This study is a cross-sectional quantitative survey research on caregivers of children between 0 and 23 months of age. A total of 360 caregivers were surveyed for this category of children across six different wards within the study area using multistage sampling techniques. The study survey involved a questionnaire administered through a survey method. From the study, it is evident that 76% of children were adequately immunized for their respective ages, 14% were partially immunized, and 10% were unimmunized against diseases for which immunization is required. Although this is an improvement from previous survey estimates on the level of improvement required for RI performances within the LGA, only one ward out of six met the decision threshold using Lot Quality Assurance Sampling. The most cited reasons for non-vaccination and incomplete immunization among children were "not given, reason unknown/others" 38.63%, unavailability of immunization vaccines in most health facilities 24.64%, distance to health facilities in most cases 13.98%, lack of time in most instances 10.66%, and cultural reasons in most instances 7.11%. In light of this, it becomes essential, based on this study, that for the areas that are performing badly to be covered, and also for areas that are doing well to be maintained, vaccine supplies should be strengthened, and community mobilization should be enhanced.

Keywords: *Caregivers, Jalingo LGA, Lot Quality Assurance Sampling, Routine immunization, Taraba State, Vaccination Coverage.*

Introduction

Generally, it is accepted as one of the most effective approaches in controlling infections and reducing mortality among children [1]. Over the past five decades, vaccination programs worldwide have been successful in preventing millions of deaths due to vaccine-preventable diseases [2]. As it is found that vaccines are cost-effective in comparison to the cost of managing infections and their complications, it is considered as one of the

cost-effectiveness health interventions, especially in developing countries [3]. Routine vaccination programs are planned to target children during their most vulnerable period without requiring significant lifestyle modifications among caregivers [4].

Despite global progress, substantial gaps in coverage remain, particularly in sub-Saharan Africa. A significant number of children in the region continue to experience vaccine-preventable illnesses due to limited access to essential vaccines [5]. Immunization coverage

in parts of Africa has stagnated in recent years, increasing the risk of outbreaks and undermining efforts to control preventable diseases [6]. The public health and economic consequences of low immunization coverage are considerable, contributing to avoidable morbidity, mortality, and financial strain on already fragile health systems [7].

Nigeria has implemented immunization programs for several decades, beginning with disease-specific campaigns and later expanding through the introduction of the Expanded Programme on Immunization (EPI) in 1979 to address high child mortality from vaccine-preventable diseases [8]. Although the country recorded early achievements, including improvements in national coverage levels, sustaining those gains has been challenging [9, 10]. National surveys have repeatedly shown that a large proportion of Nigerian children do not complete the recommended immunization schedule. For example, findings from the National Immunization Coverage Survey indicated that only about one-third of children aged 12–23 months were fully immunized at the time of assessment [11]. More recent reports have shown some improvement; however, coverage levels remain below the recommended 80% threshold required to achieve herd immunity in many states, including those in the North-East region [12].

Evidence from various national demographic surveys points to further differences in routine immunization coverage levels among different geographical areas, with northern states recording consistently lower coverage levels and a greater proportion of zero-dose children [13]. Therefore, it is important to carry out assessments at the local level to pinpoint areas that may not be performing well.

In this context, it is important to evaluate routine immunization program performance at the Local Government Area (LGA) level. The Lot Quality Assurance Sampling (LQAS) method is one such method that can be

effectively used to assess program performance at this level and pinpoint areas that may not be performing well [13]. By using this method in Jalingo LGA in Taraba State, this study hopes to generate more information on coverage levels and possible barriers to routine immunization among children less than two years of age.

Problem Statement

In spite of the availability of routine immunization services in Nigeria, outbreaks of vaccine-preventable diseases have been recorded in some regions of Nigeria, including some areas in Taraba State. The low level of routine immunization services has exposed children to preventable diseases, thereby causing unnecessary morbidity and mortality [14]. The existence of a large number of children who are either partially or not immunized at all has given rise to the high probability of transmission of diseases within the children.

Recent studies have shown that immunization coverage within some regions of Nigeria remains very low. In particular, immunization coverage within some regions of Taraba State remains below 80%, which is considered to be the benchmark to achieve herd immunity [15]. This implies that nearly half of children may not be immunized against some common diseases. This compromises the immunization program and maintains the risk of recurrence of diseases within these regions.

Routine immunization services within Jalingo Local Government Area (LGA) are provided through Primary Health Care Centers and outreach activities. However, there remains a concern about the efficacy of routine immunization services due to reports of inadequate immunization coverage among children within some wards within Jalingo LGA. Inadequate routine immunization coverage has been attributed to increased risk of exposure to vaccine-preventable diseases and poor health outcomes among children [16].

Even though immunization coverage within Taraba State may be satisfactory at the state level, it may not be entirely accurate to assess performance within some regions or wards.

In the wake of the publication of the recent reports from the surveys carried out at the national and state levels, several interventions have been carried out to improve RI services in the state. However, there is a need to assess whether the interventions have improved RI services at the ward level in Jalingo LGA. There is therefore a need to evaluate the performance of routine immunization services in Jalingo LGA using an approach that can identify poorly performing areas. The use of the Lot Quality Assurance Sampling (LQAS) approach will be helpful in assessing the performance of RI services at the sub-LGA level and determining whether the performance in specific areas is within acceptable performance thresholds [17]. In addition, the reasons for the partial immunization and non-immunization of children need to be understood to develop appropriate strategies to correct the problems. The study aims to evaluate the performance of RI services and identify the challenges affecting immunization services.

