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Individual and Socioeconomic Factors Associated With Childhood Immunization Coverage in Nigeria

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2016

Abstract

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MBBS, University of Port Harcourt, 1995

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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Immunization remains one of the most successful and cost-effective public health interventions worldwide. The purpose of this study was to examine the individual and socioeconomic factors that influence childhood immunization coverage in Nigeria. The health belief model and the social ecological model were used as the theoretical framework for the study, which examined the effects of individual, parental, and socioeconomic factors on complete immunization among Nigerian children. Univariate, bivariate, and multivariate tests were conducted within a secondary analysis of 2013 Nigerian National Demographic and Health Survey was done. Of 27,571 children aged 0 to 59 months, 22.1% had full vaccination and 29% never received any vaccination. Immunization coverage was significantly related to the socioeconomic status of the child's parents, region, and marital status ($p < 0.00$). Similarly, child birth order, delivery place, child number, and presence or absence of child health card in the family were significantly related to the level of immunization ($p < 0.00$). Maternal age, geographical location, education, religion, literacy, wealth index, marital status, and occupation were significantly associated with immunization coverage. Respondent's age, educational attainment, and wealth index remained significantly related to immunization coverage at 95% confidence interval in multivariate analysis. Implications for positive social change include evidence on hindrances to successful immunization programs and relevant information for a more effective, efficient, sustainable and acceptable immunization program for the stakeholders in Nigeria.

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Dedication

This work is dedicated to God, my Father and helper, who at the time of my career confusion expressly asked me to return to school to learn and improve myself.

The work is also dedicated to all public health practitioners all over the world who desire to make a difference, leave a legacy, and improve human health and wellbeing, and to all the staff and families of Excellence & Friends Management Care Centre (EFMC), who over the years have positively changed the lives of multitude in Nigeria and beyond.

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I must first and foremost thank God who gave me the marching orders to do this program, opened the way, guided me all through, empowered me with health and wisdom to execute it, and saw me through the entire process in record time. Be glorified and take all the praise.

To my wife, Princess Ifunanya Osita-Oleribe, whose desire to improve herself by pursuing two master's degrees at the same time at Brandies University, Boston, MA galvanized me to obey God and engage in this vision, I will forever be grateful. Also, thank you for standing by me after your return to Nigeria and believing in my ability not only start but complete this process. My wonderful children–Alpha Chimgozirim, Delight Chimziterem, and Winner Chimkaneme–were exceptional inspiration. Your exploits in school and life were major challenges to me. I made a vow never to fail you nor be a bad example in academics, ministry, and life. Thank you for being there for me.

The Excellence & Friends Management Care Centre (EFMC) office in Abuja and diaspora were my primary experimental ground all through this course. I used the staff to test the theoretical constructs and hypothesis, apply new leadership skills and concepts, implement newly acquired knowledge, and also experiment in data management, including analysis of secondary data when we did the mortality and morbidity studies in Abuja Nigeria. You all gave me the raw materials I needed to make this study worthwhile and very eventful. You also provided a platform for true positive social changes in these last two plus years. Thank you so much.

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Section 1: Foundation of the Study and Literature Review

Introduction

Immunization is one of the most successful and cost-effective public health interventions worldwide, preventing (and or eradicating) several serious childhood diseases (Hu, Li, Chen, Chen, & Qi, 2013). According to the World Health Organization (WHO), immunization prevents about 2 to 3 million deaths annually that could have resulted from vaccine preventable diseases (VPDs) such as diphtheria, tetanus, pertussis, and measles; and an additional 1.5 million deaths could be avoided if global vaccination coverage improves (WHO, 2016). In 2014, about 115 million (86%) of infants worldwide received three doses of diphtheria-tetanus-pertussis (DTP3) vaccine, and 129 countries reached at least 90% coverage of DTP3 vaccine (WHO, 2015a). This increased to 116 million (86%) of infants worldwide, while only 126 countries reached at least 90% coverage of DTP3 vaccine (WHO, 2016).

Still, about 18.7 million infants worldwide were not reached with routine immunization services in 2014, of which over 60% live in 10 countries including Nigeria (WHO, 2015a). This increased to 19.4 million in 2015 who missed out on basic vaccination globally (WHO, 2016). This results in an estimated 2.7 million children death annually from vaccine-preventable diseases, the majority of which occur in sub-Saharan Africa. Furthermore, although the under-5 mortality rate has declined globally, it is increasingly being concentrated in sub-Saharan Africa and South Asia, with these two regions accounting for 82% of under-5 deaths in 2011 (United Nations Children's Fund [UNICEF], 2012).

The expanded program on immunization (EPI), launched by the WHO in 1974, was designed to promote childhood vaccination and prevent childhood morbidity and mortality from vaccine preventable diseases through universal coverage among children less than 12 months old. Annually, the EPI, saves 2 to 3 million lives because over 115 million infants are immunized yearly (WHO, 2015a). EPI has also averted over 15.6 million deaths since 2000 through measles immunization, eliminated maternal and neo-natal tetanus from 35 out of 59 high-risk countries, and dramatically reduced the prevalence of polio globally (UNICEF, 2015).

Despite the fact that most low- and middle-income countries depend on EPI for delivery of vaccines to children, coverage is still below the expected 80% (Machingaidze, Rehfuess, von Kries, Hussey, & Wiysonge, 2013). The Nigerian EPI program initially focused on the six major vaccine preventable diseases (measles, diphtheria, tetanus, polio, tuberculosis, and pertussis) for coverage of children less than 1 year of age (National Primary Health Care Development Agency [NPHCDA], 2009). This, with time, was expanded to include hepatitis B, rotavirus, pentavalent, pneumococcal conjugate vaccine (PCV), yellow fever, MMR, chicken pox, meningitis, and typhoid fever vaccines up to the 24 month of life, although a number of these new additional were optional to the parents (The Health Team, 2012). The PCV was added in 2014 when Nigeria joined the rest of the world to make it a part of its routine immunization schedule (WHO, 2015b). Despite several programs, protocols, strategic plans, policies, and reorganizations of vaccine delivery systems in Nigeria since 1978, childhood immunization coverage in Nigeria has remained lower than expected (National Population Commission [NPC]

Nigeria and ICF International, 2014; NPHCDA, 2013). Although there are several publications on possible factors behind this national failure, no one is sure of the root cause hindering the achievement of universal coverage (NPHCDA, 2013).

This study is designed to look at the individual as well as the socioeconomic factors that are associated with poor childhood immunization coverage in Nigeria. In this study, I examined factors that facilitate or mitigate immunization coverage in children as well as made recommendations that may help improve national coverage. Implementation of the findings from this study may improve childhood immunization programs effectiveness and efficiency in Nigeria as they will provide information for evidence-based decisions, factual programming, and event-based implementation. The study will also provide additional resources that may be used for the next phase of childhood immunization strategic planning in Nigeria

In this section of this dissertation, I elaborate on the problem statement and clarify the purpose of the study. This is followed by documentation of the research questions and hypothesis, theoretical foundations for the study, nature of the study, and literature search strategy. The rest of the study is devoted to an extensive literature review in which major concepts were defined, the assumptions made itemized, and the scope of the study defined in the limitation and delimitations of the study.

Problem Statement

Immunization is a critical component in the global drive towards significant reduction in childhood mortality (Payne, Townend, Jasseh, Jallow, & Kampmann, 2014). However, there are several challenges hindering wide and complete childhood

immunization, especially in low- and middle-income countries like Nigeria (Payne et al., 2014). According to the WHO (2015c), the global vaccination targets for 2015 was not realized as 1 out of every 5 children are still missed out on routine immunizations (WHO, 2015c). UNICEF and its partners plan to provide routine immunization to 90% of children under the age of 1 and achieve at least 80% of coverage for every country district by the year 2020 (UNICEF, 2014). Nigeria is one of the six countries in the world (with India, China, Pakistan, the Democratic Republic of the Congo, and Ethiopia) that accounts for half of worldwide childhood deaths and has the 10th worst infant mortality rate in the world (Antai, 2009; Central Intelligence Agency [CIA], 2016). According to the 2015 World Factbook by the CIA (2016), the first 10 nations with the worst IMR are Afghanistan (115.08), Mali (102.23), Somalia (98.39), Central African Republic (90.63), Guinea-Bissau (89.21), Chad (88.69), Niger (84.59), Angola (78.26), Burkina Faso (75.32), and Nigeria with 72.70/ 1,000 as of 2015.

With a largely young population, Nigeria has one of the world's poorest immunization coverage rates, resulting in infants and under-5's morbidity and mortality from easily vaccine preventable diseases (WHO, 2015a). This is because more than half of the 22.4 million children who were not immunized reside in three countries: India (32%), Nigeria (14%), and Indonesia (7%; NPHCDA, 2013; WHO, 2014). In 2015, WHO announced that polio was no longer endemic in Nigeria as there was no reported case of wild poliovirus in Nigeria since 24 July 2014, which brought the country and the African region closer than ever to being certified polio-free (WHO, 2015d). This was the first time Nigeria was able to interrupt transmission of wild poliovirus that thus led to the

removal of the country from the list of nations with wild polio transmission (WHO, 2015d). The recent detection of new WPV in two Nigerian children from Borno State from surveillance activities shows a possible reintroduction or reemergence of the virus (Dore, 2015; WHO, 2015d, 2016b). This is painful as it is only after no new case status is sustained for 3 years on the continent that official certification of polio eradication will be conducted at the regional level in Africa (WHO, 2015d). The presence of new wild polio virus infections in Nigeria call for a more intensive effort to ensure that the gains of the previous years are not completely lost from poor routine immunization and surveillance systems.

As of 2013, according to the NDHS report, 2013, only one-quarter of Nigerian children aged 12 to 23 months were fully vaccinated for tuberculosis, measles, and with three doses each of DPT and polio vaccines (NPC & ICF International, 2014). Moreover, only 42% of Nigerian children received the measles vaccine, while 23% received no vaccinations at all by 2013 (NPC & ICF International, 2014). Although researchers have identified a number of reasons for no-vaccinations in Nigeria, these need further reexamination (Antai, 2012; Fatiregun & Okoro, 2012; Hu et al., 2013; Kitamura, Komada, Xeuatvongsa, & Hachiya, 2013; Lakew, Bekele, & Biadgilign, 2015; Machingaidze et al., 2013; Obiajunwa & Olaogun, 2013; Ophori, Tula, Azih, Okojie, & Ikpo, 2014; Payne, Townend, Jasseh, Jallow, & Kampmann, 2013). In this study, I examine the various parental, individual and other factors that may influence childhood vaccination in Nigeria. Furthermore, despite the current reduction in disease burden of vaccine-preventable diseases that was achieved through childhood immunization

globally, factors hindering similar progress in Nigeria need to be identified and clarified if considerable progress will be made in coverage, efficiency and equity of vaccination in Nigeria (Mathew, 2012).

Although there has been a steady decline in communicable diseases in Nigeria, they remain a major cause of death in childhood as over 40% of under-5 mortalities are due to vaccine preventable communicable diseases (WHO, 2014c). Moreover, DPT3 increased from 52% in 2008 to 83% in 2013, but the proportion of fully immunized children aged 12 to 24 months was just 23%, which varied between geo-political zones and was higher in the urban when compared to the rural areas (NPC & ICF International, 2014; WHO, 2014c). These made the realization of the measles vaccination target of 95% by 2015 impossible. These gaps have been blamed primarily on inequality persisting among zones and between the rural and urban regions. However, there may be individual and or other socioeconomic factors responsible for these differences. I explore these in this study, and by so doing define new challenges that if resolved will help the nation achieve its immunization coverage targets in particular and better child health indices in general.

Purpose of the Study

The purpose of this study is to examine the individual and socioeconomic factors that influence childhood immunization coverage in Nigeria and provide evidence on the factors hindering the realization of both global and national immunization coverage objectives. Although understanding interventions for improving immunization coverage remains a vital requirement to achieving universal childhood immunization, knowing

what the associated factors that facilitate or hinder universal coverage is critical, thus the need for this study (Machingaidze et al., 2013).

Research Questions and Hypotheses

Q1: Is there an association between socioeconomic factors (education and income level) and percentage of completeness of immunization for Nigerian children?

$H1_0$: There is no statistically significant association between parental socioeconomic factors and percentage of completeness of immunization for Nigerian children

$H1_A$: There is a statistically significant association between parental socioeconomic factors and percentage of completeness of immunization for Nigerian children

Q2: Is there an association between individual factors (child's gender and birth order)-and percentage of completeness of childhood immunization in Nigeria?

$H2_0$: There is no statistically significant association between child's demographic characteristics and degree of completeness of childhood immunization in Nigeria.

$H2_A$: There is a statistically significant association between child's demographic characteristics and degree of completeness of childhood immunization in Nigeria.

Theoretical Foundation for the Study

The theoretical framework underlying this study was the health belief model (HBM) and the social ecological model (SEM). The HBM was developed in the early 1950s initially by social psychologists in the U.S. Public Health Service to explain the widespread failure of people to participate in programs to prevent and detect disease and

later extended to study people's responses to symptoms and their behaviors in response to a diagnosed illness with particular reference to their adherence to medical regimens (Glanz, Rimer, & Viswanath, 2008; Hochbaum, Rosenstock, & Kegels, 1952; Rosenstock, Strecher, & Becker, 1994). In line with the HBM, people behave either due to the stimulus response (S-R) theory or cognitive theory (Glanz et al., 2008, 2015). The S-R theory is based on consequences of actions or reinforcement based on rewards without any regards to thinking and reasoning (Glanz et al., 2008, 2015). Cognitive theory with value-expectancy components have mental processes such as thinking, reasoning, hypothesizing, or expecting as its critical components (Glanz et al., 2008, 2015).

In line with the value-expectancy concepts in the context of health-related behaviors of HBM, it is assumed that individuals (a) value avoiding illnesses/getting well and (b) expect that a specific health action (such as immunization) may prevent (or ameliorate) illness. The expectation is influenced by the individual's (parents, caregivers and even communities) estimates of personal susceptibility to and perceived severity of an illness (such as the vaccine preventable diseases) and of the likelihood of being able to reduce that threat through vaccination (Glanz et al., 2008; Rosenstock, 1990). This means that decision-makers make a mental calculus about whether the benefits of a promoted behavior change outweigh its practical and psychological costs or obstacles (Green & Murphy, 2002).

Depending on susceptibility, seriousness, benefits, and barriers to immunization, cues to action, and self-efficacy, individuals may take action to prevent, to screen for, or

to control illness conditions (Glanz et al., 2008). This model has been used in studying people's belief concerning their perception on their susceptibility to and severity of diseases such as tuberculosis (Glanz et al., 2008; Hochbaum et al., 1952). It was, therefore, the foundation for analysis of the factors behind people's acceptance or refusal of vaccinations for their children.

Similarly, when individuals believe that they are susceptible to a condition, that the condition has serious consequences, that a course of action available to them can reduce either their susceptibility to or severity of the condition, and that anticipated benefits of taking action outweigh the barriers to taking the available action, they are likely to take action that they believe will reduce their risks (Glanz et al., 2008). Thus, perceived susceptibility, perceived severity, perceived barriers, and perceived benefits are the major constructs of HBM (Green & Murphy, 2002; Glanz et al., 2008; Hochbaum et al., 1952; Rosenstock, 1990). While perceived barriers was found to be the most powerful single predictor across several studies, perceived susceptibility (when compared to perceived benefits) was a stronger predictor of preventive health behavior than sick-role behavior, and perceived severity was found to be the least powerful predictor (Glanz et al., 2008; Janz & Becker, 1984)

These perceived beliefs along with cues to action and self-efficacy determine whether the individual will take the required step for the prevention of the disease. However, perception is subjective on how people see a disease/or a group of diseases such as VPDs that may be determined by several modifying factors such as their age, sex,

ethnic lineages, religious beliefs, educational level, marital status, socioeconomic standards, or even health literacy level.

In a study that evaluated the association between parents' beliefs about vaccines, their decision to delay or refuse vaccines for their children, and vaccination coverage of children aged 24 months in which data from 11,206 parents of children aged 24 to 35 months were analyzed, parents who did not believe in the benefits of vaccines and their ability to protect the health of their children (perceived benefits), who did not believe that their child might get a disease if they were not vaccinated (perceived susceptibility), and who did not believe that vaccines are safe (perceived severity) had significantly lower coverage for all 10 childhood vaccines (P.J. Smith et al., 2011).

In addition, to explore the socioeconomic factors associated with childhood immunization coverage, the SEM was used. This model studies the individual's interaction with his or her social environment towards the improvement of people’s lives (Visser, 2007). The SEM offers a framework for program planners to determine how to focus relevant activities and looks at it from four different levels: individual (intrapersonal), relationship (interpersonal), community (organizational and social networks), and society/public policy (Centers for Disease Control and Prevention [CDC], 2015; McLeroy, Bibeau, Steckler, & Glanz, 1988). It provides a foundation of inquiry into the multiple effects and interrelatedness of social elements and defines the need for program managers to act across multiple levels of the model at the same time for sustainable outcome (CDC, 2015). According to McLeroy et al. (1988), appropriate changes in the social environment may result in changes in individuals, and support of

individuals is essential for achieving community and societal changes (McLeroy et al., 1988). This has been used in a study on eating healthy food in Baltimore, adolescent smoking, and several other community health initiatives (Stokols, 1996: Winch, 2012). This model stipulates that there is a reciprocal relationship between individual behaviors, societal norms and rules, regulations, and guidelines (Winch, 2012).

