ROUTINE IMMUNIZATION STATUS AND ITS SOCIOECONOMIC DETERMINANTS AMONG CHILDREN ATTENDING THE FEDERAL MEDICAL CENTRE, OWERRI, NIGERIA.

FRANCIS UCHECHI IREGBU

A mini-thesis submitted in partial fulfillment of the requirements for the degree of Master of Public Health at the School of Public Health, University of the Western Cape

Supervisor: Dr. Hanani Tabana

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Keywords:

Vaccine-preventable diseases, routine immunization, vaccine coverage, missed opportunities, children, socio-economic factors, outpatient clinic, health workers, determinants, Owerri.

Abbreviations

BCG	Bacille Calmette Guerin
DTP	Diphtheria tetanus pertusis
GAVI	Global Alliance for vaccines
NDHS	National Demographic and Health Survey
NPHCDA	National Primary Health Care Development Agency
NPI	National Programme on Immunization
OPV	Oral Polio Vaccine
PCV	Pneumococcal Conjugate Vaccine
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VPD	Vaccine Preventable Disease
WHO	World Health Organization

Definition of key terms

Herd immunity: the protection provided to a population when a significant number of the population is immune to an infection, usually through vaccination.

Immunization: the process by which individuals acquire protection against infectious diseases by means of vaccines

Immunization coverage: the proportion of eligible children who receive the recommended vaccines

Routine immunization: fixed vaccination sessions given on a known schedule

Vaccine: a biological substance which stimulates or increases the development of immunity against a particular disease.

Vaccine dropout rate: a measure of the number of children who completed their vaccination against the number that started it.

Vaccine preventable disease: infectious diseases whose occurrence may be prevented by effective preventive vaccines

Declaration

I declare that Routine immunization status and its socio-economic determinants among children attending the Federal Medical Centre Owerri, Nigeria is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Francis Uchechi Iregbu

Signed 3/5/2019

Dedication

This work is dedicated to the memory of my colleague and classmate, Dr Ifon Ihegworo (nee Akpan), who assisted me a great deal in the data collection for this study, but who sadly passed away in the course of my writing the thesis.

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I acknowledge the painstaking efforts in of my supervisor, Dr. Hanani Tabana in guiding me through this work. I learnt a lot from her.

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ABSTRACT

Background

Immunization has been proven a safe and cost effective means of protecting children from vaccine preventable diseases. Attaining optimal immunization coverage rests on having a good understanding of the factors that constitute barriers to the full immunization of children.

Immunization coverage is historically low in Nigeria and other parts of sub-Saharan Africa. Despite the efforts of the Expanded Programme on Immunization (EPI) and its local successor, the National Programme on Immunization (NPI), the vaccine coverage in many parts of Nigeria is very much below the World Health Organization (WHO) target. Reports from different parts of the country show widely varying coverage levels, probably a reflection of the socio-economic circumstances of the inhabitants and the strength of their health systems. Thus, a local assessment remains the best way to determine the strength of the immunization programme in a given setting in Nigeria.

The aim of this study was to determine the immunization coverage rates of children attending the outpatient clinic of the Federal Medical Centre Owerri, Nigeria, and to ascertain the socio-economic factors associated with incomplete immunization among them.

Methodology

A cross sectional study was conducted in the outpatient clinic of the Federal Medical Centre, Owerri between March and July, 2018. The study involved 378 mothers with children aged 12 to 23 months who met the inclusion criteria and were then selected consecutively. Data collection was undertaken using interviewer-administered questionnaire to examine the vaccines received, the reasons for non completion of immunization as well as the socio-demographic details of the participants. Data were subsequently entered into EpiInfo 7 for analysis. Univariate and bivariate analyses were done to determine the immunization status of the children and the relationship between their socio-demographic variables and their immunization status. The significance level was set at 5%.

Results

The immunization coverage was 89%. Slightly more male children were fully immunized compared to females. All the children received BCG (Bacille Calmette Guerin), OPV0 (Oral Polio Vaccine), OPV1, OPV2, OPV3, Penta1(Pentavalent vaccine), and Penta2, giving 100% uptake for these vaccines. Vaccine dropout rates ranged from 2.12% for BCG/measles vaccines to 5.22% for PCV1/PCV3 (pneumococcal conjugate vaccine), with Penta 1/Penta 3 being 4.23%.

Among the socio-demographic factors, only birth order (OR 0.489; 95% CI 0.252 – 0.949) was significantly associated with completion of immunization, with second-born or higher children more likely to complete their immunization than first born children. However, more children whose mothers were older (OR 0.755; 95% CI 0.394 – 1.446), better educated (OR 1.612; 95% CI 0.807 – 3.220), and in senior job positions (OR 1.053; 95% CI 0.545 – 2.033) were fully immunized than children of younger, less educated mothers. Similarly, more children whose families earned higher (OR 0.587; 95% CI 0.300 – 1.148) and were of higher socio-economic status (OR 1.560; 95% CI 0.798 – 3.050) were vaccinated than children from families with lower income and lower SES.

Among the factors related to the health facility and its services, the most common reason for non completion of immunization was unavailability of vaccines (64.3%). With respect to personal and other factors, the common reasons include 'mother too busy' (37.0%) and fear of side effects (22.2%).

Conclusion

The immunization coverage among the sample population is high. However, there is still room for improvement as factors like unavailability of vaccines and mothers' lack of motivation are important limitations to attaining a higher level of coverage.

CHAPTER ONE – INTRODUCTION

1.1 Introduction

Vaccine-preventable diseases (VPD) cause great suffering for children across the world, especially in low and middle income countries. Every year, VPDs account for 1.5 million deaths in children less than five years old across the world (CHOP, 2017), with the largest proportion coming from sub-Saharan Africa including Nigeria (Miller and Sentz, 2006), where the burden of vaccine-preventable diseases is enormous (WHO, 2017a).

