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# Influence of Low Rate of Reporting of Adverse Events Following Immunization on Immunization Dropout

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Abstract

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## Abstract

Immunization protects millions of children. Yet, many children drop out of immunization in Jigawa State of north Nigeria. This cross-sectional quantitative correlational study based on the Health Belief Model was designed to determine whether the dropout from routine immunization (RI) was influenced by low rate of reporting of adverse events following immunization (AEFI) to health facilities by caregivers. Primary data was collected from 307 caregivers with dropout children using structured interviewer-administered questionnaire. The data were analyzed using logistic regression and descriptive statistics. The results showed that 61.3% of the children had AEFI and dropped out. Rate of reporting of AEFI to health facility was low (23.1%). This significantly influenced the dropout (95% CI; $p < .001$; $\chi^2 = .028$; OR = 2; AOR = 6). Children with AEFI were 2 times more likely to be dropouts than their counterparts with no episode of AEFI. Children with AEFI of loss of appetite or persistent crying were 4 times more likely to drop out of immunization. The place where one sought treatment for AEFI was strongly associated with the dropout (95% CI; $p < .001$; $\chi^2 < .001$). Those who sought help outside health facility were up to 5 times more likely to drop out of immunization compared to health facility treatment. Caregivers were of the view that, they would be able to improve their reporting of AEFI to health facilities for treatment and eventually complete the immunization of their children if they receive good education on immunization and the need to report AEFI to health facility. Findings of this study if appropriately disseminated could lead to positive change initiatives of preventing vaccine diseases by increasing the uptake of complete immunization through education on immunization and inclusion of caregivers' ideas in immunization interventions.

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# Dedication

This study is dedicated to my wife Vida Yenyi and my children Ogyefo, Elvis, Priscilla, and Jeuel Yenyi who supported me on this very long journey. I appreciate your encouragements, numerous reminders, and continued assistance to meeting my financial obligation of the program. To you my children, I know this efforts I have made would inspire you and push you to higher heights. This study is also dedicated to the Almighty God for the strength and courage He gave me to endure the arduous times. With love, perseverance, and gratitude I say thank you. I sincerely appreciate you all.

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# Chapter 1: Introduction to the Study

## Introduction

All humans, irrespective of age, can be infected with vaccine preventable diseases (VPDs) if not naturally immune or obtained immunity through vaccination (World Health Organization [WHO], 2016a). According to the WHO and the United Nations International Children's Emergency Fund (UNICEF, 2014), immunization adds to the global child survival efforts by preventing about 3 million deaths each year in all age groups. It is the only public health intervention that protects the index person (one who receives the immunization), the contacts, and the entire community (National Vaccine Advisory Committee [NVAC], 2013). Immunization is one of the most safe and effective public health interventions that prevents disability, disease or morbidity, and especially infant or early childhood deaths (NVAC, 2013; Ward, Attwell, Meyer, Rokkas, & Leask, 2017). According to Centers for Disease Control and Prevention (CDC, 2014a), vaccination herd immunity of 90% is enough to avoid any spread of VPDs in population. However, this herd immunity of 90% is not achieved in many communities due to varied reasons that make the children either partially immunized or unimmunized (Tsafack, & Ateudjieu, 2015; Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017). Caregivers must present their infants at routine immunization (RI) sessions four to five times to get them fully immunized and protected against VPDs for improved health outcomes (CDC, 2014b; Chatterjee, 2013). Yet, in Jigawa State in northwest Nigeria where this study was conducted, as many as 65% of the infants who start RI fail to complete the schedules due to dropout (Ministry of Health, 2016). In

same Jigawa State, a very low rate (0.004/100,000) of adverse events following immunization (AEFI) was reported to health facilities by caregivers for medical attention (Ministry of Health, 2016). Therefore, this quantitative study was conducted to find out whether the high rate of dropout was influenced by the low rate of reporting of AEFI and also to know the community-prescribed solution to addressing the issues of high dropout and low reporting of AEFI. This chapter included sections on the background, problem statement, purpose, theoretical model, research questions, significance, and assumptions of the study.

## Background of the Problem

In addition to the normal RI, Jigawa State conducts between six and 11 mass immunization campaigns annually, targeting reduction in morbidity and mortality from measles, cerebrospinal meningitis, and especially poliomyelitis. The target population for the RI are infants, while that of the mass vaccination campaign are children aged 0 to 5 years. According to the National Program on Immunization (NPI, 2017), the state vaccinates about 1.6 million children aged 0 to 5 years on average in each round of vaccination campaign. This indicates that the population is used to immunization, so the state was deeply concerned about the two occurrences of low AEFI reporting rate and high dropout rate and wanted to know if there was any link between them in order to deal with them holistically. It is clear that AEFI is associated with immunization (Tsafack & Ateudjieu, 2015). However, its effect on dropout, if any, had not been established in Jigawa State. Literature has provided evidence of dropout and interventions to minimize it, but has not showed any association between low AEFI

reporting and high dropout (Baguune, Ndago, & Adokiya, 2017; Haji et al., 2016; Khan et al., 2013). Tsafack and Ateudjieu (2015) also addressed the issue of low reporting rate of AEFI to health facilities, but did not show its effect on immunization dropout. Other researchers say some factors affect implementation of immunization programs and result in low immunization coverage for children, but have not shown whether low reporting of AEFI influence dropout and could contribute to the low coverage (Adedokun et al., 2017; Kassahun, Biks, & Teferra, 2015; Lakew, Bekele, & Biadgilign, 2015; Li et al., 2016; Oku et al., 2017; Ophori et al., 2014; Shen et al., 2014; Ward, Attwell, Meyer, Rokkas, & Leask, 2017). Interventions in the Jigawa State have so far concentrated on dealing with the two occurrences as different entities (NPI, 2017). Therefore, it was essential to establish if they were linked so that interventions could be guided to tackle them in holistic manner if found to be related.

## Statement of the Problem

The rate of reporting of AEFI to health facilities by caregivers in Jigawa State in north Nigeria was as low as 0.004 per 100,000 infants vaccinated; while the rate of immunization dropout was as high as 65% (Joshi et al., 2018; Ministry of Health, 2017). An acceptable level of immunization dropout prescribed by the NPI should be less than 10% (Ministry of Health, 2017). According to the National Health Mission (2015), the common forms of AEFI have incidence rates of more than 10%, while those of very rare forms is more than 0.01%. Tsafack and Ateudjieu (2015) also found a rate as high as 392 per 100,000 infants who received vaccination developed AEFI in Sub-Saharan Africa. These two occurrences (low AEFI reporting rate and high dropout rate) are of

great public health concern because they negatively impact the success of immunization programs (Muchekeza, Chimusoro, Nomagugu, & Kufakwanguzvarova, 2014; Tsafack & Ateudjieu, 2015; Yu, 2015). Meanwhile, the state had no adequate information to show whether the two occurrences were linked or enough evidence to explain how they relate (if any), and it did not have the appropriate solution to address such occurrences. No empirical evidence on how the two occurrences relate was found from a literature search. The National Primary Health Care Development Agency (NPHCDA, 2017) was concerned that the low rate of reporting of AEFI and high rate of RI dropout were related, but none of the administrative annual RI reports produced by the Ministry of Health from 2012 to 2017 provided any convincing information to that effect. This study was thus conducted to help the state know whether the low reporting of AEFI influenced RI dropout, and if so, how to use community-prescribed solution to break such influence.

## Purpose of the Study

The purpose of this quantitative study was to provide the state with (a) information that could explain the influence of low reporting of AEFI on immunization dropout, and (b) ideas from caregivers to address the occurrences of low reporting of AEFI to health facilities and high dropout of immunization. The findings could compel appropriate interventions and systemic actions needed to improve AEFI reporting and reduce dropouts (Li et al., 2016). The study could also help immunization service providers in educating caregivers on the need to present AEFIs at health facilities for appropriate medical assistance (Tsafack & Ateudjieu, 2015). This assistance could boost

their confidence in immunization and motivate them to continue the vaccination instead of dropping out (Brewer, Chapman, Rothman, Leask, & Kempe, 2017). The findings could inform policymakers, managers, and immunization program service providers of the gaps that must be addressed to solve the problem of low reporting of AEFI and high immunization dropout (Baguune et al., 2017; Haji et al., 2016; Jegede & Owumi, 2013; Tsafack & Ateudjieu, 2015). The dependent variable (DV) for the study was immunization dropout due to AEFI while the independent variables (IVs) were the immunization uptake factors: (a) number of children taken for RI, (b) number of children completing RI schedules, (c) child having AEFI, (d) number of children with AEFI, (e) type of AEFI, (f) AEFI not reported to health facility, (g) reason for not reporting AEFI, (h) caregivers' knowledge of type of AEFI, (i) preferred place of treatment for AEFI, (j) reason of choice of preferred place for treatment, (k) benefits of completing immunization, and (l) willingness to complete immunization by reporting AEFI to health facility for appropriate assistance.

## Theoretical Model

The purpose of this quantitative correlational study was to examine if, and to what degree, a relationship existed between the rate of reporting of AEFI to health facilities and rate of immunization dropout. This research was placed in a theoretical context that the low reporting of AEFI negatively influenced the immunization dropout. This was in the sense that caregivers perceived the AEFI as threat to continuing immunization so they stopped and did not complete the schedules which require five visits to the immunization sessions (Glanz, Lewis, & Lewis, 2002). The health belief

model (HBM) served as the theoretical foundation. This model posits that one's belief in a threat and the effectiveness of the recommended health behavior (RHB) would predict the likelihood of adopting the behavior (Painter et al., 2010; Reynolds, 1971). This model has six major constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (Painter et al., 2010). In normal circumstances, a caregiver would report any AEFI to the nearest health facility or the RI clinic where the child received the vaccination for appropriate medical assistance. However, the low rate of reporting of such incidents to health facilities indicated that some caregivers did not present AEFIs at health facilities for medical help as expected. They likely dropped out of the immunization due to the unpleasant feeling of the children as a result of the AEFI or inconvenience experienced by the caregivers as children showed painful signs and symptoms with associated sleeplessness. These unpleasant feeling of both caregivers and children might constitute a barrier to continuation of immunization (Royal Society for Public Health, 2009).

Ideally, the caregivers would present the AEFIs at health facilities and get the needed medical attention, which would remove the barrier preventing them from continuing the immunization (Brewer et al., 2017). This help is likely to go a long way to boosting their confidence and edge them to complete the immunization schedule. Such caregivers are likely to be satisfied with the immunization services and share their positive experience and ideas with others including immunization program implementers. This would be a positive behavior change for immunization success (Brewer et al., 2017). This model has been extensively used to explain health related

behaviors (Galvin, 1992; Glanz, Lewis, & Lewis, 2002; Reisi et al., 2014). In this dissertation, behavior of caregivers of infants enrolled in immunization programs was studied and used the HBM to explain the influence of low AEFIs reporting on immunization dropout.

## Research Questions

Low reporting of AEFIs and high immunization dropout have been of concern to the state primary health care development agency (SPHCDA) (Ministry of Health, 2017). The state and local government areas (LGAs) have linked these concerns to the low uptake of complete immunization in the area (Ministry of Health, 2017). There are impacts of full immunization and consequences of incomplete immunization as well as needed interventions to address AEFIs and immunization dropout (Haji et al., 2016). There have also been evidence of adverse events associated with or following immunization (Muchekeza et al., 2014), but no clear evidence has been provided on the effect of low rate of reporting of AEFIs on immunization dropout. The SPHCDA has the unique characteristic of offering fixed and outreach immunization services, but many of the infants who start the immunization do not complete the schedules for varied reasons. Low rate of reporting of AEFIs to health facilities by caregivers might lead to high rate of dropout and eventual unsuccessful completion of RI sessions. Yet, no clear information about how the two variables relate was available. Therefore, the following three research questions were used to gain insight into the influence of low reporting of AEFIs on dropout and the elements that impact successful completion of RI. Based on

the results of this study, some recommendations were made for future directions of the RI delivery package in the state that positively impact children's fully immunization.

RQ1: How would the threat of low reporting of adverse event following immunization (AEFI) and perceived severity of the event influence immunization dropout?

$H_o1$: There was no statistically significant influence of low reporting rate of AEFI on immunization dropout.

$H_1 1$: There was a statistically significant influence of low reporting of AEFI on immunization dropout.

RQ2: In what way would the caregivers whose infants have dropped out of RI program because they perceived their children as susceptible to AEFIs enhance their reporting of AEFIs to health facilities?

RQ3: How would the perceived benefits of immunization enhance the cues to action of caregivers enrolled in RI program to ultimately complete the RI schedules?

## Significance of the Study

This study has provided evidence that could influence programmatic planning and client decision about presenting AEFIs at health facilities to avoid dropout by caregivers. The study has shown that low rate of reporting of AEFI significantly influence immunization dropout. This has bridged the gap in literature in the field of immunization in general, and particularly that on the influence of low reporting rate of AEFIs on dropout. With this study findings, Jigawa State health officials are likely to

have clear insight regarding how the two occurrences relate and would be better able to plan for specific strategies to counteract their effects on immunization success. The findings and recommendations may guide future decisions, strategies, policies, resource investments, and appropriate behavior change interventions of the state for improving immunization coverage through improved AEFIs reporting at health facilities and reduction of dropout. Such efforts by the state would likely promote sustenance of future reporting of AEFIs at health facilities for appropriate medical attention and minimize dropout. It is expected that these efforts would enhance complete immunization of future children. Such increase in fully immunized children could sustain herd immunity against VPDs and the children would be healthier and be able to live up to their social responsibilities in childhood and likely adulthood (Shen, Fields, & McQuestion, 2014; WHO & UNICEF, 2014). Presently, because more infants were dropping out of RI, due to AEFI, outbreaks of VPDs were common in the state (Ministry of Health, 2017). This research may contribute to improved future social status of the state in that the money, time, human, and other resources, which otherwise should have been used to fight future outbreaks of VPDs, could be saved and used to build social infrastructures and provide social amenities which could improve peoples' lives and living conditions.

## Definition of Terms

*Reporting AEFI:* Notifying the orthodox health care delivery system (health facility or RI clinic) of the event (AEFI) by caregivers.

*Adverse event following immunization (AEFI):* "Any untoward medical occurrence which follows immunization and which does not necessarily have a causal

relationship with the usage of the vaccine. The adverse event may be any unfavorable or unintended sign, abnormal laboratory finding, symptom or disease" (WHO, 2016c).

*Dropout:* Failure to return for vaccination for four weeks or more from date of last visit.

*Caregiver:* Anyone (including parents) who provided care to the sampled child.

*Fully or completely immunized child:* Any child who received one dose of BCG, four doses of OPV, three doses of Penta, one dose of Measles, and one dose of Yellow fever vaccines as per the schedule in the country. This translates to a total of five vaccines and 10 doses received at a total of five visits to health facility or any RI service delivery point or clinic.

*Partially immunized child:* Any child who misses any of the prescribed vaccine doses. A child is said to be protected against VPDs if he or she had received all the antigens as prescribed and at right schedule.

*Not immunized child:* Any child who received none of the prescribed doses of vaccines for protection against VPDs.

*Ward:* The smallest political unit in the country with a defined geographical area. Average number of settlements that constituted a ward in the state was 41.

*Children:* Individuals aged between 0 and 5 years.

*Infant:* Individual aged between 0 and 12 months.

## Assumptions of the Study

This study was guided by the assumptions that all the data collection tools for appropriate documentation of AEFI reported by caregiver were available in the health

facilities. Therefore, AEFI would have been documented if caregivers had reported (i.e., notified the health care delivery system). The health care workers have been well trained in documentation and management of AEFI. It was also assumed that the zeal of completing immunization for their children encouraged caregivers to show interest in the study and persisted to complete the interviews. Further, it was assumed that participants provided honest answers to the survey questionnaires and that the data collected was accurate. Another assumption was that participants understood that their confidentiality was maintained, their answers were respected, and no repercussions would take place for participation or lack thereof. All participants had experience of RI, and were able to share ideas in how to uphold AEFI reporting and completion of RI schedules.

## Summary

This chapter was an introduction to the study of whether or not immunization dropout was linked to low reporting of AEFI to health facilities by caregivers. Findings could be relevant to public health workers seeking to put in place strategies to improve immunization completion rates. The recommendations from this research could further highlight issues associated with the low rates of completion of immunization. The next chapter (chapter 2) reviewed the literature in relation to dropout behavior, low immunization uptake factors, as well as social and public health implications of low population immunity.

# Chapter 2: Literature Review

## Introduction

A literature review offers a scholarly account of what has been published on a topic. It covers the current knowledge or substantive findings by researchers and scholars. It thus explains the known and unknown about the topic of inquiry and indicates any knowledge gap in a particular area of study. A literature review justifies undertaking a study (Bowling, 2009; Polit & Beck, 2014; Yoon, 2015). It helps the researcher identify the concept of the research in broad perspectives, rationalize research decisions, and determine what the research is or is not in the course of the review (Bergold & Thomas, 2012). A search of academic databases via the Walden University Library was done to gather relevant literature on how the low rate of reporting of AEFI influences immunization dropout. Specifically, the University's public health database and the library catalogue in addition to PubMed, PubMed Central, Medline, BioMed, BioMed Central, CINAHL, Cochrane library, Health sciences collection, and the Google search engine were used. Additional sources included major health organizational sites such as the WHO, National Health Service (NHS), and United Nations agencies such as United Nations Development Program (UNDP), UNICEF, and United Nations Population Fund (UNFPA). Governments' health websites of countries such as United States of America, Britain, Australia, and Nigeria were also explored. Abstracts of articles and relevant information from databases that did not grant permission to view the full versions of articles were retrieved. Some relevant literature was retrieved using the reference lists of other articles. In the following sections, themes that emerged from

careful reading and review of literature on RI, AEFI, immunization dropout, and ways of improving reporting of AEFI and completion of immunization were discussed.

## RI

The WHO (2017a) defines immunization as the "process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine" (p.1). This immunity is usually gained through RI. According to the WHO (2017a), RI is the sustainable, reliable and timely interaction between the vaccine, service provider (one who administers the vaccine), and the child or client (one who receives the vaccine) to ensure every person is fully immunized against VPDs. Strengthening RI is one of the pillars of public health (PH) for disease control, elimination, or eradication strategies (Roberts et al., 2015; Schneider, 2011). Vaccines of all forms work to protect an individual against subsequent disease or infection by stimulating the body's own immune system. In Nigeria, an infant requires a total of five visits to a health facility or any RI clinic to get fully immunized.

### Importance of Immunization

Literature shows that maternal immunity is not sufficient to protect infants against VPDs such as poliomyelitis, whooping cough, tetanus, measles, and tuberculosis (Immunization Coalition Action [ICA], 2014). So, many unimmunized children died from VPDs such as measles, polio, whooping cough, tetanus, yellow fever, and the like before RI was introduced (CDC, 2014b). These diseases are now preventable by vaccines to a very large extent. Through immunization, a disease like poliomyelitis (polio) was on the verge of being eradicated (ICA, 2014). Polio occurred in fewer places

than ever (Porter, 2012), with the year 2018 recording the lowest incidence in history in the endemic countries including Pakistan, Afghanistan, and Nigeria (Global Polio Eradication Initiative [GPEI], 2018). Good health and survival of children have been associated with immunization because it reduces morbidity and mortality (Ophori, Tula, Azih, Okojie, & Ikpo, 2014). Its contribution to lowering the incidence of diseases results in less frequent visits to health facilities by caregivers. Immunization is a cost saving and cost effective public health intervention (NVAC, 2013). Aside from its cost effectiveness, immunization minimizes the anxiety associated with raising children such that caregivers of fully immunized children usually worry less about their children suffering from VPDs (Ophori et al., 2014). It is a bridge to other life-saving care, particularly for infants in especially isolated and hard to reach families or settlements (UNICEF, 2016). Immunization is one of the cost effective and most successful PH investments one can make for future generations (UNICEF, 2016).

## Immunization as Global Child Survival Strategy

Immunization now protects children more than ever before (UNICEF, 2016). It is a reliable service that improves child survival rates (Etokidem & Johnson, 2016). It keeps children healthy and alive as it protects them against diseases (UNICEF, 2016). Over 3 million deaths each year are estimated to be averted by immunization, and nearly one in three deaths among children is prevented by vaccine (Lassi et al., 2014; UNICEF, 2016). For this reason, researchers have highlighted the importance of immunization and the need for an infant to complete all doses of a vaccination (Van der Maas et al., 2014). Research findings have supported the push by the WHO and other affiliates for an

expanded program on immunization (EPI) that aims at getting every child fully immunized (Sheikh et al., 2013). Despite the efforts of these organizations and governments, in many countries immunization efforts have not been as successful as hoped (Sheikh et al., 2013). There are many unvaccinated children who remain at risk of VPDs in many countries, especially in sub-Saharan Africa (Sanou et al., 2009). Nearly 19.4 million children, or one in five infants, missed out on the basic vaccines in 2015 (UNICEF, 2016). Meanwhile, they needed these basic vaccines to stay alive and healthy (Immunization Coalition Action, 2014). The children who continue to be the least likely to get or complete immunization are the poorest and most vulnerable (Adedire et al., 2016; UNICEF, 2016). These are the ones who need immunization the most due to their compromised immunity by infections and undernutrition. Low levels of immunization negates gains in other areas of health and well-being for children (UNICEF, 2016). Therefore, completed immunization has to be prioritized such that it gets to the most marginalized children to promote their life and prevent avoidable deaths.

## RI Schedules and Type of Antigens Used in Nigeria

Vaccines being used in Nigeria as prescribed by the NPI for RI are BCG (bacilli Calmette Guerin), hepatitis b, polio (oral polio vaccine [OPV] and injectable polio vaccine [IPV]), pentavalent (diphtheria, pertussis, tetanus, hepatitis b, and hemophilic influenza type b), measles, and yellow fever (NPI & UNICEF, 2016). The schedule for administration of these vaccines, as approved by the NPI, is as follows:

- BCG and hepatitis b, at birth (i.e. within 28 days of birth).
- Polio OPV at birth, 6 weeks, 10 weeks, and 14 weeks; IPV at 14 weeks.

- Pentavalent at 6 weeks, 10 weeks, and 14 weeks.
- Measles and yellow fever at 9 months.

These schedules suggest that an infant has to be presented at a health facility or any RI clinic or service delivery point five times (i.e. at birth, Week 6, Week 10, Week 14, and 9 months of age) to have him or her fully immunized. The Federal Ministry of Health (FMoH) considers a child as fully immunized if he or she receives all these vaccinations as per the appropriate schedules in the first year of life (infant). BCG vaccine is administered to get children protected against tuberculosis. Three doses of pentavalent are for protection against diphtheria, pertussis (whooping cough), tetanus, hepatitis b, and hemophilic influenza type b. Three doses of OPV and one dose of IPV are for protecting the children against polio disease, which has been globally earmarked for eradication. Nigeria is the only country in Africa and among the three countries (including Pakistan and Afghanistan) in the world that are still endemic with polio disease (GPEI, 2018). So, polio was declared a public health emergency in the country and vaccination against polio was a top priority of the FMoH. One dose each of measles and yellow fever vaccine protects the child against such diseases. If not for defaulting in immunization schedules and eventual dropout (as high as 65%), many children aged between 12 months and 23 months would complete immunizations and be fully immunized. Nigeria fortunately keeps track of the delivery of immunization services by offering each child who gets vaccinated as part of RI for the first time an immunization card on which each dose of antigen administered to the child is recorded.

## Immunization Dropout

In Nigeria, the national expanded program on immunization (EPI) is led by the NPHCDA. This agency, for operational purposes, defines dropout rate as percent of children who received Penta1 but did not complete the 3-dose Penta series. This definition is used to prompt quick interventions aimed at addressing immunization defaulting and eventual dropout issues. Dropout is considered to be the difference in uptake between two different doses of vaccine in sequence. So, using pentavalent vaccine (Penta) as proxy, a child received penta1 but could not follow through to have Penta3. Usually, Penta is used by proxy (as in the case of Nigeria) to measure immunization dropout among a cohort of children. Penta is also known as DPT-HepB-Hib vaccine. Other EPI services see dropout as a child starting the immunization schedule but failing to complete it (i.e., the child received BCG at birth but could not follow through to receive measles and yellow fever at age 9 months). By this, dropout rate is measured by comparing the number of infants who start the immunization schedule with the number who complete it (BCG to measles or Penta1 to Penta3).

According to Baguune, Ndago, and Adokiya (2017), the WHO recommends immunization dropout rate of 10% or less. Thus, targeted actions are required to address the reasons or factors if EPI records a dropout rate of more than 10%. High dropout rates have been noted in studies in many sub-Saharan African countries such as Ghana, Nigeria, Zimbabwe, Kenya, Ethiopia, and Uganda, and several interventions aimed at reducing it have been used (Baguune et al., 2017; Haji et al., 2014; NPHCDA, 2017; Roberts et al., 2015). In Nigeria, the recently released 2017 National Immunization

Coverage Survey (NICS) report puts national immunization dropout rate between Penta1 and Penta3 dose at 31%, while the African average is 11% (NPHCDA, 2017). The survey focused on children aged between 12 and 23 months who by Nigerian RI schedule were supposed to have completed their immunization and be fully immunized. For Jigawa State where this study was conducted, the dropout rate as reported from the 2017 NICS findings was 63.6% (using the Penta1 and Penta3 coverage) and 65.0% (using BCG and yellow fever and measles coverage). This finding clearly showed that Jigawa State has a problem with immunization dropout. Meanwhile, evidence of low rates of reporting of AEFI contributing or otherwise to this high dropout was not adequately available. A child who drops out of immunization is known from the health facility or RI clinic through the immunization register or at home through the child's immunization card. In this study, dropout children were identified from the health facility immunization register.