Objectives

The overall objective is to evaluate the performance of routine immunization in Jalingo LGA using Lots Quality Assurance Sampling (LQAS) technique.

Specific objectives: The specific objectives are:

1. To determine the proportion of uptake of RI among children under 2 years old in Jalingo local government area, Taraba state, Nigeria.
2. To find out the reasons why children are not appropriately immunized by their ages.

Literature Review

Conceptual Review

This section reviews findings from earlier studies in order to highlight common difficulties encountered when assessing routine immunization coverage among children Less than two years [18]. Evidence from different settings shows that, although national immunization programs have been in place for decades, gaps in coverage remain substantial.

For instance, an evaluation conducted in rural Anand District in Gujarat, India, noted that despite the launch of the national immunization program in 1978, millions of children were still missing essential vaccines. The study estimated that about 10 million infants and young children had not been immunized, representing one of the highest burdens of unimmunized children globally. It further reported that less than half of infants completed the full schedule of recommended vaccines within their first year of life, while a small proportion had not received any vaccine at all [19].

Similarly, a survey conducted in Umraniye, Istanbul, Turkey, examined childhood vaccination rates and explored reasons for incomplete immunization. The study focused not only on coverage levels but also on parental attitudes and contextual factors influencing immunization decisions [20]. These findings collectively demonstrate that while some regions achieve high coverage, others continue to face structural, social, and programmatic challenges that affect routine immunization performance.

The study reported that 84.5% of children were fully vaccinated, and 3.2% were not vaccinated at all. Siblings of children not vaccinated were not vaccinated themselves. Residence in remote villages, lack of knowledge, paternal opposition, illness of children, and missed opportunities were some of the reasons for not immunizing children. Parental educational level and duration of

residence in Istanbul were significant predictors [20].

For example, in Uganda, the average immunization coverage rate for diphtheria, pertussis, and tetanus (DPT), measles, and polio among children aged 12 to 18 months in the Kampala district was found to be 53%, which is significantly lower than the Uganda National Expanded Program on Immunization (UNEPI) target of 80%. The immunization coverage rate in the Kawembe division in Kampala district was even lower, at 50.3%. A cross-sectional survey of 239 households with children aged 12 to 18 months was conducted using multi-stage cluster sampling. The results showed that the immunization coverage rate was 95.8% for DPT, 89.5% for polio, and 70.7% for measles. The results also showed that the immunization completion rate was 80.3% for DPT, 81.7% for polio, and 70.7% for measles. Marital status and monthly income were significantly associated with the completion of polio and measles immunization schedules [21].

An assessment of child immunization coverage and the factors associated with full immunization status in children aged between 12 and 23 months in Mizan Aman town, Bench Maji Zone, Southwest Ethiopia showed that immunization coverage of children aged between 12 and 23 months. Out of the total of 322 children aged between 12 and 23 months who were selected and participated in the study, only 114 (35.4%) of the mothers/caretakers showed the child's vaccination card. Of the total children aged between 12 to 23 months surveyed, immunization coverage by card only showed that 114 (35.4%) of the children were immunized, and from the total children aged between 12 to 23 months surveyed, it was found that 136 (46.1%) of the children had finished all the recommended doses of the vaccine, and 159 (53.9%) had not finished the whole doses of the vaccines. Immunization coverage by card only showed that out of the total surveyed children aged between 12 to 23 months, it was found that 114 (35.4%) of the children were immunized,

and from the total children aged between 12 to 23 months surveyed, it was found that 96.5% had received OPV1 and Penta1, followed by BCG (96.4%), and OPV2 (91.2%), and Penta3 (85%), and measles (85.6%), and from the total children aged between 12 to 23 months surveyed, it was found that only 81 (25.2%) had finished all the recommended vaccines. Immunization coverage by card plus mother recall. Out of the total children aged between 12 to 23 months surveyed, it was found that from the total children aged between 12 to 23 months surveyed, 295 (91.6%) had taken at least a single vaccine, and from the total children aged between 12 to 23 months surveyed, it was found that 136 (42.2%) were fully immunized, and 159 (49.4%) were partially immunized, and 27 (8.4%) were not immunized [22].

An assessment of the Routine Immunization coverage in Nyala Locality and the reasons for non-completion of immunization in South Darfur State, Sudan was conducted. For this study, a cross-sectional survey was used in the urban, rural, and IDP populations in proportion to the total population. The survey was done through the use of a questionnaire, which was administered to the parents of the sampled children, 213 in total, aged 12-23 months. The results were then analyzed through the use of the SPSS software package. From the results, it was clear that the percentage of children who were immunized, as ascertained from the immunization card, was 63.4%. This was increased to 82.2% when the child's and the mother's history were used in combination with the immunization card. Some of the children, 5.6% in total, were also found to be non-immunized. The factors that contributed to the low percentage of children who were immunized were the knowledge problems experienced by the mothers, the access problems, and the attitude problems, which contributed 51%, 15%, and 34%, respectively. The results also showed that children whose mothers attended ANC and those in urban areas were more likely to be immunized [23].

An investigation on Childhood Vaccination Coverage and Equity Impact in Ethiopia by Socioeconomic, Geographic, Maternal, and Child Characteristics was conducted. From the results, it was clear that the full vaccination coverage was 33.3% [29.4-37.2]. The percentage of children who were immunized for a single antigen was also noted to range from 49.1% [45.1-53.1] for PCV3 to 69.2% [65.5-72.8] for BCG. The wealth and maternal education-related inequalities were also noted in the results, with the wealth and education indices being 0.30 and 0.23, respectively. From the results, it was also noted that the chances of having full immunization for a child in Addis Ababa and Dire Dawa were seven times higher compared to a child in the Afar region. In addition, the chances of having full immunization for a child in a female-headed household were 49% lower [24].