Vaccination is regarded as one of the most cost effective public health interventions to fight diseases (UNICEF, 2002; World Bank, 1993). According to the Global Alliance for Vaccines and Immunization (GAVI), vaccines also provide benefits by saving health care bills (GAVI, 2017).

It is estimated that for every dollar invested in immunization, sixteen dollars are saved in healthcare costs, lost wages and productivity due to illness; the money thus saved is more than is saved from similar investments on cardiovascular disease research, public infrastructure and pre-school education put together (Ozawa, 2016). However, across the world, about 19 million children miss the opportunity of the benefits of basic immunization (WHO, 2017b). Many African countries, including Nigeria still record less than 60% coverage for the third dose of diphtheria, tetanus and pertussis (DPT3), now pentavalent vaccine 3 (Penta 3), which is a benchmark for vaccine coverage (WUENIC, 2016).

Despite the combined efforts of government and external partners, the immunization coverage in communities has remained unsatisfactory. Nigeria's current immunization coverage stands at 42% (GAVI, 2018) which leaves many children vulnerable. While some institutional problems are duly recognized, the role of family dynamics in the problem demands scrutiny. It is speculated that some social and economic factors might be key in influencing the coverage of vaccination. Thus, factors such as maternal education, ethnicity, gender of child, living conditions and family income assume great importance in understanding health seeking behaviour (Shaikh, 2008). Therefore, having a good understanding of these determinants will help in improving health outcomes from the user perspective, and will also assist the health systems to design quality interventions.

The proposed research thus aimed to determine the immunization status of children attending the Federal Medical Centre Owerri, as well as factors that promote incomplete immunization.

Hopefully, the findings can be used to inform interventions to address the problem of suboptimal vaccine coverage.

1.2 Problem Statement

In Nigeria, the attainment of universal immunization of under-five children has remained a mirage. There is poor vaccine coverage, especially in underserved areas of the country. Poor knowledge of vaccines and their benefits, unfounded fears regarding the safety of vaccines, unjustifiable refusal of health workers to vaccinate in the face of minor illnesses are main challenges that militate against adequate immunization. Other major obstacles to optimal coverage include shortage of vaccines and frequent disruptions of service in the various health facilities. Improving knowledge of clients and health workers regarding vaccines and ensuring availability of vaccines are key to reducing vaccine preventable diseases. However, data from other parts of the country suggest that other factors may equally be important. Currently, there are scant data on the vaccination status of under-five children who use the foremost health facility in the state and the reasons why some of them are not fully vaccinated.

1.3 Purpose

The purpose of this study is to describe the immunization status of children attending Federal Medical Centre Owerri and to identify possible reasons why some of the children are not fully immunized.

CHAPTER TWO - LITERATURE REVIEW

Routine Immunization

Routine immunization (RI) has been described as the 'sustainable, reliable and timely interaction between the vaccine, those who deliver it and those who receive it to ensure every person is fully immunized against vaccine-preventable diseases' (WHO, 2017c). It has been described as a process of increasing population immunity to some diseases through the regular provision of needed vaccines to all eligible persons (Shen, Fields and McQuestion, 2014). Thus, it is easy to cause interruption of disease transmission where there is strong routine immunization.

Routine Immunization in Nigeria

The hallmark of routine immunization is that it has a known schedule, and in Nigeria, it is delivered through the National Programme on Immunization (NPI) (NPHCDA, 2013), a successor of WHO's Expanded Programme on Immunization. In Nigeria, routine immunization includes the use of vaccines such as BCG, oral and inactivated polio vaccines, Hepatitis B, the pentavalent vaccine (comprising diphtheria, pertussis, tetanus [DPT], Haemophilus influenza type b [Hib] and Hepatitis B), PCV, measles and yellow fever vaccines (UNICEF 2017).

Table 1: Routine immunization schedule in Nigeria

The National Immunization Schedule in Nigeria

Vaccine	Doses	When to give (Age)	Disease Prevention	Route of Administration	Dose	Vaccination site
BCG	1	At Birth or as soon as possible till one year	Tuberculosis	Intradermal	0.05ml	Left Upper Arm
Oral Polio Vaccine (OPV)	4	At birth and at 6, 10 and 14 weeks	Poliomyelitis	Oral	2 drops	Oral
Pentavalent	3	At 6, 10 and 14 weeks	Diphtheria, Tetanus, Pertussis, Hepatitis B and Hemophilus Influenza type b	Intramuscular	0.5ml	Left Outer Thigh
Hepatitis B	1	At birth or as early as possible within 2 weeks of age	Hepatitis	Intramuscular	0.5ml	Left Outer Thigh
Measles	1	At 9 months of age	Measles	Subcutaneous	0.5ml	Right Upper Arm
Yellow Fever	1	At 9 months of age	Yellow Fever	Subcutaneous	0.5ml	Right Upper Arm
Vitamin A	2	9 months & 15 months	Improvement of Sight	Oral	100,000IU 200,000IU	Oral
Inactivated Polio Vaccine* (IPV)	1	14 weeks of age	Poliomyelitis	Intramuscular	0.5ml	Right Outer Thigh
Pneumococcal Conjugate Vaccine (PCV)	3	At 6, 10 and 14 weeks	Pneumonia	Intramuscular	0.5ml	Left Outer Thigh
Rota***	2	At 6 and 10 weeks	Diarrhoea diseases	Oral	1.2ml	Oral

IPV: For now at 14 weeks*
*Rota**: This will be introduced in the schedule by 2018*

*From National Primary Health Care development Agency (NPHCDA, 2018)

Respectively, these vaccines cover diseases such as tuberculosis, poliomyelitis, hepatitis B, diphtheria, pertussis, tetanus, pneumonia, meningitis and sepsis arising from *Haemophilus influenzae* type b and pneumococcal infection, measles and yellow fever.