Nature of the Study

This was a retrospective cross-sectional quantitative study (Creswell, 2009) using an existing dataset from the 2013 DHS. This approach helped identify the factors associated with immunization coverage in Nigeria. This study type was chosen because it was mandated by the program and offers quicker ways of achieving results and completing the study. Moreover, it allowed for the use of randomization and could describe the pattern of relationship between variables of interest, permitting near natural and prevalence studies (Frankfort-Nachmias & Nachmias, 2008; Hennekens & Buring, 1987). It also had limited ethical issues. It was quick and easy to implement, cost effective, and efficient, and it was easy to replicate (Frankfort-Nachmias & Nachmias, 2008; Hennekens & Buring, 1987).

The key independent variables in this study were individual and socioeconomic factors of the participants in the NDHS 2013 study. I looked at highest education level, husbands/partners' education attainment, literacy, wealth index, respondent worked in the last 12 months, and respondent's occupation as measures of socioeconomic status. Childhood immunization coverage was the main dependent variable. Religion was analyzed as a covariant variable.

The secondary dataset analyzed in this study was the NDHS 2013 study dataset from Nigeria. Data were retrieved from the United States Agency for International Development (USAID), who is the primary dataset holders. The dataset was analyzed using the SPSS version 21 (IBM, 2012).

Literature Search Strategy

The following databases were used for this study: Walden University Library and Walden Library Books, PubMed, CINAHL Plus with Full Text, MEDLINE with Full Text, Cochrane Database of Systematic Reviews, Dissertations & Theses, Dissertations & Theses at Walden University, ProQuest Central, SAGE Knowledge (formerly SAGE Encyclopedias), SAGE Research Methods Online, SAGE Stats, Science Journals, and ScienceDirect. Scholar Google, Google, Walden Library Search, WHO, UNICEF, PubMed, PsycInfo and ProQuest search engines were used in this study .

The following key terms were used for the search: *immunization, vaccination, coverage, Nigeria, childhood, vaccine preventable diseases, childhood morbidity and mortality, challenges with immunization coverage, health belief model, social ecological model, social network analysis, social relations model, UNICEF report, WHO report, NDHS, HBM, SEM, and CDC immunization reports.*

Although I had an open ended search for literature, emphasis was placed on publication spanning a period of 5 years (2011 – 2016) for this study. I placed emphasis on peer reviewed primary publications within the period under review. In addition, national documents, WHO, CDC, and UNICEF periodical and reports were used to augment the literature review. Some seminal literatures like those on the HBM, SEM,

social network analysis and social relations model, as well as some critical WHO/UNICEF publications like the Primary Health Care declaration of 1978 in Alma Ata were equally reviewed, studied, and documented. Finally, a few doctoral studies/dissertations and conference proceedings from Walden library were reviewed.

Literature Review Related to Key Variables and/or Concepts

Population

According to the WHO, as of 2013, Nigeria had a population of more than 173 million with more than 44% less than 15 years of age, just 5% aged over 60 and a median age of 18 years. Of this, 46% lived in the urban areas; the total fertility rate per woman was 6.0, with more than 7 million live births and over 2 million deaths per year (WHO, 2015e). With a gross national income per capita of $5360, Nigeria spends about GDP 6.0% on health (CIA, 2016; WHO, 2015e). Nigeria also has a life expectancy at birth of 54 years and healthy life expectancy of 46 years, figures that are far lower than 58 and 50 respectively for the WHO region (WHO, 2015e). According to the same report, the country life expectancy increased by 6 years over the period from 2000 to 2012, but again, this was lower than the WHO regional average of 7 years.

Nigeria has over 250 different ethnic groups who speak more than 500 different languages and dialects, but English is the official language; while Igbo, Hausa, and Yoruba are the three main dominant local languages (WHO, 2014c). While the north is mainly Muslim, the south is predominantly Christian.

Infant and under-5 mortality ratios dropped from 75 and 153 in 2008 to 65 and 128 per 1000 live births, respectively, in 2013 (NPC & ICF International, 2014; WHO,

2014c). However, Nigeria is a signatory to the declarations on the survival, protection, and development of children, articulated at the 49th World Health Assembly in 1988, and reinforced by the World summit for children that took plane in New York in 1990 (NPHCDA, 2009).

Relevance of Immunization

Vaccine preventable diseases have remained a major public health burden as a result of suboptimal vaccination rates in many countries, including Nigeria (Danis, Georgakopoulou, Stavrou, Laggas, & Panagiotopoulos, 2010). With over 170 million people, Nigeria is one of the nations of the world with the worst childhood immunization coverage (WHO, 2015a), and some of the worst childhood mortality and morbidity rates (CIA, 2016; Obiajunwa & Olaogun, 2013). As it is one of the six nations in the world with the worst under-5 mortality rate, Nigeria contributes 11% of the total global mortality rate (WHO, 2015a). However, a large number of these deaths are preventable with full immunization achievable only when childhood vaccination is made a top priority of government and public health leaders at all levels. Furthermore, despite adopting the UNICEF/WHO EPI program in 1979, 35 years later, coverage is still below 25% (NPC & ICF International, 2014; Obiajunwa & Olaogun, 2013; WHO, 2015a). This abysmal performance is due to both known and unknown causes and factors within and around the program in Nigeria.

Immunization of children for prevention is one of the most effective, successful, and cost efficient public health intervention in the world (Kawakatsu & Honda, 2012; Kitamura et al., 2013). It is able to substantially reduce the global burden of infectious

diseases. However, an estimated 27 million children and 40 million pregnant women worldwide still do not receive this basic preventive package every year, leading to over 2 million deaths of children each year from vaccine-preventable diseases (Kawakatsu & Honda, 2012; Kitamura et al., 2013). The findings from the 2013 NDHS report have shown that while most other countries in the world have significantly improved their national immunization coverage, Nigeria is far behind accounting for a significant percentage of the burden of childhood deaths in the world. According to the Nigerian Demographic and Health Survey (2013), less than 25% of children aged 12 to 23 months were fully vaccinated, and 21% of all eligible children did not receive any vaccination at all (NPC & ICF International, 2014). Fifty-one percent received the Bacille-Calmette Guerin (BCG) vaccine, measles vaccine (42%), DPT_1 (51%), and DPT_3 (38%) showing a dropout rate of 25% (NPC & ICF International, 2014). Despite the several national Oral Poliomyelitis Vaccine (OPV) campaigns, only 54% of eligible children received OPV_3 (NPC & ICF International, 2014).

Globally, several factors account for the commencement, continuation, and completion of immunization regimen. The child or ward's parents/guardians, health care system, and health care providers related factors have significant effects on immunization coverage (Fatiregun & Okoro, 2012). Since the utilization of vaccination services in Nigeria depends on regular availability of vaccines, the provision of vaccination services in accessible locations; presence of qualified and reliable health workers; adequate safe needles, syringes, and functional cold chain systems; and a weak health care system were identified by Fatiregun and Okoro in 2012 as major barriers to childhood immunization

in Nigeria. Immunization coverage was also affected by household factors such as level of parental education, family income, and knowledge and attitude of mothers (Kitamura et al., 2013). Children of birth order 6 and higher, urban children, children whose mothers have more than a secondary education, children in the highest wealth quintile, and children from South-East and South-South zones were found to be more likely to receive vaccination than their counterparts (NPC & ICF International, 2014).

Similarly, continuation and completion of the required number of vaccinations in children also depend on mother's educational level, socioeconomic status, employment status, immigration status, experience with vaccination services, and adequate schedule information (Kitamura et al., 2013). Belonging to a minority group, having other siblings and traveling long distances to immunization site were additional barriers resulting in both incomplete and delayed vaccination (Danis et al., 2010). Other factors associated with immunization coverage were maternal age ≥30 years, health insurance, race, paternal education, parental beliefs, and attitudes towards immunization (Danis et al., 2010).

A cross sectional study in Lao People's Democratic Republic that assessed the factors affecting childhood immunization by Kitamura et al. (2013) identified maternal age, household occupation, time to the nearest health facilities, means of transportation, birth attended by medical staff, the child's birthplace, and notification of vaccination date by health workers as factors that were associated with vaccination status. The maternal age and notification of vaccination date increased the odds of full vaccination (Kitamura et al., 2013). A Nigerian study by Fatiregun and Okoro corroborated this fact showing

that maternal age, immunization cards availability at first contact, children less than 3, higher education, and maternal unemployment influenced completion of childhood immunization (Fatiregun & Okoro, 2012).

In the South Eastern Nigeria, it was discovered that private medical practitioners had a modest contribution to childhood immunization coverage (Oluoha, Umeh, & Ahaneku, 2014). Expanding public health involvement may improve general coverage; however, absence of effective public health leadership in Nigeria may have hindered improvement in expansion of immunization coverage in Nigeria.

Institutional factors such as health workers' availability (including increased frequency and quality of Community Health Workers visits), enough vaccines, and provision of relevant logistics enhance vaccine coverage (Kawakatsua & Honda, 2012). Gender inequalities, healthcare services and workers mal-distribution (Antai, 2012, 2009), parental and caregivers' vaccination hesitancy or refusal (Larson, Jarrett, Eckersberger, Smith, & Paterson, 2014; Murakami et al., 2014; Murele et al., 2014) were additional factors mitigating immunization coverage.

Immunization History in Nigeria

Since 1979 when the EPI was initiated in Nigeria, the Federal Government of Nigeria has pursued an active immunization program through the Federal Ministry of Health that has led to giving needed priority to immunization activities in Nigeria (NPI Policy 2009).

Following a decline in coverage and the program's inability to meet global targets, it was renamed National Programme on Immunization (NPI) in 1997 and

established as a Parastatal of the Federal Ministry of Health by decree 12 of 1997 (NPHCDA, 2009). The health sector reforms of 2007 led to the merging of NPI with the NPHCDA in May 2007. Since then, through routine immunization, national immunization days, and supplementary immunization days, the nation has worked to improve childhood immunization coverage in Nigeria (NPHCDA, 2009).

Challenges of Immunization in Nigeria

Several researchers have identified weak governance, inadequate funding, vaccine stock-out and poor distribution channels, nonmaintenance of the Cold Chain system, and poor staff skills and performance at state and local government levels as key challenges hindering the realization of routine immunization (Antai, 2012; Kawakatsua & Honda, 2012). Gammino et al. (2014) and Michael et al. (2014), in a similar study, concluded that the nonvaccination of children may result from inadequate vaccination team performance. Wonodi et al. (2012) similarly identified finance, service delivery, logistics, and governance, amongst several others as barriers to routine immunization. P.J. Smith et al. (2011), in line with the health belief model, was of the view that parents who had low perceived benefit, perceived severity, perceived susceptibility, and high perceived barriers were less likely to immunize their children resulting in lower coverage for all 10 childhood vaccines. Although most of the above studies looked at barriers, few looked at facilitators of complete immunization.

Operational Definitions

Complete immunization coverage: According to the Federal Ministry of Health's definition, a child is said to be fully vaccinated if he/she has received one BCG

vaccination (which protects against tuberculosis), three doses of DPT (protecting the child against diphtheria, pertussis and tetanus), at least three doses of oral polio vaccine, and one dose of measles vaccine (Doctor, Bairagi, Findley, Helleringer, & Dahiru, 2011). In this study, a child is said to have complete immunization coverage if the child had received all (one dose each of BCG, Measles Vaccine, and Yellow Fever vaccine; three doses of DPT; and four doses of OPV) by the child's 24^{th} month. Just DPT_3 is not enough for the assessment of complete vaccination coverage. Vaccination with HBV and Hib is not included in this analysis.

EPI – Expanded Programme on Immunization: Expanded Programme on Immunization targeted diphtheria, pertussis (whooping cough), and tetanus (DPT); measles; poliomyelitis; and tuberculosis (TB) first, but was later expanded to include hepatitis B (HepB), Haemophilus influenzae type b (Hib), pneumococcal conjugate vaccine (PCV), and rotavirus vaccine (UNICEF, 2014). In this study, EPI refers to all the vaccines in the Nigerian national routine immunization schedule including BCG, OPV, DPT Vaccine; Measles Vaccine, Tetanus Toxoid, Yellow Fever Vaccine, Hepatitis B Vaccine and Hib Vaccine (NPHCDA, 2009).

Immunization coverage levels: Immunization coverage levels represent the percentage of a target population that has been vaccinated (Burton et al., 2009). Coverage is usually calculated for each vaccine and for the number of doses received. It is, therefore, the percentage of children within the target population who received vaccinations against specific vaccine preventable diseases by a certain age and who were reported and documented. The children's immunization records completed at each

vaccination visit is used to measure these indices. According to the Nigerian national routine immunization schedule, every child should have received by his or her 12th month one dose each of BCG, Measles Vaccine, and Yellow Fever vaccine; three doses each of DPT, HBV, and Hib; and four doses of OPV (NPHCDA, 2009). The immunization coverage level is used to monitor the performance of immunization services; guide strategies for the eradication, elimination, and control of VPDs; identify areas of immunization systems that may require additional resources and focused attention; and assess the need to introduce new vaccines into national and local immunization systems (Burton et al., 2009).

Immunization Schedule

The immunization schedule for Nigerian children requires that they have a minimum of five contacts with the health officials (NPHCDA, 2009). This is depicted in Table 1

Table 1

Approved Immunization Schedule for the National Immunization Program in Nigeria

Contacts	Minimum target age of child	Type of vaccine
1st	At birth	BCG / OPV0
2nd	6 weeks of age	Pentavalent1 (DPT, HBV and Hib)/ OPV1
3rd	10 weeks of age	Pentavalent2 (DPT, HBV and Hib)/OPV2
4th	14 weeks of age	Pentavalent3 (DPT, HBV and Hib)/ OPV3
5th	9 months	Measles / Yellow Fever

Source: National Immunization Policy (2009)

Inequity in Vaccination Coverage

A study in India revealed considerable inequity in vaccination coverage in different states (Mathew, 2012). Similar findings were seen in the National Demographic and Health Survey with coverage varying from one region of Nigeria to the other (NPC & ICF International, 2014). The Nigerian NDHS study, 2013 revealed that children from South East and South-South zones were more likely to be vaccinated than those from

North West (52% vs. 10%). The highest full vaccination rate was seen in Imo (62%) and the lowest was seen in Sokoto (1%). In the Indian study, traditionally poor performing states were said to have greater inequities (Mathew, 2012). Individual factors such as gender and birth order; family factors such as area of residence, wealth, and parental education; demographic factor such as religion and caste; and societal factors such as access to health-care and community literacy level were associated with variation in immunization coverage (Mathew, 2012). Like the Nigerian study, Indian girls, rural infants, low household income, maternal low literacy level, and higher birth order infants have lower vaccination coverage (Mathew, 2012; NPC & ICF International, 2014).

Studies on Factors Associated With Immunization Coverage

Achieving and maintaining high levels of immunization coverage is a priority for most health systems because immunization against childhood vaccine preventable diseases is an important means of preventing childhood morbidity and mortality (Ophori, Tula, Azih, Okojie, & Ikpo, 2014). Several studies have looked at factors associated with immunization coverage in the past.

The Nigerian National Routine Immunization Strategic Plan (2013-2015) identified poor coverage of routine immunization, funding and accountability, supply chain and logistics, human resource, demand creation, and data quality, as major causes of poor routine immunization performance in Nigeria (NPHCDA, 2013).

In the South-Western Nigeria, Obiajunwa and Olaogun in 2013 published a study that looked at childhood immunization coverage in the zone. Using a cross-sectional study approach, they set out to assess both the immunization coverage in their study

populations and parental knowledge of vaccine preventable diseases and place of immunization. They discovered that, although most parents had the required knowledge of VPDs, and place of immunization, only 26.5% of their children were fully immunized with 11.9% of the children receiving no immunization at all (Obiajunwa & Olaogun, 2013). This study shows that beyond knowledge, there are other factors that may mitigate vaccination of children in any given community. The authors also reported that urban residence and increasing parental education were associated with complete immunization levels. Some challenges identified by the authors that contributed to low coverage rate seen in the study included unstable political and socio economic environments, stock out of vaccine, transportation cost, maternal factors (low literacy level, ill health or travel out of state), low family socio-economic status, and various other health delivery system factors (Obiajunwa & Olaogun, 2013). These factors were not really explored by the study, and thus call for a more detailed study on factors that mitigate immunization in Nigeria. Such a study will either validate these claims or rebut them, with verifiable facts and supporting information.

The above findings are similar to what Doctor et al. (2011) in the northern parts of Nigeria discovered when they selectively analyzed some population based baseline survey looking at maternal, new-born and child health program in northern Nigeria. They discovered that 67% of parents were unable to receive all immunizations due to lack of vaccine, and another 13% had difficulties with the long wait at immunization centers (Doctor et al., 2011). Furthermore, like in the Obiajunwa and Olaogun (2013) study, children who lived in the urban areas of Katsina, Zamfara and Yobe consistently had

higher immunization rates than those in the rural areas. However, this geographical variation was not seen with DPT_3 and OPV_3 where the rates were much closer (Doctor et al., 2011).