Country-level predictors of vaccination coverage and inequalities in GAVI-supported countries reveal considerable heterogeneity in DTP3 coverage and in the magnitude of inequalities across countries. Results for MCV were consistent with those from DTP3. Political stability, gender equality, and smaller land surface were important predictors of higher and more equitable levels of DTP3 coverage. Inequalities in DTP3 coverage were also lower in countries receiving more external resources for health, with lower rates of out-of-pocket spending and with higher national coverage. Greater government spending on health and lower linguistic fractionalization were also consistent with better vaccination outcomes [25].

A cross-sectional study was conducted, which involved the administration of an interviewer-administered questionnaire to evaluate the knowledge of the mothers of children between the ages of 12 and 23 months and the immunization coverage of the children in the rural Nigerian community of Sabongidda Ora, Edo State. The participants for the study were selected through the World Health

Organization's (WHO) immunization coverage cluster survey. The immunization coverage of the participants was assessed through the child's vaccination card and the history of the child. The child was considered to be fully immunized if the child had been given the following vaccinations: a dose of Bacille Calmette Guerin (BCG), three doses of oral polio (OPV), three doses of DPT, three doses of hepatitis B (HB), and one dose of Measles by the time the child was enrolled into the study, i.e., between the ages of 12-23 months. The knowledge of the mothers was considered to be satisfactory if the mothers scored at least 3 out of a maximum of 5 points. Logistic regression was carried out, and the result revealed that three hundred and thirty-nine mothers and 339 children, where each mother had one eligible child, were included in the survey. Most mothers (99.1%) had very positive attitudes towards immunization, and >55% were generally Knowledgeable about symptoms of vaccine-preventable diseases, except for difficulty in breathing as a symptom of Diphtheria. Two hundred and ninety-five mothers (87.0%) had a satisfactory level of knowledge. Vaccination coverage for all seven child vaccine-preventable diseases was 61.9%. However, this was significantly higher ($p = 0.002$) among those who used a vaccination card for the immunization of their child (131/188, 69.7%) than those whose immunization was assessed through the mother's history (79/151, 52.3%). From the result of the logistic regression, it was revealed that the mothers' knowledge of immunization ($p = 0.006$) and the use of a privately funded health facility for the immunization of the child ($p < 0.001$) were significantly correlated with the rate of full immunization. (Factors associated with incomplete immunization in children aged 12–23 months at the subnational level, Nigeria: a cross-sectional study [26].

A mixed method was employed to Explore Factors Influencing Immunization Utilization in Ilara and Ipara, Nigeria. Result showed that

only 56 children (32.6%) of the 172 children over 9 months of age had immunization cards available for inspection. Of these, 23 (59.6%) were fully immunized, noticeably higher in Ipara than in Ilara. However, when immunization status was assessed by card and recall, 84.9% of the children were assessed as fully immunized. Caregivers in the more rural Ilara had less knowledge of vaccine schedules. The importance of all doses was recognized more by Ipara respondents (95.5%) than in Ilara (75.3%) ($p < 0.05$). Community links to immunization and household decision-making patterns influenced immunization use in both wards. Migrants and those living in hard-to-reach areas were disadvantaged in both wards. Health service factors like the absence of delivery services, shortage of health workers, unavailability of vaccines at scheduled times, and indirect costs of immunization contributed to low utilization [27].

An econometric analysis of health workers and vaccination coverage in developing countries was carried out. Result revealed that Health worker density was significantly associated with coverage of all three vaccinations (MCV $p=0.0024$; DTP3 $p=0.0004$; polio3 $p=0.0008$). However, when the effects of doctors and nurses were assessed separately, we found that nurse density was significantly associated with coverage of all three vaccinations (MCV $p=0.0097$; DTP3 $p=0.0083$; polio3 $p=0.0089$), but doctor density was not (MCV $p=0.7953$; DTP3 $p=0.7971$; polio3 $p=0.7885$). Female adult literacy was positively associated, and land area was negatively associated, with vaccination coverage. National income per person did not affect coverage [28].

An assessment of Immunization Coverage of the Under-5 Children in Akure North Local Government Area of Ondo State, Nigeria, was conducted through a community-based descriptive cross-sectional study among 560 mother-child pairs. The results showed that the immunization coverage of the Under-5

Children of the current study is 94.6%. This figure is higher than the National figure of 25%, although lower than the figure of similar other developing nations. The dropout rate of the immunization coverage of the Under-5 Children is 7.3% for BCG/DPT1, 31.3% for DPT1/DPT3, and 35.8% for DPT3/Measles. The majority of the subjects included in the study rated the immunization staff as friendly. However, there was a significant difference in the attitude of the immunization staff between the communities included in the study. The immunization coverage of the Under-5 Children was also affected by the attitude of the immunization staff. The attitude of the immunization staff was significant, although the level of significance was less than 0.05 [29].

Record-Based Immunization Coverage Assessment in the rural area of North India was conducted through a cross-sectional study in the year 2006. The results of the study showed that out of the total of 747 eligible children, 708 (94.8%) were fully immunized. The reasons for incomplete immunization were parental indifference and migration of the child/family. In the cross-checking resurvey of 10%, the majority of the immunization records were correct. The quality of the immunization records was reasonably good. It was also feasible to estimate the immunization coverage rate through the immunization records [30].