Recent evolution in routine immunization in Nigeria

For many years, the routine schedule did not include vaccines such against *Haemophilus influenza*e type b (Hib) vaccine which was an important cause of deadly childhood diseases such as pneumonia, sepsis and meningitis. Following concerted efforts and advocacy by the Paediatric Association of Nigeria (PAN), the Hib vaccine was incorporated into the pentavalent vaccine regimen in 2012 (NHW, 2018). Prior to 2015, the pneumococcal conjugate vaccine (PCV) was available only to a privileged few who could afford to pay the expensive cost for the vaccine. However, a phased introduction of PCV was started in some states in 2015 and later spread to other states. In a bid to strengthen the fight against poliomyelitis by interrupting the wild polio virus, the inactivated polio vaccine was introduced in Nigeria also in 2015, with some northern states such as Borno, Kaduna, Kano, Sokoto and Yobe serving as pilot states (FMOH, 2018). This pilot programme was to last for two years, and by 2018, other states had been incorporated.

Although various countries have different vaccines in the routine schedule, the WHO has outlined a set of guidelines to assist in the collection of immunization data in order to standardize coverage across surveys; recommended data collection tools include vaccination cards, health centre records and recall or verbal history of vaccination (WHO, 2018). While fears have been expressed regarding the validity of history in immunization coverage, some studies have found good correlation between parental recall and health provider records (Binyaruka and Borghi, 2018; Suarez, Simpson and Smith, 1997). Moreover, where the immunization cards are not available or missing, history may be the only way of obtaining immunization information. However, a method that employs both card and history is probably more valid than history alone (WHO, 2018; Luman, Ryman and Sablan, 2009).

Immunization surveys are undertaken to provide data on coverage of various vaccines. Often, the vaccines in a country's routine schedule are studied, either through administrative reports or by different types of surveys (WHO, 2018). Such surveys entail obtaining information vaccination history as recalled by a child's caretaker or from the vaccination records.

Routine Immunization Coverage

On a global scale, routine immunization still falls short of the 90% which the World Health Assembly recommends (WHO, 2012). In 2016, the estimated global coverage for routine vaccinations, using DPT3 as the benchmark, was 84% (UNICEF, 2017).

Several studies have shown differing immunization coverage across the world. Coverage among the wealthy countries of Europe and America is very high (WUENIC, 2017). Joint WHO and UNICEF data show DPT3 coverage rates of mostly between 95-99% in Western Europe between 2015 and 2016. Similarly, the United States, Australia and New Zealand had immunization coverage rates of 95%, 93% and 92%, respectively (WUENIC, 2017). The high coverage rates may be attributable to strong routine immunization systems, which in turn is regarded as an indicator of superior health systems performance. Conversely, poor vaccine coverage is usually a problem of low income countries. Some countries in Asia and the Americas, and many in Africa recorded low coverage rates; several sub-Saharan African countries still fall far short of the desired benchmark of 90% (WUENIC, 2017).

Immunization coverage rates can vary widely even within countries and over time. Studies from India (Nath et al., 2007; Gupta, Prakash and Shrivastava, 2015; Rakesh et al., 2015) and Nigeria (Ataguba, Ojo and Ichoku, 2016; Adeloye et al., 2017; Oleribe et al., 2017) support these in-country variations. In a cross-sectional study of children aged 12-23 months in Lucknow, northern India, Gupta, Prakash and Shrivastava (2015) recorded immunization coverage of 74.7%. A similar study carried out in the same district eight years before revealed coverage of 44.1% (Nath et al., 2007). Although the difference may be explained by improvement in immunization services over time, the sites of the studies may account for the differences in immunization rates. Whereas the former study was carried in tertiary health facilities, the latter study was conducted in urban slums. The implication is that children recruited from the slums are apt to belong to disadvantaged families who are less likely to access immunization services. In Kerala, southern India, Rakesh et al. (2015) reported immunization coverage of 96.2%. In contrast, a coverage rate of 57.7% was obtained from slum areas of the same state of Kerala by Kumar et al. (2017). This lower rate reflects the increased likelihood of persons living in slums to have poorer uptake of immunization.

Vaccination coverage across South America is generally good, though it experienced a slight decline in some parts of the region in 2017. Countries such as Argentina, Brazil, Bolivia and Chile all recorded reduced levels of coverage for DTP3, with only Chile maintaining coverage above 90% (WUENIC, 2017). However, in the Middle East, excellent coverage rates were recorded with Bahrain, Israel and Jordan having a near universal coverage of DPT3 (WUENIC, 2017). In contrast, sub-Saharan African countries have poor coverage rates which cut across the various sub regions in the continent.

In a peri-urban area of Nakuru, Kenya, immunization coverage was determined via a cross-sectional community based survey to be 76.6% (Maina, Karanja and Kombich, 2013). This figure might have been influenced by the study setting which is a low income settlement with inadequate provision of health services. In the neighbouring Baringo County, Kiptoo et al (2015) showed DPT3 coverage of 55%, reflecting previous low coverage in the area. Being pastoralists and living in scattered settlements may have contributed to the low coverage always seen in this area.

Using evidence from the National Demographic and Health Survey in Ethiopia, Lakew, Bekele and Biadgilign (2015) reported full immunization coverage of 24.3%, with full immunization coverage being the receiving of at least eight vaccines. In a community based cross-sectional survey in Jijiga, eastern Ethiopia, Mohamud et al (2014) found that only 36.6% of children aged 12-23 months were fully vaccinated. Similarly, Etana and Deressa (2012) in central Ethiopia, found vaccine coverage of 36% among children of the same age.