According to Ophori et al. (2014), apart from highly ineffective primary health care services resulting from lack of investment in personnel, facilities, drugs, and poor management of existing resources; there is also lack of confidence and trust by the public in the health services due to the poor state of health facilities and low standards of delivery. In addition, "vertical" interventions by donor agencies that undermined the capacity of the local service providers to implement sustainable programs and low demand for immunization due to a lack of understanding of its value, and several other factors mitigate immunization coverage in Nigeria. These, according to the authors, include misperceptions of routine immunization, influence of religion, inadequate cold chain equipment, political problems, rejection of routine immunization from fear and confusion, and or as a result of low confidence and lack of trust on the system; and shortage of vaccines and immunization supplies (Ophori et al., 2014). A review of the 2013 Nigerian DHS dataset will provide further insight into other factors that may be facilitating or hindering immunization services in Nigeria.

In 2012, Antai examined the association between multiple dimensions of gender inequities and full childhood immunization using the 2008 Nigeria Demographic and Health Survey dataset. In a multilevel logistic regression analysis, Antai (2012) discovered that children of women whose spouse did not contribute to household earnings, female children, Yoruba children, and children resident in communities with

low illiteracy were more likely to have completed their immunization. However, children of birth order 5 or above, of women aged less than 34 years, of women with no and or just primary education, of women resident in communities with high unemployment, and of women who lacked decision-making autonomy had a lower likelihood of receiving full childhood immunization (Antai, 2012). Antai reanalyzed the 2008 Nigerian DHS report. The current study will be using the 2013 study to see if anything has changed since 2008, and if possible, identify changes in the associated factors since 2008 when this study was done.

In an earlier study in which Antai conducted a multilevel multivariable regression analysis on a sample of women aged 15-49 years using the 2003 Nigeria Demographic and Health Survey, the author identified that full immunization clustered within families and communities, with socio-economic characteristics explaining the differences in full immunization (Antai, 2009). Also, the proportion of mothers that had hospital delivery, ethnicity, mothers' occupation, and mothers' household wealth were associated with full immunization of the children (Antai, 2009).

In a similar study in Ethiopia that looked at the 2011 Ethiopian national demographic and health survey (DHS), Lakew, Bekele, and Biadgilign (2015) revealed that 24.3 % of the children were fully immunized. In this study, having a vaccination card, postnatal check-up within two months after birth, women’s awareness of community conversation program, and women in the rich wealth index were predictors of full immunization coverage (Lakew et al., 2015). Distance and geographical location were statistically associated with completion or not of childhood immunization.

Kawakatsua and Honda (2012) tried to elucidate the individual, family and community-level determinants of full vaccination coverage among children aged 12–23 months in western Kenya using a community-based cross sectional study design in the 64 sub-location covered by community health workers (CHWs) in community units (CUs) identified as level one of the health system in Kenya since 2006. Better knowledge of vaccination schedule, longer birth interval/first birth, fewer number of children under-5 in a household, high CHWs performance and interaction between literacy and wealth were factors that showed significant association with complete vaccination in the study (Kawakatsua & Honda, 2012). They found that, while maternal knowledge of immunization schedule improved completion rates, short interval between pregnancies mitigated against complete vaccination, irrespective of other factors. Also, good community health workers practice and higher socioeconomic status were seen to improve rate of completion (Kawakatsua & Honda, 2012). This study, however, did not extensively look at other maternal and child related factors such as age, occupation, region, and gender on vaccination completion rate.

Fatiregun and Okoro (2012) looked at maternal determinants of complete child immunization among children aged 12–23 months in a southern district of Nigeria. Their study took place in a community in Abia State, Nigeria with one of the lowest rates of full immunization against vaccine-preventable childhood diseases. Using cross-sectional study technique, they interviewed 540 mothers of children aged 12 – 24 months divided into 30 clusters of 18 participants per cluster. Shortage of vaccines, absence of vaccinators at the health centers, not knowing when immunization was conducted,

distance to health facilities, and the high cost of immunization were found to negate complete immunization (Fatiregun & Okoro, 2012). Children of mothers who were less than 30 years old, unemployed, educated beyond the secondary level, had less than three children, perceived immunization as safe, were aware of the benefits of immunization, and who had good knowledge of the total number of clinic visits required for complete child immunization were more likely to complete their immunization. Moreover, both parent's involvement in the decision to have their child immunized resulted in higher completion rates (Fatiregun & Okoro, 2012).

In a study to assess the contributions of private health facilities in childhood immunization in Nigeria using a pioneer public private partnership (PPP) in south-eastern Nigeria in which there was collaboration between Abia State government and private health providers to provide free childhood immunization services in the state, the authors made an interesting discovery (Oluoha, Umeh, & Ahaneku, 2014). In the four local governments where this partnership took place, private health facilities constituted 45% (79/175) of health facilities that offered immunization services in 2011 and accounted for 21% of the immunization services in the state (Oluoha et al., 2014). Although, the authors acknowledged that the PPP has made positive contribution in immunization services provision in the state, they however concluded that this contribution was modest to the state achievement of 95% for DPT3 as against the national 68% in 2011 (Oluoha, et al., 2014). What this study failed to explain was the effect of the different ways in which private and public accessed their vaccines – which was easier for public than for private, on rate of immunization in the State. Also, the study did not recognize the fact that people

pay out of pocket, sometimes, huge amount to access care in private facilities, which may be completely removed or subsidized in public facilities. However, people that normally access care in private facilities may never access care in public facilities. Thus, seeing 21% contribution as modest was unfair to the private facilities who are nearer the people, provide more people oriented and client-centered services, and able to service the needs of those who could afford them. There is therefore the need to study the effect of cost, distance, and publicity on the rate of vaccination in private as against public facilities. This study will not delve into this, but proposes this as a future study towards universal national coverage in Nigeria.

Despite the benefits of vaccination of children which is well known and documented (Antai 2012, 2009; Fatiregun & Okoro, 2012; Ophori et al., 2014); parents sometimes refuse healthcare workers from vaccinating their children and wards. In a mixed (quantitative and qualitative) study that looked at refusal of OPV in north-western Pakistan by Murakami et al. (2014), they identified too frequent OPV campaigns and misconceptions about OPV (especially as related to birth control or contains pork) as factors that mitigated acceptance of OPV vaccinations. In addition, rejection of vaccination in northern Nigeria, that OPV was a foreign or central plot against Muslims, and that the vaccination was against the Hadith were other manifestations of OPV refusal (Murakami et al., 2014). In a similar study in northern Nigeria by Murele et al. (2014), lack of information, fear of side effects, and lack of trust in the programmed were some of the reasons cited for non-acceptors. In the above study, authority of husbands, and

advice from community leader(s) and or neighbor were cited as main reasons for motivation.

Assumptions

The following assumptions were made in this study

1. The NDHS 2013 was truly a cross-sectional study carried out using a probability sampling technique.
2. Data entry was done in a most efficient and effective manner with minimal errors
3. Missing data occurred in a completely random manner and thus their absence did not bias the study, even if a listwise or casewise data deletion technique was used in data management (Langkamp, Lehman, & Lemeshow, 2010).
4. Participants in this study told the interviewers the truth concerning the various variables used for the study.
5. The expected dependent and independent variables were contained in the secondary data set identified for this study.
6. The dataset holders willingly released the data set for this analysis upon request.
7. Dataset had enough cases and variable for unbiased study of the variables of interest
8. Documentation of vaccination was complete and accurate and based on a completed child health care.

Considering these assumptions enhanced the validity of the study.

Limitations

The following limitations of this study are hereby acknowledged:

1. This study was a secondary data analysis, thus some variables that may have added value to the study were not be in the dataset.
2. Missing data may have affected the inferences drawn from this study and the researcher could not modify the dataset to ensure no missing data
3. This dataset was collected more than two years prior to the study, and the current reality on ground in Nigeria may have changed markedly.
4. The quality of the data set was dependent on the researchers and field workers who collected the primary data, the statisticians and data clerks who inputted the data into the system, and the capacity of the staff who watched over the data set at USAID. I did not have any idea of the capacity of these individuals, but agreed with good faith that they all did honorable works at the different phases of the development, collation, and data management.
5. Information bias resulting from varying levels of recall capacities of the respondents (who have different levels of health literacy) may have negatively impacted on the findings of the study.
6. The quality of the data set may have been affected by the various manipulations of the data set over the past two years.

Scope and Delimitations

This study was based on 2013 NDHS study and looked at individual and socioeconomic factors that influenced the immunization coverage of children in Nigeria.

There was no primary data collection or contact with the participants in the study. There was also a time lag between the time the study was conducted and the time this secondary analysis took place.

The delimitations of this study include;

1. This study was delimited to quantitative cross-sectional descriptive study. There were neither control groups for comparison nor interventions for temporal analysis.
2. It was purely a secondary data analysis without any opportunity for primary data collection. Thus, only variables available in the data set were analyzed.
3. The study was delimited to the variables present in the dataset selected for this study.
4. The study was delimited by the number of questions in the data collection tools as well as the sample size used for the national study
5. The study was also delimited to the information collected by the data collectors as and when the study took place
6. The study was delimited by time of data collection and by the findings in the child health cards as at 2012/2013 when the study was done.

Significance of the Study and Potential for Social Change

Nigeria is currently contributing significantly to global childhood mortality due to the poor routine immunization coverage in Nigeria (WHO, 2015a). The reasons and factors responsible and contributing to national under-vaccination or non-vaccination are yet to be fully and sufficiently explored and elucidated. This study unraveled the mystery

behind the low immunization coverage in Nigeria, provided evidence for better immunization programming and will inform the decisions of policy makers. Factors influencing achievement of global and national immunization campaign objectives were identified. Findings, if implemented, will help in evidence-based policy directives and reworking of the current childhood immunization guidelines and standard operating procedures. The study findings, when used, may strengthen decision-making and policy guidelines, and the implementation of the following decisions and policies. In addition, the study may fill the gap currently seen in knowledge concerning factors hindering effective and efficient utilization of available resources for the improvement of health of Nigerian children. As Nigeria is just at the brink of being removed from the nations with wild polio virus, this study provides additional information that should support and facilitate improved sustainable routine immunization program in Nigeria, thereby preventing reemergence of wild polio virus transmission in Nigeria as well as reduce the level of childhood mortality and morbidity from VPDs in Nigeria.

This study also contributes to national knowledge base towards a better understanding of some of the factors that affect, and or may affect the future uptake of vaccines in Nigeria. Findings from this study provides relevant, reliable and verifiable information that should guide local, state, and national policies and programs aimed at improving immunization coverage. This knowledge of the factors hindering full immunization coverage, and achievement of global and regional immunization targets should inform new strategies and policies at all levels. Also, proper use of the findings of this study may stimulate better community acceptance of vaccination, reducing vaccine

rejection rates, and enhance childhood health outcomes with reduced mortalities and morbidities. The knowledge of major stakeholders on the factors associated with universal immunization coverage may be improved, and this may galvanize better national immunization programs, wider coverage, more effective and efficient use of resources, and resultant reduction in incidence and prevalence of vaccine preventable diseases and childhood deaths. In addition, the implementation of the findings by national, state and local government agencies will result in strengthened health systems and sustained improvement in national routine immunization program within the health care systems. In addition, this may result in better health indices for Nigerian children and improved health outcomes.

Knowledge gained from the findings will empower health workers with information for better health programming in Nigeria. Findings should serve as baseline information for evidence-based health policies, especially in the management and administration of childhood immunizations in Nigeria. Findings should be used for extensive bottle-neck analysis of the national immunization program.

Finally, community engagement in the implementation of the findings may result in community empowerment and ownership, occasioning community development and sustainable public health programming. Furthermore, their involvement may help develop and institutionalize cost efficient public health programs where people live and work.

Summary and Conclusions

This section has elaborately described the practice and benefits of childhood immunization, the poor coverage seen in Nigeria which has led to avoidable deaths of children from VPDs resulting to poor health outcomes in Nigeria. In addition, the purpose of the study, the nature of the study, the research questions and hypothesis, a detailed literature review with emphasis on limitations, delimitations and assumptions were given. The section ended with a description of the social change impact of the study.

Section 2 focused on the methodology used for this inquiry. In this section, the population studied was described, the dataset used discussed, data management processes elaborated, and ethical issues and threats to validity explained.

Section 2: Research Design and Data Collection

Introduction

In this section I describe the nature of the study, the study design, methodology, operationalization of variables, ethical considerations, and data management processes.

Research Design and Rationale

I used a retrospective cross-sectional descriptive inquiry approach (Creswell, 2009). I carried out a retrospective cross-sectional quantitative study using an existing dataset. The dataset from the Nigerian DHS 2013 was used. This design was both cost and time effective and efficient as secondary data analysis can be executed quicker when compared to primary data collection and analysis, saving time and money, and avoiding duplication of effort (Ghauri & Gronhaug, 2010). In addition, it allowed for large dataset analysis that could not be possible from individually collected dataset. It also minimized ethical issues associated with primary data collection and ensured protection of clients' confidentiality (Yiannakoulias, 2011).

Methodology

In this section, I describe how the study was carried out. I began by defining the study area/population, secondary data management processes, sampling techniques, threats to validity, and ethical consideration.

Study Area

Nigeria is made up of 36 states plus the Federal Capital Territory with a population of more than 173 million and a median age of 18 years (CIA, 2016). In all, there are 774 local government areas (LGA) and area councils in Nigeria. Each LGA is

further divided into wards from which the enumeration areas (EAs) were drawn for the 2006 census. The EAs served as the primary sampling unit for the 2013 NDHS. This study was designed to cover the entire country and representative samples were collected from each enumeration area at a fixed sample of 45 per EA.

Secondary Data Set Management

I used the DHS dataset, a population-based, nationally representative survey (A. K. Smith et al., 2011). I achieved larger sample size, obtained information that differed from self-report surveys, and avoided several ethical issues like respondents' identifiability (Yiannakoulias, 2011). I addressed high impact questions on childhood immunization at cost effective and efficient manner over a very short period of time using this dataset (A.K. Smith et al., 2011).

I sought for official approval from the USAID team who are owners and holders of the dataset. Their approval granted me full access to use the data set for this study as well as to publish my findings at the end of the study (Appendix A). Following official approvals, I retrieved the required dataset and saved the files in my computer. I reviewed both the data dictionary and the dataset to ensure that all required variables were in the dataset. Once I confirmed this, I ran descriptive studies to have a better understanding of the data with emphasis on its' accuracy, skewness, kurtosis, missing data, and even outliners (Green & Salkind, 2014). See Figure 1 for the data management processes.

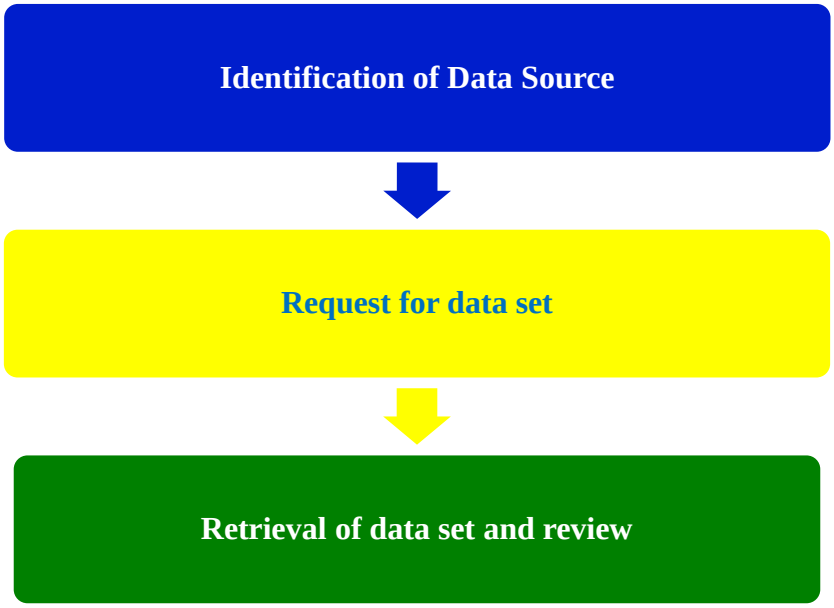


Figure 1. Data management processes.

Sampling and Sampling Procedures

The collection of the dataset selected for this study utilized a stratified multistage cluster sampling technique.

Inclusion and Exclusion Criteria

All women aged 15 to 49 who were either permanent residents or visitors to the selected households were included and interviewed. This decision was made by the primary data collectors and because they focused on women in their reproductive age period who were most likely to have children within the accepted age of 12 to 24 months and who were expected to have received the approved vaccinations.

Data Collection Tools

The DHS 2013 questionnaires were used for this study. I asked the dataset holders for access and permission to review the dataset questionnaire. This application for access and

permission was addressed to the appropriate quarter(s) who had the authorization to release the dataset questionnaire. This permission was granted as shown in Appendix A.

Independent variables of interest such as religion, state of residence, highest education level, husband's/partner's education attainment, ethnicity, literacy, wealth index, current marital status, respondent worked in the last 12 months, respondents' occupation, sex of child, child's age in months, and place of delivery were recoded to create meaningful categories for dichotomous logistic regression analysis. The dependent variable–immunization coverage–was analyzed at three levels: completed, incomplete, and no immunization for children between 12 to 24 months.

Quality Assurance and Control

To ensure quality, the data set was analyzed using SPSS® Version 21 (IBM Corp, 2012). Initial descriptive analyses were done to check for outliners, missing data, and consistency of data set.