A health economic analysis of public health workers and vaccination coverage in Zhejiang Province, Eastern China, was conducted through a cross-sectional study in the year 2014. The results of the study showed that the density of public health workers significantly affected the coverage of the measles-containing vaccine. In the analysis, the effect of vaccine personnel and other public health workers was assessed individually. It was observed that the density of vaccine personnel was significantly related to the coverage of all three vaccinations, MCV AOR = 7.05, DTP3 AOR = 1.82, PV3 AOR = 4.83, although the density of other public health workers was not. The proportion

of migrant children <7 years and the Land area were observed as negative and significant determinants of the immunization coverage, although the GDP per person did not influence the immunization coverage [31].

A multi-country study on household health surveys on the status of inequality in diphtheria-tetanus-pertussis immunization coverage in low- and middle-income countries in 2016 was conducted. The findings showed that national DTP3 immunization coverage varied across 51 countries, ranging from 32% in the Central African Republic and 98% in Jordan. The inequality in DTP3 immunization coverage between quintiles 1 and 5 suggested a pro-rich inequality, i.e., a difference of 20 percentage points or more between quintiles 1 and 5 in 20 out of 51 countries. In Nigeria, Pakistan, Laos, Cameroon, and the Central African Republic, the differences were more than 40 percentage points between quintiles 1 and 5. In 15 out of 21 countries, an improvement over time in national DTP3 immunization coverage was achieved, and this improvement was faster in quintile 1 than in quintile 5. In Burkina Faso, Cambodia, Gabon, Mali, and Nepal, an absolute increase of 2.0 or more in coverage per year was observed, and this increase was faster in quintile 1 than in quintile 5. Considerable economic-related inequality in DTP3 immunization coverage was observed in five high-priority countries: DR Congo, Ethiopia, Indonesia, Nigeria, and Pakistan, but not in Uganda [32].

A study on Immunization Coverage in an Urban Slum of Mumbai using the Lot Quality technique was conducted. In this study, out of 352 children considered, 55.40% were males and 44.60% were females. The total immunization coverage in the urban slum area was 88.07%. The most common reasons for not immunizing the child were: due to a visit to the native place/village (14.00%), the child was ill, hence not brought (8.20%), unaware of the need to return for second and third doses (5.70%), and the mother was too busy (5%) [33].

In a cross-sectional study on the determinants of childhood immunization coverage in urban poor settlements of Delhi, India, the sample was randomly selected. 1849 children aged 1 to 3.5 years from 13,451 households in 39 clusters, where the cluster was defined as the area covered by a community health worker, in 2 large urban poor settlements were included. Out of the 1849 children, 1343 completed the survey, including information on childhood immunization (BCG, OPV, DPT-HepB-Hib, HepB, Measles) from vaccination card or mother's recall. Random intercept logistic regression was used to explore the socio-demographic determinants of complete immunization coverage. Complete immunization coverage was 46.7%, and 7.5% were not immunized. The odds of complete vaccination (OR, 95% CI) were lower in female children, 0.70 (0.55 to 0.89), and Muslim households, 0.65 (0.45 to 0.94). The odds of complete vaccination were higher if the mother was literate, 1.6 (1.15 to 2.16), if the child was born within the city, 2.7 (1.97 to 3.65), if the child was from a health facility, 1.5 (1.19 to 2.02), if the child was from the highest wealth quintile, 2.46 (1.5 to 4.02) compared with the poorest, and if the child had a birth certificate, 1.40 (1.03 to 1.91). Cluster effect due to unmeasured neighborhood factors, expressed as median OR, was 1.32 [34].

Another study on the determinants of Routine Immunization coverage in Bungudu, Zamfara State, Northern Nigeria, was carried out through a cross-sectional study design. Mothers of 450 children aged 12-23 months were interviewed through a structured questionnaire to collect the required information on socio-demographic characteristics, knowledge on immunization, immunization status of the children, and reasons for non-vaccination of the children. A fully immunized child is defined as a child who has received one dose of BCG, three doses of oral polio vaccine, three doses of Diphtheria-Pertussis-Tetanus vaccine, and one dose of

measles vaccine by the age of 12 months. The result revealed that the mean age of mothers and children was 27 years (Standard Error 0.27 years) and 17 months (Standard Error 0.8 months), respectively. Among the mothers, 79% had no formal education, and 84% did not possess satisfactory knowledge of immunization. Only 7.6% of the children were fully immunized. From the logistic regression result, it was revealed that possessing satisfactory knowledge on immunization (Adjusted OR=18.4, 95% CI=3.6-94.7) and having at least secondary education (Adjusted OR=3.6, 95% CI=1.2-10.6) were correlated with full immunization [35].

Evaluation of the immunization coverage of the Expanded Program on Immunization in Kita Circle, Mali, was conducted through a cross-sectional survey in 2006. The study was conducted to ascertain the level of vaccination coverage among 12- to 23-month-old children in Kita Circle, Mali, after the implementation of the priority program. Both vaccination cards and the declarations of the mothers were used as methods of evaluation, where, in cases where the mother is unable to do so, it is done by the person in charge of the child. The study revealed that 59.9% [CI 95% (54.7-64.8)] of the children were fully vaccinated according to the vaccination cards, while 74.1% [CI 95% (69.3-78.4)] were revealed by the declarations of the mothers. The drop-out rate between DTCP1 and DTCP3 was 5.5% according to the vaccination cards. Immunization coverage was higher among the children of mothers who were vaccinated with the anti-tetanus vaccine than those who were not, with an odds ratio of 2.1, CI 95% (1.44-3.28). However, the study revealed no differences in relation to the level of knowledge of EPI diseases, distance from the health center, and socio-economic status. Lack of information was cited as one of the reasons for non-vaccination against the six EPI diseases among the children [36].