In Kwazulu-Natal, South Africa, DPT3 coverage of 84.9% was obtained among the children (Ndirangu, 2009). A prospective study of three sites in South Africa revealed full vaccination coverage ranging from 62% to 94%. The relatively high levels of coverage in South Africa may be due to the advanced health care obtained in the country relative to other African countries.

Nigeria ranked among the 10 countries with the lowest 2015 DPT3 coverage in the world. In 2016, two of these countries experienced a decline, while 4 remained stagnant in their DPT3 coverage including Nigeria. The DPT3 coverage for Nigeria for 2015 and 2016 remained unchanged at 49% (WUENIC, 2017). This estimate mirrors figures from other sub-Saharan

African countries (Etana and Deressa, 2012; Maina, Karanja and Kombich, 2013; Mohamud et al., 2014; Lakew, Bekele and Biadgilign, 2015; Kiptoo et al., 2015).

Apart for the DPT3 benchmark, the coverage of other vaccines recorded low figures. In the WHO monitoring system 2018 global summary, average 2017 estimates for Nigeria for BCG, DPT3, measles and the third polio vaccine were 53%, 42%, 42% and 40%, respectively (WHO, 2018a). These low coverage rates underscore the fact that Nigeria is one of only three countries still battling to eradicate poliomyelitis (GPEI, 2018).

Following a systematic review and meta-analysis of Nigerian data, Adeloye et al. (2017) determined that the proportion of fully immunized Nigerian children was 34.4%. The study revealed wide regional variations, with coverage ranging from 9.5% in the North-West to 51.5% in the South-South zone. The timeline of the data chosen may not reflect current realities of vaccine coverage in Nigeria, as surveys from 2005 were included. In addition, only three states of the South accounted for a quarter of the studies used, thus, the data may not reflect the country-wide situation with respect to vaccination coverage. Similar to the above study, Oleribe et al. (2017), using data from the 2013 National Demographic Health Survey, documented that residing in the southern part of Nigeria was significantly related to better immunization rates. This finding could be related to limited access to health services in the North as well as to poverty.

Poverty rates are much higher in northern Nigeria than in the south and this affects health practices including immunization (NDHS, 2008). In a rural community based study in Zamfara, northern Nigeria, Gidado et al. (2010) found that only 7.6% of the children were fully immunized. This was an improvement on the immunization coverage of 5.8% determined by the Nigeria Demographic and Health Survey in the same community two years before. Zamfara is in the North-West region of the country where poverty is widely prevalent; in addition, resistance by community leaders to vaccinations have been frequently documented (Kapp, 2004; Clements, Greenough and Shull, 2006; Jegede, 2007; Ophori et al., 2014), hence the low coverage. This contrasts sharply with the coverage rates of 57.9% recorded by Adedire (2016) in Atakumosa-west district, a rural community in Osun State, south western Nigeria, and validates the observed relationship between higher wealth indices and high immunization coverage (WUENIC, 2017).

In a cross-sectional study of four outpatient children's clinic in Enugu, eastern Nigeria, Tagbo et al. (2014) determined that 84.9% of the respondents were fully vaccinated, with 100% coverage for BCG and OPV0. These values are among the highest in Nigeria and compare favourably with vaccine coverage in more affluent parts of the world (WUENIC, 2017). Enugu is one of the largest cities in Nigeria, with an established high rate of knowledge of vaccination and vaccine preventable diseases (Tagbo, 2013). The high health literacy levels in Enugu and the high concentration of health facilities in the city may account for the high vaccine coverage levels obtained.

Determinants of immunization coverage

Several factors have been identified as being important in determining vaccine coverage. These determinants vary by setting. In different parts of the world, male gender has been associated with enhanced immunization coverage, (Fadnes et al., 2011; Gupta, Prakash and Shrivastava, 2015; Rakesh et al., 2015). In some societies, much premium is placed on having a male child and extra care is taken in raising them, including providing immunization.

Delivery at a hospital, rather than at home, is also a positive determinant of vaccine coverage. Children delivered at the hospital are more likely to be fully immunized (Rakesh et al., 2015; Maina, Karanja and Kombich, 2013; Mohamud et al., 2014; Etana and Deressa, 2012; Tagbo et al., 2014). Conversely, children delivered at home are less likely to complete their immunization than those delivered at the hospital (Fadnes et al., 2011). It is believed that those who deliver in hospitals are more likely to access hospital services such as immunization than those who deliver at home. This belief is due to the fact that women who register and deliver in hospitals have health information, including immunization provided to them on their antenatal visits. Besides, the decision to deliver in hospitals reflects confidence in the healthcare system and its services of which immunization is a key part.

Maternal education has been found to be associated with vaccination coverage. In both Africa and Asia, immunization coverage significantly increased with higher levels of education (Bbale, 2013; Maina, Karanja and Kombich, 2013; Rakesh et al., 2015). Etana and Deressa (2012) and Mohamud et al. (2014) also demonstrated that where mothers had any form of education no matter how little, immunization coverage was significantly better than where mothers were

illiterate. In South Africa, Fadnes et al (2011) showed that increased number of years spent at school by mothers resulted in less chances of untimely or incomplete education. Using nationally representative data from the Nigeria General Household Survey-Panel, Balogun et al (2017) showed that maternal education was associated with complete immunization. Although the level of education was not determined, the influence of mothers being educated, as against not being educated, was substantial. Forshaw et al. (2017) demonstrated not only the salutary effects of maternal education on complete vaccination, but also showed that higher maternal education was associated with better coverage; in a systematic review and meta-analysis, they showed that the odds of complete vaccination were 2.3 times greater in children whose mothers received at least secondary education compared to those whose mothers' highest educational level was primary school.