Procedure for Gaining Access to the Data Set

I used Google and searched for Demographic Health Survey. About 23,100,000 results came through in 0.53 seconds (Google, n.d.). I selected The DHS Program - Quality information to plan, monitor and improve population, health, and nutrition programs with the URL: www.dhsprogram.com/. When I clicked on it, I was taken to the DHS Program (Demographic Health Survey) home page. Using the dropdown tool under DATA, I clicked on Download Datasets. This took me to a list of all the countries with datasets in the website. I searched for Nigeria and clicked on Nigeria 2013, which opened up the Nigerian data page.

The study was implemented by the NPC, and the field work was carried out from February 2013 to June 2013. Thirty-eight thousand, five hundred and twenty-two households were sampled, from which 38,948 females and 17,359 males aged 15 to 49 years were interviewed (The DHS Program, n.d.a). On this page, all reports and data collection tools were seen, retrieved, and reviewed.

I then clicked on the Survey Dataset, which was said to be available, and this took me to a new page showing a listing of all dataset files available for the selected survey (i.e., Nigerian DHS, 2013). On this page, I was requested to log in if I was a registered user to gain access to these files. However, since I was not a registered user, I was directed on how to become a registered user. I proceeded to register.

The process is as shown in Figure 2:

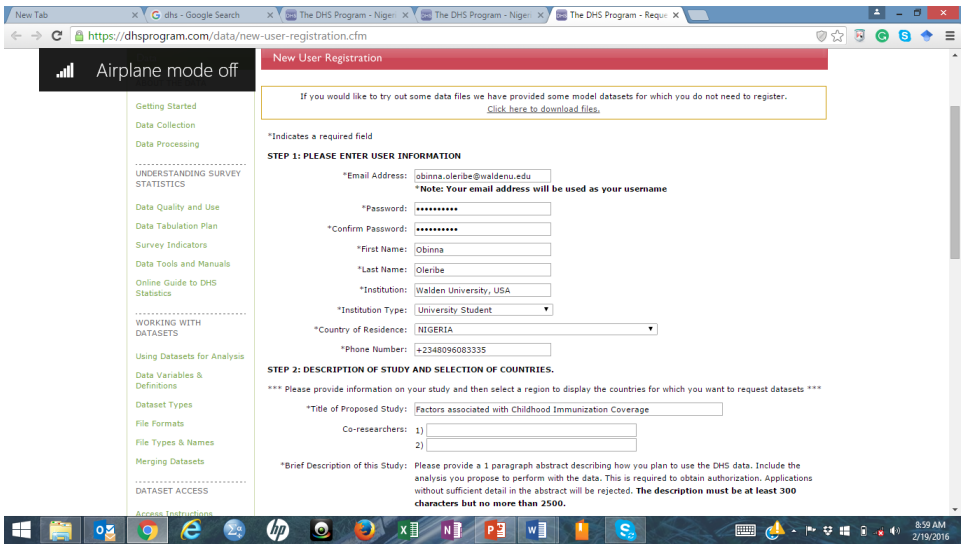


Figure 2. Registration with DHS Dataset management system.

As access to survey (DHS, MIS, and AIS) datasets (HIV, GPS, Surveys) is requested and granted by country, and when approved, full access is granted to all

unrestricted survey data sets for that country, I selected Sub-Saharan Africa and then Nigeria survey data as the request country whose datasets was needed. I saved and submitted my registration and request for dataset.

Upon completion of registration, I had view in Figure 3.

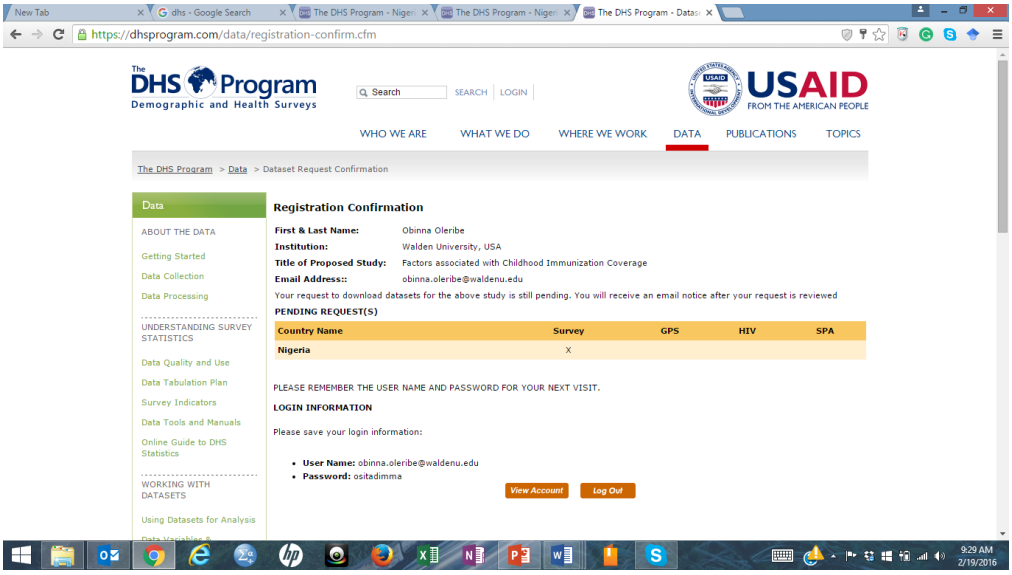


Figure 3. Registration confirmation for the DHS Program (The DHS Program, n.d.b)

This marked the end of the process. I waited for approval from the dataset holders, and this came a few days later with specific instructions on how to download the data set, what to do with it, and what to do with the report/publications that may result from the analysis (Appendix A: DHS Program Authorization).

Armed with the permission, I downloaded the dataset, saved it to my computer, and began analysis. First, I reviewed both the data dictionary and the dataset to ensure that all the required variables for the study were in the set. Once this was confirmed, I ran

a univariate descriptive study to have a better understanding of the data – accuracy, skewness, kurtosis, missing data, and even outliners (Green & Salkind, 2014).

Sample Size

In the study, I analyzed the entire samples in the data set for this study. A total of 38,522 households, 38,948 females and 17,359 males aged 15 to 49 years were sampled and interviewed for this study (The DHS Program, n.d.a).

Justification for the Effect Size, Alpha Level, and Power Level Chosen

The minimum effect size was chosen to allow for best external validity since this was a stratified multistage cluster study. The alpha level of 0.5 was chosen to reduce Type 1 error while the power level of 80 reduced Type 2 error. A nonresponse/attrition factor of 10% was added to account for nonresponse/attrition of selected women. The choice of these figures was made for better external validity and improved outcomes from generalization of the study findings. However, the sample size of 38,948 women used in this study was far higher than the calculated sample size using the above parameters.

Instrumentation and Operationalization of Constructs

DHS are nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition (The DHS Program, n.d.c). DHS could either be of the standard or interim type. This study was executed using the standard type DHS.

Operationalization

Childhood immunization coverage level was the dependent variable in this study. Completed immunization refers to any child who has had the six vaccine preventable disease vaccines (BCG, DPT_3, OPV_3, and Measles) by 24 months. Any child who received fewer vaccines (less than three OPVs [minus OPV_0], less than 3 DPT, no BGC and or measles) was classified as partial. Any child with all except OPV_0 was also classified as complete and protected. Anybody without DPT_1 and OPV_1 was classified as without immunization, irrespective of whether the child had OPV or measles vaccination from national campaign programs. A score of 4 (BCG = 1, DPT_3 = 1, OPV_3 = 1, and Measles = 1) meant complete immunization while anything less than this was seen as incomplete immunization.

The key independent variables in this study were individual and socioeconomic factors of the participants in the NDHS 2013 study. These include age, marital status, highest education level, husband's/partner's education attainment, literacy, wealth index, respondent worked in the last 12 months, and respondent's occupation (The DHS Program, n.d.d). Child related independent variables were sex, child birth order and child gender.

The variables were dichotomized for logistic regression analysis–for instance parental age was reclassified into less than 30 and above 30, marital status was reclassified into married and single, with single including single, divorced, widowed, or separated. Similarly, educational level was reclassified into having WAEC/GCE or not

having WAEC/GCE, and employment status was reclassified into employed with salary or not employed (including employed without pay).

Data unit with children aged 0 to 59 months were selected for analysis. The data set was also split into completed and not completed and analyzed at geopolitical zone level. In "received vaccination," all those who stated they did not have the vaccination were grouped along with those responded "Don't know" as it was unlikely that mothers would ever forget immunizing their children. Furthermore, all those who said their children were vaccinated were grouped together whether it was documented in their cards or not.

In analyzing for vaccination coverage, all children aged 0 to 59 months (= 0, <60) were selected and analyzed. Respondents' age was recoded into <30 and ≥30 years, region of origin into north (North Central, North East and North West) and South (South-South, South East and South West), education into not educated (none or did not complete primary) or educated (completed primary and above), religion (Islam and others), literacy (Can read and cannot read), wealth (poor and not poor), number of children (< 3 and ≥ 3), marital status (married and not married), profession (not working, professional/skilled manual and others), place of birth (home, public and private), health card (had one or did not have any), and vaccinated (was vaccinated and was not vaccinated). Respondents' spouse/partners' information were also similarly recoded. These were to allow for a dichotomous analysis of the findings.

DPT3, BCG, OPV3 and Measles were combined to compute a new variable named "Completed Immunization". Children with a value of 4 (that is received all four)

were classified as having completed immunization. Those that had none were classified as having not received vaccination–even if they had OPV0, 1 or 2; or DPT 1 and 2. This was further recoded to have children that received the four vaccines as only those who completed vaccination.

The key maternal (highest educational level, education attainment, wealth index, literacy), husband/partner (educational attainment and highest educational level) and child factors (child index, number in family, delivery place and availability of health card) were further manipulated for linear regression (bivariate) analysis. Their Z-scores were calculated and a sum of all maternal, husband/partner and child factors developed. A Linear regression of each set of factors were then developed.

Data Collection Technique

The data set was collected over a period of 18–20 months (The DHS Program, n.d.e). However, the field work occurred from February 2013 – June, 2013.

Data Analysis Plan

The analysis was in line with Figure 4.

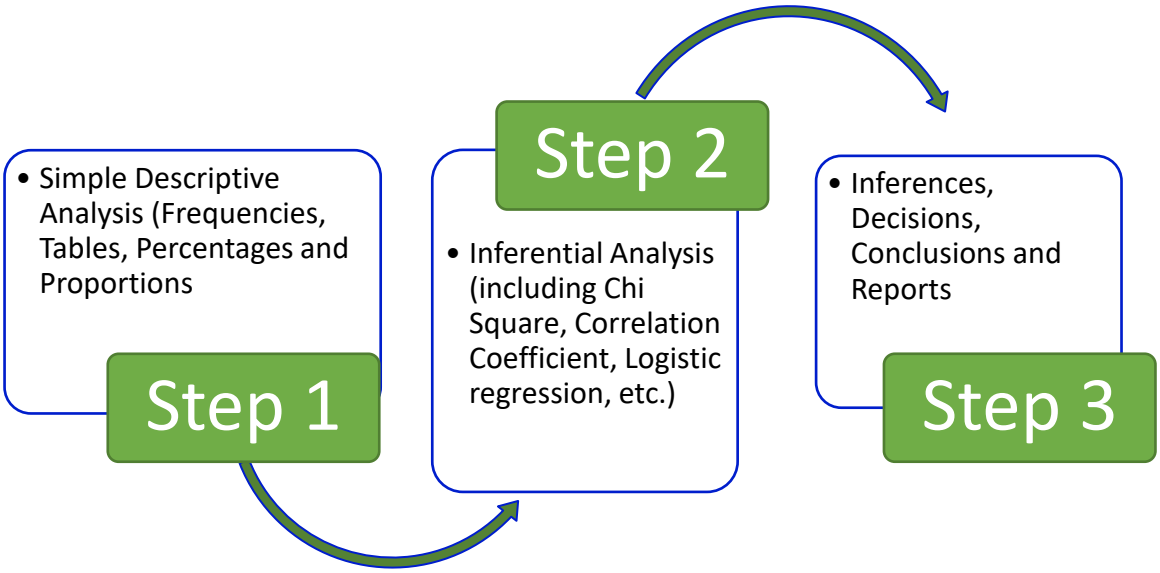


Figure 4. Data analysis process.

I analyzed the data using SPSS® version 21 (IBM Corp, 2012). I revalidated the data set using built in validation functions in SPSS® V21. I then conducted simple descriptive analyses. To ensure effective data analysis, I recoded identified variables, categorized and manipulated them in line with the research questions and data operationalization plans. From the descriptive analysis, I developed simple tables, charts and graphs to describe the dataset. Univariate (simple frequencies distributions, bar charts, line graphs and pie charts), bivariate (correlations coefficient, cross tables, Chi squares and simple linear regression) and multivariate (logistic regression) analysis were done to identify associations and measure levels of significance between independent and dependent variables (Green & Salkind, 2014).

I calculated correlation coefficient (r), alpha values and confidence intervals (Green & Salkind, 2014). Finally, I did multiple logistic and linear regression analyses to reduce statistical errors (Hall, 2015).

Research Question(s) and Hypotheses

Q1: Is there an association between socioeconomic factors (education and income level) and percentage of completeness of immunization for Nigerian children?

$H1_0$: There is no statistically significant association between parental socioeconomic factors and percentage of completeness of immunization for Nigerian children

$H1_A$: There is a statistically significant association between parental socioeconomic factors and percentage of completeness of immunization for Nigerian children

Q2: Is there an association between individual factors (child's gender and birth order-and completeness of percentage of childhood immunization in Nigeria?

$H2_0$: There is no statistically significant association between child's demographic characteristics and degree of completeness of childhood immunization in Nigeria.

$H2_A$: There is a statistically significant association between child's demographic characteristics and degree of completeness of childhood immunization in Nigeria.

Threats to Validity

Although the dataset used for this study has been validated several times in the past, there were still a few threats to validity of the study. There may be some level of content and construct validity threats. Being a secondary data analysis, there were

limitations to construct validity, limited number of variables available for analysis with absence of some essential variables, inherent bias, missing data, and unaccounted errors in data collection. In addition, as this data were collected in 2013, there could be significant changes to the current situations in Nigeria. To minimize these threats, the data was again revalidated using the SPSS preloaded rules. The data passed the validation checks.

Restricted working hours, lack of clearance to enter some clusters on a regular basis, and security threats, especially in the North East and North West regions of Nigeria may have affected coverage and limited internal validity of the project as about eight clusters in the very high volatile states were not covered. Height and weight were not measured in some conditions. This may result in a non-random missing data scenario.

Ethical Procedures

This study involved indirect research with human subjects as it entailed analysis of secondary dataset looking at key variables collected in the 2013 NDHS survey. Although IRB approvals were obtained by the primary data collector before data was collected (The DHS Program, n.d.f), ethical approvals were received from Walden University Institutional Review Board (IRB) with IRB approval number 04-12-16-0525569 (Appendix B) and National Health Research Ethics Committee of Nigeria (NHREC) with approval number NHREC Approval Number NHREC/01/01/2007-18/04/2016 (Appendix C) before proceeding to data retrieval, analysis and report development. I also sought and obtained relevant additional approvals for the use of the NDHS dataset form the data holders – United States Agency for International

Development (USAID) (Annex 1). These approvals enabled me to download the dataset, analyze and develop result report. The approvals also gave me the permission to publish the findings of the study in peer reviewed journals. As the dataset still belonged to USAID, all saved data sets were deleted from my computer after analysis and report development. The product of this secondary data analysis will be shared with USAID – if they request for it. Individual identifying information were removed and data anonymized to protect the participants before the analysis. Analysis was done in aggregates.

Dataset Treatment Post Analysis

Data set was deleted from the system once analysis and study was completed.

Summary

Section 2 of this inquiry elaborated on the research design (cross-sectional quantitative approach of inquiry), rationale and methodology of the study. In describing the methodology, the study population (Nigeria), study area using enumeration areas from 2006 national population census, secondary data set management technique, sampling and sampling procedure, and instrumentation and operationalization of constructs were described. In describing the instrumentation and operationalization of constructs, the section operationalized the variables by explaining the dependent and independent variables and their means of measurement, data collection and management techniques, and data analysis plan. In addition, the section also discussed threats to validity and ethical considerations and procedures.

In the next section, I present the results and findings of this study. In this section, the time frame for data collection, actual recruitment and response rates of the

participants are described. Also discrepancies in the use of the secondary data set which may be seen as different from the methodology are reported. Section 3 also reported on descriptive and demographic characteristics of the sample, representativeness of the sample of the study population, basic univariate, bivariate and multivariate analyses.

Section 3: Presentation of the Results and Findings

Introduction

The purpose of this study was to examine the individual and socioeconomic factors that influence childhood immunization coverage in Nigeria. Using these findings, I provide evidence on the factors hindering the realization of both global and national immunization coverage objectives. To actualize this, two key research questions were answered: (a) Is there an association between parental socioeconomic factors (education and income level) and percentage of completeness of immunization for Nigerian children, and (b) Is there an association between individual factors (child's gender and birth order) and completeness of percentage of childhood immunization in Nigeria? The null hypothesis stipulated that there is no association between parental socioeconomic factors and percentage of completeness of immunization for Nigerian children, nor between individual child factors and completeness of percentage of childhood immunization in Nigeria.

In this section, I present the result of a secondary data analysis. The NDHS 2013 was reanalyzed using SPSS Version 21. Simple descriptive, univariate, bivariate, and multivariate analyses were done. Inferential analysis and conclusions were made and reported in this section. I conclude with a summary of findings from the data analysis.