Empirical Review

Theoretical Review

The routine immunization coverage in Nigeria is inconsistent, as shown by the disparities in routine immunization coverage between the northern and southern parts of the country, and the prevalence of zero-dose children, who have not received any routine vaccines. Recent studies conducted in the country through national surveys, such as the Nigeria Demographic and Health Survey (NDHS) and the Multiple Indicator Cluster Survey (MICS), showed that routine immunization coverage in most states in the northern region of Nigeria, particularly in the North East region, is low. Another study conducted in rural Anand District in Gujarat, India, showed that despite the beginning of the immunization program in India in 1978, 10 million unimmunized infants and children were found in India. Routine levels of immunization and factors that affect the lack of completion of immunization have been studied in the Nyala locality of South Darfur State in the Sudan. The research was conducted on the urban, rural, and internally displaced populations. From the study, it was found that the level of immunization was 63.4% according to the vaccination cards, but it increased to 82.2% after considering the information provided by the caregivers. About 5.6% of the children were not immunized, and the reasons for the lack of completion of immunization schedules were lack of knowledge among the mothers, lack of access, and attitudes among the population. The children who were immunized were those whose mothers received antenatal care and those residing in the urban areas.

Qualitative research was carried out in the state of Sokoto, Nigeria. The state is characterized by the same features as the Jalingo local government. The qualitative research identified the following factors that affect the completion of immunization programs: poor health facilities, perception of

the facilities, misinformation about the vaccines, and the role of gender. (A rapid qualitative assessment of barriers associated with demand and uptake of health facility-based childhood immunizations and recommendations to improve immunization service delivery in Sokoto State, Northwest Nigeria. Opposition from male heads of households and caregivers' reports of insufficient incentives and inadequate service.

Health Belief Model (HBM)

The Health Belief Model, which was first proposed in the 1950s by Rosenstock, provides an explanation for the behavior choices that people make about their health. The model explains that the choice to do or not to do the behavior that is healthy depends on the susceptibility to the disease, the severity of the disease, the benefits of the behavior, and the barriers to the behavior. (Perception of COVID-19 Vaccination and Uptake Willingness in Northern Nigeria: Understanding Strategies to Optimize Coverage, 2022) The current study aims to identify the barriers that caregivers face in accessing healthcare services for their children. The current study aims to encourage caregivers to seek healthcare services because the benefits of seeking healthcare services far outweigh the barriers to seeking healthcare services.

Theory of Planned Behavior

According to the Theory of Planned Behavior, behavior is controlled by three variables, which are attitude toward the behavior, subjective norms, and perceived behavioral control. In addition, the Theory of Planned Behavior indicates that behavior is controlled by the intention of the individual to perform the behavior in question. (Piffelmann, n.d.) By removing barriers to the perceived behavioral control of the caregivers, the caregivers will be motivated to utilize the healthcare services in providing routine immunization services.

According to the Incentive Theory of Motivation, behavior can be motivated through rewards. The Incentive Theory of Motivation indicates that people can be motivated to perform certain behaviors in order to receive certain rewards. (Incentive Theory of Motivation: How Rewards and Punishments Drive Behavior).

Materials and Methods

In this study, the quantitative research design and the use of the questionnaire in gathering data from the caregivers of the children who were eligible to receive immunization services were employed. The quantitative research design and the use of the questionnaire were employed in this study because of the ability to obtain data that can be statistically analyzed to identify patterns, trends, and relationships. The questionnaire employed in the study had the following components: the demographic characteristics of the respondents, the rate of visiting the health facility to attend the immunization session, the constraints to visiting the immunization session, and the caregivers' reasons not to immunize the children according to their age.

The population that was targeted in this research was caregivers of children who were taken for immunization. The number of people who took part in this research was 360 (Mothers/Caregivers). The population that was targeted in this research was adequate in order to carry out statistical analysis on the data that was collected. The criteria that were used in this research were that the population that took part in this research were caregivers of children who were taken for immunization. The research was based on caregivers of children who took part in the immunization process. The research was not based on the caregivers of children who did not take part in the immunization process. The research was not based on the caregivers of children who were not willing to give their consent to take part in the research. The research used a questionnaire to carry out its

purpose. The questionnaire was designed in accordance with the research that was to be carried out. The questionnaire was designed in a manner that was closed and multiple-choice format. The closed and multiple-choice nature of the questionnaire was carried out in order to have accuracy and reliability in the data that was obtained. The questionnaire was also reviewed by public health experts. Some of the key issues that were obtained through the research were the number of times caregivers visited the health facility for the immunization session.

Data was collected through the use of questionnaires that were filled in by the respondents through the assistance of trained field enumerators. The respondents were made aware of the intention of the study and that it was purely voluntary.

The analysis of the data was conducted through the application of both descriptive and inferential statistics. Frequency tables, percentage, and cumulative percentage were used to describe the data collected regarding the distribution of the respondents regarding the study variables. The data was also represented in the form of tables to enhance easy comprehension. This analysis is offered.