## Interventions for Reducing Dropout

Several strategies and interventions have been used to reduce dropout rates in many countries (Haji et al., 2014). These included (a) sticker reminders strategically placed within the home with recommended return dates for vaccination; (b) use of postcards, automated telephone, or mails reminders; (c) outreach immunization services; (d) use of mobile phones to remind mothers or caregivers on return days for immunization; (e) linking immunization to free treatment of minor ailments and supply of nutritional supplements; (f) provision of training for immunization service providers; and (g) use of short message services (SMSs) through mobile phones (Bangure et al.,

2015; Haji et al., 2014). Another intervention was the use of community volunteers engaged in community-based communication with the aim of prompting RI defaulting caregivers to go for the service (Ophori et al., 2014). Muchekeza et al. (2014) also reported the use of the AEFI surveillance and training of health workers to reduce immunization dropout. Though these interventions or strategies to some extent resulted in reduction of dropout for immunization services, none of such interventions was linked to reasons or approaches that relate to addressing low reporting of AEFI to health facilities.

## Uptake of Immunization in Nigeria

Low vaccination uptake is associated with outbreaks of VPDs (Haji et al., 2014). Yet, from the 2017 NICS report 40% of children (12-23 months) in Nigeria did not receive any vaccine through the RI system even though most live close to RI-designated health facilities. From the survey report, only 7.1% of children (12-23 months) of Jigawa State were fully immunized as against a national average of 22.9%. A study in Nigeria by Henry and colleagues as reported by Ophori et al. (2014), showed that only 5.1% of one year olds received all the 3 doses of the diphtheria-pertussis-tetanus (DPT) containing vaccines while that of the children aged 12-23 months was 2.2%. According to the WHO (2016b), Nigeria in May 2012 joined other member states of the World Health Assembly (WHA) to endorse the Global Vaccine Action Plan (GVAP) agenda for universal access to immunization by 2020. Yet, immunization uptake in the country as per community-based assessments (e.g. coverage surveys) has been consistently low. A publication by Adedokun, Uthman, Adekanmbi, and Wiysonge (2017) showed that

proportion of children that completed immunization schedules (i.e. fully immunized) in Nigeria between 1990 and 2008 ranged from 13% to 30%. The Nigeria Demographic and Health Survey (NDHS) data published in 2013 showed that RI coverage of infants for all recommended antigens saw a marginal rise from 21% in 2003 to 25% in a decade (National Population Commission and ICF Macro, 2013). These findings point to the fact that immunization coverage has remained poor in the country for a long time. Yet, evidence of any association between this (low immunization uptake) and low reporting of AEFI seems to be lacking.

## Adverse Events Following Immunization (AEFI)

AEFI may result from vaccine reactions or program errors, or coincidental events, or injection reaction, or an unknown event, and can negatively affect the desire or interest of caregivers to continue with the immunization schedule. So, surveillance system is usually put in place in immunization programs to detect AEFI early enough for prompt and appropriate response (Muchekeza et al., 2014). This early detection and prompt response is necessary to lessen the impact on the individual, the immunization program, and the health of vaccines. Unfortunately, the AEFI surveillance system seems not to be strong in the state and many AEFI remain unreported. To facilitate the ease of surveillance and documentation of AEFI in the EPI program, the WHO has developed generic guidelines that can be adapted to local situations (WHO, 2013). Normally, the documentation should be event or case-based (i.e. each AEFI should be notified, documented, and investigated by designated health worker using the appropriate reporting forms) but many caregivers do not report such events to health facilities or

immunization service delivery points. The reasons for the low reporting can be many and varied (WHO, 2013).

## Reasons for Low Reporting of AEFI

Literature is clear about immunization resulting in AEFI (Muchekeza et al., 2014; Tsafack & Ateudjieu, 2015; Yu, 2015). However, many reasons account for why caregivers do not report AEFI to health facilities or immunization service delivery points (RI clinics). The reasons can be attributed to the role of the health system, health worker or immunization service provider, and the caregiver.

### Role of Health System

The health system in place is supposed to have all the necessary AEFI surveillance forms to be able to document any AEFI reported to health facilities. Strong AEFI surveillance system is needed for improved reporting of AEFI (Muchekeza et al., 2014). The Nigerian AEFI notification guidelines require a complete documentation on any AEFI reported. Therefore, absence of relevant AEFI data or information capturing tools or forms and its management inputs at the reporting sites can deter the reporting. In view of this, all immunization service providers, disease surveillance and notification officers (DSNOs), local immunization officers (LIOs), front line health workers (e.g. clinicians, prescribers, nurses) have been trained on AEFI detection, investigation, and notification. Again, all health facilities in the state have been equipped with all the relevant AEFI notification forms. Availability of these forms is very important for improved AEFI documentation (Adedokun et al., 2017). AEFI documentation forms made available at the primary health care (PHC) facilities and vaccination posts included

the notification form, investigation form, linelist form (for all minor and serious AEFI), summary forms (for serious AEFI), and monthly AEFI surveillance report (specific for RI). At the designated referral health facilities, AEFI forms made available were investigation forms (for serious AEFI), summary form for AEFI investigation (for serious AEFI), laboratory request forms (for serious AEFI), and autopsy forms. For summarizing all the documented AEFI at local government area (LGA) level, each LGA has been provided with monthly LGA summary of AEFI surveillance report (specific for RI), AEFI investigation form (for serious AEFI), LGA AEFI summary forms for all AEFI (minor and serious), blank copies of all forms (for replenishment to health facilities and referral health facilities). Additionally, AEFI investigation, documentation, and management guidelines; data and decision flowchart; treatment protocol; as well as AEFI kits have been made available to all health facilities. AEFI case definitions have also been displayed in all health facilities. These are part of the efforts made to improve the documentation of AEFI but still the AEFI reporting to the RI service delivery points or health facilities has been very low and the numbers are insignificant.

**Role of Health Worker**

Having equipped all the health facilities with the necessary AEFI information and data tools, the onus rested on the health workers to document all the AEFI reported. However, inadequacy of knowledge and management skill of health workers on AEFI have been noted as the main challenges to reporting AEFI (Muchekeza et al., 2014). To address this challenge, health workers have been trained in AEFIs definition, detection, management, treatment, and notification to the AEFI surveillance system. By these

interventions, no health facility or health worker has reason(s) for failure to document and notify the surveillance system of AEFI cases reported to the health facility.

**Role of Caregiver or Client**

A caregiver's lack of knowledge or awareness on AEFI can result in weak reporting to health facilities (Adedokun et al., 2017; Muchekeza et al., 2014). However, as part of the efforts being made to overcome this problem, each immunization session was preceded by health talk on AEFI. Notwithstanding, the quality of the health talks and the extent to which they informed or educated the caregivers needs to be assessed in another study. Aside knowledge and awareness gaps on the part of the caregivers, other factors come into play to influence low reporting of AEFI to health facility (Adedokun et al., 2017; Aina & Ejembi, 2013; Ateudjieu et al., 2014; Muchekeza et al., 2014; Sanou et., 2009; Tsafack & Ateudjieu, 2015). These factors include poor health care seeking behavior, no felt need attitudes, inaccessibility, wrong thoughts and fear of immunization, service unavailability, low conviction of value of orthodox treatment, preference to home treatment, non-perceived severity of AEFI, ineffective communication, wrong religious notion, and low socioeconomic status (Adedokun et al., 2017; Aina & Ejembi, 2013; Ateudjieu et al., 2014; Muchekeza et al., 2014; Sanou et., 2009; Tsafack & Ateudjieu, 2015). For a child to have AEFI, it means he or she has been presented to the facility before for immunization. This may suggest that the caregiver values immunization and other preventive health care. It could also be said, such caregiver has positive attitude, capability, and interest of visiting health facility. Therefore, the reason for not going back to report any adverse event experienced by the

child or infant after an immunization might either be lack of knowledge or something else. This means that reason might have contributed to the dropout. Probably, the caregiver saw the AEFI as disturbing or traumatic for the child and himself or herself. So, he or she decided not to have anything (especially related to immunization) to do with the health facility anymore. By this, the caregiver has failed to report the AEFI and also dropped out of the RI services.

## Types and Categories of AEFI

Adverse events following immunization (AEFI) are of two types. They can be serious or minor. Whatever it is, a caregiver should have the motivation to report it to the health facility or RI service delivery point where the child was vaccinated or any available clinic for appropriate medical attention.

### Types of AEFI

The serious type of AEFI is an event causing a potential risk to the health or life of the recipient of the vaccine. AEFI is said to be serious if it results in life threatening conditions; hospitalization or prolongation of existing hospitalization (e.g. encephalopathy, seizures, aseptic meningitis); persistent or significant disability or incapacity (e.g. paralysis); congenital anomaly or birth defect; death; or requires intervention to prevent permanent impairment or damage. The minor ones are those events that are not serious and do not pose potential risk to the health of the person who was vaccinated. However, all AEFI, whether minor or serious are supposed to be reported into the AEFI surveillance network and entered into an AEFI line list in health facilities. ‘Serious’ is not synonymous with ‘severe’. Serious is based on the event

outcome and serves as a guide for defining regulatory reporting obligations or criteria for action. In this context, the term severe should not be used as it connotes a measure of the intensity or severity of the event (as in mild, moderate, or severe) although the event itself may be of relatively minor medical significance (such as severe headache).

**Categories of AEFI**

The World Health Organization and Council for International Organizations of Medical Sciences (CIOMS) currently revised the existing AEFI classification to cause-specific categorizations and introduced the following five categories (WHO, 2017b).

1. Vaccine product-related reaction. These categories of AEFI are caused or precipitated by a vaccine due to one or more of the inherent properties of the vaccine product. Example of this category of AEFI is extensive limb swelling following DTP or Penta vaccination.
2. Vaccine quality defect-related reaction. These are AEFI that are caused or precipitated by a vaccine due to one or more quality defects of the vaccine product including its administration device as provided by the manufacturer. Example of such AEFI is a case of paralytic polio due to failure by the manufacturer to completely inactivate a lot of the inactivated polio vaccine.
3. Immunization error-related reaction. This category of AEFI is caused by inappropriate vaccine handling, prescribing, or administration. Example, transmission of infection by contaminated multi-dose vial. Potential causes for immunization errors include non-sterile injection, reconstitution error, injection at incorrect site, vaccine transported or stored incorrectly, and

contraindications ignored. Immunization errors can result in a cluster of events. Cluster of events is two or more cases of the same adverse event related in time, place or vaccine administered. Evidence of clustering is AEFI occurring with unusual frequency, by vaccine, by type of reaction, or by locality or health facility.

4. Immunization anxiety-related reaction. An AEFI arising from anxiety about the immunization. Example, vasovagal syncope in especially adolescents following vaccination. Episodes of immunization anxiety include fainting, hyperventilation, vomiting, and convulsions.
5. Coincidental event. These are AEFI caused by something else other than the vaccine product, immunization error, or immunization anxiety. Example, fever after vaccination (temporal association) and malarial parasite isolated from blood. Tsafack and Ateudjieu (2015) in a randomized field trial study on improving community based AEFI reporting rate through telephone "beep" in a Cameroon, realized that 35% of the AEFI reported were coincidental fever.

## Classification of Vaccine Reactions

A vaccine reaction is an individual's response to the inherent properties of the vaccine, even when the vaccine has been prepared, handled, and administered correctly. From the study by Tsafack and Ateudjieu (2015), 45% of reported AEFI were local reactions at the site of injection. There is low public tolerance of vaccine adverse reactions (Tsafack & Ateudjieu, 2015). So, vaccines are only licensed when the

frequency of severe reactions is very rare and when only minor or self-limiting reactions are reported. Vaccine reactions can be classified into minor and severe reactions. The minor types usually occur within a few hours of injection. It is caused when the recipient's immune system reacts to antigens contained in the vaccine. Minor reactions are resolved after short period of time and pose little danger. It is usually localized (includes pain, swelling or redness at the site of injection) and systemic (includes fever, malaise, muscle pain, headache or loss of appetite). The severe reactions usually do not result in long-term problems. However, they can be disabling and rarely life threatening. Such reactions include seizures and allergic reactions caused by the body's reaction to a particular component in a vaccine. Based specifically on (a) cause and (b) severity and frequency, vaccine reactions may be grouped into two broad categories. These are cause-specific vaccine reactions (i.e. vaccine product-related reaction and vaccine quality defect-related reactions) and vaccine reactions by severity and frequency (i.e. common - minor reactions and rare-serious reactions).

## Interventions for Improving Reporting of AEFI

Knowing the extent of AEFI prevalence in communities through reporting is important. Such reports provide better understanding of the safety issues around vaccines. Immunization clients reporting of AEFI allow the immunization program implementers to monitor the rates and trends of the events in an area. Reporting also assists in identifying issues related to the vaccine manufacture, incorrect vaccine handling, administration, storage, and delivery. Increased reporting of AEFI is likely to improve adverse events safety, information and education strategy, as well as sharpening

the skills of health care providers in the management of AEFI. In view of this, some interventions have been carried out in various settings to improve community initiated AEFI reporting to health facilities. In Cameroon for instance, interventions such as use of telephone “beep” (Tsafack & Ateudjieu, 2015) and sending weekly short text messages or weekly supervisory visits (Ateudjieu et al., 2014) to remind immunization clients on AEFI reporting have been tried. Yet, no significant and sustained increase in AEFI reporting was achieved. Others have tried community-based active AEFI case search or surveillance with intention of improving AEFI reporting as recounted by Muchekeza et al. (2014) but still AEFI reporting remained as an issue in many immunization program settings.

## Link between AEFI and Immunization Dropout

Prior to this study findings, no clear cut information which showed the link between low reporting of AEFI and immunization dropout existed. However, common sense and normal thoughts could easily predict a link between AEFI and dropping out of immunization. For instance, a caregiver who had a sleepless night due to child suffering from AEFI might not be motivated to present same child for the second and subsequent doses of same antigen (vaccine) or even a different type. By this, the child would possibly be a defaulter at the next immunization session and eventually become a dropout of the immunization services. Meanwhile, evidence showing the association between these two variables (AEFI and dropout) seemed non-existing or very limited in the state and in literature. If care is not taken, this caregiver with such undesired experience might influence other caregivers to avoid immunization. This phenomenon

could cyclically or sequentially results in increased number of caregivers boycotting immunization and thereby leading to high dropout and unimmunized children.

## Factors Predicting Immunization Dropout

Different studies have predicted that certain factors promote dropout and slow down immunization uptake rates. These included low awareness, little knowledge, poor attitudes to preventive care, inappropriate health seeking behavior, inaccessibility to health facility, unclear thoughts and fear of immunization, service unavailability, weak parental conviction of value of immunization, ineffective or insufficient communication, misguided religious beliefs, and poor socioeconomic status or conditions (Adokiya, Baguune, & Ndago, 2017; Aina & Ejembi, 2013; Sanou et., 2009). Other predictions as made by Baguune et al. (2017) showed that factors such as marital status, religion, sex of child, and possession of immunization card were statistically significant with immunization dropout. Baguune and colleagues (2017) further explained that children from unmarried mothers or homes were more likely to drop out of immunization services than their counterparts from married mothers or homes. Again, Christian mothers were less likely to have their children dropped out of immunization services than non-Christians. Female child was less likely to drop out of immunization schedule than the male counterpart. Also, children who possessed immunization cards were less likely to drop out than those without it.

A study by Jegede and Owumi (2013) in the southwest of Nigeria showed that delays in vaccine supply, negative attitude of staff members of immunization clinics, clash of vaccination day with other must-do socioeconomic activities of caregivers

(especially the market days) significantly contribute to increased defaulting and eventual dropout. Nonetheless, the study indicated that patronage of immunization services was not strongly influenced by perceived side effects of vaccines (Jegede & Owumi, 2013). What was not made clear in the study was whether such patronage has been occurring in a sustained manner and had contributed to a reduction of the dropout rate or had improved the fully immunized status of children. Guided by these predictions, many interventions have been put in place in many immunization programs to address the dropout and improve uptake but in all of those, the role of low reporting of AEFI in dropout has remained unclear or silent.

## Factors Linked to Immunization Compliance

Literature is very clear about the fact that some factors are positively linked to improved immunization uptake and by proxy reduced dropout (Adedokun et al., 2017; Aina & Ejembi, 2013; Sanou et al., 2009). Such factors included availability of services, easy access, adequate awareness, being well-informed, healthy care seeking behavior, right attitudes to preventive health services, and caregiver conviction of value of immunization. Others are positive thoughts and acceptance of immunization, effective communication, right religious beliefs, and improved socioeconomic status. According to Aina and Ejembi (2013) these factors have very high chances of helping or influencing a caregiver to present a child at an appropriate site for vaccination and ensuring that the child gets fully immunized. These immunization enhancement or compliant factors work individually or collectively to address the issues related to an individual, community, or society that hinder optimal uptake of immunization. Presence

of such favorable factors take care of place of residence or proximity to services, difficulty experienced in getting to health facilities (either by distance, terrain, or lack of transportation), ethnicity diversity index, and other social or economic related hindrances (Adedokun et al., 2017). Wide range of effective, efficient, appropriate, and targeted communication interventions also promote uptake of childhood immunization (Oku et al., 2016).

Political support has been a very big booster and major facilitator to immunization activities in the research location. Locally available mass vaccination campaign data has it that campaigns which were preceded by flag-off led by the state governor recorded higher coverage and lesser number of non-compliant households than those without pre-implementation flag-off (NPI, 2017). However, a detailed study is needed to affirm this assertion. RI also tends to be stronger with improved coverages in areas where the state and local governments have thrown their personal and political weight behind the program (Callaway, 2013). Reaching the settlements with RI services by way of outreach or mobile outreach sessions have been shown to be effective in areas where physical distance was identified as a barrier (Crocker-Buque, Mindra, Duncun, & Mounier-Jack, 2017). Interventions such as community-based education or awareness creation programmes, effective use of SMS messaging services, and financial incentives have also proven to be boosters of immunization compliance (Crocker-Buque et al., 2017). However, no locally-based report or study findings which showed the enhancers to immunization uptake in the state existed but the findings of this study have unveiled the enhancers to AEFI reporting and completion of RI schedules in the locality.

## Barriers to Completing Immunization Schedules (Fully Immunized)

The 2017 NICS report released by the Nigeria National Bureau of Statistics attributed the non-fully immunized status of children to four broad reasons. These were (a) lack of awareness (42%); (b) service delivery issues (25%); (c) mistrust or fear (22%); and (d) lack of time, money for transportation, or other family issues (18%). The mistrust or fear might include episode of AEFI. Usually, reasons for unimmunized were provoked or invoked by state, community, and individual related factors. These factors (extensively explained below) significantly influenced incomplete child immunization or child not exposed to immunization at all. This suggested that, state, community, and individual level characteristics should be taken into consideration in all interventions aimed at improving the uptake of immunization. These factors are to be properly considered during planning; formulation; and implementation of activities, strategies, or policies by non-governmental and governmental organizations. It is of great benefit to improving childhood immunization coverage if all factors linked to the expected success are considered (Adedokun et al., 2017).

Weak communication and its associated interventions also contributed to incomplete immunization (Opel et al., 2015). In fact, work done by Oku and colleagues (2016) showed that wide range of effective communication interventions promoted uptake of childhood immunization. Other critical barriers to immunization in particularly north of Nigeria where this study took place were no felt need for immunization and vaccination non-compliance (i.e. households refusing vaccination). In many northern Nigeria communities until recently, 4-5 households out of every 10

(40%-50%) refused at least a type of vaccination (Callaway, 2013). Recent rounds of mass polio vaccination campaigns conducted in the state reported an average of 6,057 non-compliant children per round (NPHCDA, 2017). Caregivers alleged that the vaccine was a western conspiracy to make the population sterilize (Callaway, 2013). Due to non-compliance, the vulnerable populations were still facing the menace of VPDs and many children suffered or died of VPDs each year (National Population Commission, 2014; NPI, 2017).

Migration has also been noted to be an important determinant of vaccination participation (Antai, 2010). However, how it influences non-compliance has not been adequately researched. Refusing vaccination services have been linked to migrant populations in the locality but no published data or credible documented evidence has been made available (NPI, 2017). Therefore, it is worthwhile to uncover the influence of migration on the non-compliance situation in the locality.

## Effect of Vaccination Non-Compliance

Globally, close to 95% of an estimated 14 million deaths of children less than 5 years old occurred in developing countries and approximately 70% of these deaths were VPDs related (Shann & Steinhoff, 1999; UNICEF, 2015). Again, childhood illnesses (especially the vaccine preventable types) adversely affected children at high rates (Aina & Ejembi, 2013; Sanou et al., 2009). Yet, refusal of immunization services has been very common among individuals, households, and settlements in northern Nigeria (Callaway, 2013; NPHCDA, 2017). The phenomenon has contributed to children suffering or dying of VPDs each year (National Population Commission, 2014).

According to Ogunjimi, Ibe, and Ikorok (2012) and UNICEF (2015), Nigeria recorded deaths of 23,000 to 25,000 children and 145 women of childbearing age every day. This made the country the second largest contributor to the maternal and child mortality rate in the world (UNICEF, 2015). Tetanus, which was highly preventable by vaccination was noted as one of the causes of maternal and child deaths (UNICEF, 2015). Other VPDs of concern were measles and polio. All the diseases are vaccine preventable but due to non-compliance they significantly feature in many settlements. The non-compliant attitude had contributed to Nigeria being one of the least successful African countries in the past 40 years when it comes to achieving improvements in child survival (National Population Commission, 2014). As highlighted by the National Population Commission (2014) the attainment of the two most critical health-related Millennium Development Goals (MDGs) of reducing the maternal mortality and child mortality could not be reached by the 2015 end line.

## Factors Affecting RI

Immunization uptake rates in northern Nigeria were among the lowest in the world (Ophori et al., 2014). This state of affairs has been linked in many studies to funding constraints, poor economic conditions, little knowledge about immunization issues, insufficient communication, inadequate infrastructure and equipment, health worker-related, political, and community level factors (Aina & Ejembi, 2013; Ophori et al., 2014). These factors are broadly categorized into health system factors (funding constraints, inadequate infrastructure and equipment, health worker-related); governance or political factors (weak oversight); and socioeconomic factors (individual, community,

stakeholders, and environment). These factors are explained below. However, it must be noted that any factor or phenomenon that negatively affects uptake of immunization can eventually contribute to high dropout and increased number of either unimmunized children or partially immunized ones.

**Ineffective Primary Health Care Services**

The PHC services have to be strong and effective to be able to pull immunization programs along. According to Ophori et al. (2014), issues such as low investment in personnel, inadequate service facilities, and poor management of existing resources deteriorate primary health care services and make it highly ineffective. This ineffectiveness could lead to poor state of immunization facilities and low standards of immunization service delivery resulting in lack of trust and confidence by the public. Occurrences such as outside agencies (e.g. health development partners, non-governmental organizations, and civil society organizations) implementing non-sustainable interventions which undermine the capacity of the local service providers also exacerbate the problem of ineffectiveness. This situation could promote immunization dropout.

**Inadequate Cold Chain Equipment**

Items such as vaccine carriers, ice packs, cold boxes, fridges, refrigerators, and cold rooms are needed to maintain cold chain at specific levels of the immunization service delivery. Uninterrupted cold chain is needed to maintain the efficacy and potency of vaccines. Where power supply from the national grid is a problem like as it is in northern Nigeria, more solar fridges and generator sets are needed to manage the cold

chain. Though significant quantities of cold chain equipment have been received by the health facilities LGAs, evidence on the ground showed that much of the equipment were not functioning optimally. Again, most of the cold rooms or cold chain offices needed refurbishment. There were also instances where the cold rooms exist but were poorly equipped or maintained. Other equipment were badly managed. In a study authored by Ophori et al., (2014), it was reported that more than half of the cold chain equipment assessed had either worn out or broken down. It is obvious that absence of reliable cold chain materials and inputs could negatively affect the optimal uptake of immunization. Under such circumstances a planned fixed or outreach RI session would fail to hold and this could result in high defaulting and eventual dropout rates.

**Shortage of Vaccines and Immunization Supplies**

The mandate of the NPI includes supporting the states and LGAs in their immunization programs. The NPI is responsible for supplying cold chain equipment, needles and syringes, vaccines, safety boxes, and other materials or logistics required for immunization services. Nonetheless, due to insufficient and late release of funds from the federal government the states and LGAs sometimes experience shortage of one antigen or the other. In an attempt to arrest the problem of especially vaccine shortages, UNICEF through a procurement services agreement with the federal government has been saddled with the responsibility for supplying vaccines to the country. Yet, problem of vaccine shortages persisted (Ophori et al., 2014). For instance, the state experienced shortage of BCG vaccine for over three months in 2017. Overly delay in supply of cerebrospinal meningitis (CSM) and measles vaccines required for vaccination

campaigns has also been reported (Ophori et al., 2014). The delay resulted in some states having no option than to purchase their own stock of CSM vaccine using state funds. In the case of the measles vaccine, the late and insufficient quantity delivery escalated the effect of measles outbreaks (Ophori et al., 2014).

Issues related to shortage or lack of child immunization cards also arose in many instances. Supportive supervision findings have indicated shortage of immunization cards in many RI service delivery points and health facilities in 2017. All these happenings directly or indirectly contributed to child defaulting in the immunization schedule and eventually dropping out of the service. There were instances where caregivers walked for distance of about 5km to health facility for RI services, only to be told of vaccine shortage or no RI card. This situation could demotivate the caregivers such that they might not come back for the next doses of the vaccines. It has been reported by Jegede and Owumi (2013) that delay in vaccines supply and its related factors are gradually eroding the enthusiasm for improving immunization uptake. Sustainable cold chain system preferably using solar direct drive (SDD) refrigerators should be encouraged and maintained in especially the local and hard-to-reach settlements to sustain uninterrupted immunization service delivery. This has the potential to minimize dropout. In case immunization session is to be conducted and situation of shortage of vaccination cards arise, records of the vaccinated children could be kept in the immunization register for later issuance of immunization cards to children. If the problem is due to vaccine shortage, nothing can be done than to ask the clients to come

back at another schedule and in many instances such clients do not return giving ample room for dropout.