Data Collection of Secondary Data Set

The entire DHS process takes between 18 and 20 months. However, field work for data collection took place February 2013 to June 2013. All states of Nigeria were involved in the process and data were collected from 45 households in each EA. Trained

field workers collected the data but were supervised by technical team members who also doubled as state coordinators (NPC & ICF International, 2014).

According to the primary data collectors, all aspects of the NDHS data collection procedures were pretested in November 2012 with 20 members of the technical team training all trainers, and the questionnaires reviewed thoroughly. Field workers were trained to administer the questionnaires and take anthropometric measurements (NPC & ICF International, 2014).

The recruitment of field workers was done by the technical team. This was decentralized and only individuals with right qualification (at least Ordinary National Diploma [OND]) and field experience were selected. Of the 40,320 households selected from 896 sample points, 38,904 were found to be occupied at the time of the fieldwork, out of which 38,522 were successfully interviewed. This yielded a household response rate of 99%. Similarly, of a total of 39,902 women aged 15 to 49 eligible for individual interviews, 38,948 women (i.e., 97.6%) were successfully interviewed.

The recruitment, interview, and data collection processes went according to plan except for the regions where there were elements of security challenges (like in the North East and North West) that hindered proper data collection.

In some of these locations, there were restricted work hours, and some field workers were not granted access and clearance to enter earmarked clusters. Some field workers were unable to take anthropometric measurements (weight and height) of the children. Due to these challenges, survey was not completed in eight clusters. In addition,

although data collection was expected to end in May 2013, it continued into June in two states – Lagos and Kano due to various factors.

Univariate Analysis

Descriptive Characteristics of the Sample Population:

A total of 31,482 persons who responded to the survey had children within the age of 0 to 5 years. Nineteen percent (7,466) of the respondents did not have children qualified to be included in the study and thus were not analyzed. Respondents were born between 1963 and 1998 (aged 15 – 49 years), with an average age of 29.46 ± 7.0, and a modal age of 30 years (Table 1).

Table 2

Age Group of Participants of the NDHS Study, 2013

	Frequency	**Percent**	**Cumulative percent**
15-19	1531	4.9	4.9
20-24	6083	19.3	24.2
25-29	8762	27.8	52
30-34	6936	22	74
35-39	4923	15.6	89.7
40-44	2344	7.4	97.1
45-49	903	2.9	100
Total	31482	100	

All respondents were ever married; however, the majority (31.5%) were from the North-West region of the country (Table 3).

Table 3

Region of Origin of Participants to the NDHS Study, 2013

	Frequency	Percent	Cumulative percent
North-Central	4614	14.7	14.7
North-East	6517	20.7	35.4
North-West	9906	31.5	66.8
South-East	2816	8.9	75.8
South-South	3747	11.9	87.7
South-West	3882	12.3	100.0
Total	31482	100.0	

About one-third (10352, 31.9%) resided in urban regions, while the rest (21131, 67.1%) resided in the rural areas of their respective states. About half of the participants (46.9%) had no formal education (Table 4). Only 6.1% had a higher qualification.

Table 4

Highest Education Level of Participants of the NDHS 2013 Study

	Frequency	Percent	Cumulative percent
No education	14762	46.9	46.9
Primary	6432	20.4	67.3
Secondary	8365	26.6	93.9
Higher	1923	6.1	100.0
Total	31482	100.0	

The majority of these who started primary and secondary school education did not complete them (Table 5).

Table 5

Educational Attainment of Participants to the NDHS Survey, 2013

	Frequency	**Percent**	**Cumulative percent**
No education	14762	46.9	46.9
Incomplete primary	1961	6.2	53.1
Complete primary	4471	14.2	67.3
Incomplete secondary	3635	11.5	78.9
Complete secondary	4730	15.0	93.9
Higher	1923	6.1	100.0
Total	31482	100.0	

Over a half (58.3%) of the respondents were of the Muslim faith (Table 6).

Table 6

Religion of Participants of the NDHS 2013 Study

	Frequency	**Percent**	**Cumulative percent**
Catholic	2540	8.1	8.1
Other Christian	10114	32.1	40.4
Islam	18354	58.3	99.0
Traditionalist	302	1.0	100.0
Other	12	.0	100.0
Total	31322	99.5	
Missing	160	.5	
	31482	100.0	

Note. 160 (5%) did not indicate their religion.

Household members had a range of 1 to 35 persons/household, and the number of children aged 0 to 5 years in a household (dejure) also ranged from 0 to 9 children/household. Of all females interviewed, 83.1% (26,153) were wives to their husbands. Others were heads of their households (2089; 6.6%), daughters (1556, 4.9%), or daughters-in-law (947, 3.0%). The rest were granddaughters, mothers, mothers-in-law,

nieces, sisters, sisters-in-law, and adopted. Only 0.3% (93) were not related to the child in any way. While 89.4% (28,133) lived in a male headed household, 57.7% (18,153) could not read at all (Table 7).

Table 7

Literacy Level of Participants in the 2013 NDHS Study

	Frequency	**Percent**	**Cumulative percent**
Cannot read at all	18153	57.7	57.9
Able to read only parts of sentence	2165	6.9	64.8
Able to read whole sentence	10879	34.6	99.6
No card with required language	128	.4	100.0
Blind/visually impaired	10	.0	100.0
Total	31335	99.5	

A total of 45.9% were either classified as poorer or poorest (Table 8), and 78.1% had no mosquito nets in their homes (Table 9).

Table 8

Wealth Index of Participants of the NDHS, 2013

	Frequency	**Percent**	**Cumulative percent**
Poorest	7076	22.5	22.5
Poorer	7386	23.5	45.9
Middle	6272	19.9	65.9
Richer	5806	18.4	84.3
Richest	4942	15.7	100.0
Total	31482	100.0	

All the demographic indices were normally distributed with skewness within normal limits.

Table 9

Type of Mosquito Bed Net(s) Slept Under Last Night by Participants in the NDHS, 2013

	Frequency	Percent	Valid percent	Cumulative percent
No net	24666	78.3	78.3	78.3
Only treated nets	6166	19.6	19.6	97.9
Only untreated nets	650	2.1	2.1	100.0
Total	31482	100.0	100.0	

While about 80% of the respondents had between 1 to 5 living Children (Table 10), more than 85% were not using any form of contraceptive at the time of the study (Table 11).

Table 10

Number of Living Children Reported by the Participants in 2013 NDHS

	Frequency	Percent	Cumulative percent
0	334	1.1	1.1
1	4544	14.4	15.5
2	6203	19.7	35.2
3	5932	18.8	54.0
4	4750	15.1	69.1
5	3728	11.8	81.0
6 - 16	5991	19	98.0
Total	31482	100.0	

Table 11

Current Contraceptive Method of Participants in the 2013 NDHS Study

	Frequency	Percent	Cumulative percent
Not using	26798	85.1	85.1
Pill	644	2.0	87.2
IUD	191	.6	87.8
Injections	974	3.1	90.9
Condom	775	2.5	93.3
Periodic abstinence	564	1.8	95.2
Withdrawal	873	2.8	98.0
Others	663	2	-638
Total	31482	100.0	

Note. Others include diaphragm, female sterilization, implants/norplant, lactational amenorrhea (LAM), Female condom, others.

Furthermore, 99.4% (31,288) of the participants were not tobacco users in any form, 97.9% (30,826) were not covered by any form of health insurance, and 92.5% were currently married (Table 12).

Table 12

Respondents and Their Current Marital Status

	Frequency	Percent	Cumulative percent
Never in union	604	1.9	1.9
Married	29116	92.5	94.4
Living with partner	874	2.8	97.2
Widowed	367	1.2	98.3
Divorced	286	.9	99.3
No longer living together/separated	235	.7	100.0
Total	31482	100.0	

About 30% of the respondents were not working at the time of the survey (Table 13).

Table 13

Working Status of Respondents at the Time of the Survey

	Frequency	**Percent**	**Cumulative percent**
No	9649	30.6	30.8
Yes	21697	68.9	100.0
Total	31346	99.6	
9	136	.4	
	31482	100.0	

The majority of those working were either farmers or in the petty trading business (Table 14).

Table 14

Respondent's Occupation (Grouped)

	Frequency	**Percent**	**Cumulative percent**
Not working	9099	28.9	29.0
Professional/technical/managerial	1149	3.6	32.7
Clerical	98	.3	33.0
Sales (petty trading)	11964	38.0	71.2
Agricultural - self employed	260	.8	72.0
Agricultural - employee	3541	11.2	83.3
Household and domestic	38	.1	83.5
Services	1487	4.7	88.2
Skilled manual	3636	11.5	99.8
Unskilled manual	15	.0	99.9
Other	41	.1	100.0
Total	31328	99.5	

Sociodemographic characteristics of spouses of respondents

More than 36% of their spouses were without any formal education (Table 15), 31.3% were in agricultural sector (Table 16).

Table 15

Husband/Partner's Education Level

	Frequency	Percent	Cumulative percent
No education	11610	36.9	37.8
Primary	5985	19.0	57.3
Secondary	9009	28.6	86.6
Higher	3981	12.6	99.6
Don't know	121	.4	100.0
Total	30706	97.5	

Table 16

Husband/Partner's Occupation (Grouped)

	Frequency	Percent	Cumulative percent
Did not work	276	.9	.9
Professional/technical/managerial	3653	11.6	12.8
Clerical	239	.8	13.6
Sales	5869	18.6	32.7
Agricultural - self employed	1425	4.5	37.3
Agricultural - employee	9861	31.3	69.5
Services	1733	5.5	75.1
Skilled manual	6154	19.5	95.2
Unskilled manual	1475	4.7	100.0
Other	5	.0	100.0
Total	30690	97.5	

Note. Less than one percent of the spouses were not working at the time of this survey.

Descriptive Analysis of respondents with Children aged 0 – 59 months

Fourteen thousand, two hundred and seventy-one (51.8%) respondents were less than 30 years; 66.3% (18,274) were from the northern part of Nigeria; 52.1% (14,362) did not complete their primary school education or did not attend any school at all; and 41.7 (11,487) were of the Moslem faith. Also, 57.4% (15,745) were unable to read and write, 44.6% (12, 307) were either classified as poor or poorer, 95.8% (18,138) were married, and 55.7% (15,362) were either professionals or in skilled manual works.

Among the husband/partners, 85% (23,432) were 30 years or more, 65.8% (18.138) were either professionals or involved in skilled manual works, and 39.9% (10,991) were unable to read.

Child Descriptive Analysis

A total of 27,571 children were within the age of 0 to 59 months with an average age of 28.01 ± 17.31 months, (median = 27 months; mode = 13 months). About half were of opposite sex (Figure 5).

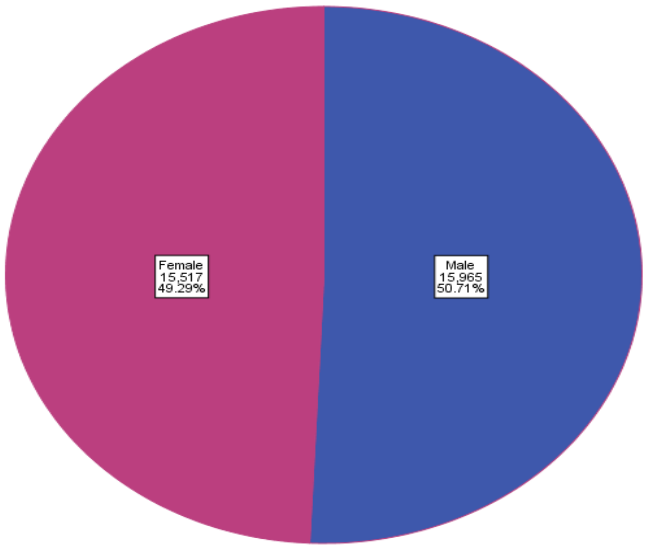


Figure 5. Sex distribution of children aged 0 to 59 months

Over sixty percent (61.8%, 17,026) of the children were delivered at home and 48.3% (13,311) had no health cards for their children (Figure 6). While 51.3% (14,155) children were within the first three birth order, more than 75% of all children were born within the first five birth order as depicted in Table 17.

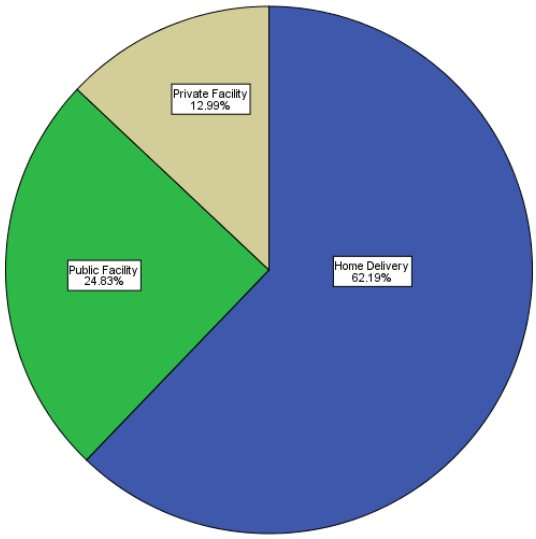


Figure 6. Place of delivery of infant 0 to 59 months in the NDHS 2013 survey

Table 17

Birth Order of the Child

	Frequency	**Percent**	**Cumulative Percent**
1	5208	18.9	18.9
2	4752	17.2	36.1
3	4195	15.2	51.3
4	3607	13.1	64.4
5	2974	10.8	75.2
6	2294	8.3	83.5
7	1669	6.1	89.6
8	1175	4.3	93.8
9	784	2.8	96.7
10	454	1.6	98.3
11 - 18	459	1.7	798.8

Majority of the children were delivered at home (respondents home (54.1%) or other people's homes (7.7%) as shown in Table 18 below:

Table 18

Place where child was delivered

	Frequency	Percent	Cumulative Percent
Respondent's home	14909	54.1	54.4
Other home	2117	7.7	62.1
Government hospital	4060	14.7	76.9
Government health center	2540	9.2	86.2
Government health post	188	.7	86.9
Other public sector	9	.0	86.9
Private hospital/clinic	3492	12.7	99.6
Other private medical sector	64	.2	99.9
Other	34	.1	100.0
Total	27413	99.4	

156 (0.6%) did not indicate where their babies were born.

Most participants were born within the first three birth columns (99.8%) as shown in Table 19.

Table 19

Birth Column Number

	Frequency	**Percent**	**Cumulative Percent**
1	18515	67.2	67.2
2	7958	28.9	96.0
3	1047	3.8	99.8
4	45	.2	100.0
5	5	.0	100.0
6	1	.0	100.0
Total	27571	100.0	

Close to half of all household enrolled for the study did not have a healthcare card at home (Table 20).

Table 20

Presence of health monitoring card in the house of participants

	Frequency	**Percent**	**Cumulative Percent**
No card	13304	48.3	48.5
Yes, seen	7083	25.7	74.3
Yes, not seen	6420	23.3	97.8
No longer has card	617	2.2	100.0
Total	27424	99.5	

Note. 147 (0.3%) did not answer this question in the questionnaire.

A large number of the children were not properly immunized as about 29% had never received vaccination before (Figure 7), and more than 48% did not receive the BCG vaccination (Table 21); and the absolute number of people vaccinated increased gradually over the years from 2008 to 2012, but suffered a major decline in 2013 (Figure 8)

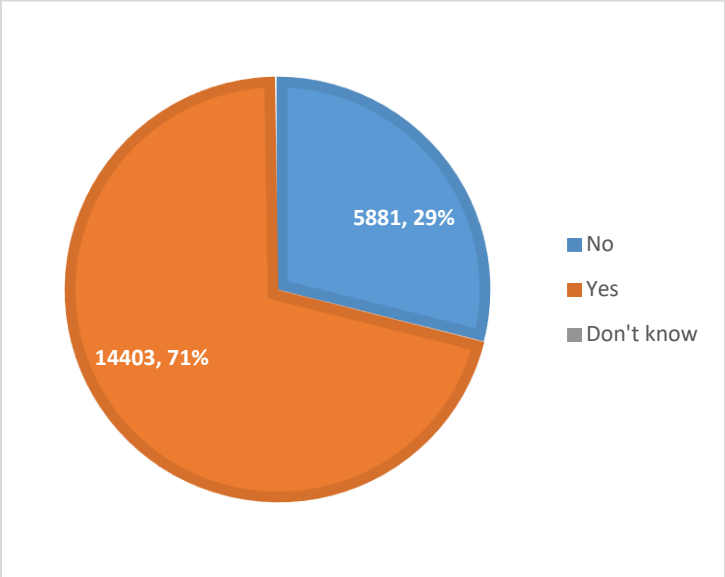


Figure 7. Pie chart depicting participants' responses on ever had vaccination or not.