Tagbo et al. (2014) in southern Nigeria showed that in cases where mothers had secondary education or higher, the chances of a child being fully immunized were doubled over cases where education was less. As mothers became more educated, they had increased awareness of the usefulness and safety of vaccinations and thus felt more confident to embrace it.

Higher wealth indices are associated with better immunization coverage (Fadnes et al., 2011; Rakesh et al, 2015). Using data from the Uganda Demographic and Health Survey, Bbale (2013) determined that the richest stratum had the highest probability of being fully immunized. In Kerala, India, Rakesh et al. (2015) showed that although the rates of full immunization were similar between the Lower and the Middle/Upper SES, far more children who were partially immunized came from the lower SES. However, this difference is not statistically significant. Similar findings were made in a study using dataset from a nationally representative survey in which it was shown that close to half of the children in the top quintile were fully vaccinated compared to about 23% from the lowest quintile (Ataguba, Ojo and Ichoku, 2016).

When vaccines are unavailable, immunization coverage is negatively affected. This effect is shown in a study by Adeloye et al. (2017). Unavailability of vaccines cause missed opportunities in which children who are eligible for vaccinations do not get the vaccines due to health systems failure. Similarly, poor knowledge of vaccination was also shown to reduce immunization coverage (Kumar et al., 2017; Maina, Karanja & Kombich, 2013; Adedire et al., 2016). By

contrast, having satisfactory knowledge of vaccines significantly correlated with a higher rate of completion of immunization (Odusanya et al, 2008).

The rate of vaccination coverage tends to increase as maternal age increases. Mohamud et al. (2014) in Ethiopia showed that the probability of a child being fully immunized increased with maternal age. Similar findings were made by Etana and Deressa (2012) also in Ethiopia, but with the latter study, the increase in immunization coverage with increased maternal age was not statistically significant. In the United States, (Salmon, 2009) demonstrated a peak maternal age group at which completion of immunization occurred; in addition, it was shown that the lowest age group had the lowest coverage.

Challenges of routine immunization in Nigeria

Lack of trust in health interventions may result in mass rejection of such interventions. This lack of trust may be engendered by religious and political considerations (Kapp, 2004; Clements, Greenough and Shull, 2006) such was the case in a few states of Northern Nigeria where religious leaders called for the boycott of polio vaccination programmes in 2003. Such vaccination programmes were perceived as plot by Western countries to enforce a reduction in the population of the local communities (Ophori et al., 2014). The boycott severely disrupted the polio eradication efforts of the WHO's Global Polio Eradication Initiative and contributed to Nigeria being one of the remaining polio endemic countries in the world (Jegede, 2007).

Reasons related to health services, parental knowledge and attitudes have been identified. In a review carried out in collaboration with the WHO by Favin et al (2012), factors such as access to health services, attitudes and practices of health care providers, parental knowledge of vaccines, fear of side effects were cited. Also recognized were conflicting parental priorities and beliefs as well as lack of confidence in the vaccines where the expectation that a single vaccine should provide immunization against all childhood illnesses (Ophori et al., 2014).

In Nigeria and other parts of Africa, health worker strike is often frequent and prolonged and has been identified as a challenge to sustainable access to health services (Ophori et al., 2014). Unavailability of vaccines is also a significant challenge as identified by Ophori et al. (2014), Itimi, Dienye and Ordinioha (2012) and Adebayo, Oladokun and Akinbami (2012), despite the diversity of sources of immunization funding.

CHAPTER THREE – METHODOLOGY

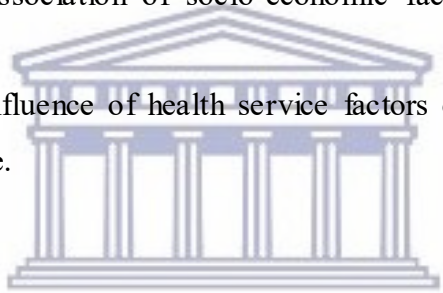
3.1 Aim and Objectives

Aim

To determine the immunization coverage and the socio-economic factors that influence it among children presenting at the Federal Medical Centre Owerri.

Objectives

1. To ascertain the level of completion of routine vaccination among children aged 12 to 23 months in Owerri;
2. To determine the association of child factors with routine vaccination coverage;
3. To determine the association of socio-economic factors with routine vaccination coverage and
4. To determine the influence of health service factors on non completion of routine vaccination coverage.



3.2 Study Design

An analytical cross-sectional design was used. This study aimed to determine the immunization coverage and the socio-economic factors that influence it among children presenting at the Federal Medical Centre Owerri. The analytical cross-sectional design was the most appropriate because it permitted the determination of the routine immunization coverage of the reference population at the given period of time in which the researcher had to conduct his study; the study design also enabled the verification of the associations between the highlighted independent variables and immunization status. Both of these goals are in line with the stated objectives of the study. The analytical cross-sectional study evaluates the extent of a health problem or a health service provision as well as the possible associations between it and potential causes (Hennekens and Buring, 1987).

3.3 Study Setting

The study was carried out at the children outpatient clinic of the Federal Medical Centre Owerri from March to July, 2018. Owerri is the capital city of Imo State in the south eastern part of Nigeria, with an estimated population of 401873 as at the last census in 2006 (FRN, 2007). It is

populated by a blend of civil servants, artisans, traders and professionals. The residents of Owerri are predominantly of the Igbo tribe, with majority being Christians. Imo State generally has a high literacy rate, with a poverty index that is very much below the national average (UNDP, 2018). Owerri serves as a gateway to many of the cities in the South-East region of Nigeria, and is easily accessible to most residents in the state as well as to residents from the neighbouring states. As such, people prefer to utilize its health facilities, especially the Federal Medical Centre, which is the largest health facility in the state. Consequently, the centre serves a diverse clientele.