**Financial Constraints**

Inadequate funding has been consistently implicated as one of the major barriers to implementing effective immunization interventions (Oku et al., 2017). For instance, if funding for transportation to conduct either fixed or outreach immunization session was not provided, the session would not hold. This could lead to children due for immunization not having the services and thereby results in increasing defaulting rate and eventual dropout. The association between poor funding to immunization services and incomplete childhood immunization has been reported (Adedokun et al., 2017). Inadequate funding disrupting all aspects of immunization programs has also been confirmed (Oku et al., 2017). Communication activities aimed at improving uptake of immunization and minimizing dropout have also been known to be worst hit by inadequate funding (Oku et al., 2017). This is obvious because the wider and frequent manner in which appropriate communications are made to community members on benefits of immunization and consequences of not being immunized, the better will they be informed or motivated to complete the vaccinations for their wards. According to Oku and colleagues (2017), immunization receives optimum desired attention among community members and general public if communication is prioritized and well-funded. Besides, adequate funding is needed to acquire all the inputs (e.g. vaccines, transportation, manpower, safety boxes, syringe and needles, cotton wool, disinfectants, AEFI kits, data tools, etc.) required to effectively and efficiently run the immunization

systems (e.g. cold chain) and services (especially at very hard to reach settlements and for nomad populations). So, immunization program will woefully suffer if there is financial constraints.

**Inadequate Equipment and Infrastructure**

Immunization program will certainly not click well in settings where basic infrastructure and equipment are lacking or inadequate. Equipment such as freezers, refrigerators, cold boxes, vaccine carriers, temperature monitoring kits, motorcycles and other means of transportation (for outreach services in hard to reach areas), vehicles (for carting vaccines from state to LGAs, wards, and health facilities), and computers are required for effective immunization programs. Equally, infrastructure such as cold rooms, well equipped offices, and accessible service delivery points are very essential for smooth immunization service delivery. Communities will not be well informed about immunization if the basic requirements to conduct extensive and effective community mobilization are not readily available. To this end, community mobilizers need communication equipment and materials such as mobile cinema and information van, megaphones, public address system (PAS) for town announcement, as well as printed communication materials such as leaflets, flyers, and posters.

**Shortage of Health Workers**

Human resource factors which independently or collectively influence uptake of immunization relate to shortages of health worker, training deficiencies, as well as poor attitudes of immunization services providers and vaccination teams. This deficit in human resources affects the delivery of immunization services and vaccination

communications. For instance, planned immunization session will not hold if there is no skilled or trained service provider. In this part of the country some health facilities have only one health worker who is responsible for all the various tasks in the vaccination clinic. These tasks include conducting health education sessions, registration of clients, administration of vaccines, and completion of all the necessary documentations that go with the vaccination. The health personnel with these daunting tasks could easily break down and no or very limited immunization services might take place during the period he or she was indisposed. The heavy work load could also compromise the quality or efficiency of the job. According to Oku et al. (2017), it is the 70% populations who usually reside in the rural areas that are heavily hit by general shortage of health personnel. In many instances, urban area health facilities are staffed far well than rural areas. This happens from the fact that many health workers especially those whose husbands are politicians or holding high positions in the civil service usually want to be stationed in the urban areas. In many instances, “big men” want their wives to be in the urban area. Generally, transferring such personnel (politicians and big men’s wives) to the rural settings has been a big problem and this has contributed to the rural areas always having shortage of staff. In some health facility catchment areas, this gap was partially addressed by using volunteer community mobilizers (VCMs) as well as traditional and religious community leaders to do the mobilization and communication for the immunization while the few technical personnel available focus on the actual administration of the vaccines and the data entry aspects. Sometimes other competing priority activities take the service provider away from the health facility and

immunization sessions are not conducted even after the mobilization. This situation has direct implication on high dropout.

**Training Deficiencies**

Evidence as alluded by Oku et al. (2017) showed that training deficiencies impact negatively on immunization services. This could easily happen if the health facilities do not have well-trained and qualified personnel or structures at the community level to manage immunization program and its related communication activities. There can be personnel at health facility level but they may not be able to provide immunization services because of lack of appropriate skill or training to do so. The general situation on the ground is that, many personnel at health facilities especially in the rural areas who provide immunization services have though completed the relevant health training schools but have not been certified to give injections. Such personnel might not be skillful enough and their continued practice of giving injectable antigens at RI sessions might cause increased incidence of AEFI. In Nigeria as specified by law, an appropriate regulatory body (e.g. nurse and midwives council) has to certify a health worker through professional exams for license to give injections. So, even among the few service providers on the ground some are not qualified to provide immunization services. Lack of well-trained communication personnel at the local level for vaccination services has also been implicated as one of the barriers to effective mobilization needed to optimize uptake of immunization (Oku et al., 2017). Immunization program may not meet its desired or expected objectives due to training deficiencies in proper program monitoring and supervision. The program supervisors and monitors may lack the

requisite knowledge, understanding, or skill needed for supportive supervision and focused monitoring. Any intervention aimed at improving immunization uptake should consider among its priorities training and re-training of service providers, community mobilizers, as well as monitors and supervisors. Such interventions should look at the possibility of training the key players in negotiation skills to deal with especially non-compliant situations. It is very clear that many health workers and for that matter immunization service providers have very weak negotiation skills and poor communication abilities (Shen, et al., 2014). In many instances, they are not able to negotiate for complete immunization of children or communicate convincingly the benefits of immunization (Shen, et al., 2014). Field observations have it that many vaccinators are usually found wanting in communicating well the purpose of their visits to communities, especially when they meet resistant (non-compliant) households during outreach vaccination, home visit, or mobilization for immunization sessions.

**Poor attitudes of Health Workers and Vaccination Teams**

Poor attitude of health workers to immunization service delivery and lack of commitment to community or social mobilization for RI services in this locality has been reported (Callaway, 2013; Oku et al., 2017; Ophori et al., 2014). This attribute can impact negatively on vaccination activities and communication interventions with resultant sub-optimal uptake of immunization. The poor attitude and uncommitted posture exhibited by the health workers is usually linked to previous experiences of services rendered for which payment was assured but not received. There has also been instances where service providers used their own financial resources to carry out

especially outreach immunization activities with the promise of reimbursement no fulfilled. These phenomena dampen the spirit of the service providers and are not motivated to do more. On the other hand, the poor attitude and the uncommitted acts are rooted in sheer desires of the individual. Immunization services are likely to suffer severely if such poor attitude and uncommitted habit are not checked. Such attributes can translate to non-conduct of planned immunization sessions or poor service provider-client relationship. Other school of thought suggests that many of the health workers and immunization service providers are interested in what they stand to gain financially but not committed to meeting the demands and objectives of the program (Oku et al., 2017). Common practices seen on the field have it that health care and immunization services providers have tagged every activity required of them to financial gains. In some instances, they would not initiate or carry out the expected activity and would wait or play mediocre role till the expected funds is disbursed. This attitude has been said to significantly influence poor performance in terms of achieving the desired immunization coverage outcomes (Oku et al., 2017). This can increase the dropout rate as there are high chances of not holding sessions of immunization as planned.

**Governance and Political Issues**

Right governance and enabling political atmosphere can positively influence immunization programs and packages. In contrast, wrong or controversial political pronouncements, failure of government to own immunization programs, and non-prioritization of immunization and its related communication interventions by policy makers can harm the program at all levels (national, state, LGA, ward, and settlement).

According to Ophori et al. (2014), political, governance, and constitutional crisis or problems are associated with low uptake or downward trends in immunization coverage. For example a political stance taken against polio antigen in three states of northern Nigeria in 2003 led to a total boycott of polio vaccinations (Callaway, 2013). This created a serious national immunization crisis that has affected the global polio eradication initiative (GPEI) till date. Nigeria is the only polio endemic country in Africa and this state of affairs has been linked to the boycott and its repercussions (Callaway, 2013). Political problems such as low commitment of government to ensuring the fulfilment of immunization policy can negatively affect the immunization programs. Over-centralization in the administration of immunization programs at the national level can also results in the services not reaching the target population in especially the rural areas. Political influence resulting in frequent changes of immunization program managers can bring about staff incompetency issues and administrative gaps. This situation of politically motivated frequent changes of RI program managers can results in break in resource (e.g. vaccine, funds, and other materials) supply chain system. With this, there can be shortage of vaccines and other inputs of vaccination leading to poor coverage of immunization with its high attendant dropout or unimmunized children. The practice of changing staff due to different political affiliation (especially when there is a change government) and replacing them with inappropriately qualified ones in many instances is very common practice in the locality. However, there seem not to be any study done so far which ascertained the effect of such politically-informed abrupt changes of key immunization personnel on the immunization service provision and by

proxy the coverages. Absence of political or government support to immunization can undermine the delivery of immunization services (Ophori et al., 2014). In this case, the basic inputs required to render the immunization services may not be forthcoming and the program may fail to achieve its expected objective. Government support to immunization has generally been very weak in this area such that most immunization interventions have been donor-driven. There has been many instances where international health development partners such as the WHO, UNICEF, Bill and Melinda Gate Foundation (BMGF) had to call on governments (federal, state, and LGAs) and other key stakeholders (e.g. traditional leaders) to intervene in improving immunization coverage in especially high risk states or LGAs. High risk states and LGAs are those with polio virus still in circulation and frequent outbreaks of VPDs.

Some health development partners involved in immunization and implementation of vaccination-based communication interventions such as UNICEF has noted that most local and state governments as well as political leaders fail to show ownership of immunization programs (Ophori et al., 2014). In instances like this, the leaders do not provide funds for the needed immunization interventions or ensure the deployment of competent staff to where services are critically needed. Even where some funds are provided, it would not be in timely manner. Such leaders also usually fail to provide the requisite training, materials, and equipment needed to appropriately and effectively deliver the RI services. Political leaders are usually more interested in committing resources to more visible infrastructure (such as roads, electrification

projects, school buildings, etc.) and taking credit for their existence than services like immunization.

Policy makers in some instances are inattentive to PHC issues in general and immunization in particular. Sometimes, they are heavily inclined to clinical care than preventive services. Preventive interventions such as vaccination is usually viewed as a sort of optional add-on to the array of needs of communities. So, the communication intervention that goes with it is even not considered at all or perceived as a minor service component. In some instances, the policy maker tends not to see that the immunization service provider requires training on both the technical components of the immunization program and communication skills. They usually used to focus on the technical aspects and erroneously neglect the communication component of immunization. With such perceived lack of priority, the level of funding to be allocated to communication activities will demonstrate the extent of the neglect. This attitude of not seeing communication as a critical component to optimizing immunization achievements can trickle down to all levels of government and results in not being given the attention it needs. This could be a recipe for dropout as people would not be adequately informed about the consequences of incomplete immunization.

**Socioeconomic Issues**

Increases in vaccine preventable disease morbidity, mortality, and disability are noted in populations where public health system, infrastructure, and immunization interventions are weak (Rowitz, 2014). One way for promoting the population immunity and child health is by implementing the needed public and community health initiatives

which cover immunization, health, and socioeconomic needs of the people (Robinson & Green, 2010). This, must be solution-oriented. Lots of evidence exist that socioeconomic factors influence immunization uptake (Adedokun et al., 2017; Lakew, Bekele, & Biadgilign, 2015; Papadimos, 2007; Shen et al., 2014). These factors include nature of upbringing, level of education and awareness, age of mother, nature or attitude of community groups or organizations, religion, attitude of community and traditional leaders, social status, wealth status, economic status, type of employment, income level, and other societal inflicted ones. This suggests that these factors need to be improved through appropriately linked interventions to sustain the improved health strata and immunity status suitable for the rich and poor in communities. This phenomenon requires putting in place relevant health and immunization services, proper vaccination intervention planning, targeted community-based immunization coverage assessment, and economic analysis of potential innovations or initiatives. All of these are very valuable to improving community immunity status efforts. Basic health service like vaccination should not be allowed to be negatively influenced by any of socioeconomic factors (Lorenz & Khalid, 2012). If allowed, it will result in low fully immunized coverages, high dropout, and high unimmunized children.

**Wealth or economic status and income level.** A study published by Shen et al. (2014) reported that people living in poverty continue to exhibit the worst health and immunization status. Another study in Ethiopia by Lakew et al. (2015) highlighted that wealth index was significantly associated with fully immunized status of children. It has also been established that the occupation of the head of household is also significantly

associated with the fully immunized status of children (Adedokun et al., 2017; Kusuma, Kumari, Pandav, & Gupta, 2010; Lakew et al., 2015). This suggests that households having members with secured salaried job are more likely to have the economic and other supportive means to ensure that their children are not dropouts but fully immunized.

**Level of education or awareness.** Community members, families, or individuals with low educational background are likely to have low demand for immunization due to weak understanding of its value (Ophori et al., 2014). In such populations dropouts are likely to be high. Head of household or mother's high level of education or awareness has been found to be significantly associated with fully immunized status of his or her child (Adedokun et al., 2017; Johri et al., 2015; Lakew et al., 2015). It could be said that if a caregiver or head of household is well educated or well informed, he or she would be better placed in understanding the preventive role of vaccines and the need to complete the scheduled vaccinations. According to Subhani, Yaseen, Khan, Jeelani, and Fatima (2015), highly educated mothers immunize their children more than the less educated or illiterate ones. Weak knowledge about the preventive role of vaccines is a threat to completing RI (Johri et al., 2015). Yet, incorrect or weak knowledge on the preventive role of vaccination is widespread in Nigeria (Ophori et al., 2014). This incorrect knowledge was linked to illiteracy, lack of easy access to government-owned facilities, and no utilization of public health facilities for basic health care or treatment of common illnesses (Ophori et al., 2014). These were said to be those with the higher likelihood to demonstrate incorrect knowledge about the preventive role of vaccines.

**Caregiver's age.** A caregiver's age is a socio-demographic characteristic that has positive association with the fully immunized status of children (Adedire et al., 2016; Adokiya et al., 2017; Johri et al., 2015; Kusuma et al., 2010). A matured caregiver could understand better the burden of VPDs and be motivated to ensure that her children are fully immunized against them. Again, an elderly or matured caregiver is likely to have higher health literacy that can inform her decision to complete immunization than the one with lower health literacy (Johri et al., 2015). This suggests that dropout is likely to be minimal in population of elderly caregivers.

**Attitude of community groups or organizations and leadership.** In every settlement the actions or inactions of groups and individuals can influence the extent of uptake of immunization. A positive or negative stance to immunization taken by groups such as civil society organizations (CSOs), non-governmental organizations (NGOs), and faith-based organizations (FBOs) could go a long way to affect immunization in general and fully immunized coverage in particular (Oku et al., 2017). These groups if taken a positive stance could have the ability to mobilize communities for successful immunization programs and execution of other felt need public or community health interventions if convinced about their benefits. Organizations on ground such as the Local Social Mobilization Committees (LSMCs) and Village Development Committees (VDCs) have been described as very useful in coordinating and engaging appropriate channels for immunization communication (Ophori et al., 2014). The VDCs have been working as committees that provide links between the settlements and health system as

well as mobilization support to community-based vaccination. They significantly contribute to the implementation of communication activities at the settlement level.

In contrast, same groups can be negative to immunization services and serve as stumbling block to vaccination programs. Individuals such as opinion leaders, influential persons, religious leaders, and traditional leaders can also play a role that can positively or negatively influence immunization. For instance, in 2003 some conservative Islamic clerics in Nigeria called for a total boycott of polio vaccinations in the north of the country where Muslims form the far majority of the population. They alleged that the vaccine was a western conspiracy to make the population sterilize (Callaway, 2013). According to them vaccine is infidel and its main purpose was to sterilize Muslims. They claimed that it was un-Islamic to vaccinate children and those who died of polio or any vaccine preventable disease were martyrs (Lorenz & Khalid, 2012). From thence, the whole vaccination exercise was seen as western ploy against Muslims. So, polio disease exploded in the country during the one year boycott period and seeped into the nearby countries (e.g. Cameroon, Niger, and Côte d'Ivoire) which had then succeeded in breaking the circulation and transmission of the polio virus. Efforts made by some community-based groups, influential persons, traditional, religious, opinion, and community leaders helped to break the jinx to an appreciable extent (Callaway, 2013). They mainly used dialogues based on royalty, respect, and authority they have to resolve such non-compliance. Up till now some people and groups still hold on to this perception and are refusing their children of vaccination of all forms. It has been shown

that households with positive attitudes to immunization get their children fully immunized (Kassahun, Biks, & Tefarra, 2015).

Community engagement, coalitions, and partnerships have also been found to be positively associated with improved uptake of immunization (Ransom, Schaff, & Kan, 2012). Organizational factors such as leadership, resources, and credibility have also been linked to success in improving childhood immunization coverage rates (Ransom, et al., 2012). However, there have been instances where community groups or members demanded money from immunization service providers in exchange of support to immunization services. Some community gatekeepers (e.g. organized groups or leaders) have used boycott of vaccination as bait for negotiating for other social amenities (Oku et al., 2017). In such situations the whole community refuse vaccination (i.e. block rejection) and insist that government provide basic necessities such as school, clinic, accessible road, etc. before the vaccination can take place. This practice has been observed as part of field visits in especially hard-to-reach areas and settlements where inhabitants feel marginalized. This habit of immunization boycott or block rejection can fuel high dropout.

**Religion.** Many studies have positively linked religion to improved immunization uptake (Adokiya et al., 2017; Baguune & Ndago, 2017; Johri et al., 2015; Kassahun et al., 2015; Subhani et al., 2015). Evidence provided by Adokiya et al. (2017) pointed to the fact that Christianity is more significantly associated with the likelihood of completing immunization schedule (likelihood of being fully vaccinated) than the other ones. A study authored by Ophori et al. (2014) also showed an average

immunization coverage among Christian populations as 24.2% while that of Muslims was 8.8%. According to Ophori et al. (2014), the greatest challenge to acceptance of vaccination in Nigeria is a religious one. It dwells more among the Muslims in the north. This has led to the north having the lowest (less than 10%) fully immunized coverage in Nigeria (MICS, 2017; Ophori, 2014).

In any case, the level of involvement and achievements of religious groups and leaders in immunization in northern Nigeria could not be overemphasized. Religious leaders and bodies have been engaged very effective in breaking the barrier of non-compliance (resistance households and settlements) to vaccinations. They have also facilitated the delivery of mobilization and targeted communication for immunization and other primary health care activities (Callaway, 2013; Oku et al., 2017). Religious leaders are revered, trusted, and respected in society. So, their interventions go a long way in improving the demand and acceptance of vaccination. They easily counter the resistance to vaccinate edge in religious sects and communities. Religious leaders mostly serve as advocates for immunizations and play very useful role in immunization programs. Such roles include making announcement and holding discussions about need for child immunization at mosques and churches as well as being part of dialogue teams that usually tackle the problem of hesitancy for immunization in families and settlements. Their actions really promote sound uptake of immunization and discourage dropout.

**Misperceptions of RI.** Misconceptions and misperceptions about immunization are rife among especially the population of the north. For example, certain Islamic

scholars and anti-polio vaccine campaigners along the line spread false rumor which nearly killed the global polio eradication initiative (GPEI) in Nigeria. By this fall outs of rumor, Nigeria still remains the only polio endemic country in Africa and one of the three in the world. The remaining two are Pakistan and Afghanistan. According to the Islamic clergy, embedded into polio vaccine were HIV virus or anti-fertility drugs aimed at checking population growth in Muslims (Callaway, 2013; Oku et al., 2017). This unfounded rumor posed a very big challenge to immunization in northern Nigeria such that many parents, families, households, and Islamic religious bodies and members vehemently rejected polio and other vaccinations. It took especially the traditional and religious leaders a great deal of task to salvage the situation to some extent.

**Fear and confusion about immunization.** It has been made known by Oku et al. (2017) and Ophori et al. (2014) that household heads and caregivers reject RI due to fear, untrue rumor, and incorrect information. Expression of fears and confusion relating to immunization are common in many parts of Nigeria, especially in the north (Callaway, 2013). Some households link immunization to attempts by NGOs to increase mortality rate among especially children and reduce the local population (Ophori et al., 2014). They claimed the NGOs are being sponsored by unknown enemies in developed countries. This notion is riffed because, the vaccination programs in especially the north of the country is mainly donor and NGO-driven. The phenomenon eventually leads to increase number of either unimmunized children or partially immunized ones due to dropout. Literature linking this fear or confusion to AEFI is not readily available. Efforts towards increasing immunization coverage must include intense community-based and

media awareness creation aimed at changing people's mindset and behavior (Opel et al., 2015).

**Low confidence and lack of trust in immunization.** Lack of confidence and trust in vaccination as effective preventive health intervention appears to be common among rural and urban populace (Ophori et al., 2014). Belief in a secret vaccination agenda is prevalent in many States in the north of the country. Many caregivers believe immunization activities are to impose population control on the local Muslim communities and is fueled by western countries (Callaway, 2013). This belief and other misleading information have led to low confidence and lack of trust in immunizations in many settlements. Therefore, mobilizing and educating the community members (especially mothers, parents, caregivers, household heads) and the public to support immunization services is central to the EPI. Health workers (especially RI service providers) and trusted individuals could be used to build trust and confidence among clients of immunization. Health workers have been consistently cited by caregivers in local immunization quality and coverage evaluations as the most important source of information on immunization (NPHCDA, 2018). It is unfortunate the health workers who need to lead this confidence and trust-building process usually receive limited supervision and training on interpersonal communication (IPC) skills and its importance. Till date some caregivers have no faith in immunization (Ophori et al., 2014). This 'no faith' has been based on widespread misconceptions. Some have mistaken belief that immunization can prevent all childhood diseases. Such belief reduces trust when

immunization, as it must, fails to give the perceived protection. Should this happen, faith is lost in vaccination as in preventive intervention for any and all diseases.

**Upbringing.** In northern Nigeria until recently, almost 2-4 in every 10 caregivers rejected or prevented their wards from being vaccinated with oral polio vaccine (OPV) in particular and other antigens in general (Callaway, 2013). Northern Nigeria aside RI runs between 6-8 rounds of mass vaccination (oral polio, measles, CSM) campaigns in a year. The polio vaccination campaigns are house-to-house based while that of measles and CSM temporal vaccination post based. In such exercises, some parents vehemently refuse the vaccination teams entrance into their homes or hide the children or under declare the number of eligible children (0-5 years) they have when teams enter their houses. This is just to avoid their children being vaccinated. The house-to-house free vaccination strategy makes it so easy for an individual and households to be suspicious about its usefulness and easily reject it. Besides, no explicit law exists to take care or deal with the refusals. So the traditional leaders use mainly dialogues based on royalty, or respect, or authority they have to resolve such refusals. Common reasons for such refusals border on ignorance, no felt need, politics, and religious beliefs (NPI, 2017). Generally, literacy or health education on importance of vaccination has been very weak. This phenomenon contributes to the weak understanding or knowledge gap on the importance of vaccination. Interactions with households who refuse vaccination show that many have opinion or perception that as long as the vaccine is given freely it means it is not good. Also, as it is given to children who are not sick and in their homes suggest a hidden motive. So they refuse. This attitude and action of caregivers negatively

influence uptake of vaccination (Dempsey, Fuhrel-Forbis, & Konrath, 2014; Lorenz & Khalid, 2012). By this, an individual growing up in such homes may also grow to refuse vaccination if not educated very well about safety and usefulness of vaccines. In contrast, parents in the southern part of the country willingly present their children for vaccination and even look for the teams to vaccinate their children during mass vaccination campaigns if the child is found to have been missed out.

**Access Issues**

Some common access factors are associated with vaccination coverage in different context (Crocker-Buque et al., 2017). Among these are rural-urban migration, physical distance to clinics (service delivery points), quality of service, and involvement of multiple components in interventions. According to Subhani et al. (2015), the immune status of children conferred by vaccination in rural areas is less than their counterparts in the urban areas. Publication made by Crocker-Buque et al. (2017) showed rural-urban migration as having a universally negative effect on uptake of immunization. Difficulty in accessing immunization services also came up as one of the reasons for under-immunization in the study done by Crocker-Buque et al. (2017). Long physical distance and rough terrain to clinic are said to have negative impact to uptake of immunization (Subhani et al., 2015). Aspects of service quality issues also affect uptake of immunization. Interventions designed with the full involvement of communities have also proven to be effective in reaching more children for vaccination (Hu, Li, Chen, Chen, & Qi, 2013). A situation of AEFI and dropout suggests that the child has been presented for RI before and even if access was difficult the caregiver

could still have the wish or motivation to go back for the next doses if AEFI or other issue has not discouraged him or her to do so.

**Demography Factors**

Migration affects immunization status (Hu et al., 2013; Johri et al., 2015; Kusuma et al., 2010). According to Hu et al. (2013) and Kusuma et al. (2010), recent migrant children have low immunization status and can easily be at risk of catching VPDs than their settled counterparts. Recent migrant populations keep on relocating and stand the chance of missing their immunization schedules. They end up not receiving full immunization at any point in their journeys. This happens particularly in the vulnerability context of their livelihood, insecurity, and alienation. Implementers of immunization programs have to invest into strategies aimed at securing full immunity status of migrant child to avoid possible spread of VPDs. Routes and transit points of such populations have to be mapped out and immunization services delivered to their children in a sustain and equitable manner such that they receive complete immunizations.