Description of the Study Area

The research study area is Jalingo Local Government Area, located in Taraba State. Taraba State is a state in North East Nigeria, created in 1991 from Gongola State, named after the River Taraba, which runs through it, and its capital is Jalingo. (Taraba State, 2025) The state is very rich culturally, being home to over 80 ethnic nationalities, including the Mambilla, Tiv, Jukun, and Mumuye, among

others. (Taraba State, 2023) The state is located in the North East zone of Nigeria, bordered on the east by Adamawa State, on the North by Gombe State, on the West by Benue State, and on the South by the Cameroun Republic. The people are predominantly Christian, Muslim, and Traditional religionists, and practice mainly agricultural and Forestry activities. The state consists of 16 Local Government Areas. (Taraba State, 2023) According to the 2006 census, the total population of the State is 3,925,717, while the total population below 1 year is 157,029. (Taraba State Population by Local Government Area (2025), 2024).

Jalingo Local Government Area (LGA) is the capital of Taraba State, Nigeria. It was founded as a military post for the Muri Emirate in the late 1800s. It is the capital of Taraba State, established in 1991. The LGA comprises 10 political wards, including Barade, Kachalla Sembe, Kona, Majidadi, Sarkin Dawaki, Sintali A, Sintali B, Turaki A, Turaki B & Yelwa. The LGA population projection based on the 2006 census figures showed that the total population of the LGA in 2025 is 240,735, of which the population under the age of 1 year is 9,629 (4%). (Census Tribunal nullifies 2006 census figures for 3 LGAs in Taraba, 2012).

Study population

Jalingo Local Government Area population projection based on the 2006 census figures showed that the total population of the LGA is 240,735, of which the population under the age of 1 year is 9,629 (4%). This is according to the last population census conducted in the country. The table below shows the population of the ward where the study was conducted.

Table 1. Sample Population

Ward Name	Projected pop 2025	Pop under 1yr
Barade	29,149	1166
Kachalla Sembe	18,997	760
Kona	12,028	481
Majidadi	36,118	1,445

Sarkin Dawaki	31,158	1,246
Sintali A	16,988	680
Study area pop	144,438	5778

SPSS, 2026

Variables and Measurements

In the present investigation, both the dependent and independent variables were identified and defined as per the objectives of the investigation. In the present investigation, the dependent variable was the participation of caregivers in the immunization sessions, which was measured through the responses received regarding the participation and regularity of the caregivers in bringing the children to the immunization process. This was done through the responses received from the participants regarding the completion and/or avoidance of the visits for the immunization process. The major independent variable of the present investigation was the barriers to the participation of caregivers in the immunization process, which was measured through the responses received from the participants. These barriers included financial issues, lack of awareness, cultural issues, no transport, long queues at the immunization centers, and other commitments. All the variables were measured through the nominal scale, where the participants were asked to choose the best option. (Gross, 1996).

In the present investigation, other socio-demographic variables such as the age, gender, level of education, marital status, occupation, and family income of the respondents were also considered to understand the respondents' characteristics and the role these played in the decision-making process. In the present investigation, all the variables were measured through the correct scale, where the ratio scale was used to measure the age and family income of the respondents, whereas the nominal scale was used to measure the level of education, marital status, and gender of the respondents. (Scales of measurement and presentation of statistical data, 2018, pp. 197-205).

All the variables were coded in an organized manner for analysis. For example, binary variables such as having been immunized appropriately for one's age were coded as;

"1 = Yes" and "0 = No.

"Ordinal variables,"

For example, the frequency of the receipt of incentives, were coded in the following order:

"1 = Never," "2 = Rarely,"

"3 = Sometimes,"

and "4 = Always."

This style of coding ensured uniformity in the data entry and analysis process. It also helped in the development of summary statistics. The specification of the exact nature of the data helped in the development of a well-structured data set. The data set was then analyzed systematically to enhance the reliability of the results obtained from the study. It also helped in the accurate interpretation of the results obtained from the study.

Statistical Analysis

While conducting the study, the Statistical Package for Social Sciences (SPSS) was used for the analysis of the data. Descriptive statistics such as the mean and standard deviations were used to analyze the continuous data. On the other hand, frequency distributions, cross-tabulations, as well as chi-square tests, were used to analyze the categorical data with the objective of establishing any possible association that may have existed between the data under consideration. With regard to the continuous data, independent sample t-tests as well as analysis of variance were used to analyze the data under consideration. This helped to create a platform for the descriptive as well as the inferential analysis of the data under consideration.

Sampling Technique

For the study under consideration, the multistage sampling technique was used. The technique is important since it helps in the development of a systematic sample of the population under consideration.

First Stage: Selection of Local Government Area

For the study under consideration, the Local Government Area was selected using the purposive sampling technique. Jalingo LGA was selected for the study since the LGA met the criteria set for the study. The criteria set for the study were the availability of functional Primary Health Care Centres that provide routine immunization services. The LGA should also have a history of suboptimal performance in the past MICs/NICs. In addition to that, the LGA should also have urban characteristics.

Second stage: Selection of Ward within LGA

The selection of the wards for the LQAS assessment within the Local Government Area was done using the Population Proportionate Sampling (PPS). The total number of wards identified for the LQAS assessment was six. The wards include Barade Kachalla Sembe, Kona, Majidadi, Sarkin Dawaki, and Sintali.