3.4 Population and Sampling

The target population was all children aged 12 to 23 months and their mothers who presented at the Children Outpatient Clinic of the Federal Medical Centre. The children outpatient clinic runs from Monday to Friday and attends to an average of 200 children every week.

3.4.1 Inclusion and Exclusion Criteria

Inclusion Criteria:

i). Children aged between 12-23 months.

ii). Children cared for by their mothers from birth

ii). Children whose mothers have resided in the state for at least 9 months

Exclusion Criteria:

i). Children with persistent severe immune-compromise (these conditions may preclude the use of some vaccines like the live vaccines or cause a delay in receiving vaccines at the appropriate time)

ii). Children who presented with caregivers other than their mothers.

Mothers alone, and not other caregivers, were chosen because they are principally the ones who take the children for immunization. They are therefore in the best position to know what vaccines are given in the absence of an immunization card. In addition, mothers are more likely than any other individual to know why a child was not vaccinated. Therefore, to maintain consistency and to ensure veracity of information received, only mothers were chosen.

3.4.2 Sample Size

The sample size for the proposed study was determined using the formula (Kirkwood and Sterne, 2003):

$$n = \frac{z^2 \times p(1-p)}{d^2},$$

where n = minimum sample size; z = standard normal deviation (1.96);

p = prevalence of full immunization coverage (as measured by the DPT3 coverage in Nigeria by 2015), which is 56% or 0.56 (WUENIC, 2016),

while d = tolerable error margin (5%). Therefore the minimum sample size n

$$= \frac{1.96^2 \times 0.56 (1-0.56}{0.0025} = \frac{3.8416 \times 0.56 (0.44)}{0.0025} = 378$$

3.4.3 Sampling Procedure

Consecutive sampling was used whereby every child who met the inclusion criteria was recruited until the desired sample size was achieved.

3.5 Data Collection

Participants were accessed at the Children Outpatient's Clinic (CHOP) of the Federal Medical Centre (FMC) Owerri. The mothers of children whose ages fell within the designated age range were approached while they waited to be attended by the nurses or doctors at the CHOP. The essence of this timing was to give minimal disturbance to both patients and health care staff. The attendance register at the CHOP was used to determine the ages of the children included in the study. The mothers of the children whose ages fell within 12 to 23 months were then approached, and following appropriate introduction, evaluated for the inclusion and exclusion criteria. Those who met the inclusion criteria were then informed about the details of the study and requested to give informed consent in form of writing. To this end, a consent form was given and the contents of the consent form were duly explained to those who could not readily comprehend it. Thereafter, participants who gave written informed consent were subsequently enrolled in the study.

Data were collected with the use of questionnaire administered face to face by the principal researcher and his assistants who were trained for the purpose. Information on the children's

ages, birth orders and vaccines received were collected. The parents' ages, level of education and occupation were also determined. Questions were asked about the family income and the reasons for not completing the immunization, where appropriate.

3.5.1 Validity and reliability

Formulating the questionnaire based on known facts in the literature about immunization coverage and related factors helped to ensure content validity. Every eligible participant was selected and the contents of the questionnaire explained to them in English and Igbo languages. The principal researcher and his assistants ensured that the participants all understood the contents of the questionnaire. The research assistants were a nurse and resident doctors who were trained on extracting details and observing confidentiality. In addition, there was a stringent classification of the outcome (immunization status) and exposure variables so that these variables are easily reproducible.

To improve and check the reliability of the study, a pilot study was conducted. The pilot study helped to assess the repeatability of the findings, thus, consistency in responses implied a degree of reliability of the questionnaire.

3.6 Data Analysis

Using the Oyedeji's method (Oyedeji, 1985), social class was determined and classified using a combination of the mother's level of education and the father's occupation (Appendix F). A child is said to have complete immunization if it received all 14 vaccines in the schedule.

Prior to the final analysis, variables were further defined. Data such as birth order, social class, family income, mother's age, mother's educational level, employment status and knowledge of vaccines were disaggregated into meaningful categories for the purposes of further analyses (Appendix G).

The raw data were put into an Excel spreadsheet and updated on a daily basis. Thereafter, the data were cleaned and imported into Epi Info 7. Descriptive statistics (frequencies and percentages) were calculated. Charts were used to show the age and gender distribution of the children, birth order, the overall vaccine coverage, vaccine dropout rate and the reasons for incomplete immunization. On reasons for incomplete immunization, "no reason" refers to a situation where a mother's response was, "I don't have a reason."

Bivariate analysis was done to determine the associations between immunization status (complete immunization/incomplete immunization) and the socio-demographic variables. Multilevel analysis was not done because many of the datasets had very few samples within the units. A p-value of < 0.05 was used to interpret the significance of the statistical tests.

3.7 Ethics considerations

Ethical approval was received from the University of the Western Cape Biomedical Research Ethics Committee. The Ethics Committee of the Federal Medical Centre Owerri also granted ethical approval prior to the commencement of the study (Appendix H, I).

Participation in the study was voluntary and participants were informed that they could withdraw at any stage in the study. Details and benefits of the study were provided and clarified in Igbo language in the Information Sheet (Appendix A). Informed consent was sought from the participants and only those who were willing to take part in the study participated further and signed the consent form (Appendix B). Study participants were assured of the confidentiality of the information they gave; they were also assured of being under no financial obligation as all costs related to the research were borne by the researcher. Participants were interviewed in a corner of the clinic in order to give them some privacy and put them at ease so as to encourage honest responses.

CHAPTER 4: RESULTS

The results are presented in three sections; the first section has the details of the demographic characteristics of the children, their mothers and the family. In the second section, data on the immunization coverage are presented. A summary of the demographic parameters and their associations with vaccine completion make up the third section.