Another characteristics that affect immunization status are child's sex, birth order, and size at birth (Adedokun et al., 2017; Adokiya et al., 2017; Johri et al., 2015). Findings from a study published by Adokiya et al. (2017) showed female children as being more likely to be fully immunized than their male counterparts. This is in contrast to evidence provided by Johri et al. (2015) which showed females as having lower likelihood to be fully immunized than males. With respect to birth order and size at birth, it has been established that children considered small at birth and those of higher

birth order of more than seven are more likely to be incompletely immunized (Adedokun et al., 2017).

## VPDs as Public Health Problem

Thousands of children are victims of vaccine-preventable diseases (Ophori et al., 2014). In northern Nigeria particularly and sub-Saharan Africa in general, childhood illnesses (especially the vaccine preventable types) adversely affect children at high rates (Aina & Ejembi, 2013; UNICEF, 2015). Osazuwa-Peters (2011) indicated that Nigeria is the largest and populous black nation and considered it a reservoir for VPDs. Diseases like polio, measles, cerebrospinal meningitis, and yellow fever have been very debilitating and damaging to the population. Polio for instance has paralyzed thousands of people who have remained a burden to their families and society (Callaway, 2013). VPDs spread rapidly and cross social, religious, geographical, political, as well as even policy borders (NPI, 2017). VPDs victims in African settings in many instances become public and social burden (Osazuwa-Peters, 2011). Therefore, intensified and concerted efforts to reduce such illnesses with their attendant problem of child or infant morbidity and mortality should be the priority for all governments and stakeholders. This is why any study aimed at uncovering the associates of immunization dropout such as low reporting of AEFI should be a welcoming idea. Due to non-compliance and other reasons for incomplete immunizations, populations are still having significant numbers of cases and outbreaks of VPDs in many settlements (NPI, 2017).

## Problem Solution Requiring Community Support

The findings of this study would be disseminated to community members. This could prompt them to implement the community-inclined recommendations. According to Antai (2010), solving the problem of low rate of reporting of AEFI to health facilities and high immunization dropout requires strong involvement of the community. Such could be achieved if the evidence have been disseminated and issues to be addressed seem convincing and in line with their interest. The community's support in terms of putting in place strategic priorities, resources, and assets to solve the problem might be difficult to get, but it is necessary (The Community Tool Box, 2014). According to Shapiro and Atallah-Gutiérrez (2012), evidence from research is relevant for guiding communities in planning basic interventions and services required to minimize their problem in a bottom-up manner. Communities have ability to harness its own efforts to solve a problem with minimal or no external support (Emshoff et al., 2007). So, an evidence-based efforts and lessons learnt from the research could be packaged in a manner required to change habit of dropout to fully immunize. Participatory health promotion practices triggered by the evidence from the research could improve the preventive health perspectives of the people (Shapiro & Atallah-Gutiérrez, 2012). Such improved perception could bring about personal awareness, habit, intention, and behavior change towards presenting cases of AEFI at health facilities and avoidance of immunization dropout.

## Public Health Policy and Social Implications in Immediate, Medium, and Long Term

Many countries including Nigeria have instituted policies of implementing immunization activities. This is in line with the argument put forward by researchers highlighting vaccination as a right for humanity and not a privilege (Kereiakes & Willerson, 2014; The Robert Wood Johnson Foundation, 2013). By this, governments and major health development partners have identified the basic components of immunization and have been providing for such components to cover all individuals. Nigeria's policy on immunization services and activities is geared toward improving population survival through immunization (NPI, 2017) but the ideals of the policy seem not to be having any impact on the population as many households refuse the immunization for which same policy seeks to promote. As more studies expose the issues that require a policy push in the area of immunization, the policy makers might be tempted to take a second look at the policies and enforce its implementation. The findings of this study can contribute to the push for the full implementation of the policies. One aspect the policies aim to address is to break the transmission of wild polio virus (WPV) and thereby eradicates polio disease in the country. Another aspect is to achieve reduction in morbidity and mortality of measles and other VPDs (NPI, 2017). Despite these policy directions, immunization coverage has been very poor in especially the northern part of the country. As this study establishes and documents the link between the low reporting of AEFI and immunization dropout, the evidence could inform and guide the policies to give attention to reporting AEFI and addressing issues

related to immunization dropout. Such attention might contribute to improved uptake of RI which is known as having very poor coverage in the locality (NPI, 2017). The improved coverage of immunization would be one of the goals expected to be achieved by the policies.

Social change basically is about the alteration in the social order of a society (Gostin, 2010). It describes the variances in the social behavior of a group of people. It may include changes in nature, social behaviors, social institutions, or social relations. Sociologists see social change as any significant alteration in cultural values and behavior patterns. A great example is the progression Americans have made in their acceptance and interactions with minorities. Another example might be the fact that at one time it was almost unheard of for a woman to work outside the home, but now it is commonplace. The term social change is often used in the study of sociology, but it also applies to education, health, and any other discipline that deals with people. Where you find people you would always find some social change as people do not stay the same for very long (Fraenkel, et al., 2012). Social change is not always about a progress. Sometimes it is a negative one. However, the type of change this study is expected to bring about might have a lasting effect on society's culture and habit towards immunization. According to Fraenkel et al. (2012), findings from research could influence a change of positive transformation.

Evidence from research could be a force for social change (Fraenkel et al., 2012). A research could be linked to the principle of mutual benefit, co-learning, and long term commitment of society in line with improving health outcomes (Nguyen, et al., 2010).

This research had an ultimate aim of promoting uptake of immunization in communities through resolving the existing issue of low reporting of AEFI influencing dropout. Such promotion could results in children being fully immunized and prevented from crippling and other forms of disabilities due to VPDs. The change in uptake of vaccination habit could go a long way to promote the health of the community by preventing the incidence and spread of VPDs. Avoiding vaccine preventable infections in communities requires appropriate herd immunity. Using polio disease as an example, breaking through the disease by ensuring complete immunization for especially children could prevent the disease and its associated way side begging by polio victims. This directly or indirectly promote social change. Directly in the sense that, preventing polio disease through vaccination could make people who otherwise would have been polio victims and begging on streets free from the disease. Polio usually cripples or deforms its victims. With the polio-free status, the people would be normal and healthy. They could then live a meaningful life and contribute to the society upbringing and development that impact on social life. For instance, the normal and healthy individuals could contribute physically, manually, financially, or otherwise in a school building project that utilizes communal efforts. Indirectly in the sense that, aside children completing immunization and getting fully immunized against VPDs, the vaccination acceptance habit that would be gained in communities could go a long way to support healthy life and well-being of the population. With such healthy state of affairs, the society could improve in economic and other productivity ventures. This could influence social life or status and in the process promote positive change in personal and community social strata.

## Summary

This chapter 2 was about the review of literature on AEFI and reasons for its low reporting to health facilities, immunization and reasons for dropout, as well as barriers to incomplete immunization. It also covered the community support required to overcome the two occurrences (i.e. low reporting of AEFI to health facilities and high dropout of immunization) and the medium to long term public health policy and social implications of these occurrences. Specifically, the review covered areas such as RI and its importance, immunization schedules and types of antigens, dropout and interventions for its reduction, uptake level of immunization, AEFI and reasons for low reporting to health facilities, and the interventions for improving reporting of AEFI. Other specific areas covered included the link between AEFI reporting and immunization dropout, factors predicting dropout, barriers to fully immunization of children, factors affecting RI, and VPDs as public health problem. It was clear from the review that literature was limited on whether low reporting of AEFI to health facility influences immunization dropout. The following chapter 3 addressed the design and methods used for this study. Based on the design and methods, the research findings established that low rate of reporting of AEFI to health facilities influenced the high rate of immunization dropout in the area. This finding has, to a very large extent closed the gap in literature which was to a significant extent silent about the association between the two occurrences.

# Chapter 3: The Methodology

## Quantitative Method

Immunization is a core mandate of the SPHCDA in Jigawa State. It is considered as one of the fundamental pillars of primary health care delivery. Focus in this PHC delivery is placed on RI services for infants. For this reason, the primary health care agency has a strategy called reaching every ward (REW), which aims at providing each settlement with RI services. The REW strategy has components of rendering RI sessions at a fixed post (i.e., health facility), outreach points (i.e., settlements with distance of 2-5km from the health facility), and mobile outreach points (i.e., settlements of more than 5km from the health facility). The idea behind REW strategy is to make RI services accessible to all infants. Five visits at specified intervals to RI sessions are required to get an infant completely or fully immunized. However, many children drop out for a variety of reasons. The purpose of this quantitative study was to find out if low rate of reporting of AEFI influenced the dropout. It also sought to find out how to improve the reporting of AEFI to health facilities and uptake of complete immunization from the view point of the caregivers. The goal was to use the findings to help identify and recommend the assistance, interventions, and support structures needed to improve reporting of AEFI to health facilities in order to avoid immunization dropout.

This section contains a description of the role of the researcher, research design and approach, justification for the design, setting and sample, eligibility criteria, instrumentation and materials, data collection and sampling strategies, data analysis and validation, protection of participants' rights, limitations, scope, and delimitation of the

study. Primary data was collected through a survey using a structured interviewer-administered questionnaire. The results from this study was intended to be shared with the SPHCDA, partners, and other key stakeholders such as traditional leaders, religious leaders, and civil society organizations who support immunization programs as a foundation for addressing low reporting of AEFI and dropout issues to optimize coverage of fully immunized children.

## Role of Researcher and Others in the Study

For over 20 years, the researcher has been involved in public health programs with key role in immunization activities. This role included working with policy makers, managers, service providers, partners, and other stakeholders of immunization programs to improve the quality and coverage of vaccination services. In addition, the researcher has participated in immunization programs evaluation, coverage assessment surveys, client satisfaction surveys, service delivery assessments, and other operational research related to immunization. The researcher has served on a variety of committees including those concerned with immunization policy and strategy planning, program success, and development of materials or tools for immunization. His role as a public health practitioner and being in the field of immunization for such a long period gave him a unique insight into planning, service delivery, evaluation, and dissemination sides of the immunization programs. The idea for this study originated from frequently hearing the concerns of immunization program implementers regarding low rate of reporting of AEFI and high rate of dropout. When visiting health facilities or communities for supportive supervision, coverage assessment, and other forms of engagement, the

researcher held discussions on the way out with RI service providers whose records showed more than 10% dropout rate and caregivers. Same conversation was held with RI program managers about their views regarding the low AEFI reporting and high dropout rate, and how to improve the situation. One recurring theme from many of these discussions was that not very much is known about how the low reporting rate of AEFI impacts dropout and eventually incomplete immunization. The researcher is conversant with primary data collection and analysis using SPSS software. He is also familiar with the processes for producing reports for immunization programs. The researcher has previously completed some operational research on household refusal of immunization services as part of his duties. Findings from the previous research showed understanding of the high number of unimmunized children in non-compliant households. In non-compliant households, many children who initiated RI failed to complete the schedules. He tried to find out how low rate of reporting of AEFI affected immunization dropout in this study and his role was to lead the process.

Through the assistance and guidance from dissertation committee chair (Dr. Frazier Benjamin Beatty) and committee member (Dr. John Wieland Oswald) at Walden University, the researcher finalized the study proposal and started field data collection as planned. In the communities, males of 18 years and above are not permitted to talk directly with married women without the consent of their husbands. In addressing this cultural practice and societal norm, a matured woman who speaks the local language was used as an interpreter and mediator when the caregiver was a woman and did not

understand English. Direct interviews were conducted between male caregivers and the researcher where the caregiver speaks and understands English.

## Research Design and Approach

A correlational research design and quantitative approach were used for the study. Specifically, it was a cross-sectional survey which identified whether the low rate of reporting of AEFI affected the high rate of immunization dropout in Jigawa State in the northwest part of Nigeria. Additionally, the study looked for ideas and ways from caregivers of infants enrolled in RI programs regarding how they could increase the reporting of AEFI to health facilities for appropriate assistance and completion of RI as per schedule. The target respondents were caregivers whose infants were dropouts of RI program. A structured interviewer-administered questionnaire was used for this survey. The questionnaire was designed to capture information related to basic socio-demographics, how low reporting of AEFI relates to dropout, ways of improving reporting of AEFI to health facilities by caregivers, and ways of avoiding immunization dropout. A quantitative method was used to gather primary data and the results would be utilized to comprehend the local problem of low reporting of AEFI to health facilities and high immunization dropouts (see Creswell, 2012). The recommended local solutions to the problem as provided by the caregivers would also be shared with program managers for implementation. Generally, quantitative research provides valuable insight to the ordering of reality and summaries of data that support generalization about the problem under study (Savela, 2017). This study design and approach provided a better interpretation of the research problem (Savela, 2017). Logistic regression statistical tests

procedure, Pearson's Chi square test procedure, and descriptive statistics (i.e., frequencies, percentage and cross tabulation) were used to analyze the data derived from Statistical Package for the Social Sciences (SPSS) 24 software.

## Justification for Design

The main justification for using a correlational cross section survey design for this study was to give a deeper understanding of quantitative primary data which uncovers whether there was a link between the low rate of AEFI reporting and the high rate of immunization dropout. It also helped to understand the local solution for improving the reporting of AEFI to health facilities and avoiding dropout. This design was appropriate because it helped in measuring the variables and showed whether the IVs and the DV were related (Gordon, 2012). It also helped to figure out the correlation between the variables and gave a reliable picture of what the state expected at the time of the study (Hall, 2008; Noble et al., 2014). This type of design again allowed for making correlational inferences base on the findings (Statistical Correlation, 2015). Such inferences were used to address the research hypotheses and eventually answered the research questions. The results generated using this design were enough to answer the three research questions. The basic rationale for this design was that the form of data collection supplied the strengths needed to provide a more complete understanding of the research problem.

## Setting and Sample

Jigawa State in northwest Nigeria was purposefully selected because of its low rate of reporting of AEFI to health facilities by caregivers and high rate of immunization dropout. 20 LGAs out of the 27 in the state were purposefully selected and used for the study guided by the magnitude of dropout rate recorded from their RI reports. The LGAs chosen were those with immunization dropout rate of more than 10%. For each of the selected LGAs, all the health facilities with more than 10% dropout rate were line listed. Then, through random selection three to five health facilities with more than 10% dropout rate per LGA were picked using random number table. The RI register in each health facility was checked for names and contact details or traceable addresses of caregivers of dropout children. As a quantitative cross-sectional survey, the sampling of dropout children per health facility was randomly done using random number table. The names and addresses were used to trace the location of the caregivers in their communities and conducted the interviews at their convenience, having obtained ethical clearance from the SPHCDA for the data collection. All necessary community entry protocols and due process for contacting the participants as part of the questionnaire administration were followed. The research protocols conformed to the local norms, traditional values, cultural expectations, existing ethics, and the legal standards in line with the ethical framework of the study (Thomas & Gostin, 2013). A female interpreter was used for interviewing participants who did understand English and women respondents as men are not allowed to talk directly to married women in the area. An informed consent was obtained from each respondent. The participation in the study was

purely voluntary. The target population was caregivers whose infants have health facility-based records of immunization dropout. The fieldwork for data collection commenced after obtaining IRB approval, University permission, and ethical clearance from the SPHCDA. The study questionnaire was administered in communities on face-to-face basis for 320 caregivers. The study team was a collaborative effort involving the researcher, the SPHCDA, and Walden University. The actual field work for data collection was done by the researcher and a trained interpreter recruited from the state capital. Walden University through the dissertation committee played the overall supervisory role.

## Eligibility Criteria for the Study Population

In order for caregivers to be eligible to participate in this study, they were required to have an infant who had dropped out of immunization based on their last and next visit schedule dates as documented in the health facility RI register. Since almost all health facilities in the state provide RI services, the list of the prospective participants were obtained from health facilities where RI record showed a 3-month average of dropout rate of more than 10%. Each health facility, as part of monitoring the uptake of RI, calculates the dropout rate on monthly basis. So, such health facilities with more than 10% dropout rate especially using Penta1 and Penta3 as proxy were easily identifiable in the RI monthly report of the LGA. The health facilities also had RI registers that showed names and traceable addresses of all defaulters and dropouts.

## Instrumentation and Materials

A structured interviewer-administered questionnaire was developed and used for the study. This questionnaire was crafted to meet the focus of the study because no standard instrument was available. Extensive library search was done to locate a suitable existing research instrument but none was found. So, the questionnaire was developed by combining appropriate items from other similar studies to establish the internal reliability and validity (Stallone, 2003; Varney, 2003). It was expected that the internal reliability of the instrument developed was approximately the same for the study based on the previous similar researchers' findings. Regardless, a small pretest study was done prior to the implementation of the actual data collection process to test and revise the research questionnaire. As part of the revising process, estimates of internal reliability was employed using SPSS in order to increase the reliability of the instrument (Green & Salkind, 2011). The researcher was sensitive to the community characteristics of the population studied in developing the questionnaire. No special material or instrument other than questionnaire and SPSS software were used.

## Possible Types and Sources of Data

Quantitative data collected from primary source was used. It was collected through sample survey using structured interviewer-administered questionnaire. Community-based face-to-face interviewing approach of data collection was used to gather information from caregivers whose infants have dropped out of immunization. Respondents were reached in their communities and interviewed in a setting or

environment conducive enough to have their cooperation in participation and genuine responses.

## Data Collection and Sampling Strategies

Sample survey data collection method was chosen because it helped to obtain the data from a subset of the population (i.e. caregivers of infants with immunization dropout record at health facility) in order to find out if low rate of reporting of AEFI influenced the immunization dropout (Haji, et al., 2014). The strategy helped to reach respondents in a setting or environment conducive enough to have their cooperation in participation and genuine responses. With this strategy, the actual targets for the questions were reached with broad base of people as possible for the questionnaire (Barratt, & Kirwan, 2009). The face-to-face strategy for data collection improved the quality of the data collected (Rimando, et al., 2015) in the sense that interviewer had opportunity to clarify questions being asked and followed up with necessary probing. Records of immunization dropouts were obtained from health facilities offering RI. Random sampling method was used to select caregivers of dropout infants and followed up for interviews in their communities. The study protocol and methodology were designed such that the association between the two variables (i.e. AEFI reporting and dropout) could be measured per data analysis. Also, the ideas for addressing the issue of low reporting of AEFI to health facility or RI clinic and high dropout could be sought from caregivers to answer the research questions. The primary data collection through interviewing was done for 30 days and interviewed 329 respondents. The sampling technique and questionnaire was pre-tested in two settlements in two LGAs outside

those selected for the actual survey. For the field pretesting of the sampling technique and questionnaire, 36 caregivers with dropout infants were interviewed using the same data collection tools for the actual survey. The questionnaire was then reviewed to clarify ambiguous questions, removed duplicate questions, and closed open-ended questions as necessary as possible. The field pretesting provided a sense of interviewing time. The researcher served as an interviewer and principal investigator for the field work. In each settlement the respondents were contacted and interviewed as per the list obtained from the health facility. The questionnaire was designed to capture all forms of AEFI and their association to dropout (if any) as well as ways of improving the reporting of AEFI to health facilities and avoiding dropouts. Aggregation of all responses helped to provide answers to the research questions. The questionnaire was also designed to take less than 30 minutes to administer (including community entry protocols). Allowing for travel time, identifying the listed respondent in communities, and mapping of interview locations, an average of 12 interviews were done per day. The main field work lasted for 30 days (including all follow up visits). The entire duration for the data collection, entry, and analysis was about 10 weeks.

A combination of probability and non-probability sampling methods were used. It was non-probability in the sense that the selection was based on the available line list of immunization dropouts. The probability aspect used different sampling (random and purposeful) methods to select the health facilities, participants, and LGAs. Focus was placed on caregivers of infants who have dropped out of immunization. Participants were recruited using the existing line list of dropouts obtained from the RI register

available in the health facilities. This list was used to randomly select the responding caregivers and communities they live. The G-Power sample calculating software was used to calculate the sample size. The calculation based on statistically chosen parameters (power - 95%, p value - 0.05, and effect size - 0.30) gave 300 respondents as sample size.

## Data Analysis and Validation

The field work provided primary data. This data was captured using SPSS 24 and analysed using the same software. In order to present an overarching result of all the questions, data generated from the primary source was processed into a usable form to ensure that the data and results were accurate. All the data was organized and prepared for logistic regression statistical tests procedure and descriptive analysis in several ways. Responses from 'other specify' options were coded using an alpha numeric coding system to minimize a breach of confidentiality. Data assessment within the data spreadsheet was done and performed inferential and descriptive analysis.

Data screening was done to ensure data accuracy and confirmed the adequacy of the planned statistical test. Descriptive statistics included testing for normal distribution by examining the frequencies, percentage, and cross tabulation for the variables. Charts were used to present pictorial representation of the variables (Fraenkel, Wallen, & Hyun, 2012). In calculating correlations between collinearity statistics and predictor variables (tolerance and variance inflation factor), the assumption of multicollinearity was tested. Additionally, a homoscedasticity analysis helped to determine whether logistic regression model's ability to predict a variable was consistent across all values of that

variable. Two-tailed tests with an alpha level of .05 and confidence level of 0.95 were used for all inferential statistical tests. Logistic regression analysis was used to test for the null hypothesis to answer the research question one. This statistical technique measured the strength of relationship between two or more variables within the sample. The logistic regression analysis was appropriate to utilize when the data for the variables were expressed in a quantifiable method (Fraenkel, Wallen, & Hyun, 2012). Data from the survey was captured using SPSS 24 and analysed using the same software. The main outcome measures (i.e. if low rate of reporting of AEFI affected immunization dropout and ways of improving AEFI reporting and completion of immunization) were analysed using logistic regression and descriptive statistics and procedures. Findings were analysed in line with the study objectives and reported accordingly. The outcome was extrapolated and generalized to cover the state. The DV for the study was immunization dropout due to AEFI while the IVs were the immunization uptake factors. The main areas covered in the structured interviewer-administered questionnaire for the interview survey were basic socio-demographics, reporting of AEFI, immunization dropout, knowledge on immunization and AEFI, access to health facility, and enhancers to presenting AEFI at health facility and avoiding dropout.

## Protection of Participants Rights

The research was aimed at finding out if association existed between low rate of reporting of AEFI and immunization dropout. So, the main respondents were the dropouts (i.e. caregivers of infants who failed to complete immunization schedules). The recruitment of the dropouts and interviewing them in their communities did pose some

ethical concerns because in the locality, it is religiously prohibited for women and men to interact openly. Also, adult men (aged more than 18 years) are not culturally allowed to enter other peoples' homes unless permitted by male head of household. These two practices are forbidden in the locality and the process of recruitment and interviewing gave consideration to them. Nonetheless, every research be it community-based, institutional-based, or laboratory-based requires ethical or legal considerations (Resnik, 2015).

Records of immunization dropouts existed in all the health facilities providing RI (RI) services. Through an ethical clearance from the SPHCDA, access to the records was granted and caregivers were followed up to their communities. The research protocol conformed to the local norms, traditional values, cultural expectations, existing ethics and the legal standards (Thomas & Gostin, 2013). All actors in the study were prompted to comport themselves in line with the ethical framework of the study.

The Institutional Review Board from Walden University and the SPHCDA assessed the study protocol and provided ethical clearance. Additionally, all respondents were provided with information on the purpose of the study, type of information required, and how the results would be utilized. Respondents were informed about their rights and informed consent received individually from them before data collection. The consent form was read out and explained to each respondent in the local language and gave an opportunity to ask for clarification. They were made to understand that participation in the study was voluntary and they could withdraw their participation at any stage of the study without this having any impact on current or future immunization

services for their children. At the interviewing, complete recall of any AEFI was encouraged through effective and careful probing. This, in few cases aroused sad emotions and caused a kind of social discomfort to the respondent (especially when the AEFI was a serious type). However, any on-going treatment or management of AEFI was not stopped or modified. Besides, households benefitted from the process of participation through the opportunity to share their understanding and present their perspectives. This created an increased level of awareness, knowledge, and joint ownership of the study. The outcome of the study in terms of knowing the correlation between the two occurrences (i.e. low reporting of AEFI to health facility and high dropout of immunization) could be utilized to put in place the relevant interventions to improved fully immunized coverage in communities. The lessons learned from the study might be applicable to other communities or LGAs outside the study coverage area.

Every piece of information from the study has been treated as confidential. All documents are stored in locked cabinets and codes were used instead of recording names. Interviews were conducted at the convenience of respondents and in an environment that ensured privacy. No interview was held at where there was noise, crowd, or unfavorable conditions. Socio-cultural issues and norms in community that border on privacy were strictly observed. Participants for the interviews were not given any token or money. Instead, they were offered verbal appreciation for their time spent on the interview. As health and academic researcher, I was interested in the study with the view to come out with findings that could help shape interventions and policies capable of reducing the burden of AEFI related dropout to the immunization program.

The findings of this study would be disseminated to all the stakeholders (i.e. Health Directorate, local government, partners, traditional authority and the communities). The results would be written up and reported in literature using appropriate journals. Throughout the interviewing, there were three refusals or non-respondents. These refusals were indicated on consent forms but no interview data was collected on them.

## Limitation

This study was limited in the sense that only caregivers who were willing to respond to the questionnaire partook in the survey. Errors and biases would have been more if a small sample size was obtained. This would have limited the generalization of results outside the participants studied. The study relied on self-reporting of AEFI with no attempt by investigators at objective validation. All data provided were from participating caregivers. It required a detailed history of the event and subjected to recall bias. There could also be a misrepresentation or tendency of exaggeration based on the phenomenon of socially desirable responses. Reporting of the AEFI to interviewer could be limited if the event was considered minor or under estimated. However, previous experiences related to identifying AEFI have been positive (Steffen et al., 2014). Response from caregivers was likely to exclude AEFI with less easily recognizable forms. There could be potential bias where respondents gave answers to impress the researcher than the truth. The interpreter was trained to be able to identify such responses using relevant interviewing techniques to check consistency of responses. Where responses were unambiguously determined to be misleading, they were excluded from the analysis. The survey was prone to researcher error especially where inaccurate

assumptions were made about the sample. It was also easier to miss out rigidity. A failure by us to account for all possible and relevant answers led to missing out on data for 22 respondents.