Table 21

BCG vaccination among children aged 0 to 59 months in 2013 NDHS survey

	Frequency	**Percent**	**Cumulative Percent**
No	13255	48.1	48.1
Vaccination date on card	6603	23.9	72.1
Reported by mother	7541	27.4	99.5
Vaccination marked on card	87	.3	99.8
Don't know	56	.2	100.0
Total	27542	99.9	

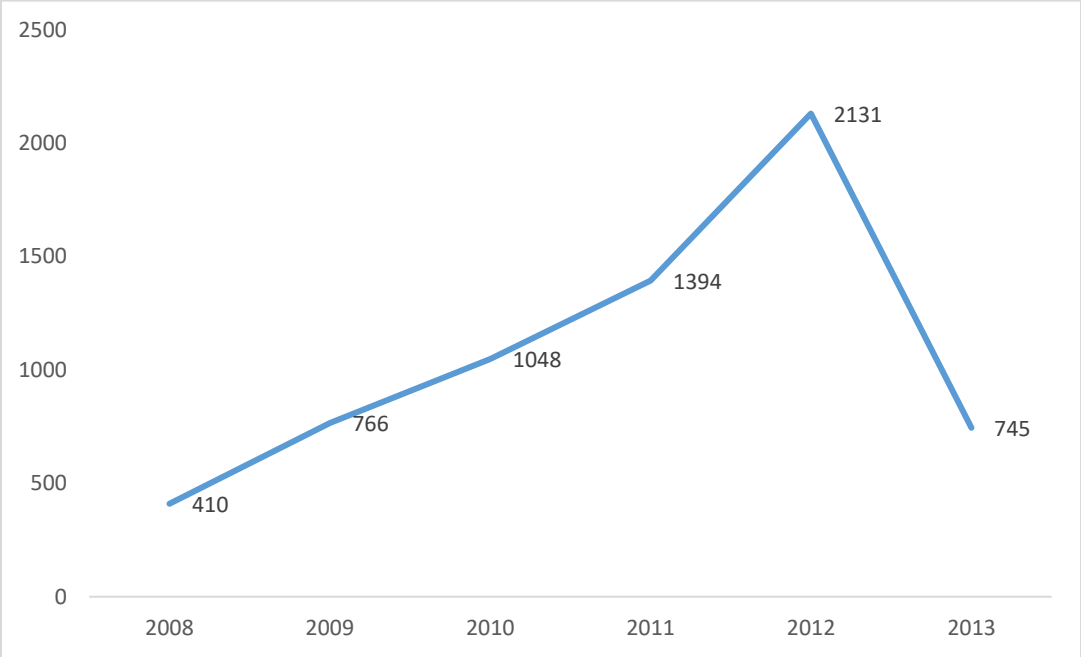


Figure 8. Trend in BCG vaccination coverage from 2008 to 2013 for children aged 0 to 59 month.

Over 50% of the children did not receive DPT 1, 2 and 3; and the number that did not receive increased progressively from DPT 1 to DPT 3 (Table 22).

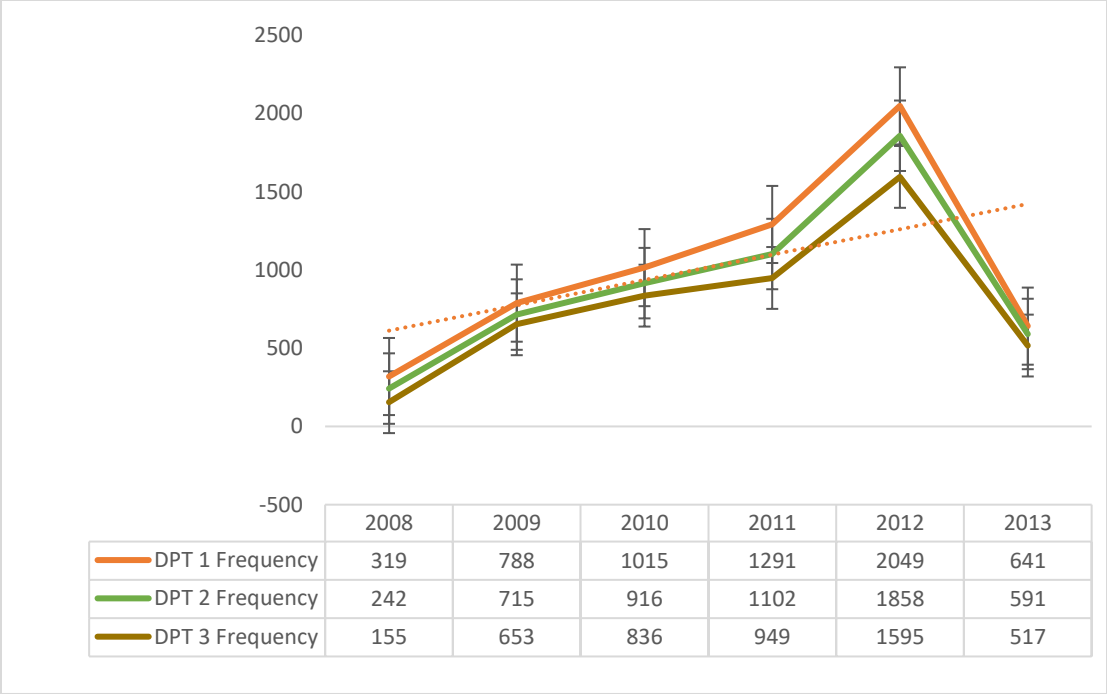
Table 22

DPT coverage rate in children aged 0 to 59 years in NDHS, 2013

	DPT 1		**DPT 2**		**DPT3**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
No	13913	**50.5**	15434	**56.0**	17301	**62.8**
Vaccination date on card	6189	22.4	5494	19.9	4769	17.3
Reported by mother	7230	26.2	6410	23.2	5242	19.0
Vaccination marked on card	87	.3	72	.3	98	.4
Don't know	102	.4	102	.4	102	.4
Total	27521	99.8	27512	99.8	27512	99.8

Note. Fifty (0.2%) participants did not respond to the question for DPT1, and 59 (0.2%) for DPT 2 and 3.

However, there was an increase in absolute DPT reach between 2008 and 2012 with a deep in 2013 as shown in Figure 9.



	2008	2009	2010	2011	2012	2013
DPT 1 Frequency	319	788	1015	1291	2049	641
DPT 2 Frequency	242	715	916	1102	1858	591
DPT 3 Frequency	155	653	836	949	1595	517

Figure 9. Trend of DPT1 – 3 from 2008 through 2013 in NDHS, 2013 survey

Over 55% of children did not receive Polio 0 which may be a reflection of the high level of home delivery in Nigeria (Table 23).

Table 23

Polio vaccination coverage via the routine immunization system in Nigeria

	Polio 0		**Polio 1**		**Polio 2**		**Polio 3**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
No	15182	55.1	7674	27.8	9547	34.6	13833	50.2
Vaccination date on card	6123	22.2	6016	21.8	5324	19.3	4599	16.7
Reported by mother	6065	22.0	13619	49.4	12066	43.8	8484	30.8
Vaccination marked on card	159	.6	117	.4	110	.4	131	0.5
Don't know	26	.1	26	.1	26	.1	26	0.1
Total	27555	99.9	27452	99.6	27073	98.2	27073	98.2

Note. The number of missing responses increased from 16, 0.1% (Polio 0), to 119, 0.4% (Polio 1), 489 (1.8%) for Polio 2 and Polio 3.

Like BCG and DPT, polio vaccination coverage increased from 2008 through 2012, but reduced in 2013 (Figure 10) and Table 24.

Table 24

Polio vaccination from 2008 through 2013 in NDHS study, 2013

	Polio 0		**Polio 1**		**Polio 2**		**Polio 3**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
2008	395	1.4	311	1.1	230	.8	150	.5
2009	738	2.7	746	2.7	694	2.5	624	2.3
2010	986	3.6	1003	3.6	873	3.2	783	2.8
2011	1333	4.8	1282	4.6	1110	4.0	922	3.3
2012	1930	7.0	1960	7.1	1770	6.4	1570	5.7
2013	636	2.3	625	2.3	573	2.1	492	1.8

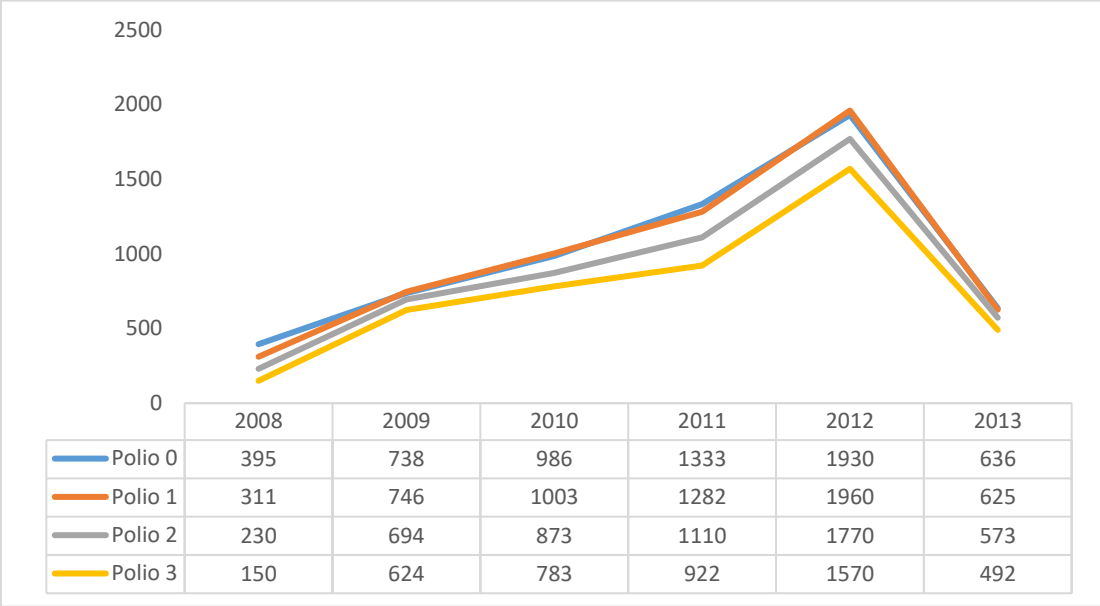


Figure 10. Trend of OPV vaccination from 2008 through 2013

More than 60% of all children did not receive measles vaccination over the six-year period (Table 25), however, absolute reach increased over the first five years, but decreased in the sixth year (2013) as shown in Figure 11.

Table 25

Measles vaccination among children 0 to 59 months old in NDHS, 2013

	Frequency	**Percent**	**Cumulative Percent**
No	16899	61.3	61.6
Vaccination date on card	3785	13.7	75.3
Reported by mother	6580	23.9	99.3
Vaccination marked on card	120	.4	99.7
Don't know	69	.3	100.0
Total	27453	99.6	

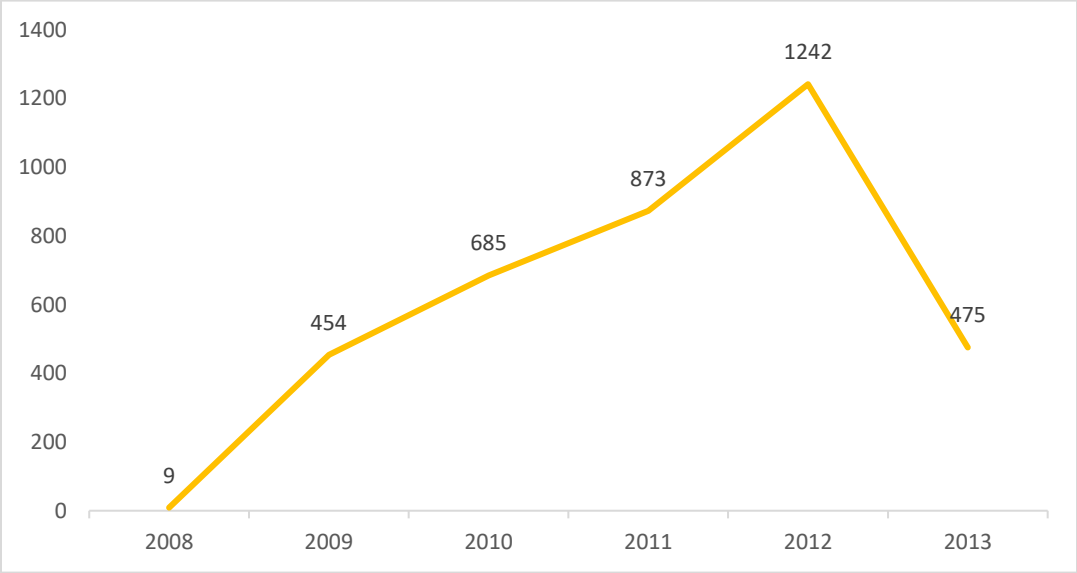


Figure 11. Trend of measles vaccination for children 0 – 59 years from 2008 to 2013

Only 6,384 participants responded to the question on female genital mutilation. Of these, close to 70% were not mutilated (Table 26).

Table 26

Female genital mutilation (vagina cutting) among female participants in the DHS 2013 survey

	Frequency	**Percent**	**Cumulative Percent**
No	4402	69.0	69.0
Yes	330	5.2	74.1
Don't know	1652	25.9	100.0
Total	6384	100.0	

In summary, while close to one third of the children did not receive any vaccination at all; a total of 22.1% had full vaccination as at the time of the survey as shown in Figure 12.

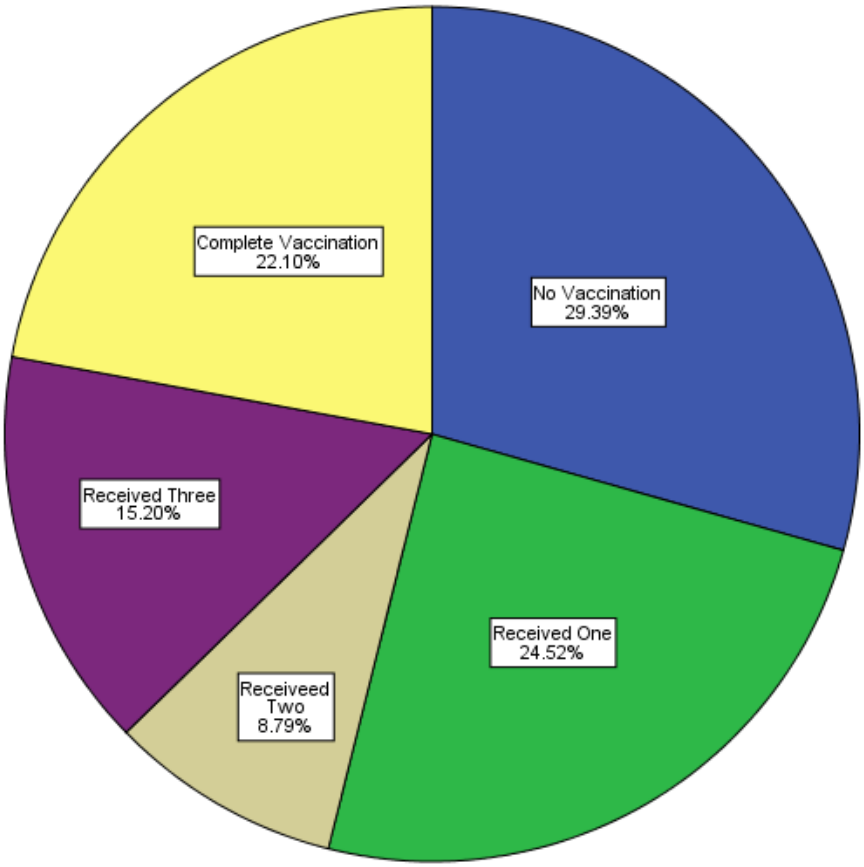


Figure 12. Degree of vaccination of children in the DHS study population.

Bivariate Analysis

Analysis of the respondents', husbands/partners' and child's personal and socioeconomic status revealed a number of significant findings as shown in Tables 27 through 31.

Table 27

Respondents' personal and socioeconomic factors influence on vaccination coverage in DHS 2013 survey.

Vaccination	Chi Squared (X^2)	d.f	Test (2-sided)	Eta
AGE				
BCG	108.2	1	0.00	0.063
DPT 3	173.5	1	0.00	0.079
OPV 3	40.7	1	0.00	0.039
Measles	236.5	1	0.00	0.093
REGION				
BCG	5350.5	1	0.00	0.441
DPT 3	4531.5	1	0.00	0.406
OPV 3	37.8	1	0.00	0.037
Measles	2640.5	1	0.00	0.31
EDUCATION				
BCG	7859.8	1	0.00	0.534
DPT 3	6043.8	1	0.00	0.469
OPV 3	222.2	1	0.00	0.091
Measles	4200.5	1	0.00	0.391
RELIGION				
BCG	5704.3	1	0.00	0.456
DPT 3	4474.8	1	0.00	0.404
OPV 3	55.1	1	0.00	0.045
Measles	2948.2	1	0.00	0.329
LITERACY				
BCG	7398.8	1	0.00	0.519
DPT 3	5788.1	1	0.00	0.46
OPV 3	289.3	1	0.00	0.104
Measles	3915.6	1	0.00	0.379
WEALTH INDEX				
BCG	6370	1	0.00	0.481
DPT 3	4981.8	1	0.00	0.426
OPV 3	104.9	1	0.00	0.62
Measles	3242.4	1	0.00	0.344
MARITAL STATUS				
BCG	210.6	1	0.00	0.519
DPT 3	116.4	1	0.00	0.46

OPV 3	8.5	1	0.00	0.104
Measles	76.5	1	0.00	0.379
OCCUPATION				
BCG	669.2	2	0.00	0.137
DPT 3	540	2	0.00	0.127
OPV 3	171.7	2	0.00	0.075
Measles	605.7	2	0.00	0.128

Table 28

Respondents' husband/partners' individual and socioeconomic factors influence on vaccination coverage in DHS 2013 survey.