4.1 Demographic characteristics of the study participants

A total of 378 mother-child pairs were recruited for the study. Among the children, 168 were female, while 210 were male. Three hundred and thirty-seven (89%) children completed their routine vaccinations, while 41(11%) had incomplete vaccinations.

4.1.1 Distribution of the demographic characteristics of the children

4.1.1.1 Age distribution of the children

The ages of the children ranged from 2 months to 23 months. Figure 1 shows that the 12-15 month age group had the highest number of children.

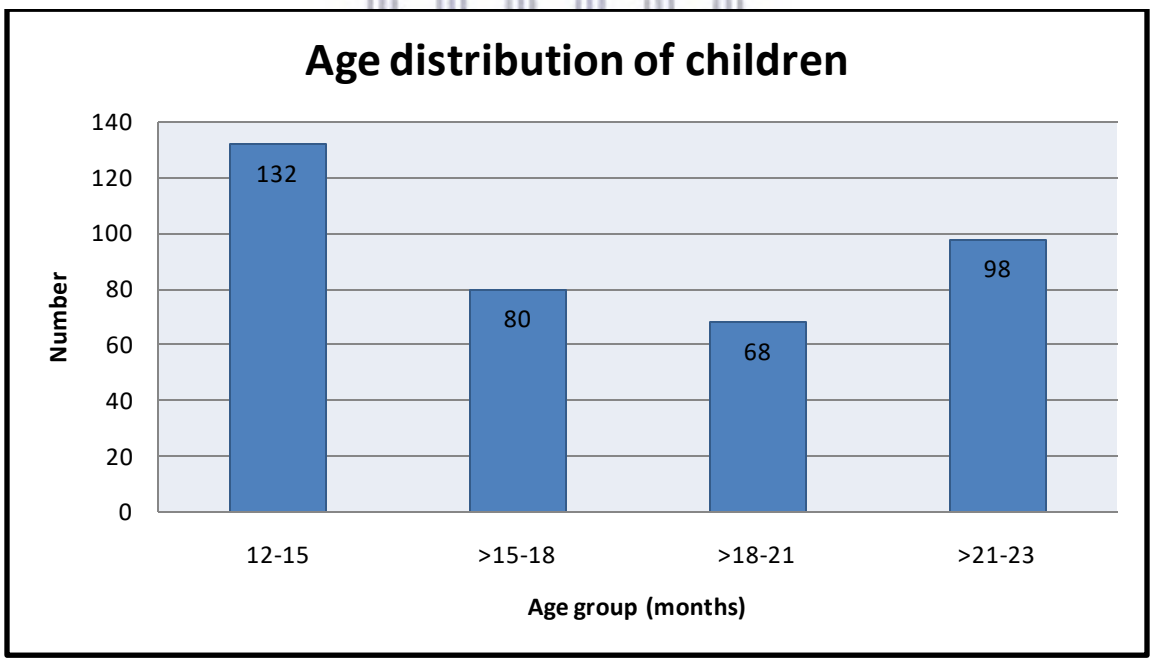


Figure 1: Age distribution among the children

4.1.1.2 Gender distribution of the children

Figure 2 show that male children constituted 56% of the participants against 44% for female children.

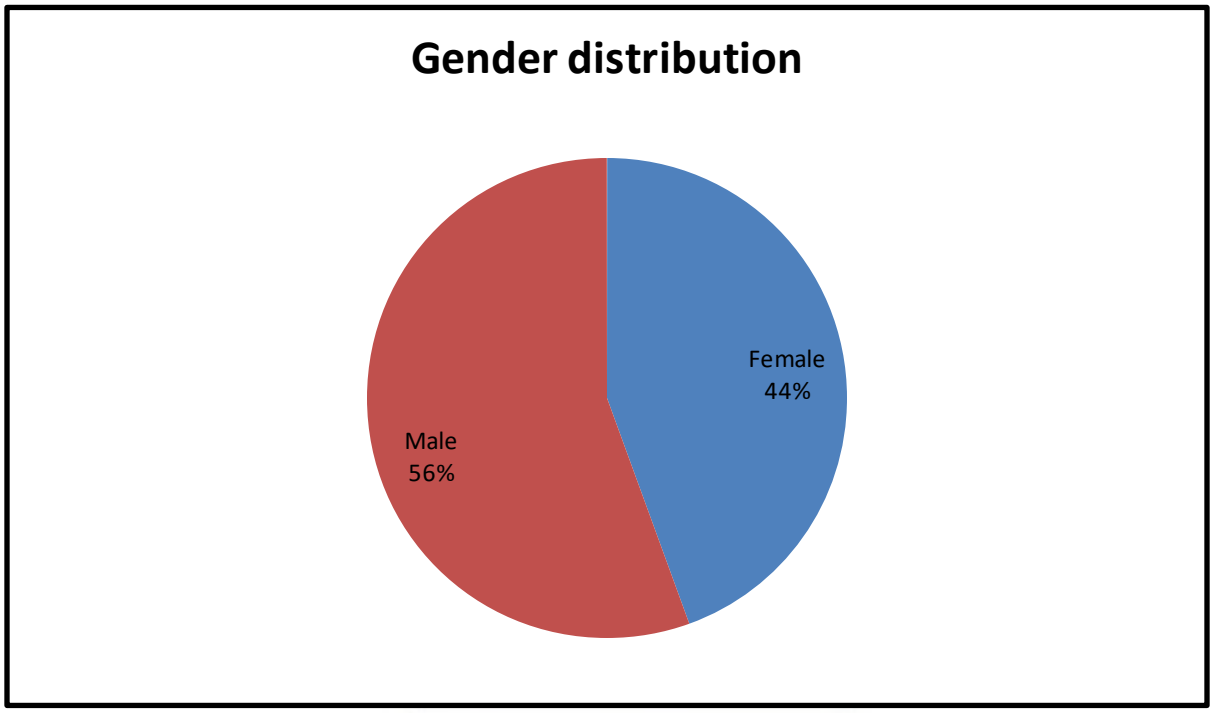


Figure 2: Gender distribution among the children

4.1.1.3 Birth order distribution among the children

Most children were of birth order 1st to 4th, with 2nd- to 4th-born children making up the majority. Only 19 children had a higher birth order than 4th (Figure 3).