## Scope

This study was limited to caregivers enrolled in RI with immunization dropout infants because of interest in AEFI, dropout, and edge to have every child who initiated RI completed it. The scope did not cover caregivers who have defaulted in their immunization schedules and were not yet dropouts because their period of default was less than four weeks. The study covered 20 LGAs with more than 10% dropout rate out of the 27 LGAs in the state.

## Delimitations

The content of the informed consent was read in local language to the respondents at the beginning of each interview. This was to ensure that they qualify to be enrolled in the survey and understand that they were voluntarily partaking with no direct incentive. Each participant answered series of questions but was free from harm as they could opt out of the survey at any point during their participation.

## Summary

Chapter 3 provided information on the study design, methodology, sampling, data analysis technique, and ethical considerations. The DV and IVs were all clearly indicated and defined. Such definitions guided the data analysis and results produced in chapter 4.

# Chapter 4: Data Analysis and Results

## Introduction

This was a quantitative correlational study. It used primary data to examine if a relationship existed between the low rate of reporting of AEFIs to health facilities and dropping out of immunization due to AEFI. Specifically, the correlation between low reporting of AEFIs to health facilities or RI clinics for necessary assistance and high rates of dropout from immunization due to AEFI among caregivers whose infants were enrolled in RI was examined. Researchers have provided evidence of dropout and interventions to minimize it, but have not shown any association between low rate of reporting of AEFI and high rate of dropout from RI (Baguune, Ndago, & Adokiya, 2017; Haji et al., 2016; Khan et al., 2013). Given this gap, this research looked at the association between the rate of reporting of AEFI and immunization dropout in Jigawa State of northwest Nigeria. The following questions and hypothesis (for question one) guided the study.

RQ1: How would the threat of low reporting of adverse event following immunization (AEFI) and perceived severity of the event influence immunization dropout?

$H_o1$: There was no statistically significant influence of low reporting rate of AEFI on immunization dropout.

$H_1 1$: There was a statistically significant influence of low reporting of AEFI on immunization dropout.

Q2: In what way would the caregivers whose infants have dropped out of RI program because they perceived their children as susceptible to AEFIs enhance their reporting of AEFIs to health facilities?

RQ3: How would the perceived benefits of immunization enhance the cues to action of caregivers enrolled in RI program to ultimately complete the RI schedules? Based on these research questions, the summary of results has been divided into three main sections. First was for the preliminary data analysis. Second, offered a summary of the descriptive statistics for background information, effect of AEFI, knowledge about AEFI and care seeking actions, benefits of RI, and enhancers of reporting AEFI and avoiding dropout. Third, provided a summary of inferential statistics which includes Pearson Chi square test to determine the association between independent variables and dropout of immunization due to AEFI, as well as logistic regression analysis to examine the influence of the predicting variables on the criterion construct (i.e. dropout of immunization due to AEFI) as required for RQ1. The predicting variables were (a) number of children taken for RI, (b) number of children completing RI schedules, (c) child having AEFI, (d) number of children with AEFI, (e) type of AEFI, (f) AEFI not reported to health facility, (g) reason for not reporting AEFI, (h) caregivers' knowledge of type of AEFI, (i) preferred place of treatment for AEFI, (j) reason of choice of preferred place for treatment, (k) benefits of completing immunization, and (l) willingness to completing immunization by reporting AEFI to health facility for appropriate assistance. The study was conducted in 20 out of the 27 LGAs of Jigawa

State. These 20 LGAs were those with more than 10% dropout of immunization. Local permission to conduct the study was obtained from the SPHCDA.

## Preliminary Data Analysis

Usually in quantitative research, researchers consider preliminary data analysis using exploratory data analysis (EDA) necessary for the purpose of cleaning the data from errors, normality testing the data distribution, linearity between the IVs and the DV, equality of variance, missing values and the reliability, and to find out if the assumptions of the selected tests were met or violated, and if other patterns existed (Pallant, 2007). EDA is an important step in data cleaning and/or elimination of error because no matter how carefully the data are keyed in, some errors are bound to occur. As a result, before undertaking any statistical analysis for a quantitative measurement, exploratory data analysis should be carried out for all the variables. Norusis (1992) suggested that a researcher could examine in detail a variable or a set of variables before running any specific or confirmatory statistical analysis on any data collected by using EDA. In this study, EDA was considered essential for the success of the data analysis. The EDA was checked using descriptive statistics to identify missing data and outliers, hence logistic regression does not require a test of normality. This is aimed at identifying errors so that necessary correction, smoothing and re-expression of data can be made easily. Thus, a total of 329 questionnaires were keyed in. However, after the EDA test, 22 responses were removed from the data set due to missing data and extreme outliers on some variables. This reduced the sample size to 307, which were used for data analysis in order to clear the data from any type of error and inconsistency.

## Descriptive Data

### Background Information of Respondents

This section described the background information variables using appropriate charts. These are age distribution respondents, sex of dropout child, number of children less than 2 years in household, ethnicity, occupation, level of education, marital status, religion, and number of children of the caregiver. Age distribution. The ages of the respondents ranged between 18 years and 55 years. Figure 1 shows that the age group of 25-35 years old were 58.6%, which constituted the majority. The other participants were in the age group of 36-45 years constituting 20.5%, 18-24 years representing 17.6%, and more than 45 years were 3.3%. The age mean score was 30.97 years with standard deviation of 7.7 years.

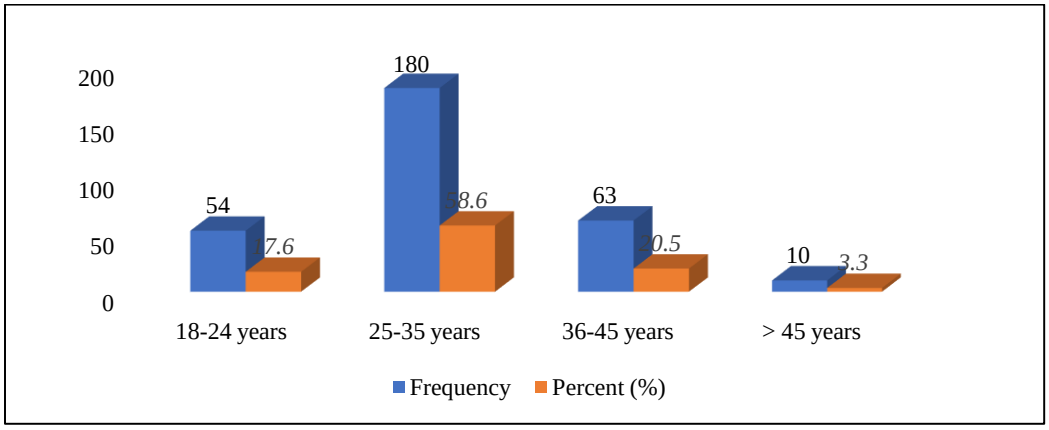


*Figure one.* Age distribution of respondents.

**Sex of dropout child.** Among the total of 307 dropout children sampled, males constituted 57.0%, while and females were 43.0% as illustrated in Figure 2 below.

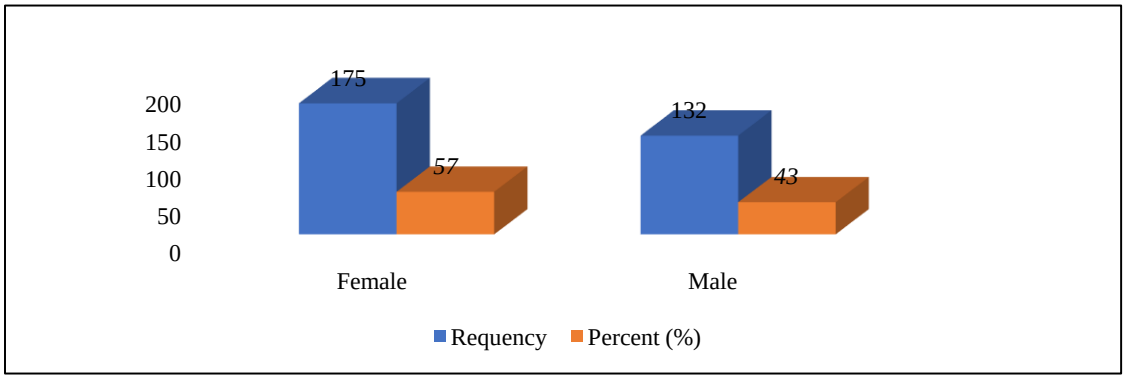


*Figure two.* Sex of dropout child.

**Number of children less than 2 years in household.** The number of households with 1 child less than 2 years were 66.4%. Other households had 2 or more children less than 2 years as shown in Figure 3 below. This finding confirms that each household has taken at least one child for immunization in the last 2 years.

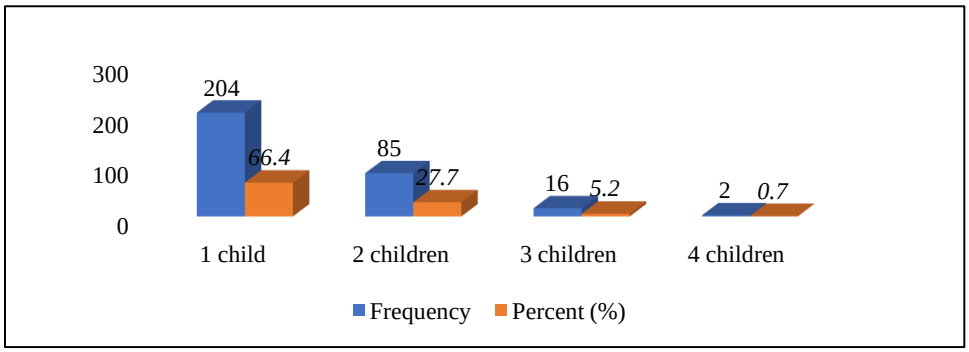


*Figure three.* Number of children < 2 years in households.

**Ethnicity and religion of respondents.** Among the caregivers interviewed, 81.4% of were of Hausa ethnic background, while 10.1% were Fulani and 8.5% were of other ethnic groups. All respondents were Muslim.

**Occupation of caregivers.** Figure 4 displays the occupational diversity of the sampled population for which those who were into trading represented 35.8%, farming was 29.3%, and others including housewife was 27.4%. The remaining 7.5% were fisher folks, craftsmen, office workers, and apprentice or student.

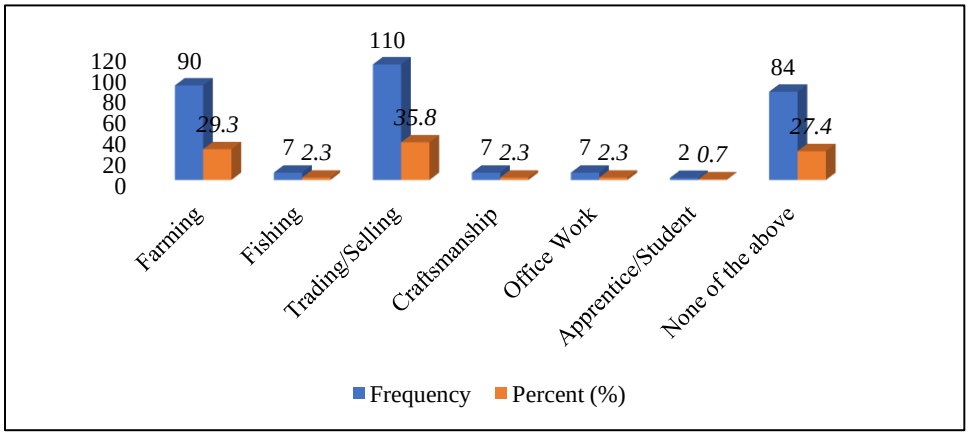


*Figure four.* Occupation of caregivers.

**Caregivers level of education.** With regards to caregiver level of education, the findings in Figure 5 showed that those who did not have formal education constituted the majority, 53.1%. Those who attended only primary school were 26.4%, secondary school were 17.3%, and tertiary institutes were 3.3%.

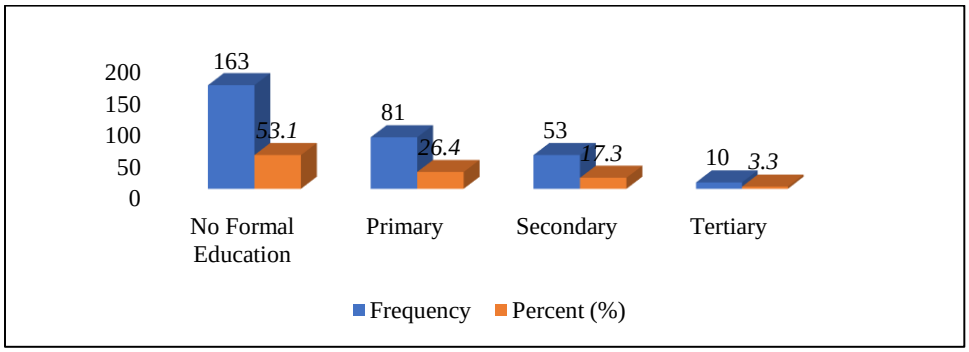


*Figure five.* Level of education of caregivers.

**Marital status of respondents.** Of the 307 respondents, 303, representing 98.7%, were married, while the remaining 1.3% were divorcees.

**Birth order of dropout child.** The study showed that more children with birth order of more than six dropped out of immunization. This category of children represented 43.0%. The dropouts among children with birth order of 4-6 were 35.8%, and those of 1-3 were 15.6%.

**AEFI and Dropping out of ImmunizationChildren who stopped RI due to AEFI.** Of the 307 children sampled, 53.4% dropped out of immunization due to AEFI. Additionally, the reported evidence gathered from the caregivers showed that 61.3% of all the children they have ever taken for RI have experienced AEFI and dropped out of RI. The findings showed a total of 402 children ever taken for RI in the sampled households including the sampled children but 247 had AEFI and dropped out of the immunization. Additionally, 23.8% of the respondents stated that they knew other caregivers who had stopped RI because their children suffered from AEFI. These

findings suggest that dropping out of immunization due to AEFI is a prevailing issue in the area.

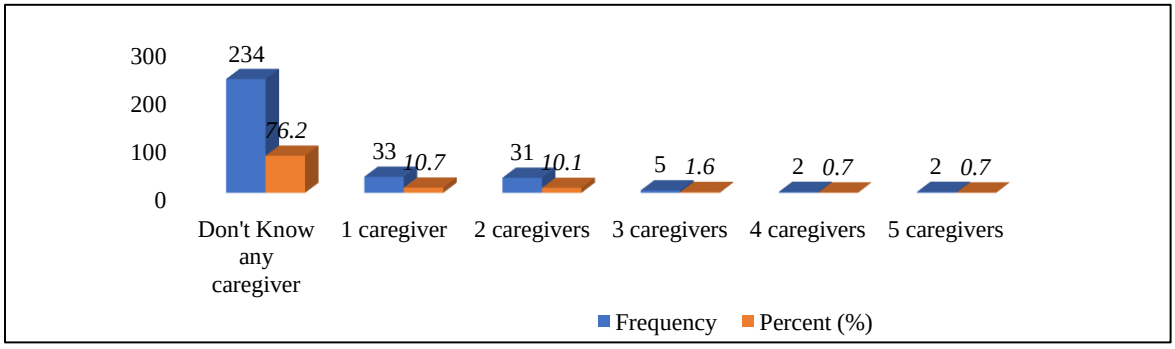


*Figure six.* Respondent knowing others caregivers who have stopped RI due to AEFI.

**Type of the AEFI**. As reported by the caregivers, 36.0% of the children suffered serious AEFI, while 64.0% had mild to moderate types.

**Knowledge of caregiver about AEFI and treatment options.** With regard to either the caregivers understand that there can be an adverse event following immunization or not, 43.8% of the 307 respondents answered yes while the remaining 56.2% said no. However, a greater proportion of them (79.2%) knew AEFI could be managed at health facilities while the remaining 20.8% thought it should be managed at other places outside health facility. The reasons why despite this high knowledge only 23.1% of the 164 caregivers who dropped out of RI due to AEFI presented the event at the health facilities have been shown in the Table 1 below.

Table 1

*Frequency and Percentage of Reasons Why AEFI Not Reported to Health Facility*

| Reasons | Frequency | Percent |
|---|---|---|
| Didn't see AEFI as severe so managed it at home | 64 | 39.0 |
| Long distance/difficult access to health facility | 13 | 7.9 |
| Visited a chemist and other unorthodox treatment sites | 42 | 25.6 |
| No money for transportation and other payments | 27 | 16.5 |
| No time to go to health facility to report AEFI | 7 | 4.3 |
| No reason/did nothing | 11 | 6.7 |

n = 164.

From the findings, I did not find access to health facility and cost of service to be major hindrances to reporting AEFI to health facilities. This is so because 81.4% of the 164 participants had ever taken their sick child to a health facility for treatment and the cost of treatment ranged from nothing to 1000 Naira (N) for 89.5% of them and for 10.5% the cost ranged from N1000 to N2000, though 18.6% had never done so (N360.00 = 1USD).

**Enhancers to Reporting AEFI at Health Facility**

The views of the 307 respondents in terms of what would enhance their efforts to report AEFI to health facility defer as shown in Table 2 below. However, 80.1% of them held the view that seeing AEFI as condition that needs to be managed at health facility, easy access by distance and time to the health facility, and having good knowledge or

understanding about AEFI and its reporting lines would enhance their efforts to present AEFI at health facilities.

Table 2

*Frequency and Percentage of Enhancers of Reporting AEFI and Avoiding Dropouts*

| Enhancer | Responses | |
|---|---|---|
| | Frequency | Percentage |
| See AEFI as condition that needs to be managed at health facility | 111 | 36.2 |
| Short distance/easy access to health facility | 40 | 13.0 |
| Friendly attitude and encouragement from health worker and family | 24 | 7.8 |
| Good knowledge/understanding about AEFI and its reporting lines | 63 | 20.5 |
| Have money for transportation and other payments at health facility | 22 | 7.2 |
| Have time to go to health facility to report AEFI | 32 | 10.4 |
| Incentive, e.g. insecticide treated bed net, ORS, Paracetamol syrup | 15 | 4.9 |

n = 307.

**Enhancers to Completing RI**

Six major enhancers to completing RI, as identified by the caregivers in the study, were (a) being able to see immunization as service for which one must complete at all costs, (b) easy access to the RI service delivery points, (c) friendly attitude and encouragement of health workers, (d) good knowledge and understanding about immunization schedules, (e) having a means of reminder on the due date for the next visit, and (f) provision of basic incentives (e.g., insecticides treated bed net, ORS, paracetamol syrup). Table 3 below illustrates frequencies and percentages of the responses obtained from the caregivers.

Table 3

*Frequency and Percentage of Enhancers to Completing RI*

| Enhancer | Responses | |
|---|---|---|
| | Frequency | Percentage |
| See immunization as service for which one must complete at all cost | 49 | 16.0 |
| Short distance/easy access to health facility | 32 | 10.4 |
| Friendly attitude and encouragement from health worker | 33 | 10.7 |
| Support/encouragement from family member or relative | 18 | 5.9 |
| Have a means of reminder on the due date for the schedules | 40 | 13.0 |
| Good knowledge and understanding about immunization schedules | 48 | 15.6 |
| Have money for transportation and other payments | 23 | 7.5 |
| Have time to go for immunizations as scheduled | 24 | 7.8 |
| Incentive, e.g. insecticide treated bed net, ORS, Paracetamol syrup | 40 | 13.0 |

n=307

## Chi Square Analysis

Pearson's Chi Square test was conducted to determine the association between 12 of the study IVs and the DV which was dropout of immunization due to AEFI. These IVs are (a) number of children taken for RI, (b) number of children completing RI schedules, (c) child having AEFI, (d) number of children with AEFI, (e) type of AEFI, (f) AEFI not reported to health facility, (g) reason for not reporting AEFI, (h) caregivers' knowledge of type of AEFI, (i) preferred place of treatment for AEFI, (j) reason of choice of preferred place for treatment, (k) benefits of completing immunization, and (l) completing immunization by reporting AEFI to HF for appropriate assistance with dropping out of immunization due to AEFI. Tables 4-15 below illustrate the Chi square analysis of the independent and the dependent variables.

The Pearson's Chi square analysis in Table 4 below shows that, there was no significant association between number of children taken for RI and dropping out of immunization ($\chi^2$ (2, n = 307) = 1.513, Cramer's V = .070, $p$ = .469). However, the descriptive statistics for number of children taken for RI across the 3 categories indicated that, respondents who dropped out of immunization were higher compared to those who did not.

Table 4

*Pearson's Chi square of the Association between Number of Children taken for RI and Dropping out of Immunization Due to AEFI*

| | Dropout due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variables | Yes | No | $\chi^2$ – Stat. | *df* | Cramer's V | Sig-$\chi^2$ |
| Number of Children | | | 1.513 | 2 | .070 | .469 |
| 1 | 115 (37.5%) | 99 (32.2%) | | | | |
| 2 | 43 (14.0%) | 29 (9.4%) | | | | |
| 3 or more | 6 (2.0%) | 15 (4.9%) | | | | |

n = 307

However, the Chi square analysis in Table 5 below indicated a significant association between child having AEFI and dropping out of immunization ($\chi^2$ (1, n = 307) = 4.405, Phi = .120, *p* = .036). Additionally, the descriptive analysis of dropping out of immunization related to child having AEFI showed that children having AEFI are more in dropout of immunization category than non-dropout of immunization category.

Table 5

*Pearson's Chi square of the Association between Child having AEFI and Dropping out Due to AEFI*

| Independent Variables | Dropout Due to AEFI | | $\chi^2$ – Stat. | *df* | Phi | Sig-$\chi^2$ |
|---|---|---|---|---|---|---|
| | Yes | No | | | | |
| Child having AEFI | | | 4.405 | 1 | .120 | .036 |
| Serious | 113(36.8%) | 82 (26.7%) | | | | |
| Not Serious | 51 (16.6%) | 61 (19.9%) | | | | |

n = 307

The Chi square results in Table 6 below shows that, there was a significant association between type of AEFI and dropping out of immunization ($\chi^2$ (3, n = 307) = 7.749, Cramer's V = .159, $p$ = .049). From the descriptive analysis, the number of respondents who were dropouts of immunization were higher than the non-dropouts. For dropouts of immunization in relation to type of AEFI, fever constituted 21.5%, pain or swelling or redness at site of injection was 16.9%, loss of appetite and continued crying was 11.1%, and severe allergic reactions was 3.9%.

Table 6

*Pearson's Chi square of the Association between Type of AEFI and Dropping out Due to AEFI*

| | Dropout Due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variable | Yes | No | $\chi^2$ – Stat. | *df* | Cramer's V | Sig -$\chi^2$ |
| Type of AEFI | | | 7.749 | 3 | .159 | .49 |
| Fever | 66 (21.5%) | 41 (13.4%) | | | | |
| Pain or swelling or redness at site of injection | 52 (16.9%) | 46 (15.0%) | | | | |
| Loss of appetite or crying a lot | 34 (11.1%) | 34 (11.1%) | | | | |
| Severe allergic reactions | 12 (3.9%) | 22 (7.2%) | | | | |

n=164

The finding in Table 7 below shows the Pearson's Chi square analysis between AEFI not reported to health facility and dropping out of immunization. The results indicated a significant association between the two variables ($\chi^2$ (1, n = 307) = 4.800, Phi = .125, $p$ = .028). So, the descriptive statistics shown that, for dropout of immunization categories in relation to AEFI not reported to health facility variable respondents who did nothing or treated outside health facility treatment constitutes 8.5%

for “Yes” and 3.6% for “No”; while those who reported it to health facility/RI session constitutes 45.0% for “Yes” and 43.0% for “No” respectively.

Table 7

*Pearson’s Chi – Square of the Association between AEFI not reported to Health Facility and Dropping out Due to AEFI*

| | Dropout Due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variables | Yes | No | $\chi^2$ – Stat. | *df* | Phi | Sig-$\chi^2$ |
| AEFI not Reported | | | 4.800 | 1 | .125 | .028 |
| Did Nothing or sought treatment outside HF | 148 (48.2%) | 117 (38.1%) | | | | |
| Reported it to Health Facility | 16 (5.2%) | 26 (8.5%) | | | | |

n = 307

The Pearson’s Chi square analysis in Table 8 below indicates a significant association between reason for not reporting AEFI to health facility and dropping out of immunization ($\chi^2$ (3, n = 307) = 8.087, Cramer’s V = .162, $p$ = .044). Additionally, the descriptive analysis of dropping out of immunization categories against reason for not reporting AEFI to health facility showed that respondents who dropped out of immunization are more than non-dropouts across the 4 categories of reason for not reporting AEFI to health facility (HF).