Vaccination	**Chi Squared (X2)**	**d.f**	**Test (2-sided)**	**Eta**
HUSBAND/PARTNERS' AGE				
BCG	4.3	1	0.39	0.013
DPT 3	32.9	1	0.00	0.035
OPV 3	47	1	0.00	0.043
Measles	60.2	1	0.00	0.048
HUSBAND/PARTNERS' OCCUPATION				
BCG	1513.6	2	0.00	0.21
DPT 3	1258.7	2	0.00	0.191
OPV 3	80.9	2	0.00	0.047
Measles	775.1	2	0.00	0.149
HUSBAND/PARTNERS' EDUCATION ATTAINMENT				
BCG	6381.1	1	0.00	0.488
DPT 3	4632.5	1	0.00	0.416
OPV 3	203.5	1	0.00	0.088
Measles	3285.7	1	0.00	0.351

Table 29

Child factors influence on vaccination coverage in DHS 2013 survey.

Vaccination	Chi Squared (X2)	d.f	Test (2-sided)	Eta
SEX OF CHILD				
BCG	1.2	1	0.27	0.007
DPT 3	1.6	1	0.21	0.008
OPV 3	0.2	1	0.67	0.003
Measles	0.2	1	0.64	0.003
CHILD BIRTH COLUMN				
BCG	0.03	1	0.86	0.001
DPT 3	0.23	1	0.63	0.003
OPV 3	0.46	1	0.50	0.004
Measles	0.72	1	0.40	0.005
CHILD BIRTH ORDER				
BCG	412.9	1	0.00	0.122
DPT 3	337	1	0.00	0.111
OPV 3	4.9	1	0.03	0.014
Measles	165.8	1	0.00	0.078
CHILD NUMBER				
BCG	179.4	1	0.00	0.081
DPT 3	172.6	1	0.00	0.079
OPV 3	8.62	1	0.00	0.018
Measles	108.2	1	0.00	0.063
DELIVERY PLACE				
BCG	7225.4	2	0.00	0.482
DPT 3	5866.5	2	0.00	0.437
OPV 3	156.8	2	0.00	0.64
Measles	3700.9	2	0.00	0.345
CHILD HEALTH CARD				
BCG	17063.4	1	0.00	0.789
DPT 3	11861.4	1	0.00	0.658
OPV 3	897.3	1	0.00	0.183
Measles	7980.4	1	0.00	0.541

Table 30

Head of household factors influence on vaccination coverage in DHS 2013 survey.

Vaccination	Chi Squared (X2)	d.f	Test (2-sided)	Eta
BCG	575.3	1	0.00	0.145
DPT 3	441.9	1	0.00	0.127
OPV 3	3.38	1	0.07	0.011
Measles	238.4	1	0.00	0.093

Table 31

Individual and socioeconomic factors on completed immunization rate

Description	Chi Squared	d.f	Test	Eta
Respondents'				
Age	213.9	4	.000	0.087
Region	4338.4	4	.000	0.378
Education	6351	4	.000	0.468
Religion	4534.2	4	.000	0.388
Literacy	60.98.7	4	.000	0.461
Wealth Index	5016	4	.000	0.451
Marital Status	160	4	.000	0.071
Occupation	860.8	8	.000	0.169
Respondents' Husbands/partners				
Age	55	4	.000	0.041
Occupation	1328.8	8	.000	0.214
Education	5017	4	.000	0.413
Respondents' Children				
Birth Column	3.36	4	.000	.000
Birth Order	322.6	4	.000	0.102
Number of Children	193.4	4	.000	0.078
Delivery Place	5922.7	8	.000	0.449
Health Card	13460.6	4	.000	0.69

Analysis using the recoded complete vaccination variable (completed vs. not complete immunization) revealed same level of significance as those above.

Correlation Studies

Correlation coefficients were computed among the various independent variables with the dependent variables. There were two assumptions underlying the significance test associated with a Pearson correlation coefficient between two variables which were respected in this study: (a) The variables are bivariate and normally distributed; and (b) The cases represented a random sample from the population, and the scores on variables for one case were independent of scores on these variables for other cases (Green & Salkind, 2013). Also, a test of Kurtosis and Skewness showed that the sample was normally distributed. Respondents husband/partner's and child's factors were subjected to this analysis as shown in Table 32 to 34

Table 32

Pearson Correlation for respondents to the NDHS 2013 survey

	BCG	**DPT 3**	**OPV 3**	**Measles**
Age	.063**	.079**	.039**	.093**
Region of Respondents	.441**	.406**	.037**	.310**
Education	.534**	.469**	.091**	.391**
Religion	-.456**	-.404**	-.045**	-.329**
Literacy	.519**	.460**	.104**	.379**
Wealth	.481**	.426**	.062**	.344**
Marital Status	-.087**	-.065**	-.018**	-.053**
Occupation	.137**	.127**	.075**	.128**

Using the Bonferroni approach to control for Type I error across the 10 correlations, a *p* value of less than .005 (.05/10 5.005) was required for significance. The results of the correlational analyses presented in Table 32 shows that 12 out of the 32 correlations were statistically significant and were greater than or equal to .35. The correlations of vaccination and age, marital status and occupation tended to be lower and not significant. In general, the results suggest that high literacy, better wealth index, and residing in the southern part of the country were significantly related to improved vaccination rate.

Table 33

Pearson Correlation for respondents Husband/Partners' to the NDHS 2013 survey

	BCG Pearson Correlation	**Sig.**	**DPT 3 Pearson Correlation**	**Sig.**	**Polio 3 Pearson Correlation**	**Sig.**	**Measles Pearson Correlation**	**Sig.**
Age	.013*	.039	.035**	.000	.043**	.000	.048**	.000
Education	.488**	.000	.416**	.000	.088**	.000	.351**	.000
Occupation	.210**	.000	.191**	.000	.047**	.000	.149**	.000

Again, Bonferroni approach was used to control for Type I error across the 10 correlations, a *p* value of less than .005 (.05/10 5.005) was required for significance. The results of the correlational analyses presented in Table 33 show that 3 out of the 12 correlations were statistically significant and were greater than or equal to .35. The correlations of vaccination and husbands/partners' age and occupation tended to be lower

and not significant. In general, the results suggest that high husband/partner's literacy is significantly related to improved vaccination rate.

Table 34

Pearson Correlation for respondents' child to the NDHS 2013 survey

	BCG Pearson Correlation	Sig.	**DPT 3** Pearson Correlation	Sig.	**Polio 3** Pearson Correlation	Sig.	**Measles** Pearson Correlation	Sig.
Sex of Child	-.007	.273	-.008	.212	.003	.670	-.003	.637
Birth Column	.001	.856	.003	.633	-.004	.496	.005	.398
Birth Order	-.122**	.000	-.111**	.000	-.014*	.026	-.078**	.000
No of Children	-.081**	.000	-.079**	.000	-.018**	.003	-.063**	.000
Place of Delivery	.482**	.000	.437**	.000	.064**	.000	.345**	.000
Health Card	.789**	.000	.658**	.000	.183**	.000	.541**	.000

Bonferroni approach was used to control for Type I error across the 10 correlations, a *p* value of less than .005 (.05/10 5.005) was required for significance. The results of the correlational analyses presented in Table 34 show that 5 out of the 24 correlations were statistically significant and were greater than or equal to .35. The correlations of vaccination and child's gender (sex), birth order, and child column tended to be lower and not significant. In general, the results suggest that place of delivery, presence of a health card and number of children in the family significantly related to improved vaccination rate.

Correlation was also done for the complete vaccination process using a five-level concept. The correlation between the complete immunization and region (r [27894].38);

educational attainment (r [27894].47); religion (r [27750].39); literacy (r [27768].46); and wealth index (r [27894].42); were significant, p.001.

Furthermore, the respondents, husband/partner's and child variables were subjected to binary logistic regression as shown in Table 35 to 37.

Table 35

Binary Logistic regression of respondents' variables

Description	**B**	**S.E.**	**Wald**	**d.f**	**Sig.**	**Exp (B)**
Age	.268	.033	66.019	1	.000	1.307
Region	.137	.042	10.859	1	.001	1.147
Education	.591	.059	101.539	1	.000	1.806
Religion	-.593	.042	196.856	1	.000	.553
Literacy	.469	.053	77.423	1	.000	1.599
Wealth Index	.936	.045	431.005	1	.000	2.551
Marital Status	-.122	.071	2.989	1	.084	.885
Occupation	.146	.026	31.891	1	.000	1.157
Constant	-3.666	.193	361.007	1	.000	.026

Apart from marital status, all other variables were statistically significant at $\alpha = 0.05$ level.

Table 36

Binary Logistic regression of respondents' husbands'/partners' variables

Description	**B**	**S.E.**	**Wald**	**d.f**	**Sig.**	**Exp (B)**
Occupation	.219	.032	46.909	1	.000	1.244
Age	.353	.053	43.624	1	.000	1.423
Educational Attainment	1.758	.043	1675.417	1	.000	5.800
Constant	-3.504	.115	931.363	1	.000	.030

All other variables were statistically significant at $\alpha = 0.05$ level.

Table 37

Binary Logistic regression of child oriented variables

Description	B	S.E.	Wald	d.f	Sig.	Exp (B)
Sex of Child	-.015	.034	.204	1	.651	.985
Birth Column	.415	.442	.883	1	.347	1.515
Birth Order	-.070	.037	3.580	1	.058	.932
Number of Children	-.149	.044	11.271	1	.001	.862
Delivery Place	.229	.023	99.450	1	.000	1.258
Health card at home	3.253	.062	2782.633	1	.000	25.859
Constant	-4.021	.459	76.645	1	.000	.018

Sex of the child, birth column and birth order were not significant at $\alpha = 0.05$ level.

Linear Regression Analysis

Linear (bivariate and multivariate) regression analysis was conducted to evaluate the completion of immunization from respondents, husband/partners' and child factors. This was based on the random-effects model that seems more appropriate for non-experimental studies (Green & Salkind, 2013). A scatterplot was first done to check on the linearity of the independent to dependent variable and to ensure there were no outliners or non-linearity. This analysis was based on the following assumptions: (a) The X and Y variables are bivariately normally distributed in the population; and (b) The cases represent a random sample from the population, and the scores on each variable are independent of other scores on the same variable (Green & Salkind, 2013). The scatterplot of the various variables indicates that the two variables were linearly related. The 95% confidence interval for the slope shows that respondent (.217, .225), husband/partner (.419, .447) and child (.339, .355) did not contain the value of zero, and therefore overall relationship was significantly related to the overall immunization coverage. As hypothesized, parental individual and socioeconomic factors as well as

child factors have significant influence on vaccination coverage in Nigeria. However, accuracy in predicting the immunization coverage was moderate as shown in Table 38.

Table 38

Bivariate analysis of respondents, husband/partners and child's related factors

Model	B	Std. Error		Sig.	95.0% Confidence Interval for B Lower Bound	Upper Bound
Respondents Factors	.221	.002	103.348	0.000	.217	.225
Husband/Partners Factors	.433	.007	60.742	0.000	.419	.447
Child Factors	.347	.004	82.860	0.000	.339	.355

Finally, a multiple regression analysis was conducted to evaluate how well the factors of interest predicted immunization coverage in children. In the multivariate analysis, two key assumptions were made: (a) The variables analyzed in this study are multivariately normally distributed in the population, and (b) The cases presented represent a random sample from the population, and the scores on variables are independent of other scores on the same variables (Green & Salkind, 2013). As a random effects model was used (as in the bivariate analysis), scatterplots between each predictor and the criterion were used to scrutinize for nonlinearity.

The predictors were the maternal (respondents) age, educational attainment, literacy and wealth index; husband/partners educational attainment and age; and child's line number in household, place of delivery, index to birth history, has health card and child's age in months; while the criterion variable was the overall immunization coverage. The linear combination of maternal, paternal and child variables were significantly

related to immunization coverage, Maternal = R 2 =.3, F (4, 27765) = 2927.9 p =.000; husband/partner = R 2 =.19, F (2, 26275) = 3127 p =.000; and Child = R 2 =.39, F (5, 26658) = 3419.3 p =.000. The sample multiple correlation coefficient was .53 (maternal), .51 (husband/partner) and .37 (child).

Also, of all the variables included in this model, only literacy of respondents had zero in its confidence interval (-.004, .064). This makes it less significant in determining the immunization coverage of children. Respondents age (.019, .024), educational attainment (.271, .311), and wealth index (.242, 2.72) all did not have zero in their 95% confidence interval of the slope showing a significant relationship between these variables and immunization coverage of children.

Summary

In this section, I presented the results of a re-analysis of the 2013 NHDS survey. A total of 38,522 people were successfully interviewed out of which 31, 482 persons had children between ages 0 to 59 months and an average age of 29.46 ± 7.0. Parental (maternal and paternal), child oriented (e.g. sex and birth order) and societal (where child was delivered and presence of child health card) were all analyzed and found to be significantly related to immunization coverage. Univariate, bivariate and multivariate analyses were done that revealed the importance of maternal, paternal and child factors in immunization coverage in Nigeria.

In the next and final section of this work, I discussed these findings in relation to other publications on similar studies. In addition, I proposed a functional theory and

strategies that will, if applied and implemented, help improve immunization coverage in Nigeria.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

Immunization coverage is still very poor in Nigeria. This is evidenced by the fact that Nigeria, after been polio free for over two years, has again wild polio virus in circulation in some parts of the country (Dore, 2016; WHO, 2016b). The purpose of this study was to examine the individual and socioeconomic factors that influence childhood immunization coverage in Nigeria. The study was designed to provide evidence on the factors hindering the realization of both global and national immunization coverage objectives. A secondary analysis was done using the 2013 NDHS survey dataset. Analysis was done using SPSS version 21 where univariate, bivariate and multivariate analyses were done.

Concise Summary of Findings

A total of 31,482 persons with children within the ages of 0 to 5 years responded to the survey with an average age of 29.46 ± 7.0. The majority (31.5%) of the respondents were from the North-West region of the country and one-third (10,352, 31.9%) were residing in urban regions. Over half of the respondents did not complete primary education and were Muslims. Households had a range of 1 to 35 persons and 0 to 9 of children aged 0 to 5 years per household. Over 45% were classified as either poorer or poorest, 85% were not using any form of contraceptive at the time of the study, and 97.9% (30,826) were not covered by any form of health insurance. This may not be usual as about 30% of the respondents were not working at the time of the survey, and the majority of those working were either farmers or in the petty trading business.

A total of 27,571 children were within the age of 0 to 59 months with an average age of 28.01 ± 17.31 months, and about half were females. Half of the children were born within the first three birth-orders, half were delivered at respondents' homes, and slightly above half of the respondents did not have a child health card at the time of the survey.

Close to one third of the children did not receive any vaccination at all while a total of 22.1% had full vaccination as at the time of the survey. Slightly over 28% of the children received DPT 3, 21.2 % received OPV3, and 21.69% received measles vaccination

Although there was slight increase in rate of immunization over the years with a fall in 2013, 29% had never received any vaccination before the survey, and more than 48% did not receive BCG vaccination. In addition, over 50% of the children did not receive DPT 1, 2, and 3; 55% of children did not receive Polio 0, which may be a reflection of the high level of home delivery in Nigeria, and 60% of all children did not receive measles vaccination.

Immunization coverage was significantly related to the socioeconomic status of the child's parents, region of residence, and marital status ($p < 0.00$). Similarly, child birth order, delivery place, child number, and presence or absence of child health card in the family were significantly related to level of immunization ($p < 0.00$). At the individual level, maternal (respondents) age, region, education, religion, literacy, wealth index, marital status, and occupation were all significantly related to immunization coverage. However, only respondents' age, education, and occupation were significantly related to immunization coverage.

Correlation studies have suggested that respondent's high literacy, better wealth index, residence in the southern part of the country, and respondent's husband/partner's high literacy were all significantly related to improved vaccination rate. Correlations have also shown that child factors such as place of delivery, presence of a health card, and number of children in the family were significantly related to improved vaccination rate.

In a multivariate analysis, respondent's age (.019, .024), educational attainment (.271, .311), and wealth index (.242, 2.72) revealed a significant relationship with immunization coverage of children at 95% confidence interval.

In this study, I reviewed the factors responsible for the abysmal immunization coverage performance in Nigeria that, according to various reports, is due to both known and unknown causes and factors within and around the program in Nigeria (Antai, 2012; Fatiregun & Okoro, 2012; Hu et al., 2013; Kitamura et al., 2013; Lakew et al., 2015; Machingaidze et al., 2013; Obiajunwa & Olaogun, 2013; Ophori et al., 2014; Payne et al., 2013). Although several of the above referenced studies identified many reasons for poor immunization coverage, these reasons needed reexamination. I explored maternal, paternal, and child related factors and reexamined identified and not-yet identified factors.

In reviewing the immunization coverage in Nigeria, I answered two basic research questions: (a) Is there an association between socioeconomic factors (education and income level) and percentage of completeness of immunization for Nigerian children, and (b) is there an association between individual factors (child's gender and birth order) and completeness of percentage of childhood immunization in Nigeria?

Interpretation of the Findings

General Issues and Immunization Coverage

There were high illiteracy and poverty rates among the respondents in this study. These high illiteracy (over half of the respondents did not complete primary education) and poverty (as over 45% were classified as either poorer or poorest) rates are unacceptable for a country classified as the largest economy in Africa in 2014 (British Broadcasting Corporation [BBC], 2014; The Economist, 2014).