Third Stage: Selection of Eligible Households and Caregivers

Systematic random sampling was done to select the eligible households from the settlement identified in the second stage of the sampling process. This is done by creating a list of the eligible households within the settlement, which have at least one child between 0-23 months of age. The sampling interval, k , is

obtained by dividing the total number of eligible households by the number of respondents required from the settlement.

If the total number of eligible households within the settlement is 200, the number of respondents required from the settlement is 20. Therefore, the sampling interval, k , is 10.

The random start, which ranges from 1 to k , is obtained by generating random numbers between 1 and 10. The selection of the households within the settlement is done by selecting every k th household from the settlement. If more than one participant were present within the selected household, the participant was selected at random from the total number of participants within the household.

selected. If the household was not available or declined to participate in the study, another household was selected. This ensured that all the households were equally given an opportunity to participate in the study.

Sample Size

The population of interest is the mothers of the children below 2 years of age in the selected settlements and not visitors. There are 10 children to be reached in each settlement. In each of the wards, 6 settlements were selected, making 60 children in each ward and 360 children nationwide to be assessed at LGA level. (Akinyemi et al., 2013).

Data Collection Tools

The instruments used for data collection were:

1. Table of Random Numbers.
2. Table of random numbers for children.
3. Questionnaire.
4. Overall summary sheet for the LGA.

Table 2. Color-Codes of the LQAs Scores

Decision Rule	Color code	Criteria for accepting and rejecting lot
>56		Lot is rejected when number of children unimmunized >56
33-56		Lot is rejected when number of children unimmunized is between 33-56

9- 32		Lot is rejected when number of children unimmunized is between 9-56
<8		Lot is accepted when number of children unimmunized is <8

SPSS, 2026

Table 3. Children Fully/Appropriately Immunized for Age

Ward Name	Total Children Sampled	Number of children fully/appropriately immunized for age	% Children fully/appropriately immunized for age	Number of children not fully/appropriately immunized for age	Findings
Barade	60	53	88%	7	Lots Accepted
Kachalla Sembe	60	49	82%	11	Lots Rejected
Kona	60	48	80%	12	Lots Rejected
Majidadi	60	44	73%	16	Lots Rejected
Sarkin Dawaki	60	42	70%	18	Lots Rejected
Sintali A	60	38	63%	22	Lots Rejected
Jalingo LGA	360	274	76%	86	Lots Rejected
Btotal					

SPSS 2026

Results

Children's Immunization Status

The results have shown that 76% of the children were provided with the complete immunization. It is very clear from the results that 274 out of 360 mothers/caregivers were able to prove through the immunization cards that they were able to provide the required vaccinations to the children according to their

respective ages. The result is very encouraging. It has shown that two-thirds of the mothers/caregivers were able to provide the required vaccinations to the children according to their respective ages. The result has also shown that the mothers/caregivers were not only aware of the importance of the vaccinations, but they also possess the required motivation and ability to do so, and possibly because of the efforts of the LGA intervention.

Table 4. Age Distribution of Mothers (Caregivers)

Age group (yrs)	Frequency	Percentage
15 – 19	26	7.11%
20 – 24	77	21.33%
25 – 29	119	33.18%
30 -34	85	23.70%
35 – 39	38	10.66%
40+	15	4.03%
Total	360	100%

SPSS 2026 (Questionnaire)

Descriptive Statistics

As presented in Table 4, the distribution of the age of the respondents showed that most

caregivers among those surveyed belong to the young to early middle adult stage, specifically to the age range of 25 to 29 years, where the

highest percentage of 33.18% is found, followed by 23.70% for the age range of 30 to 34 years, and then 21.33% for the age range of 20 to 24 years. The younger and older age ranges, specifically for 15 to 19 years and 40+ years, have the lowest percentage at 7.11% and 4.03%, respectively, compared to the rest. This showed that most of the primary caregivers for children less than two years old belong to the young adult stage, which is the stage of their childbearing years.

This young age demands that the efforts to enhance the rate of immunization, child health education, and resource mobilization among the community are made relevant to the level of the young parents, especially the young mother. The young caregivers might have different characteristics, which might affect the success rate of the immunization of the children.

The small number of caregivers in the older age group (35+ years), as well as the teenage age group (15 to 19 years), should also not be ignored, as they might have differing needs for support services. For example, the teenage caregivers, who are likely to be young mothers, might need special education services to help them overcome the stigma and/or lack of knowledge about health and hygiene, while the older caregivers, who are likely to be guardians or grandparents, might need to be followed up to ensure that the immunization of the children is up to date.

The number of caregivers by age is, therefore, very crucial in ensuring that the support services are relevant to the entire caregivers' population being targeted by the proposed study.

Table 5. Marital Status of the Respondents (Caregivers)

Marital status	Frequency	Percentage
Single	34	9.48%
Married	299	82.94%
Widowed	24	6.64%
Divorced	3	0.95%
Total	360	100%

SPSS 2026

From the descriptive statistics provided in the survey, there is an impression of the identity of the respondents. From the marital status of the respondents, the majority are married, making up 82.94% of the sample, while 9.48%

are single, and 0.94% are widowed. It was established in a similar survey conducted in the north of the country that the caregivers who used the immunization services are married women.

Table 6. Educational Level of Mother (Caregiver)

Education Level	Frequency	Percentage
No formal education	68	18.96%
Primary	171	47.39%
Secondary	94	26.07%
Tertiary	27	7.58%
Total	360	100%

SPSS 2026

In terms of educational attainment, the data showed that 18.96% did not attend any educational institution, 47.39% only received

primary education, 26.07% received secondary education, but only 7.58% received higher education. The data are similar to previous

research, which found low educational attainment for women in the north of Nigeria,

an important factor for the low rate of health-seeking behaviors and immunizations.