Table 8

*Pearson's Chi square of the Association between Reasons for not reporting AEFI to Health Facility and Dropping out Due to AEFI*

| Independent Variable | Dropout Due to AEFI | | $\chi^2$ – Stat | *df* | Cramer's V | Sig -$\chi^2$ |
|---|---|---|---|---|---|---|
| | Yes | No | | | | |
| Reason for not Reporting AEFI | | | 8.087 | 3 | .162 | .04 |
| Didn't see AEFI as severe so managed it at home | 15 (4.9%) | 26 (8.5%) | | | | |
| Long distance or difficult access to HF | 74 (24.1%) | 59 (19.2%) | | | | |
| Health worker behavior | 53 (17.3%) | 33 (10.7%) | | | | |
| No knowledge on reporting AEFI to HF | 25 (7.2%) | 22 (8.1%) | | | | |

n=307

Based on Pearson's Chi square analysis as shown in Table 9 below, the results revealed that, there was a significant association between caregivers' knowledge of type of AEFI and dropping out of immunization ($\chi^2$ (3, n = 307) = 29.342, Cramer's V = .309, $p$ = .000). The descriptive analysis also indicated that respondents who dropped out of immunization were more than respondents who did not drop out across the 4 caregivers' knowledge of type of AEFI categories.

Table 9

*Pearson's Chi square of the Association between Knowledge of Caregivers on Type of AEFI and Dropping out Due to AEFI*

| | Dropout Due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variable | Yes | No | $\chi^2$ – Stat. | *df* | Cramer's V | Sig-$\chi^2$ |
| Caregivers' Knowledge | | | 29.342 | 3 | .309 | .000 |
| Fever | 55 (17.9%) | 57 (18.6%) | | | | |
| Pain or swelling or redness at the site of injection | 59 (19.2%) | 20 (6.5%) | | | | |
| Loss of appetite or crying a lot | 34 (11.1%) | 26 (8.5%) | | | | |
| Severe allergic reactions | 16 (5.2%) | 40 (13.0 %) | | | | |

n = 307

Furthermore, the Pearson's Chi square analysis in Table 10 below shows that, there was a significant association between preferred place of treatment for AEFI and dropping out of immunization ($\chi^2$ (2, n = 307) = 19.926, Cramer's V = .255, $p$ = .000). The descriptive statistics for preferred place of treatment for AEFI categories indicated

that, the dropouts whose preferred place of treatment was outside the health facility were higher compared to the non-dropouts.

Table 10

*Pearson's Chi square of the Association between Preferred Place of Treatment for AEFI and Dropping out Due to AEFI*

| | Dropout Due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variable | Yes | No | $\chi^2$ – Stat. | *df* | Cramer's V | Sig-$\chi^2$ |
| Preferred Place of Treatment | | | 19.926 | 2 | .255 | .000 |
| Home treatment | 77 (25.1%) | 40 (13.0%) | | | | |
| Other places outside Health Facility | 72 (23.5%) | 66 (21.5%) | | | | |
| Health facility | 15 (4.9%) | 37 (12.0%) | | | | |

n = 307

Table 11 below shows the Pearson's Chi square analysis between reasons of choice of preferred place for treatment and dropping out of immunization. The findings have shown a significant association between reason of choice of preferred place for treatment and dropping out of immunization ($\chi^2$ (2, n = 307) = 33.497, Cramer's V = .330, $p$ = .000). Likewise, the descriptive statistics indicated that, respondents who

dropped out of immunization were higher than non-dropouts in reasons of choice of preferred place for treatment.

Table 11

*Pearson's Chi square of the Association between Reason of Choice of Preferred Place for Treatment and Dropping out Due to AEFI*

| | Dropout Due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variable | Yes | No | $\chi^2$ – Stat. | *df* | Cramer's V | Sig-$\chi^2$ |
| Reason of Choice | | | 33.497 | 2 | .330 | .000 |
| It is cheaper and faster | 84 (27.4%) | 30 (9.8%) | | | | |
| It works better for me | 43 (14.0%) | 45 (14.7%) | | | | |
| The service provider's attitude is good | 37 (12.1%) | 68 (22.0%) | | | | |

n = 307

The Pearson's Chi square analysis as shown in Table 12 below indicated a significant association between knowing the benefits of completing immunization and dropping out of immunization ($\chi^2$ (2, n = 307) = 8.087, Cramer's V = .406, $p$ = .000). The descriptive analysis of dropping out of immunization categories against benefits of completing immunization showed that for respondents who dropped out of

immunization due to AEFI, 13.7% said immunization prevents disease and makes children healthy, 24.4% said it saves their family time and money, and 15.3% indicated no benefit. For the others who did not drop out due to AEFI, 22.2%, said immunization prevents disease and makes children healthy, while those who said it saves my family time and money were 20.2% and no benefit category were 4.2%.

Table 12

*Pearson's Chi square of the Association between Benefits of Completing Immunization and Dropping out Due to AEFI*

| Independent Variable | Dropout of Due to AEFI | | $\chi^2$ – Stat. | *df* | Cramer's V | Sig-$\chi^2$ |
|---|---|---|---|---|---|---|
| | Yes | No | | | | |
| Benefits of Completing Immunization | | | 50.692 | 2 | .406 | .000 |
| Prevents disease and makes children healthy | 42 (13.7%) | 68 (22.2%) | | | | |
| Saves my family time and money | 75 (24.4%) | 62 (20.2%) | | | | |
| No benefit | 47(15.3%) | 13 (4.2%) | | | | |

n = 307

The finding in Table 13 below shows that, there was a significant association between completing immunization by reporting AEFI to HF for appropriate assistance and dropping out of immunization ($\chi^2$ (1, n = 307) = 11.716, Phi = -.195, $p$ = .001). Also, the descriptive analysis of completing immunization by reporting AEFI to HF for appropriate assistance against dropping out of immunization showed a slight difference in both categories of "Yes and No".

Table 13

*Pearson's Chi square of the Association between Completing Immunization by Reporting AEFI to Health Facility or RI clinic for Appropriate Assistance and Dropping out Due to AEFI*

| | Dropout Due to AEFI | | | | | |
|---|---|---|---|---|---|---|
| Independent Variable | Yes | No | $\chi^2$ – Stat. | *df* | Phi | Sig-$\chi^2$ |
| Completing Immunization | | | 11.716 | 1 | -.195 | .001 |
| Health Facility | 125 (40.7%) | 130 (42.3%) | | | | |
| RI Clinic | 39 (12.7%) | 13 (4.2%) | | | | |

n = 307

## Binary Logistic Regression

A Simple and Multiple Binary Logistic Regression using Enter Method were performed to determine the individual and collective effects of 10 IVs on likelihood that the respondent dropped out of immunization due to AEFI or not using dichotomous options of "0" = not dropout of immunization due to AEFI or "1" = dropout of immunization due to AEFI. These IVs are (a) number of children taken for RI, (b) child having AEFI, (c) type of AEFI, (d) AEFI not reported to health facility, (e) reason for not reporting AEFI, (f) caregivers' knowledge of type of AEFI, (g) preferred place of treatment for AEFI, (h) reason of choice of preferred place for treatment, (i) benefits of completing immunization, and (j) completing immunization by reporting AEFI to HF for appropriate assistance with dropping out of immunization due to AEFI.

A Simple Logistic Regression analysis as shown in Table 14 below was conducted to determine the effect of number of children taken for RI on the likelihood that respondents were dropouts due to AEFI or dropout not due to AEFI. The model containing only one independent variable (number of children taken for RI) is not significant ($\chi^2$ (2, n = 307) = 1.522, $p$ = .467). This indicated that the model was unable to distinguish between dropouts due to AEFI and those who were not. This also means that, the result of both Simple and Multiple Logistic Regressions models of dropping out of immunization due to AEFI, based on Unadjusted (OR) and Adjusted Odd Ratio (AOR) was not statistically significant. In this regard, number of children taken for RI is not a significant predictor of dropping out of immunization due to AEFI.

Table 14

*Association between Number of Children taken for RI and Dropping out of Immunization Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *P* | Lower | Upper |
| Number of Children | | | | | | | | |
| 1 – 3 | .718 | .229 | .419 | 1.231 | .449 | .093 | .176 | 1.142 |
| 4 – 6 | 1.065 | .916 | .333 | 3.402 | 2.058 | .552 | .191 | 22.222 |

For SLR: Cox and Snell $R^2$ = .005; Nagelkerke $R^2$ = .007; [($\chi^2$ (2, n = 307) = 1.522, $p$ = .467)]

Variable(s) entered on step 1: Number of children taken for RI

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

However, the result of the Simple Binary Logistic Regression model analysis have shown a statistically significant association between child having AEFI and dropping out of immunization ($\chi^2$ (1, n = 307) = 44.990, $p$ = .000). This revealed that the model was able to differentiate between "1 = dropout due to AEFI" and "0 = dropout not due to AEFI based on child having AEFI categories. The result produced by Simple Logistic Regression Model showed that, between 1.4% (Cox and Snell R square = .014) and 1.9% (Nagelkerke R squared = .019) of the variance in likelihood of dropping out of

immunization was explained by child having AEFI; and correctly classified 56.7% of cases. The result in Table 15 below shows that, there is a significant effect of "Yes" for Child having AEFI on dropping out of immunization among the respondents based on the OR = 1.648, $p$ = .036, (95% CI 1.032, 2.632). This also shown that, respondents who answered "Yes" for Child having AEFI are almost 2 times more likely to drop out of immunization compared to respondents who answered "No". After controlling for the compounding variables using Multiple Logistic Regression, the result showed a very high and significant increase in respondents who answered "Yes" for Child having AEFI on dropping out of immunization among the respondents based on the AOR = 6.171, $p$ = .001, (95% CI 2.025, 18.803). This is an indication that, respondents who answered "Yes" for Child having AEFI are 6 times more likely to drop out of immunization.

Table 15

*Association between Child having AEFI and Dropping out of Immunization Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *p* | Lower | Upper |
| Child having AEFI | | | | | | | | |
| Yes | 1.648 | .036 | 1.032 | 2.632 | 6.171 | .001 | 2.025 | 18.803 |
| For SLR: Cox and Snell $R^2$ = .014; Nagelkerke $R^2$ = .019; [($\chi^2$ (1, n = 307) = 4.406, $p$ = .036)] | | | | | | | | |

Variable(s) entered on step 1: Child having AEFI

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

The Simple Binary Logistic Regression analysis performed to determine the association between type of AEFI and likelihood of dropout is illustrated in Table 16 below. Thus, the model containing type of AEFI as a predictor variable was statistically significant ($\chi^2$ (3, n = 307) = 7.811, $p$ = .049). This indicated that the model was able to distinguish between respondents who "1 = dropout due to AEFI" and those who "0 = not dropout due to AEFI" based on type of AEFI categories. The result of the Simple Logistic Regression Model indicated that, between 2.5% (Cox & Snell R square = .025) and 3.4% (Nagelkerke R squared = .034) of the variance in dropping out of immunization due to AEFI was explained by type of AEFI of the respondents; and correctly classified 56.7% of cases. Additionally, the result in Table 16 shows that, there was a significant relationship between loss of appetite or continued crying and dropping out of immunization [OR = 2.951, $p$ = .008, (95% CI 1.321, 6.595)]. This means, children who had AEFI of loss of appetite or continued crying are almost 3 times more likely to drop out of immunization. However, the result indicated that, there is no significant effect of fever [OR = 1.424, $p$ = .213, (95% CI .817, 2.483)] and pain, or swelling, or redness at site of injection [OR = 1.610, $p$ = .129, (95% CI .871, 2.977)] on dropping out of immunization due to the AEFI. After controlling for the compounding variables using Multiple Logistic Regression the result showed an increased in the Adjusted Odd Ratio (AOR) to 3.656, $p$ = .046, (95% CI 1.026, 13.027) for loss of appetite or continued crying, which means children who had loss of appetite or continued crying were almost 4 times more likely to drop out of immunization compared to children with fever and pain, swelling, or redness at site of injection.

Table 16

*Association between Type of AEFI and Dropping out of Immunization Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *p* | Lower | Upper |
| Type of AEFI | | | | | | | | |
| Fever | 1.424 | .213 | .817 | 2.483 | 1.145 | .739 | .516 | 2.538 |
| Pain, swelling or redness at injection site | 1.610 | .129 | .871 | 2.977 | 1.233 | .643 | .509 | 2.985 |
| Loss of appetite or crying a lot | 2.951 | .008 | 1.321 | 6.595 | 3.656 | .046 | 1.026 | 13.027 |

For SLR: Cox and Snell $R^2$ = .025; Nagelkerke $R^2$ = .034; [($\chi^2$ (3, n= 307) = 7.811, $p$ = .049)]

Variable(s) entered on step 1: Type of AEFI

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

Furthermore, the findings of the Simple Binary Logistic Regression analysis showed that there was a significant association between AEFI not reported to health facility or RI clinic and dropping out of immunization ($\chi^2$ (1, n= 307) = 4.955, $p$ = .026). This indicated that the model was able to differentiate between "1 = dropout due to

AEFI" and "0 = dropout not due to AEFI based on AEFI not reported to health facility or RI clinic categories. The result generated by Simple Logistic Regression Model showed that, between 1.6% (Cox and Snell R square = .016) and 2.1% (Nagelkerke R squared = .021) of the variance in likelihood of dropping out of immunization due to AEFI was explained by AEFI not reported to health facility or RI clinic; and correctly classified 53.4% of cases. The result in Table 17 below shows that, there is a significant effect of "Yes" for AEFI not reported to health facility on dropping out of immunization due to AEFI among the respondents based on the OR = 2.261, $p$ = .032, (95% CI 1.074, 4.759). This shows that, respondents who answered "Yes" for AEFI not reported to health facility or RI clinic are 2 times more likely to drop out of immunization due to AEFI compared to respondents who answered "No". After controlling for the compounding variables using Multiple Logistic Regression, the result showed a significant increase in respondents who answered "Yes" for AEFI not reported to health facility or RI clinic on dropping out of immunization due to AEFI among the respondents based on the AOR = 3.119, $p$ = .042, (95% CI 1.041, 9.349). This indicated that, respondents who answered "Yes" for AEFI not reported to health facility or RI clinic are 3 times more likely to drop out of immunization due to AEFI.

Table 17

*Association between AEFI not Reported to Health Facility or RI Clinic and Dropping out of Immunization Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *p* | Lower | Upper |
| AEFI not reported Did Nothing or treated outside HF | 2.261 | .032 | 1.074 | 4.759 | 3.119 | .042 | 1.041 | 9.349 |

For SLR: Cox and Snell $R^2$ = .016; Nagelkerke $R^2$ = .021; [($\chi^2$ (1, n= 307) = 4.955, $p$ = .026)]

Variable(s) entered on step 1: AEFI not reported to health facility

*Note*. OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

Similarly, the result in Table 18 shows a statistically significant association between reason for not reporting AEFI to health facility or RI clinic and dropping out of immunization due to the AEFI ($\chi^2$ (3, n= 307) = 8.131, $p$ = .043). This indicated that the model was able to differentiate between "1 = dropout due to AEFI" and "0 = dropout not due to AEFI" based on the reason for not reporting AEFI to health facility or RI clinic

categories. The result produced by Simple Logistic Regression Model showed that, between 2.6% (Cox and Snell R square = .026) and 3.5% (Nagelkerke R squared = .035) of the variance in likelihood of dropping out of immunization due to AEFI was explained by reason for not reporting AEFI to health facility or RI clinic; and correctly classified 58.0% of cases. The finding further showed that, there was a significant effect of reason of didn't see AEFI as severe so managed it at home [OR = .460, $p$ = .035, (95% CI .224, .947)] and long distance or difficult access to site of reporting site (i.e. health facility or RI clinic) [OR = .359, $p$ = .009, (95% CI .166, .776)] on dropout due to AEFI. However, the result indicated no significant influence of health worker behavior on dropout due to AEFI [OR = .656, $p$ = .333, (95% CI .279, 1.543)].

This also shows that, caregivers who didn't see AEFI as severe so managed it at home and long distance or difficult access to the site of reporting were respectively almost 0.5 times and 0.4 times less likely to drop out of immunization compared to respondents who answered health worker behavior. However, after controlling for the compounding variables using Multiple Logistic Regression, the result showed a slight significant decrease in respondents who didn't see AEFI as severe so managed it at home [OR = .342, $p$ = .039, (95% CI .123, .947)] and long distance or difficult access to the site of reporting [OR = .264, $p$ = .014, (95% CI .091, .762)] on dropout due to AEFI. This reveals that, respondents who didn't see AEFI as severe so managed it at home and long distance or difficult access to the site of reporting were almost 0.3 times less likely to drop out of immunization due to AEFI compared to respondents who answered "health worker behavior."

Table 18

*Association between Reason for not reporting AEFI to Health Facility and Dropout Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *p* | Lower | Upper |
| Reason for not Reporting AEFI | | | | | | | | |
| Not serious so managed it at home | .460 | .035 | .224 | .947 | .342 | .039 | .123 | .947 |
| Long distance to HF or difficult access | .359 | .009 | .166 | .776 | .264 | .014 | .091 | .762 |
| Health worker's behavior is poor | .656 | .333 | .279 | 1.543 | .541 | .336 | .155 | 1.892 |
| For SLR: Cox and Snell $R^2$ = .026; Nagelkerke $R^2$ = .035; [($\chi^2$ (3, n= 307) = 8.131, $p$ = .043)] | | | | | | | | |

Variable(s) entered on step 1: Reason for not reporting AEFI to health facility

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

The finding in Table 19 revealed that, knowledge of caregiver on type of AEFI was a significant predictor of likelihood to dropout due to AEFI. This means that, the result of Simple Logistic Regressions showed a statistical significant association between fever [OR = .327, $p$ = .000, (95% CI .175, .613)] and loss of appetite [OR = 2.412, $p$ = .012, (95% CI 1.212, 4.800)] with dropout due to AEFI. Children with fever as AEFI were 0.3 times less likely to drop out of immunization due to the AEFI but those with loss of appetite or continued crying were 2 times more likely to be dropouts due to the AEFI. Pain or swelling or redness at the site of vaccination had no significant effect on dropout due to AEFI [OR = .738, $p$ = .345, (95% CI .393, 1.387)]. However, after controlling for the compounding variables in the model the result showed a significant decrease on fever which reduced to .243 times [AOR = .243, $p$ = .002, (95% CI .100, .588)] less likely to drop out of immunization while pain or swelling or redness at the site of vaccination and loss of appetite were found to be insignificant. Moreover, the Simple Logistic Regression model of caregivers' knowledge on type of AEFI and dropout due to AEFI was statistically significant ($\chi^2$ (3, n= 307) = 30.417, $p$ = .000) by indicating between 9.4% (Cox & Snell R square = .094) and 12.6% (Nagelkerke R squared = .126) of the variance in the dropout due to AEFI as explained by caregivers' knowledge of type of AEFI; and correctly classified 61.9% of cases.

Table 19

*Association between Caregivers' Knowledge of Type of AEFI and Dropout Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *p* | Lower | Upper |
| Caregivers' Knowledge | | | | | | | | |
| Fever | .327 | .000 | .175 | .613 | .243 | .002 | .100 | .588 |
| Pain or swelling or redness at site of vaccination | .738 | .345 | .393 | 1.387 | .747 | .559 | .281 | 1.986 |
| Loss of appetite | 2.412 | .012 | 1.212 | 4.800 | 2.024 | .171 | .738 | 5.546 |
| For SLR: Cox and Snell $R^2$ = .094; Nagelkerke $R^2$ = .126; [($\chi^2$ (3, n= 307) = 30.417, *p* = .000)] | | | | | | | | |

Variable(s) entered on step 1: Knowledge of caregivers on type of AEFI

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

Additionally, the Simple Logistic Regression model of preferred place of treatment for AEFI and dropout due to AEFI was statistically significant ($\chi^2$ (2, n= 307)

= 20.335, *p* = .000). This indication between 6.4% (Cox and Snell R square = .064) and 8.6% (Nagelkerke R squared = .086) of the variance in dropout due to AEFI was explained by preferred place of treatment for AEFI and correctly classified 60.6% of cases. Simple Logistic Regression analysis was used to examine the effect of preferred place of treatment for AEFI and dropout due to AEFI. The finding in Table 20 shows that, preferred place of treatment for AEFI had a significant effect on dropout due to AEFI. This means that, the result of both Simple and Multiple Logistic Regressions based on Unadjusted (OR) and Adjusted Odd Ratio (AOR) were statistically significant in the relationship between home treatment [OR = 1.765, *p* = .028 (95% CI 1.062, 2.931)] and other places outside health facility [OR = 4.748, *p* = .000 (95% CI 2.332, 9.670)] with dropout due to AEFI. This indicated that, home treatment and seeking help from other places outside health facility were respectively almost 2 times and 5 times more likely to drop out of immunization due to AEFI compare to health facility. After controlling for the compounding variables in the model the result increased 3 times [AOR = 2.925, *p* = .004, (95% CI 1.411, 6.063)] more likely to drop out of immunization due to AEFI for home treatment and decreased to 4 times [AOR = 3.611, *p* = .021 (95% CI 1.212, 10.756)] more likely to drop out of immunization due to AEFI for other places outside health facility compared to health facility.

Table 20

*Association between Preferred Place of Treatment for AEFI and Dropout Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *p* | Lower | Upper | AOR | *P* | Lower | Upper |
| Preferred place of treatment | | | | | | | | |
| Home treatment | 1.765 | .028 | 1.062 | 2.931 | 2.925 | .004 | 1.411 | 6.063 |
| Other places outside health facility | 4.748 | .000 | 2.332 | 9.670 | 3.611 | .021 | 1.212 | 10.756 |
| For SLR: Cox and Snell $R^2$ = .064; Nagelkerke $R^2$ = .086; [($\chi^2$ (2, n= 307) = 20.335, $p$ = .000)] | | | | | | | | |

Variable(s) entered on step 1: Preferred place of treatment for AEFI

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

The Simple Logistic Regression model of dropping out of immunization due to AEFI against reason of choice of preferred place for treatment was statistically significant ($\chi^2$ (2, n = 307) = 34.531, $p$ = .000). The model revealed that between 10.6% (Cox and Snell R square = .106) and 14.2% (Nagelkerke R squared = .142) of the

variance in dropout due to AEFF not reported in health facility was explained by reason of choice of preferred place for treatment and correctly classified 64.2% of cases. Further, the finding in Table 21 below has shown that there was a significant relationship between the reason "it is cheaper and faster [OR = 2.930, *p* = .000 (95% CI 1.624, 5.288)]" and "it works better for me [OR = 5.146, *p* = .000 (95% CI 2.887, 9.173)]" with dropping out of immunization due to AEFI among the respondents. This means, respondents who agreed that, reason of choice of preferred place for treatment was because of "it is cheaper and faster" and "it works better for me" were respectively 3 times and 5 times more likely to drop out of immunization due to AEFI compared to those who agreed as "the service provider's attitude is good." Moreover, after controlling for the compounding variables using Multiple Logistic Regression, the result for "it is cheaper and faster" showed a significant increase in the Adjusted Odd Ratio (AOR) to 4.287, *p* = .001, (95% CI 1.880, 9.777) and significant decrease for "it works better for me" in the Adjusted Odd Ratio (AOR) to 4.118, *p* = .000, (95% CI 1.876, 9.043). This shows that the caregivers who agreed with both "it is cheaper and faster" and "it works better for me" were 4 times each more likely to be dropout of immunization due to AEFI compared to those who were in the reason "the service provider's attitude is good" category.

Table 21

*Association between Reason of Choice of Preferred Place for Treatment and Dropout of Immunization Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *p* | Lower | Upper | AOR | *P* | Lower | Upper |
| Reason of choice of preferred treatment | | | | | | | | |
| It is cheaper and faster | 2.930 | .000 | 1.624 | 5.288 | 4.287 | .001 | 1.880 | 9.777 |
| It works better for me | 5.146 | .000 | 2.887 | 9.173 | 4.118 | .000 | 1.876 | 9.043 |
| For SLR: Cox and Snell $R^2$ = .106; Nagelkerke $R^2$ = .142; [($\chi^2$ (2, n= 307) = 34.531, *p* = .000)] | | | | | | | | |

Variable(s) entered on step 1: Reason of choice of preferred place for treatment

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

For benefits of completing immunization, the finding from Simple Logistic Regression analysis showed a statistically significant association between knowing the benefits of completing immunization and dropping out due to AEFI ($\chi^2$ (2, n = 307) =

55.132, $p$ = .000). The result of the model revealed that, between 16.4% (Cox and Snell R square = .164) and 22.0% (Nagelkerke R squared = .220) of the variance in dropout due to AEFI was explained by benefits of completing immunization and correctly classified 66.8% of cases. Likewise, the result in Table 22 below shows that, there was a significant association between the benefit "prevents disease and makes children healthy" [OR = .107, $p$ = .000, (95% CI .053, .216)] whereas benefit "saves my family time and money" was found to be insignificant [OR = .815, $p$ = .457, (95% CI .475, 1.398)]. This means, caregivers who answered "prevents disease and makes children healthy" for benefit of completing immunization were .107 times less likely to be dropout due to AEFI compared to those who said "saves my family time and money" and "no benefit." Besides, after controlling for the compounding variables using Multiple Logistic Regression, the result for "prevents disease and makes children healthy" indicated a significant decrease in the Adjusted Odd Ratio (AOR) to .057, $p$ = .000, (95% CI .021, .155) This suggests that participants with the view of immunization having benefit of "preventing disease and making children healthy" category were .057 times less likely to drop out of immunization due to AEFI.