In this study, less than 23% of qualified children received complete immunization, and close to one third of the children did not receive any vaccination at all. This is similar to what Obiajunwa and Olaogun (2013) found in South-Western Nigeria where they recorded 26.5% coverage in a region that was expected to have very high immunization coverage, and what Lakew et al. (2015) found in Ethiopia where there was just 24.3 % full immunization coverage. It is also similar to WHO's (2015c) assertion that 1 out of every 5 children still miss routine immunizations. This means that Nigeria, with an under-5 population of 30,546,274 as of 2013 (United Nations, 2013), contributed over 7.5 million (34%) children to the global 22.4 million un-immunized pool. This made the development of herd immunity impossible and the risk of vaccine preventable diseases very high among under 5-year-old children (WHO, 2014). This may also explain why Nigeria is one of the six nations in the world with the worst under-5 mortality rate (117.4/1000), contributing 11% of the total global mortality rate (UNICEF/WHO/The World Bank/UN Pop Div, 2014; WHO, 2015a). With the reemergence of the wild polio virus in Nigeria in after its near elimination having had two years of no new infection, in

this study, I have shown that both the government and people of Nigeria have a lot of work towards ensuring the elimination of polio and other vaccine preventable diseases and deaths in Nigeria (WHO, 2015d; 2016b).

In this study, I further discovered that 29% of qualified children had not received any vaccination at all. This figure was significantly higher than the 11.9% documented by Obiajunwa and Olaogun (2013) in the South-Western Nigeria. Among these qualified children who never received any vaccination, more than 48% did not receive BCG vaccination, over 50% of the children did not receive DPT 1, 2, and 3, and 55% of children did not receive Polio 0, which may be a reflection of the high level of home delivery in Nigeria that is said to be between 40 to 45% (Envuladu, Agbo, Lassa, Kigbu, & Zoakah, 2013).

Child Factors

Child related factors such as number of children in the household, place of delivery, child birth order, and presence/absence of child health card affected immunization coverage ($p < 0.00$). Correlations also showed that child factors such as place of delivery, presence of a health card, and number of children in the family were significantly related to improved vaccination rate.

These findings are in agreement with Kawakatsua and Honda's (2012) findings in western Kenya where better knowledge of vaccination schedule, longer birth interval/first birth, fewer number of children under-5 in a household, and interaction between literacy and wealth were found to be significantly associated with complete

vaccination. However, the sex of the child was found not to be significant in determining immunization coverage in Nigeria ($p > 0.05$).

Who attended to the birth of a child (similar to delivery place) had previously been found to affect immunization coverage in Lao People's Democratic Republic by Kitamura et al. (2013). A similar finding was also documented by Fatiregun and Okoro in 2012 in a previous Nigerian study. In another study in Ethiopia, researchers discovered that having a vaccination card improved the chances of immunization coverage (Lakew et al., 2015). However, how immunization card presence affects coverage is unknown and required further qualitative or mixed studies.

Maternal Factors

In previous studies, maternal factors have been found to impact childhood immunization coverage (Danis et al., 2010; Kitamura et al., 2013; Obiajunwa & Olaogun, 2013). In this study, statistical analysis revealed that maternal age, region, religion, education status/literacy level, wealth index, marital status, and occupation directly affected commencement, continuation, and completion of immunization. Multivariate analysis showed that high literacy, better wealth index, and residing in the southern part of the country were significantly related to better vaccination rates. This finding supports Kitamura et al.'s (2013) and Danis et al.'s (2010) findings that continuation and completion of the required number of vaccination in children depends on the mother's educational level, socioeconomic status, employment status, immigration status, race, experience with vaccination services, health insurance, parental beliefs, attitudes towards immunization, and adequate schedule information. Although not all the variables studied

by Kitamura et al. (2013) and Danis et al. (2010) were studied in this work, maternal factors were clearly shown to affect commencement, continuation, and completion of required number of immunizations ($p < 0.00$). Maternal age, education, and occupation were still statistically significant factors affecting immunization coverage after multivariate analysis.

Moreover, region and geographical location were previously documented to influence immunization coverage by Doctor et al. (2011) in northern Nigeria, with people living in urban areas having usually higher coverage rate. This may be a result of better access, a good transportation system, higher rates of literacy, and a better wealth index. This was not, however, studied in this current work as the dataset analyzed did not differentiate respondents based on urban or rural locations. The influence of religion as a factor was also documented by Ophori et al. (2014). Furthermore, Lakew et al.'s (2015) findings in Ethiopia are similar to this as they discovered that full immunization coverage was commoner among women in rich wealth index group.

Paternal Factors

The least studied variable concerning immunization coverage is paternal factors. I discovered that paternal age, occupation, and educational status directly affected immunization coverage. For instance, the results suggested that husband's high literacy is significantly related to improved vaccination rate. The study corroborates findings by Danis et al., (2010) that paternal education level directly affects the rate of immunization of children within the household.

Unlike Fatiregun and Okoro (2012), this study did not study healthcare system factors that may have affected immunization coverage. The study revealed that immunization coverage was significantly related to the socioeconomic status of the child's parents, region, and marital status ($p < 0.00$) and validates findings by Antai (2012) from a high level multivariate analysis of the same dataset.

Analyze and Interpret the Findings in the Context of the Theoretical and/or Conceptual Framework

In line with the HBM, parents' perception of the severity and susceptibility of VPDs and barriers and benefits of vaccination affects their willingness to ensure the commencement, continuation, and completion of vaccination for their children or wards. As this was a secondary data analysis, indirect analysis shows that health literacy affects perception of severity and susceptibility of VPDs as well as barriers and benefits of vaccination. As this study revealed that parental (mother and fathers' education level) significantly affects vaccination coverage, and education level is directly related to health literacy, effective use of HBM could improve vaccination coverage for the qualified child.

The current low immunization coverage of 23% may be related to the high illiteracy level as over 50% of the parents were found to be illiterate (did not complete primary education). It will, therefore, be important to improve the health literacy levels of parents by improving their educational status towards improving the immunization coverage.

Similarly, perceptions are colored by poverty. With more than 45% of the parents within the poor or poorest group, perception of severity and susceptibility are negatively affected. Improving the socioeconomic status of parents in Nigeria will directly enhance immunization coverage. This is also supported by the fact that multivariate analysis revealed that better wealth index directly improves immunization coverage.

Furthermore, better education and improved wealth index will reduce the barriers to vaccination and improve parental sense of their children's susceptibility. Thus, by the HBM concepts, improving the socioeconomic status of parents will improve immunization coverage rate in Nigeria.

Similarly, in line with SEM, individual (education, wealth index), relationship (type of relationship in the family), community (location of community–north or south), and society/public policy are all relevant to the actualization of complete immunization in Nigeria (CDC, 2015; McLeroy et al., 1988). Improving the education of parents (mother and fathers) will improve their involvement in child related issues and use of health facilities. This will also improve their interaction with the communities (including the health community), enhance better habits and health seeking behavior, and ensure full child immunization.

Limitations of the Study

The findings of this study could be generalized to the entire Nigerian population as the study sample population, both size and power, were adequate and fully representative of the Nigerian population. This is despite the fact that this is a secondary

data analysis as the dataset was previously validated, and over the years the DHS studies have been found to be trustworthy, reliable, and very valid in describing national indices.

However it is necessary not to generalize this to the entire West Africa or sub Saharan Africa as there may be different drivers of immunization coverage due to different sociocultural characteristics of the different countries and regions.

Recommendations

The current secondary data analysis did not exhaustively explore the factors that may be responsible for immunization coverage in Nigeria as parents and key stakeholders were not interviewed using a tailored data collection tool. Moreover, in-depth interviews and focus group discussions were not carried out to identify the root cause of the low coverage.

To this end, a study involving both quantitative and qualitative data collected primarily by the researcher is recommended. Although this may be more expensive and time involving, it will produce better insight into the real and root causes of poor immunization coverage in Nigeria. The current study will serve as a baseline for the proposed study.

The proposed study will also look at other relevant variables such as rural/urban, health system, community related and even policy/governance factors which the current study did not explore. Finally, although education level was found to significantly relate to immunization coverage, the relationship between educational level and health literacy should be explored further using qualitative studies.

These additional studies will help develop tailored mechanisms and processes to improve immunization coverage rate to eliminate VPDs in Nigeria. They will also properly document population figures for accurate baseline for analysis, and provide strategies that will ensure sufficient vaccines are available for immunization. In addition, these additional studies will help educate parents (father and mother) on the severity and susceptibility of their children to VPDs, improve follow up for children of higher birth order towards complete vaccination, and mentor and support parents that have more than three children. Finally, they will document the need to: (a) improve the socioeconomic status of parents and access to health through health insurance, (b) educate healthcare workers on the need to ensure that health cards are provided to all parents, (c) support facility based delivery for every woman, and (d) improve awareness and vaccination activities in the northern part of Nigeria.

Implications for Professional Practice and Social Change

The current study has shown that child, maternal and paternal factors could positively or negatively affect immunization coverage in Nigeria. This study, to the best of the researcher's knowledge, is the first to look at all three factors in Nigeria.

Professional Practice

This study shows that secondary data analysis is cost and time effective and able to provide relevant information for decision making at all levels within a very short time. As there are several secondary datasets in Nigeria such as hospital based data; programming data by development partners; national datasets at the national agencies like National Agency for the Control of AIDS (NACA), NPHCDA, National Malaria

Elimination Program ((NMEP), National Health Insurance Scheme (NHIS), etc.; and Federal/State Ministries of Health, there is the need to mobilize for and ensure the analysis of these data to provide baseline information for Nigeria healthcare practice.

In addition, data already analyzed like the current NDHS 2013 could be re-analyzed for new insights into various issues relating to health. In this study, I have only re-analyzed the data on immunization coverage. There were several other variables that someone else could re-analyze and from them draw insights on how to improve the healthcare outcomes of Nigeria. Secondary data analysis should be encouraged and if possible mandated by policy directives at various levels of the healthcare industry for better health practice in Nigeria.

Positive Social Change

At the individual and family level, this study has generated information that shows that everybody – the father, the mother and the child – all have significant parts to play towards full immunization coverage in Nigeria. In a male dominated society like Nigeria, these findings may empower women to seek their husbands' supports towards the full immunization of their children. As birth order and number of children were found to influence immunization coverage, this may serve as advocacy tool to non-governmental organizations campaigning for adoption and improvement of family planning practices (which this study showed was very low) in Nigeria.

At the community and society level, these findings may help (when properly utilized) to reduce or eliminate the hindrances of ignorance, poverty and large families that affect immunization coverage. The findings of this study could also be used to

redesign immunization programs in Nigeria to improve reach, coverage and development of herd immunity. When this is achieved, childhood morbidity and mortality from VPDs will be reduced resulting in better health indices and health outcomes. Secondly, applying the findings of this study in policy development or review will ensure that new or revised policies are based on scientific facts and that decisions are evidence based. This will reduce the current use of estimates or guesstimates in decision making in Nigeria.

As this study has rightly identified child, maternal and paternal factors that affect immunization coverage, focusing on these factors to either improve the positives or reduce the negatives will result in more effective and efficient programming in Nigeria. This study and its findings will, therefore, positively influence policy development, program implementation, monitoring and evaluation of programs as well as eventual health outcomes in Nigeria.

Conclusion

The findings from this study revealed that: (a) there is an association between parental socioeconomic factors (education and income level) and (b) child individual factors (child's gender and birth order) and percentage completeness of childhood immunization in Nigeria. Immunization still remains the most effective and efficient public health intervention to date, and is able to cost-effectively reduce childhood morbidity and mortality across the world. Many other nations of the world have fully adopted this practice and by so doing reduced significantly childhood morbidity and mortality in their nations. It is time for Nigerian government and the people to take the right steps, make the right decisions and implement the right policies towards better child

survival indices in Nigeria. That Nigeria still contributes over 25% of global childhood deaths is unacceptable. That over 50% of Nigerian parents are ignorant and over 45% live below the poverty level is also unacceptable. That only 23% of Nigerian children are fully protected against VPDs is unacceptable. That WPV has resurfaced in Nigeria after two years is equally unacceptable. However, that major parental and child related factors hindering immunization coverage are preventable is a good indication that with the right political will, proper funding, social mobilization, and institutionalization of routine immunization, Nigerian children could be saved from avoidable VPDs, and untimely deaths.

It is time therefore for all hands to be on deck to do the right things, change the tide of history and safeguard the health and destinies of Nigerian children. Immunization should be made compulsory for all children. Parents should be supported to access these services. Health insurance should be provided to reduce out of pocket expenditures and community support should be galvanized to ensure that every child is fully immunized. Finally, mentors should be developed for families with high birth order to ensure that no child falls through the cracks and fails to receive his or her vaccination. Let the re-emergence of WPV in Nigeria provide that stimulate needed to make the necessary changes in the healthcare industry.

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Appendix A: DHS Authorization for Dataset Use

On Fri, Feb 19, 2016 at 4:01 PM, < XXXXX> wrote:

See Attached.

You have been authorized to download data from the Demographic and Health Surveys (DHS) Program. This authorization is for unrestricted countries requested on your application, and the data should only be used for the registered research or study. To use the data for another purpose, a new research project request should be submitted. This can be done from the "Create A New Project" link in your user account.

All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. The data sets must not be passed on to other researchers without the written consent of DHS. Users are required to submit a copy of any reports/publications resulting from using the DHS data files. These reports should be sent to: XXXXX

To begin downloading datasets, please login at: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm

Once you are logged in, you may also edit your contact information, change your email/password, request additional countries or Edit/Modify an existing Description of Project.

If you are a first time user of DHS Data, please view the following videos on downloading and opening DHS data: http://www.dhsprogram.com/data/Using-DataSets-for-Analysis.cfm#CP_JUMP_14039

Additional resources to help you analyze DHS data efficiently include: http://dhsprogram.com/data/Using-Datasets-for-Analysis.cfm, a video on Introduction to DHS Sampling Procedures - found at: http://youtu.be/DD5npelwh80 and a video on Introduction to Principles of DHS Sampling Weights - found at: http://youtu.be/SJRVxvdIc8s

The files you will download are in zipped format and must be unzipped before analysis. Following are some guidelines:

After unzipping, print the file with the .DOC extension (found in the Individual/Male Recode Zips). This file contains useful information on country specific variables and differences in the Standard Recode definition.

Please download the DHS Recode Manual: http://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-

manuals.cfm

The DHS Recode Manual contains the documentation and map for use with the data. The Documentation file contains a general description of the recode file, including the rationale for recoding; coding standards; description of variables etc. The Map file contains a listing of the standard dictionary with basic information relating to each variable.

It is essential that you consult the questionnaire for a country, when using the data files. Questionnaires are in the appendices of each survey's final report: http://dhsprogram.com/publications/publications-by-type.cfm

We also recommend that you make use of the Data Tools and Manuals: http://www.dhsprogram.com/accesssurveys/technical_assistance.cfm

For problems with your user account, please email archive@dhsprogram.com.

For data questions, we recommend that users register to participate in the DHS Program User Forum at: http://userforum.dhsprogram.com

The Demographic and Health Surveys (DHS) Program LOGIN INFORMATION:
Login Email: XXXXX@waldenu.edu
Password: (use the password you entered when you registered)

Appendix C: Walden University IRB Approval – Full

On Thu, Apr 28, 2016 at 12:37 AM, IRB <XXXXX@waldenu.edu> wrote:

Dear XXXXX,

This email confirms receipt of the NHERC approval for the community research partner. As such, you are hereby approved to conduct research with this organization.

Congratulations!

XXXXX
Research Ethics Support Specialist, Office of Research Ethics and Compliance

XXXXX
IRB Chair, Walden University

Information about the Walden University Institutional Review Board, including instructions for application, may be found at this link:http://academicguides.waldenu.edu/researchcenter/orec

Appendix D: National Health Research Ethics Committee, Nigeria – Approval

National Health Research Ethics Committee of Nigeria (NHREC)

Promoting Highest Ethical and Scientific Standards for Health Research in Nigeria

Federal Ministry of Health

NHREC Protocol Number NHREC/01/01/2007-21/03/2016

NHREC Approval Number NHREC/01/01/2007-18/04/2016

Date: 20th April 2016

Re: Individual and Socioeconomic factors associated with Childhood Immunization Coverage in Nigeria

Health Research Ethics Committee (HREC) assigned number: NHREC/01/01/2007

Name of Student Supervisor(s): Dr Vibha Kuamr, Walden University

Dr Adebowale Idowu Awosika-Olumo

Name of Student Investigator: Dr. Obinna Oleribe

Address of Student Investigator:

XXXX@expertmangers.org

www.expertmanagers.org

Date of receipt of valid application: 21-03-2016

Date when final determination of research was made: 18-04-2016

Notice of Expedited Review and Approval

This is to inform you that the research described in the submitted protocol the consent forms, advertisements and other participant information materials have been reviewed

and *given expedited committee approval by the National Health Research Ethics Committee.*

This approval dates from 18/04/2016 to 17/04/2020. If there is delay in starting the research, please inform the HREC so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. *All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study.* In multiyear research, endeavor to submit your annual report to the HREC early in order to obtain renewal of your approval and avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the HREC. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification.

Signed

XXXXX

Chairman, National Health Research Ethics Committee of Nigeria (NHREC)