Table 7. Reasons for Not Being Fully/Appropriately Immunized for Age

Reason	Frequency	Percentage
Reason not given/ Others	139	38.63%
Vaccine not available	89	24.64%
The health facility is too far	50	13.98%
No Time	38	10.66%
Vcultural or religious belief	26	7.11%
Not aware	18	4.98%
Total respondents	360	100%

SPSS 2026 (Questionnaire)

Table 7 illuminated the reasons why some caregivers did not complete or continue their children's immunizations, and how these reasons vary with age. From the total of 360 respondents, the highest response was "Reason not given/Others" as indicated by 139 persons (38.63%). This may imply that some of the caregivers did not want to elaborate on their reasons or that there are personal and tacit ones that they did not want to disclose.

A number of the respondents, 89 (24.64%), claimed that the vaccine was not available at the health facilities. While strengthening vaccine supply chains should improve availability, these findings demonstrate the problem of stockouts that can affect immunization coverage. When supplies are unavailable, provider return rates may be lower; dropout rates may be higher; and trust in the health system may decline. Causes can range from problems with logistics to failures in refrigeration and errors in forecasting.

Other frequent reasons include distance to health facilities 13.98%, lack of time by the caregiver 10.66%, and cultural or religious beliefs take 7.11%. These highlight the still-persistent structural and social barriers to accessing routine immunization. While some of these barriers might be amenable to outreach or education, others would clearly require system-level changes, such as greater support for mobile immunization efforts or making the immunization process easier for caregivers.

Analysis of the Result

The study indicates that 76% of children were able to attain full immunization by the expected ages. From 360 children, 274 could produce an immunization card to prove their child had been immunized against all diseases appropriate for their age. The results are similar to what Fatiregun et al. (2013) found when they conducted a study on the immunization coverage level of children aged 12-23 months and their determinants in the Atakumosa-West district of Osun State in Nigeria. Only one out of six wards in the LGA met the standard when checks were made on LQAs and lots, while the rest did not meet the standard since there were fewer than eight immunized children targeted in a lot.

In analyzing the hindrances to attending immunization sessions, the predominant problem was the 'Reason not given,' accounting for 38.63%, followed by 'Vaccine not available' at 24.64%, and distance to the health facility, which accounted for 13.98%.

Analyzing the trend of the graph above, the immunization coverage within RI in the LGA of Jalingo has clearly improved compared to the 2021 results of the MICs/NICs, as reported by the UNICEF (2024). In order to sustain such improvement, the strategies should be tailored to increase the accessibility of the health facilities, reducing the distance of travel, and reducing transportation barriers. Some other

significant strategies include providing a full range of antigens for each immunization session, flexibility of the immunization timetable to accommodate the needs of the caregiver, and other immunization awareness education to alleviate any remaining concerns.

Conclusion

The study reveals that only two-thirds of kids, i.e., 76%, are totally immunized up to a certain age. The study offers insight into various socio-demographic determinants, barriers, and perspectives that guide caregivers in Jalingo LGA, Taraba state, in choosing whether or not to immunize their children from particular illnesses. The most important insight in the study is that the vast majority and bulk of respondents are women in childbearing years with lower educational levels. (Gender Barriers and Behavioral and Social Drivers Analysis for Immunization in Nigeria, n.d.).

At the same time, the study reveals important system-wide challenges that affect the processes of routine immunization in the LGA, such as stockouts of vaccines, distances to health facilities, and no reason given for not completing immunization schedules. (Political economy of vaccine distribution and acceptance in Nigeria: critical analysis of global health interventions and local realities, 2025). On a more positive note, effective management, finance, and health supervision appear to be critical factors (Babylon et al., 2025).

Thus, it can be suggested that tackling this issue needs a multi-faceted approach, which ranges from health education and infrastructure to the adoption of best practices using the zero-dose and under-immunized children, especially those living in hard-to-reach urban settings, as a target group. (Health workers are reaching zero-dose children in Nigeria's urban slums, 2023).

Conflict of Interest

The author declares that there is no conflict of interest in the publication of this article. The

work that is to be conducted is purely for academic and research purposes without any financial or personal interests that may influence the outcome of the work or the interpretation of the work. There is no specific grant awarded by any public, commercial, or non-profit organization to conduct the intended work. The data is collected and processed independently, and the interpretation of the data is based on the author's own comprehension of the data.

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Ethical Approval

The study has received ethical clearance from the relevant ethics committee of Taraba State, where the study is conducted. The participants gave their consent before they were asked to participate in any data collection that might mean sharing their information for analysis. The confidentiality of all participants has been maintained, and they are all willing

members of society. The brain behind the study was the author themselves, who designed the structured questions that helped to collect information from members of the community about their views or opinions concerning immunization barriers that exist within their community and beyond. The author has conducted all parts of the statistical analysis and written all parts of this article from abstract to conclusion, as they are keen on discussing immunization barriers within the community under consideration. The researcher has solid training in public health and community health, having a background in public health studies, quantitative methods, and epidemiology.

Data Availability

The results of this study can be supported by information that can be requested from the

corresponding author after a reasonable request. This is because, owing to certain moral issues in respect of the protection of the privacy of the caregiving professionals who have taken part in the study, some information is confidential in nature and cannot be shared through this platform. However, anonymized information can be shared.

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