Table 22

*Association between Benefits of Completing Immunization and Dropout Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *P* | Lower | Upper |
| Benefits of completing RI Prevents disease and makes children healthy | .107 | .000 | .053 | .216 | .057 | .000 | .021 | .155 |
| Saves my family time and money | .815 | .457 | .475 | 1.398 | .624 | .226 | .291 | 1.338 |
| For SLR: Cox and Snell $R^2$ = .164; Nagelkerke $R^2$ = .220; [($\chi^2$ (2, n= 307) = 55.132, *p* = .000)] | | | | | | | | |

Variable(s) entered on step 1: Benefits of completing immunization

*Note.* OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

As analyzed, the result of the Simple Binary Logistic Regression analysis indicated that there was a significant association between completing immunization by reporting AEFI to HF for appropriate assistance and dropping out of immunization due to AEFI ($\chi^2$ (1, n= 307) = 12.265, *p* = .000). The model showed that, between 3.9% (Cox

and Snell R square = .039) and 5.2% (Nagelkerke R squared = .052) of the variance in likelihood of dropping out of immunization due to AEFI was explained by completing immunization by reporting AEFI to HF for appropriate assistance and correctly classified 55.0% of cases. The result in Table 23 below showed that, there was a significant effect of "yes" for completing immunization by reporting AEFI to HF for appropriate assistance on dropping out of immunization due to AEFI among the respondents based on the OR = .321, $p$ = .001, (95% CI .163, .629). This indicated that, respondents who answered "yes" for completing immunization by reporting AEFI to HF for appropriate assistance were .321 times less likely to drop out of immunization due to AEFI compared to respondents who responded "no". After controlling for the compounding variables using Multiple Logistic Regression, the result showed a significant decrease in respondents who answered "yes" based on the AOR = .094, $p$ = .000, (95% CI .034, .258). This indicated that, respondents who answered "yes" for completing immunization by reporting AEFI to HF for appropriate assistance were .094 times less likely to drop out of immunization due to AEFI.

Table 23

*Association between Completing Immunization by Reporting AEFI to HF for Appropriate Assistance and Dropout Due to AEFI*

| | Simple Logistic Regression | | | | Multivariate Logistic Regression | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 95% C.I. for EXP(B) | | | | 95% C.I. for EXP(B) | |
| Variable | OR | *P* | Lower | Upper | AOR | *P* | Lower | Upper |
| Completing immunization | | | | | | | | |
| Yes | .321 | .001 | .163 | .629 | .094 | .000 | .034 | .258 |
| For SLR: Cox and Snell $R^2$ = .039; Nagelkerke $R^2$ = .052; [($\chi^2$ (1, N = 307) = 12.265, $p$ = .000)] | | | | | | | | |

Variable(s) entered on step 1: Completing immunization by reporting AEFI to HF for appropriate assistance

*Note*. OR:- Odd Ratio; AOR:- Adjusted Odd Ratio; *p*:- p – value; CI:- Confidence Interval; SLR:- Simple Logistic Regression.

**Assessing the Final Model**

The 10 categorical predicting independent variables contributing to dropout due to AEFI were used for the Multiple Logistic Regression model analysis. In this regard, the Omnibus Tests of Model Coefficients illustrated that, the Multiple Logistic Regression model is statistically significant ($\chi^2$ (25, N = 307) = 168.394, $p$ = .000) for the all predictor variables entered in to the regression equation. The result of the

Multiple Logistic Regression Model in Table 24 indicated that, between 42.2% (Cox & Snell R square = .422) and 56.4% (Nagelkerke R squared = .564) of the variance in likelihood of dropping out of immunization due to AEFI was explained by all predictor variables in the model; and correctly classified 81.4% of cases.

Additionally, the Multiple Logistic Regression analysis after controlling for the compounder variables, showed that the results of number of children completing RI schedules, child having AEFI, number of children with AEFI, type of AEFI, AEFI not reported to health facility, reason for not reporting AEFI to HF, caregivers' knowledge of type of AEFI, preferred place of treatment for AEFI, reason of choice of preferred place for treatment, and benefits of completing immunization as well as completing immunization by presenting AEFI at HF for appropriate assistance were significant predictors of likelihood of dropping out of immunization due to AEFI or not. However, it was only number of children taken for RI which was found to have no significant association with likelihood of dropout of immunization due to AEFI. This means number of children taken for RI was not a significant predictor of dropout due to AEFI.

Table 24

*Predictive Model on the Dropping out of Immunization Due to AEFI for Multivariate Logistic Regression*

| Model Fits Information | | | | | Pseudo R – Square | | |
|---|---|---|---|---|---|---|---|
| Model | -2 Log Likelihood | Chi – Square | *df* | *p* | Cox & Snell | Nagelkerke | Hosmer and Lemeshow Test |
| Final Model | 255.760 | 168.394 | 25 | .000 | .422 | .564 | (5.361, *p* = .718) |

# Chapter 5: Discussion, Conclusion, and Recommendation

## Introduction

This quantitative cross-sectional study was designed to provide evidence regarding whether or not AEFI contributed to the high immunization dropout phenomenon in Jigawa State of northwest Nigeria. It was a correlational research aimed at unearthing the association between exposure to AEFI and dropping out of immunization without reporting the AEFI to a health facility or RI clinic. The purpose was to help the state with information that could explain the influence of low reporting of AEFI on immunization dropout and provide ideas from caregivers to address the occurrences of low reporting of AEFI to health facility and dropout of immunization. In this chapter, the findings were interpreted and provided conclusions and recommendations. The chapter also covered the social correlational implications for the study and the theoretical context of the findings.

## Summary of Findings

A total of 307 caregivers between the ages of 18 and 55 years whose children had dropped out of RI within the last 2 years were interviewed. A representation of 58.6% who constituted the majority were in the age bracket of 25 to 35 years. All respondents were Muslim, and 81.4% belonged to the Hausa ethnic background. Of the respondents, those whose occupations were trading and farming made up 65.1%. A proportion of 79.1% of the respondents either did not have any formal education or ended up in primary school. Fifty seven percent of the dropout children were males, whiles 43.0% were females and 78.8% of them were of the birth order of 4 or more.

Though 53.4% of the sampled children dropped out of RI due to AEFI, responses from the caregivers showed as high as 61.3% of children ever taken for RI in their households had episode of AEFI and dropped out of immunization. Meanwhile, only 23.1% of the caregivers presented the child with AEFI at health facility or RI clinic for appropriate treatment. As high as 79.2% of them knew AEFI could be managed at a health facility, yet 76.9% of the children who experienced AEFI were managed at other places outside the health facility for a variety of reasons. The major reason why the child with AEFI was not presented at a health facility or RI clinic was that caregivers did not see the AEFI as severe so managed it at home. Others, by convenience and easy access, visited chemists and other unorthodox treatment sites for assistance, while some attributed the reason to no money for transportation and other payments to be made at the health facility. The study clearly showed that dropout from immunization due to AEFI is high in the area (95% CI; $p < .001$; $\chi^2 = .036$). It indicated that children having AEFI were almost 2 times more likely to drop out of immunization compared to those without AEFI. Also, the rate of AEFI reporting to health facilities was low and this significantly influenced dropout from immunization. The study showed that there was a significant association between the AEFI not reported to the health facility and dropping out of immunization due to the AEFI (95% CI; $\chi^2 = .028$; $p = .032$). Respondents who did not report AEFI to the health facility or RI clinic were 2 times more likely to drop out of immunization due to AEFI compared to respondents who subscribed to health facility treatment. Additionally, there was a significant evidence indicating that reporting AEFI to a health facility or RI clinic for appropriate assistance was associated with

completing immunization (95% CI; $\chi^2$ =.001; $p < .001$). The respondents with the view of completing immunization by reporting AEFI to health facility or RI clinic for appropriate assistance were 3 times less likely to drop out of immunization due to AEFI. On the other hand, caregivers who sought for home treatment and assistance from other places outside the health facility in managing the AEFI were respectively almost 2 times and 5 times more likely to drop out of immunization due to AEFI compare to those who sought health facility treatment.

According to the caregivers, the two most preferred enhancers required to report AEFI to health facility for necessary assistance and possible avoidance of dropouts were (a) caregivers should be made aware through education to see AEFI as a condition that needs to be managed at a health facility, and (b) to have a good knowledge or understanding about AEFI and its reporting lines. According to the caregivers, the major enhancers required for completing RI schedules were (a) seeing immunization as service for which one must complete at all cost, (b) good knowledge and understanding about immunization schedules, (c) having a reminder on the due date of immunization, and (d) incentives (e.g., insecticide treated bed net, oral rehabilitation salt, and paracetamol syrup). These reported enhancers require RI program managers and service providers to put in place strategies that adequately engage clients enrolled in RI programs to ensure their clear understanding of AEFI and the need to report it at a health facility or RI clinic. The strategies should also be packaged such that they build the conscience of the RI clients to see immunization as a “must complete” venture. I hope that the

implementation of this study's recommendations based on the findings would ultimately contribute to improved immune status of infants with a reduction in incidence of VPDs.

## Discussion on the Findings

None of the background variables was statistically significant in influencing dropout of a child from immunization. These variables were sex of dropout child, age, number of children less than 2 years in household, ethnicity, occupation, number of years stayed in the community, level of education, marital status, religion, and number of children of the caregivers. However, a majority (76.2%) of the caregivers with dropout children were in the age group of 18-35 years. Those above 35 years were 23.8%. This finding corroborated the one which indicated that matured caregivers could understand better the burden of VPDs or have higher health literacy that could inform their decision to complete immunization and get their children fully immunized (Adedire et al., 2016; Adokiya et al., 2017; Johri et al., 2015; Kusuma et al., 2010). This suggests that dropout is likely to be less in populations of elderly (more than 35 years) caregivers than younger ones.

With respect to sex of child and chances of dropping out of immunization, this study showed that more males were dropouts than females. This is in line with Adokiya et al.'s (2017) findings that showed female children as being more likely to be fully immunized than their male counterparts, but it is in contrast with evidence provided by Johri et al. (2015) that showed females as having lower likelihood to be fully immunized than males.

All respondents were Muslim. Other researchers have shown higher incomplete immunization rates with Muslims than their Christian counterparts in the country. Adokiya et al. (2017) pointed to the fact that Christianity is more significantly associated with the likelihood of completing immunization schedule (likelihood of being fully vaccinated) than other religions. Ophori et al. (2014) showed an average fully-immunized coverage among Christian populations in the location as 24.2%, while that of Muslims was 8.8%. According to Ophori et al. (2014), the greatest challenge to acceptance of vaccination in Nigeria is a religious one and it dwells more among the Muslims in the north. This has led to the north having the lowest (less than 10%) fully immunized coverage in Nigeria (MICS, 2017; Ophori, 2014). Many studies have positively linked religion to improved immunization uptake (Adokiya et al., 2017; Baguune & Ndago, 2017; Johri et al., 2015; Kassahun et al., 2015; Subhani et al., 2015).

Contrary to the fact that socioeconomic factors influence complete immunization uptake (Adedokun et al., 2017; Lakew, Bekele, & Biadgilign, 2015; Papadimos, 2007; Shen et al., 2014), 72.6% of the caregivers were in occupations such as trading, farming, fishing, craftsmanship, and office work, but these did not translate to completing the immunization of their children.

Regarding caregivers' level of education, those who did not have formal education or ended at primary school level constituted the majority, 79.5%. This low level of education could be a contributing factor to the high dropouts. Ophori et al. (2014) indicated that community members, families, or individuals with low educational background are likely to have low uptake for complete immunization due to weak

understanding of its value. In such populations, dropouts are likely to be high. Caregivers' high level of education or awareness has been found to be significantly associated with fully immunized status of his or her child (Adedokun et al., 2017; Johri et al., 2015; Lakew et al., 2015). It could be said that if a caregiver is well educated or well informed, he or she would be better placed in understanding the preventive role of vaccines and the need to complete the scheduled vaccinations. According to Subhani, Yaseen, Khan, Jeelani, and Fatima (2015), highly educated mothers immunize their children more than the less educated or illiterate ones. Weak knowledge about the preventive role of vaccines is a threat to completing RI (Johri et al., 2015).

Children of birth order of more than six were the majority category of the dropouts. They constituted 43.0% of the sampled children. This was followed by those with birth order 4-6, who represented 35.8%. These results align with Adedokun et al. (2017) findings indicating that children of higher birth order of more than seven are more likely to be incompletely immunized. Over 97% of the respondents were married, but this status did not translate to improved uptake of full immunization as reported by some writers (Baguune et al., 2017; Oleribe, 2016).

As high as 61.3% of all the children ever taken for RI in the sampled households have experienced AEFI and dropped out of RI. This finding differs from that of Jegede and Owumi (2013), which indicated that patronage of immunization services is not strongly influenced by perceived side effects of vaccines. Meanwhile, only 23.1% of those who dropped out of RI due to AEFI presented the event at health facilities or RI clinics for necessary assistance. Additionally, 23.8% of the respondents stated that they

knew other caregivers who had stopped RI because of AEFI. These findings have confirmed the prevailing issues of low rate of reporting of AEFI at health facilities by caregivers and high rates of dropout from immunization in the area as reported (NPHCDA, 2017). Beyond confirming the report, this study has shown that dropout from immunization was significantly linked to episodes of AEFI (95% CI; $\chi^2 = .028$; $p = .001$).

**Research Questions**

Based on the background of the problem, three research questions were put forward and accordingly answered.

**Question 1.** How will the threat of low reporting of adverse event following immunization (AEFI) and perceived severity of the event influence immunization dropout?

Grounded in the alternative hypothesis ($H_1$), the study established a statistically significant influence of low rate of reporting of AEFI on immunization dropout. The study clearly established the fact that dropout of immunization due to AEFI was high in the area and significant association existed between child having AEFI and dropping out of immunization (95% CI; $p < .001$; $\chi^2 = .028$). It indicated that children having AEFI were almost 2 times more likely to drop out of immunization compared to those without AEFI (OR = 1.648; AOR = 6.171). However, there was no significant association between number of children taken for RI and dropping out of immunization (95% CI; $\chi^2 = 1.522$; $p = .469$). This showed that number of children taken for RI was not a significant predictor of dropping out of immunization due to AEFI. In this regard,

caregivers did not place any prevention of vaccine preventable disease value on children hence any child could drop out of immunization. The dropout which resulted from type of AEFI (i.e. serious or minor) related to fever, pain or swelling or redness at site of injection, loss of appetite and continued crying, as well as severe allergic reactions were significantly associated (95% CI; $p = .049$). However, children who had AEFI of loss of appetite or persistent crying were almost 3-4 times more likely to drop out of immunization compared to those having fever, pain or swelling or redness at the site of vaccination (OR = 2.951, $p = .008$; AOR = 3.656, $p = .046$).

The rate of reporting AEFI to health facility was low and this significantly influenced the dropout of immunization. The study showed that there was a significant association between the AEFI not reported to health facility and dropping out of immunization due to the AEFI (95% CI; $\chi^2 = .028$; $p = .028$). From the findings, respondents who held the view for AEFI not reported to health facility or RI clinic were 2-3 times more likely to drop out of immunization due to AEFI compared to respondents who subscribed to health facility treatment (OR=2.261, $p = .032$; AOR = 3.119, $p = .042$). Again, the reasons given for not reporting AEFI to health facility significantly influenced the dropout of immunization (95% CI; $p = .044$). Those who didn't see AEFI as severe so managed at home were 0.5 times less likely to drop out (OR =.460, $p = .035$) while those whose reason was long distance or difficult access to health facility or RI clinic were 0.4 times less likely to drop out of immunization due to AEFI (OR = .359, $p = .009$) compared to respondents whose reason was poor health worker behavior.

There was a significant association between knowledge of caregivers on type of AEFI and dropout of immunization (95% CI; $p < .001$). This means the caregivers could tell the types of the AEFI but such did not prompt them to seek for appropriate assistance which could have avoided the dropout. Knowledge of caregiver on type of AEFI was a significant predictor of likelihood to dropout due to AEFI. Children with fever as AEFI were 0.3 times less likely to drop out of immunization due to the AEFI (OR = .327, $p < .001$) but those with loss of appetite or persistent crying were 2 times more likely to be dropouts due to the AEFI (OR = 2.412, $p = .012$) compared to pain or swelling or redness at the site of vaccination.

The preferred place of treatment for AEFI significantly influenced their dropping out of immunization (95% CI; $p <.001$). This suggests that as long as caregivers chose to seek for assistance in managing AEFI outside the health facility they are likely to be dropouts of immunization. Caregivers who did home treatment (OR = 1.765, $p = .028$; AOR = 2.925, $p = .004$,) or sought help from other places outside health facility (OR = 4.748, $p < .001$; AOR = 3.611, $p = .021$) were respectively almost 2-3 times and 4-5 times more likely to drop out of immunization due to AEFI compared to health facility treatment. Their reasons for choice of the preferred place for treatment influenced their dropout (95% CI; $p <.001$). Those with the reason of choice of preferred place for treatment for AEFI as "it is cheaper and faster (OR = 2.930, $p < .001$; AOR = 4.287, $p = .001$) and "it works better for me" (OR = 5.146, $p < .001$; AOR= 4.118, $p < .001$) were respectively 3-4 times and 4-5 times more likely to drop out of immunization due to AEFI compared to those who said "the service provider's attitude is good."

A significant association existed between not knowing the benefits of completing immunization and dropout (95% CI; $p<.001$). This showed that if caregivers are helped to understand the benefit of completing immunization through appropriate information, education, and communication (IEC) strategies, their chances of dropping out of immunization could be minimized. Additionally, there was a significant evidence which pointed to the fact that reporting AEFI to health facility or RI clinic for appropriate assistance was associated with completing immunization (95% CI; $\chi^2 =.001$; $p =.001$). Caregivers who knew benefit of immunization as "preventing diseases and making children healthy" (OR =.107, $p < .001$; AOR = .057, $p < .001$) were .107 times less likely to be dropout due to AEFI compared to those who said "saves my family time and money" and "no benefit." The respondents with the view of completing immunization by reporting AEFI to health facility or RI clinic for appropriate assistance were .321 times less likely to drop out of immunization due to AEFI compared to those who sought treatment outside the health facility (OR = .321, $p = .001$; AOR = .094, $p < .001$). On the other hand, caregivers who sought for home treatment and help from other places outside health facility in managing AEFI were respectively almost 2 times and 5 times more likely to drop out of immunization due to AEFI compare to health facility.

**Question 2.** In what way will the caregivers whose infants have dropped out of RI program because they perceived their children as susceptible to AEFIs enhance their reporting of AEFIs to health facilities? From the viewpoint of the caregivers, the two most subscribed enhancers to reporting AEFI to health facility or RI clinic were to see AEFI as condition that needs to be managed at health facility and to have a good

knowledge or understanding about AEFI and its reporting lines. If caregivers are made to adequately know and understand the preventive role of vaccination and the need to complete the immunization schedules at all cost through appropriate health education and community engagements, they will endeavor to present AEFI to health facilities or RI clinics in their quest to get their children fully immunized (Subhani et al., 2015; Yaseen et al., 2015). Other enhancers identified were (a) short distance or easy access to health facility, (b) friendly attitude and encouragement from health worker and family, (c) having money for transportation and other payments at health facility, (d) having time to go to health facility to report AEFI; and (e) provision of incentives (e.g. insecticide treated bed net, ORS, Paracetamol syrup). Nonetheless, these other five enhancers can be overcome if caregivers get conviction about reporting AEFI at health facilities. This conviction can be attained if appropriate strategies are used at both health facility and community levels to educate and disseminate the need to report AEFI to caregivers. Should this happen, the caregivers will appropriately understand and be well grounded in their desire to get AEFI reported in health facility and in the process get their children fully immunized as access and cost did not come up strongly.

According to the caregivers, 36.0% of the children suffered serious AEFI while 64.0% had mild to moderate types. This suggests that majority of the events were not critical such that the local primary health care centers could not manage. Besides, 79.2% knew AEFI could be managed at health facilities. What seemed to be lacking was sufficient knowledge and understanding about possible adverse event following

immunization of their children. Less than half of them, 43.8% were in the known of the fact that there could be adverse event following the immunization the children received.

**Question 3.** How will the perceived benefits of immunization influence cues to action of caregivers with infants enrolled in RI program to ultimately complete the RI schedules?

The four major enhancers needed to complete RI schedules as emphasized by the caregivers were (a) to see immunization as service for which one must complete at all cost, (b) good knowledge and understanding about immunization schedules, (c) have means of reminder on the due date of immunization, and (d) incentives (e.g. insecticide treated bed net, Oral Rehabilitation Salt, Paracetamol syrup). Strategies of providing means of reminder to caregivers on their next immunization schedule and incentives to enhance complete RI uptake have been reported (Crocker-Buque et al., 2017). What needs to be strengthened as highlighted by the caregivers were health education and effective communication which includes provision of means of reminder for their next immunization session. Interventions such as community-based education or awareness creation programmes, effective use of SMS messaging services, and some forms of incentives have proven to be boosters of immunization compliance (Crocker-Buque et al., 2017). According to Oku et al. (2016) and Opel et al. (2015), weak communication and its associated interventions contribute to incomplete immunization. Oku and colleagues (2016) again showed that wide range of effective communication interventions promote uptake of childhood immunization. Enhancers such as friendly attitude and encouragement from health worker, have money for transportation and other

payments, and have time to go for immunizations as scheduled were also mentioned by the caregivers but did not come up strongly though other publications noted them as factors which influenced uptake of complete immunization (Adedokun et al., 2017; Aina & Ejembi, 2013). If caregivers are made to adequately know and understand the preventive role of vaccination and the need to complete the immunization schedules at all cost through appropriate health education and community engagements, they will endeavor to get their children fully immunized (Subhani et al., 2015; Yaseen et al., 2015).

## Interpretation of Findings in Context of the Theoretical Model

The Health Belief Model (HBM) was used to provide the theoretical basis for the study. It was modeled in the theoretical context that low rate of reporting of AEFI to health facilities negatively influenced immunization dropout. This was theorized in the sense that if caregivers perceived AEFI as threat to continuing immunization they would stop the immunization and the child becomes dropout (Glanz, Lewis, & Lewis, 2002). From the findings, this theory is fulfilled. The caregivers adopted the behavior and dropped out of immunization when the children were exposed to AEFI. The HBM posits that one's belief in a threat and the effectiveness of the recommended health behavior (RHB) will predict the likelihood to adopt the behavior (Painter et al., 2010; Reynolds, 1971). All the six major constructs were expressed by the caregivers. They perceived that children were susceptible to AEFI which was severe and with inadequate understanding of benefits of immunization, they perceived the AEFI as barrier to completing the immunization and were convinced by their actions of stopping the

immunization (Painter et al., 2010). On the normal circumstance they should have reported the AEFI to nearest health facilities for necessary assistance but they did not. This behavior confirmed the low rate of reporting of AEFI to health facilities. They dropped out due mainly to the unpleasant feeling of the children persistently crying and having loss of appetite. This phenomenon inconvenienced the caregivers as children showed painful signs and symptoms with associated sleeplessness. These unpleasant feeling of both caregivers and children constituted barrier to continuation of the immunization even after the AEFI was no more (Royal Society for Public Health, 2009).

## Implication for Social Change

The findings of this study are very relevant to the caregiver, family, and the players of immunization programs. As revealed, the evidence of AEFI significantly influencing dropout has not been covered much in literature. Therefore, these findings can be used by immunization program planners and implementers to guide their efforts aimed at optimizing the uptake of immunization. These findings can also be used as advocacy tool for reducing the level of ignorance about especially AEFI among caregivers whose children are enrolled in immunization programs. With these achieved, coverage of fully immunized children could be improved, hence morbidity and mortality from VPDs among especially infants and children less than five years could be reduced. This could result in better health status of the children and funding as well as other resources which otherwise could have been used to contain avoidable VPDs could be used to address other pressing social needs at the household, family, and government levels. The findings can also inform policy decisions or implementations such that

community-based education on immunization and AEFI reporting as well as improving health workers' preparedness and skills to manage AEFI could be given attention more than it is now.

## Limitations of the Study

The data for this study were primary data generated from the field through interviewing of caregivers whose infants have dropped out of immunization. Episode of AEFI was noted purely by history. No attempt or efforts was made to verify the AEFI from any examination or records at orthodox and unorthodox health facilities. I did not verify children immunization cards to validate the dropout. Caregivers who could not be located for interview were replaced. The data for the various LGAs had unequal sample sizes. This was due to the differences in the number of health facilities sampled with more that 10% dropout rates. Despite these limitations, episodes of AEFI associated with dropout were established. The study provided a better understanding of the predictors of dropout of immunization due to AEFI.

## Conclusion

Different studies have predicted that certain factors promote dropout and slow down immunization uptake rates. These include low awareness, little knowledge, poor attitudes to preventive care, inappropriate health seeking behavior, inaccessibility to health facility, unclear thoughts and fear of immunization, service unavailability, weak parental conviction of value of immunization, ineffective or insufficient communication, misguided religious beliefs, and poor socioeconomic status or conditions (Adokiya, Baguune, & Ndago, 2017;  Aina & Ejembi, 2013; Sanou et., 2009). Absence among

these factors was episode of AEFI. However, this study has clearly established that low rate of reporting of AEFI to health facilities or RI clinics significantly influence high immunization dropout rate. Nonetheless, if caregivers are helped to understand the benefit of completing immunization through appropriate information, education, and communication (IEC) strategies at RI clinics, health facilities, and communities their chances of reporting AEFI at health facilities could be improved and dropping out of immunization could be minimized.

## Recommendations

This was a cross-sectional quantitative correlational study which used primary data analysis and to a very large extent explored the influence of low rate of reporting of AEFI on immunization dropout as well as the enhancers required to improve AEFI reporting to health facilities by caregivers and complete immunization uptake as prescribed by the caregivers who have had experience of child dropout of immunization. As revealed by this study, AEFI associated dropout of immunization is a big issue in the area. Also, sound knowledge and understanding of AEFI, the need to report it at health facility, and the need to complete vaccination at all cost seemed inadequate among RI service clients. Therefore, RI program managers and service providers must put in place targeted information, education, and communication (IEC) strategy to get the caregivers well informed about AEFI reporting and need to complete immunization. This strategy should be community and health facility based. All caregivers who attend RI service sessions should have education on the importance of avoiding dropout by reporting AEFI to health facilities. Clinicians and prescribers at health facilities should continue

talking to caregivers about importance of immunization and demand child's immunization card as part of comprehensive treatment any time a child less than two years is brought to the health facility. Planned community evening educational programs on immunization focusing of AEFI reporting as part of requirement to completing immunization should be carried out targeting caregivers. Intervention to sufficiently engage the community in immunization education and communication should be instituted. Findings of this study should be disseminated to RI program managers, service providers, clients, and community leaders. The use of well trained and skilled interviewer is required to do more effective probing to counter the challenge of caregivers giving responses to impress the interviewer other than the truth. Larger sample size should be obtained to minimize errors and biases. Responses determined to be ambiguous and misleading should be excluded from the analysis of study of this nature. Further study is required to evaluate the quality and impact of health talks offered at health facilities and RI clinics prior to RI sessions.

## References

Adedire, E. B., Ajayi, I., Fawole, O. I., Ajumobi, O., Kasasa, S., Wasswa, P., & Nguku, P. (2016). Immunization coverage and its determinants among children aged 12-23 months in Atakumosa-west district, Osun State Nigeria: A cross-sectional study. *BMC Public Health, 30*(16), 905-908 doi:10.1186/s12889-016-3531-x.

Adedokun, S. T., Uthman, O. A., Adekanmbi, V. T., & Wiysonge, C. S. (2017). Incomplete childhood immunization in Nigeria: A multilevel analysis of individual and contextual factors. *BMC Public Health*, *17*, 236-240. doi:10.1186/s12889-017-4137-7

Adokiya, M. N., Baguune, B., & Ndago, J. A. (2017). Evaluation of immunization coverage and its associated factors among children 12–23 months of age in Techiman Municipality, Ghana, 2016. *Archives of Public Health, 75*, 28-33. doi:10.1186/s13690-017-0196-6

Aina, O., & Ejembi, C. L. (2013). Socioeconomic status of women and immunization status of under five children in Northern Nigeria - A case study of poliomyelitis in Kaduna state. *1st Annual International Interdisciplinary Conference Proceedings, AIIC 2013*, 24-26. Retrieved from eujournal.org/index.php/esj/article/download /1398/1407

Antai, D. (2010). Migration and child immunization in Nigeria: Individual- and community-level contexts. *BMC Public Health, 10*, 116-119. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2847974/

Ateudjieu, J., Stoll, B., Nguefack-Tsague, G., Tchangou, C., & Genton, B. (2014). Vaccine safety; effect of supervision or SMS on reporting rates of adverse events following immunization (AEFI) with meningitis vaccine (MenAfriVac™): A randomized controlled trial. *Vaccine, 32*(43), 5662-5668. doi:10.1016/j.vaccine .2014.08.012

Baguune, B., Ndago, J. A., & Adokiya, M. N. (2017). Immunization dropout rate and data quality among children 12–23 months of age in Ghana. *Archives of Public Health, 75*, 18-23. doi:10.1186/s13690-017-0186-8

Bangure, D., Chirundu, D., Gombe, N., Marufu, T., Mandozana, G., & Tshimanga, M. (2015). Effectiveness of short message services reminder on childhood immunization programme in Kadoma, Zimbabwe - A randomized controlled trial, 2013. *BMC Public Health, 15*(1), 137-138. doi:10.1186/s12889-015-1470-6.

Barratt, H., & Kirwan, M. (2009). Cross-sectional studies: Design, application, strengths and weaknesses of cross-sectional studies. *Health Knowledge*. Retrieved from http://www.healthknowledge.org.uk/public-health-textbook/research-methods/1a-epidemiology/cs-as-is/cross-sectional-studies

Bergold, J., & Thomas, S. (2012). Participatory research methods: A methodological approach in motion. *Forum: Qualitative Social Research, 13*(1), 30-37. Retrieved from http://nbn-resolving.de/urn:nbn:de:0114-fqs1201302.

Bowling, A. (2009). *Research Methods in Health: Investigating Health and Health Services* (3rd ed.). London, England: Open University Press.

Brewer, N.T., Chapman, G. B., Rothman, A. J., Leask, J., & Kempe, A. (2017). Increasing vaccination: Putting psychological science into action. *Psychological Science in the Public Interest, 18*(3), 149-207. doi:10.1177/1529100618760521

Callaway, C. (2013). Public health: Polio's moving target. *Nature, 496*, 290-292. Retrieved from http://www.nature.com/news/public-health-polio-s-moving-target-1.12817

CDC. (2014a). Update on the global status of polio.Retrieved from http://wwwnc.cdc.gov/travel/notices/in-the-news/polio-outbreaks.htm

CDC. (2014b). Polio vaccination. Retrieved from http://www.cdc.gov/vaccines/vpd-vac/polio/

Chatterjee, P. (2013). Childhood immunization: Added benefits of polio eradication. *BMJ, 346*, f3378. Retrieved from http://www.bmj.com/content/346/bmj.f3378

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Upper Saddle River, NJ: Pearson Education.

Crocker-Buque, T., Mindra, G., Duncun, R., & Mounier-Jack, S. (2017). Immunization, urbanization and slums - A systematic review of factors and interventions. *BMC Public Health, 17*, 56-62. doi:10.1186/s12889-017-4473-7

Dempsey, A. F., Fuhrel-Forbis, A., & Konrath, S. (2014). Use of the Carolina HPV immunization attitudes and beliefs scale (CHIAS) in young adult women. *PLOS.* Retrieved from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0100193

Emshoff, J. G., Darnell, A. J., Darnell, D. A., Erickson, S. W., Schneider, S., & Hudgins, R. (2007). Systems change as an outcome and a process in the work of community collaboratives for health. *American Journal of Community Psychology, 39*(3/4), 255-267. Retrieved from the Walden Library databases. http://ovidsp.ovid.com.ezp.waldenulibrary.org/ovidweb.

Etokidem, A. J., & Johnson, O. (2016). Child survival strategies: Assessment of knowledge and practice of rural women of reproductive age in Cross River State, Nigeria. *Journal of Tropical Medicine, 2016*(2016). doi:10.1155/2016/5098463

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education.* New York: McGraw-Hill Higher Education.

Galvin, K. T. (1992). A critical review of the health belief model in relation to cigarette Smoking behavior. *Journal of Clinical Nursing, 1*(1), 13-18. doi:10.1111/j.1365-2702.1992.tb00050.x

Glanz, K., Lewis, B. K., & Lewis, F. M. (2002). *Health behavior and health education. Theory, research, and practice.* San Francisco: Wiley & Sons.

Global Polio Eradication Initiative. (2018). The global fight against polio. Retrieved from http://www.polioeradication.org/

Gordon, O. (2012). Correlation (Part Two): Correlational designs. Retrieved from http://www.psych.utah.edu/gordon/Classes/Psych_3010/Lecture%20Correlation_2.html

Gostin, L. O. (2010). *Public health law, ethics, and human rights: Mapping the issues*. University of California Press. Retrieved from http://www.publichealthlaw.net/Reader/ch1/ch1.htm

Green, S. B., & Salkind, N. J. (2011). *Using SPSS for the MacIntosh and Windows: Analyzing and understanding data.* Prentice Hall PTR.

Haji, A., Lowther, S., Ngan'ga, Z., Gura, Z., Tabu, C., Sandhu, H., & Arvelo, W. (2016). Reducing routine vaccination dropout rates: Evaluating two interventions in three Kenyan districts, 2014. *BMC Public Health, 16*(152). Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4754928/

Hall, J. (2008). Cross-sectional survey design. In P. J. Lavrakas (Ed), *Encyclopedia of Survey research methods* (pp. 173-174). Thousand Oaks, CA: Sage.

Hu, Y., Li, Q., Chen, E., Chen, Y., & Qi, X. (2013). Determinants of childhood immunization uptake among socioeconomically disadvantaged migrants in East China. *International Journal of Environmental Research and Public Health, 10*, 2845-2856. doi:10.3390/ijerph10072845

Immunization Coalition Action. (2014). Polio: Information about the disease and vaccines. Retrieved from http://www.immunize.org/catg.d/p4215.pdf

Jegede, A. S., & Owumi, B. E. (2013). Factors influencing infant immunization uptake in the Yoruba community of Southwestern Nigeria. *Journal of Community Medicine and Health Education, 3*, 215-219. doi:10.4172/2161-0711.1000215

Johri, M., Subramanian, S. V., Sylvestre, M., Dudeja, S., Chandra, D., Koné, G. K., Sharma, J. K., & Pahwa, S. (2015). Association between maternal health literacy and child vaccination in India: A cross-sectional study. *Journal of Epidemiology and Community Health, 69*(9), 849–857. doi:10.1136/jech-2014-205436

Joshi, J., Das, M. K., Polpakara, D., Aneja, S., Agarwal, M., & Arora, N. K. (2018). Vaccine safety and surveillance for adverse events following immunization (AEFI) in India. *Indian Journal of Pediatrics, 85*(2), 139-148. doi:10.1007/s12098-017-2532-9.

Kassahun, M. B., Biks, G. A., & Teferra, A. S. (2015). Level of immunization coverage and associated factors among children aged 12-23 months in Lay Armachiho District, North Gondar Zone, Northwest Ethiopia: A community based cross sectional study. *BMC Research Notes, 8*, 239-41. doi:10.1186/s13104-015-1192-y

Kereiakes, D. J., & Willerson, J. T. (2014). US health care: Entitlement or privilege? Retrieved from http://circ.ahajournals.org/content/109/12/1460.full

Khan, I. A., Saha, A., Chowdhury, F., Khan, A. I., Uddin, M. J., Begum, Y. A., …. Qadri, F. (2013). Coverage and cost of a large oral cholera vaccination program in a high-risk cholera endemic urban population in Dhaka, Bangladesh. Vaccine, *31*(51), 6058-64. doi:10.1016/j.vaccine.2013.10.021.

Kusuma, Y. S., Kumari, R., Pandav, C. S. & Gupta, S. K. (2010). Migration and immunization: Determinants of childhood immunization uptake among socioeconomically disadvantaged migrants in Delhi, India. *Tropical Medicine & International Health, 15,* 1326-1332. doi:10.1111/j.1365-3156.2010.02628.x

Lakew, Y., Bekele, A., & Biadgilign, S. (2015). Factors influencing full immunization coverage among 12–23 months of age children in Ethiopia: Evidence from the national demographic and health survey in 2011. *BMC Public Health, 15,* 728-733. doi:10.1186/s12889-015-2078-6

Lassi, Z. S., Mallick, D., Das, J. K., Mal, L., Salam, R. A., Bhutta, Z. A. (2014). Essential interventions for child health. *Reproductive Health, 11*(Suppl 1), S4. doi:10.1186/1742-4755-11-S1-S4

Li, X., Wiesen, E., Diorditsa, S., Toda, K., Duong, T. H., & Nguyen, L. H. (2016). Impact of adverse events following immunization in Viet Nam in 2013 on chronic hepatitis B infection. *Vaccine. 34*(6), 869-873. Retrieved from www.sciencedirect.com/science/article/pii/S0264410X15007409

Lorenz, C., & Khalid, M. (2012). Influencing factors on vaccination uptake in Pakistan. *Journal of Pakistan Medical Association*. *62*(1), 59-61. Retrieved from http://www.jpma.org.pk/full_article_text.php?article_id=3230

Ministry of Health. (2017). Health management information system. Retrieved from https://dhis2nigeria.org.ng/dhis/dhis-web-dashboard-integration/index.action

Muchekeza, M., Chimusoro, A., Nomagugu, N., & Kufakwanguzvarova, W. P. (2014). Adverse events following immunization (AEFI) surveillance in Kwekwe District, Midlands Province, Zimbabwe, 2009-2010. *Journal of Vaccines, 5*, 232-239. doi:10.4172/2157-7560.1000232

National Health Mission. (2015). AEFI surveillance and response operational guidelines. Ministry of Health and Family Welfare. Government of India. Retrieved from http://www.itsu.org.in/repository-resources/AEFI-Surveillance-and-Response-Operational-Guidelines-2015.pdf

National Program on Immunization (NPI). (2017). IPDs Report. State Ministry of Health. Jigawa State, Nigeria.

National Population Commission (NPC). (2014). 2013 Nigeria Demographic and Health Survey (NDHS): North West. Retrieved from http://dhsprogram.com/pubs/pdf/OF23/OF23NW.pdf

National Population Commission and ICF Macro. (2013). Nigeria Demographic and Health Survey. Abuja, Nigeria.

National Vaccine Advisory Committee (NVAC). (2013). Protecting the public's health: Critical functions of the section 317 immunization program - A Report of the National Vaccine Advisory Committee. *Public Health Report, 128*(2), 78-95. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3560865/

Nguyen, G., Hsu, L., Kue, K.N., Nguyen, T., & Yeun, E. J. (2010). Partnering to collect Health services and public health data in hard-to-reach communities: a community-based participatory research approach for collecting community

health data. *Progress in Community Health Partnerships: Research, Education, and Action, 4*(2), 115-119. Retrieved from http://search.proquest.com.ezp.waldenulibrary.org/docview/845495983

Noble, N. E., Paul, C. L., Carey, M. l., Sanson-Fisher, R. W., Blunden, S. V., Stewart, J. M., & Conigrave, K. M. (2014). A cross-sectional survey assessing the acceptability and feasibility of self-report electronic data collection about health risks from patients attending an Aboriginal Community Controlled Health Service. *BMC Medical Informatics and Decision Making, 14*(34). Retrieved from http://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-14-34

Norusis, M. J. (1992). *SPSS for Windows: Professional Statistics User's Guide, Release 5.0*. SPSS Incorporated.

NPHCDA. (2017). National immunization coverage survey report -2017. Ministry of Health, Nigeria.

NPI/UNICEF. (2016). Assuring vaccine security in Nigeria. Report of NPI/UNICEF Vaccine Security mission.

Ogunjimi, L. O., Ibe, R. T., & Ikorok, M. M. (2012). Curbing maternal and child mortality: The Nigerian experience. *International Journal of Nursing and Midwifery*, *4*(3), 33-39. Retrieved from http://www.academicjournals.org/IJNM

Oku, A., Oyo-Ita, A., Glenton, C., Fretheim, A., Eteng, G., Ames, H., ... Lewin, S. (2017). Factors affecting the implementation of childhood vaccination communication strategies in Nigeria: A qualitative study. *BMC Public Health, 17*, 200-207. doi:10.1186/s12889-017-4020-6

Oku, A., Oyo-Ita, A., Glenton, C., Fretheim, A., Ames, H., Muloliwa, A., …. Cartie, Y. (2016). Communication strategies to promote the uptake of childhood vaccination in Nigeria: A systematic map. *Global Health Action, 9*, 30337. doi:10.3402/gha.v9.30337

Oleribe, O. O. (2016). Individual and socioeconomic factors associated with childhood immunization coverage in Nigeria. Retrieved from Walden Library. http://www.panafrican-med-journal.com/content/article/26/220/full/

Opel, D. J., Mangione-Smith, R., Robinson, J. D., Heritage, J., DeVere, V., Salas, H. S., … Taylor, J. A. (2015). The influence of provider communication behaviors on parental vaccine acceptance and visit experience. *American Journal of Public Health, 105*(10), 1998-2004. doi:10.2105/AJPH.2014.302425

Ophori, E. A., Tula, M. Y., Azih, A. V. Okojie, R., & Ikpo, P. E. (2014). Current trends of immunization in Nigeria: Prospect and challenges. *Tropical Medicine and Health, 42*(2), 67-75. doi:10.2149/tmh.2013-13

Osazuwa-Peters, N. (2011). Determinants of health disparities: The perennial struggle against Polio in Nigeria. *International Journal of Preventive Medicine. 2*(3), 117-121. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3143522/

Painter, J. E., Sales, J. M., Pazol, K., Grimes, T., Wingood, G. M., & DiClemente, R. J. (2010). Development, theoretical framework, and lessons learned from implementation of a school-based influenza vaccination intervention. *Health Promotion Practice, 11*(S1), 42S-52S.

Pallant, J. (2007). SPSS survival manual, 3rd. *Edition. McGrath Hill*.

Papadimos, T. J. (2007). Healthcare access as a right, not a privilege: A construct of western thought. *Philos Ethics Humanit Med*., *2*, 2. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1847832/

Peterson, A. A., & Merunka, D. R. (2014). Convenience samples of college students and research reproducibility. *Journal of Business Research*, *67*(2014), 1035-1041. Retrieved from https://www.mccombs.utexas.edu/~/media/Files/MSB/Research/Publications/2014Q1/Convenience%20samples%20of.pdf

Porter, C. (2012). Africa: Polio at all-time low as eradication pledge renewed. *All Africa.* Retrieved from http://allafrica.com/stories/201209281435.html

Polit, D. F., & Beck, C. T. (2014). *Essentials of nursing research: Appraising evidence for nursing practice.* Philadelphia: Wolters Kluwer Health /Lippincott Williams & Wilkins.

Ransom, J. I., Schaff, K., & Kan, L. (2012). Is there an association between local health department organizational and administrative factors and childhood immunization coverage rates? *J Health Hum Serv Adm, 34*(4), 418-55. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22530285

Reisi, M., Javadzade, S. H., Shahnazi, H., Sharifirad, G., Charkazi, A., & Moodi, M. (2014). Factors affecting cigarette smoking based on health-belief model structures in pre-university students in Isfahan, Iran. *Journal Education Health Promotion, 3*, 23-27. doi:10.4103/2277-9531.127614

Resnik, D. B. (2015). What is ethics in research and why is it important? Retrieved from http://www.niehs.nih.gov/research/resources/bioethics/whatis/

Reynolds, P. (1971). *A primer in theory construction*. Retrieved from http://www.soc.iastate.edu/sapp/soc401theory.html

Rimando, M., Brace, A. M., Namageyo-Funa, A., Parr, T. L., Sealy, D., Davis, T. L., … Christiana, R. W. (2015). Data collection challenges and recommendations for early career researchers. *The Qualitative Report, 20*(12), 2025-2036. Retrieved from http://nsuworks.nova.edu/tqr/vol20/iss12/8

Roberts, D. A., Ng, M., Ikilezi, G., Gasasira, A., Dwyer-Lindgren, L., Fullman, N., … Gakidou, E. (2015). Benchmarking health system performance across regions in Uganda: A systematic analysis of levels and trends in key maternal and child health interventions, 1990–2011. *BMC Medicine, 13*, 285-287. doi:10.1186/s12916-015-0518-x

Robinson, J., & Green, G. P. (2010). *Introduction to community development: Theory, practice, and service-learning.* (Eds.). Thousand Oaks, CA: Sage.

Rowitz, L. (2014). Public health leadership putting principles into practice. Retrieved from http://samples.jbpub.com/9781284021738/45212_FMxx_Rowitz.pdf

Royal Society for Public Health. (2009). Why theory matters for effective health promotion: A briefing. Shaping the Future of Health Promotion. Retrieved from www.rsph.org.uk/download.cfm?docid=9388382A-FACA-4E50...

Sanou, A., Simboro, S., Kouyaté, B., Dugas, M., Graham, J., & Bibeau, G. (2009). Assessment of factors associated with complete immunization coverage in children aged 12-23 months: A cross-sectional study in Nouna district, Burkina Faso. *BMC International Health and Human Rights*. 9(Suppl 1), S10. Retrieved from http://www.biomedcentral.com/1472-698X/9/S1/S10

Savela, T. (2017). The advantages and disadvantages of quantitative methods in schoolscape research. *Linguistics and Education,* (In Press). doi:10.1016/j.linged.2017.09.004

Schneider, M. J. (2011). *Introduction to PH* (3rd Ed.). Jones & Bartlett Publishers, LLC. Sudbury, Massachusetts. USA.

Shann, F., & Steinhoff, M. C. (1999). Vaccines for children in rich and poor countries. *Lancet*. *354*(Suppl 2), SII7-11. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10507252

Shapiro, E. R., & Atallah-Gutiérrez, C. (2012). Latina re-visionings of participatory health promotion practice: Cultural and ecosystemic perspectives linking personal and social change. *Women and Therapy, 35*(1/2), 120-133. Retrieved from the Walden Library databases. https://eds-a-ebscohost-com.ezp.waldenulibrary.org/eds/detail/detail?vid

Sheikh, A., Igbal, B., Ehtamam, A., Rahim, M., Shaikh, H. A., & Usmani, H. A. (2013). Reasons for non-vaccination in pediatric patients visiting tertiary care centers in a polio-prone country. *Arch Public Health*. *71*(1), 19-20. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3716633/

Shen, A. K., Fields, R., & McQuestion, M. (2014). The future of RI in the developing world: Challenges and opportunities. *Global Health Science Pact., 2*(4), 381-394. doi:10.9745/GHSP-D-14-00137.

Stallone, M. N. (2003). *Factors associated with student attrition and retention in an educational leadership doctoral program*. (Texas A&M University - Kingsville). *ProQuest Dissertations and Theses,* 153-153. Retrieved from http://search.proquest.com/docview/305231549?accountid=14872. (305231549).

Statistical Correlation (2015). Retrieved from https://explorable.com/statistical-correlation.

Steffen, C., Tokplonou, E., Jaillard, P., Dia, R., Alladji, M. N. B., & Gessner, B. (2014). A field based evaluation of adverse events following MenAfriVac®vaccine delivered in a controlled temperature chain (CTC) approach in Benin. *Pan*

*African Medical Journal,* I, SSN 1937-8688. Retrieved from http://www.panafrican-med-journal.com/content/article/18/344/pdf/344.pdf

Subhani, S., Yaseen, R., Khan, M. A., Jeelani, G., & Fatima, R. (2015). Impact of mother's education on child immunization: A comparative study of India and Pakistan. *Journal of Finance and Economics, 3*(3), 51-54. doi:10.12691/jfe-3-3-1.

The Community Tool Box. (2014). Qualitative methods to assess community issues. Retrieved from http://ctb.ku.edu/en/table-of-contents/assessment/assessing-community-needsand-resources/qualitative-methods/main

The Robert Wood Johnson Foundation. (2013). Right, privilege or tragedy of the commons. Retrieved from http://www.rwjf.org/en/blogs/human-capital-blog/2013/08/right_privilege_or.html

Thomas, B. P., & Gostin, L. O. (2013). Tobacco endgame strategies: challenges in ethics and law. *Tobacco Control, 22*(1), i55-i57. Retrieved from http://tobaccocontrol.bmj.com/content/22/suppl_1/i55.full

Tsafack, M., & Ateudjieu, J. (2015). Improving community based AEFI (Adverse Events Following Immunization) reporting rate through telephone "beep" in a Cameroon health district: A randomized field trial. *The Pan African Medical Journal, 22*, 351-353. Retrieved from http://www.panafrican-med-journal.com/content/article/22/351/full/#.V6aYYo-cHIV

UNICEF. (2016). Immunization. Retrieved from https://www.unicef.org/immunization/

UNICEF. (2015). Maternal and child health. *UNICEF Nigeria*. Retrieved from http://www.unicef.org/nigeria/children_1926.html

Van der Maas, N. A., Mollema, L., Berbers, G. A., Van Rooijen, D. M., Van der Avoort, H. G., & Conyn-Van Spaendonck, M. A. (2014). Immunity against poliomyelitis in the Netherlands, assessed in 2006 to 2007: The importance of completing a vaccination series. *Euro Surveillance, 19*(7), 5. Retrieved from http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20705

Varney, J. J. (2003). *A study of the relationships among doctoral program components and dissertation self-efficacy on dissertation progress.* (Aurora University). *ProQuest Dissertations and Theses*, 218-218. Retrieved from http://search.proquest.com/docview/305221667?accountid=14872. (305221667).

Ward, P. R., Attwell, K., Meyer, S. B., Rokkas, P., & Leask, J. (2017). Understanding the perceived logic of care by vaccine-hesitant and vaccine-refusing parents: A qualitative study in Australia. *PLoS ONE, 12*(10), e0185955. doi:10.1371/journal.pone.0185955

World Health Organization. (2017a). Immunization. Retrieved from http://www.who.int/topics/immunization/en/

World Health Organization. (2017b). Vaccine safety basics e-learning course. Module 3: Adverse events following immunization. Retrieved from http://vaccine-safety-training.org/classification-of-aefis.html

World Health Organization. (2016a). What are some of the myths – and facts – about vaccination. Retrieved from http://www.who.int/features/qa/84/en/

World Health Organization. (2016b). Global Vaccine Action Plan 2011–2020. Retrieved from http://www.who.int/immunization/global_vaccine_action_plan/en/

World Health Organization. (2016c). Adverse Events Following Immunization. *Global Vaccine safety.* Retrieved from http://www.who.int/vaccine_safety/initiative/detection/AEFI/en/

World Health Organization. (2013) Immunization safety surveillance: Guidelines for immunization program managers on surveillance of adverse events following immunization.

World Health Organization &United Nations International Children's Emergency Fund. (2016). Progress and challenges with achieving universal immunization coverage: 2015 estimates of immunization coverage. Retrieved from https://www.unicef.org/immunization/files/unicef-who-immunization-coverage-2015.pdf

World Health Organization (WHO) & United Nations International Children's Emergency Fund. (UNICEF). (2014). Global immunization data. Retrieved from http://www.who.int/immunization/monitoring_surveillance/global_immunization_data.pdf?ua=1

Yoon, S. K. (2015). The importance of literature review in research writing. Retrieved from https://owlcation.com/misc/literature_review.

Yu, H. (2015). Does an education seminar intervention improve the parents' knowledge on Vaccination? Evidence from Yiwu, East China. *Int. J. Environ. Res. Public Health*, *12*, 3469-3479. doi:10.3390/ijerph120403469