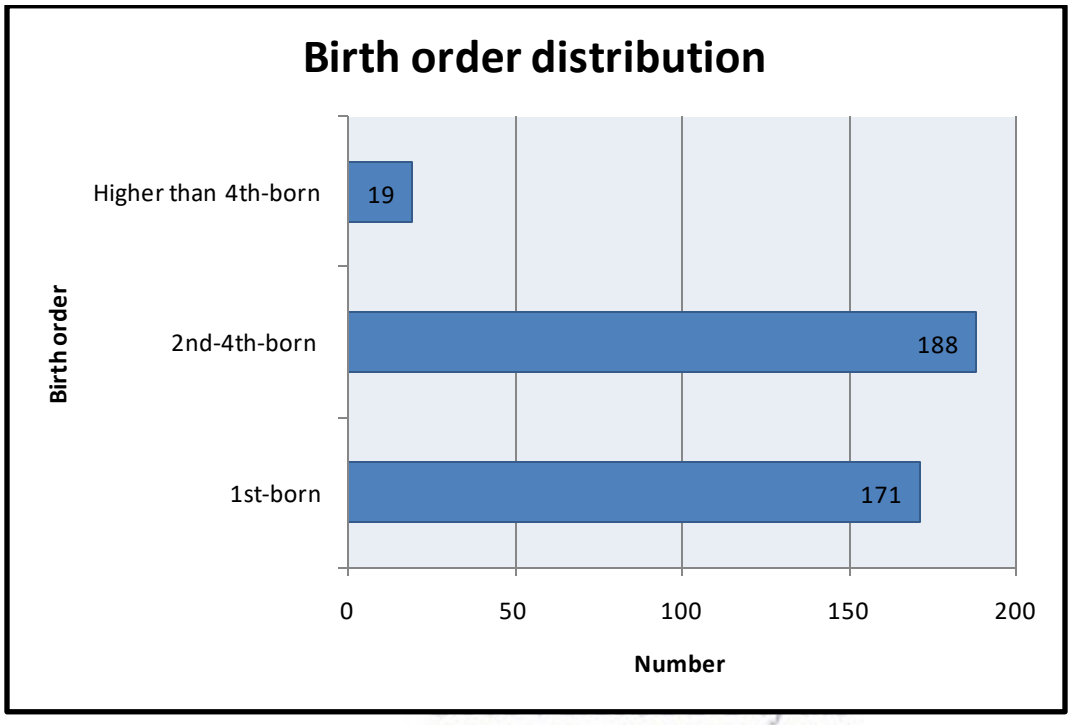


Figure 3: Distribution of birth order of the children

4.1.2 Demographic characteristics of the mothers

Table 2 shows that the predominant age group for the mothers was 31-40 year range which has 50% of the population. Mothers over 40 years of age constituted the least proportion (7.41%). All the mothers had at least primary level of education, while more mothers than not attained university education or equivalent (74.60%). Only 1.06% of the mothers were senior public servants, while majority of the mothers were professionals, large scale traders and senior school teachers (41.53%). Similar proportion of mothers had excellent knowledge of vaccines (23.01%) as did have good knowledge (23.54%). The least proportion of the mothers (2.91%) was considered to have very poor knowledge of vaccines.

Table 2: Distribution of the mothers' demographic characteristics

Variable	Frequency	Percent
Maternal Age		
20-30	161	42.59
31-40	189	50.00
>40	28	7.41
TOTAL	**378**	**100**
Maternal Educational Attainment		
University Graduate	282	74.60%
School Certificate with professional training	33	8.73%
School Certifcate	51	13.49%
Primary School	12	3.17%
No formal education	0	0
TOTAL	**378**	**100**
Maternal Occupation		
Senior Public servant	**4**	**1.06%**
Professionals/Managers, Large Scale Trader, Intermediate Grade Public Servants/Senior School Teachers	157	41.53%
Junior school teacher/Artisans	37	9.7%
Petty trader/Labourer	72	19.05%
Unemployed/Student	108	28.57%
TOTAL	**378**	**100**
Mother's knowledge of vaccines		
Excellent	87	23.01
Good	89	23.54
Average	106	28.04
Poor	84	22.22
Very poor	12	3.17
TOTAL	**378**	**100**

4.1.3 Family demographics

4.1.3.1 Socio-economic status and family income of the study participants

Among the social classes represented in Table 3, social class II had the most number of families (66.67%), while the least number belonged to social class 1. No family belonged to social class V. Close to half of the participants (48.15%) earned above ₦100000 (R4860), while about a tenth (9.52%) earned less than ₦30000 (R1458).

Table 3: Distribution of the social class and family income of the participants

Variable	Number	Percent
Social class		
I	12	3.17%
II	252	66.67%
III	92	24.34%
IV	22	5.82%
V	0	0
TOTAL	**378**	**100**
Family income		
<₦30000 (<R1458)	36	9.52%
₦30000-₦100000 (R1458-R4860)	160	42.33%
>₦100000 (>R4860)	182	48.15%
TOTAL	378	100

4.2 Immunization coverage

4.2.1 Overall immunization coverage

Figure 4 showed that 89% of the children completed their routine vaccination, while 11% had incomplete vaccination.

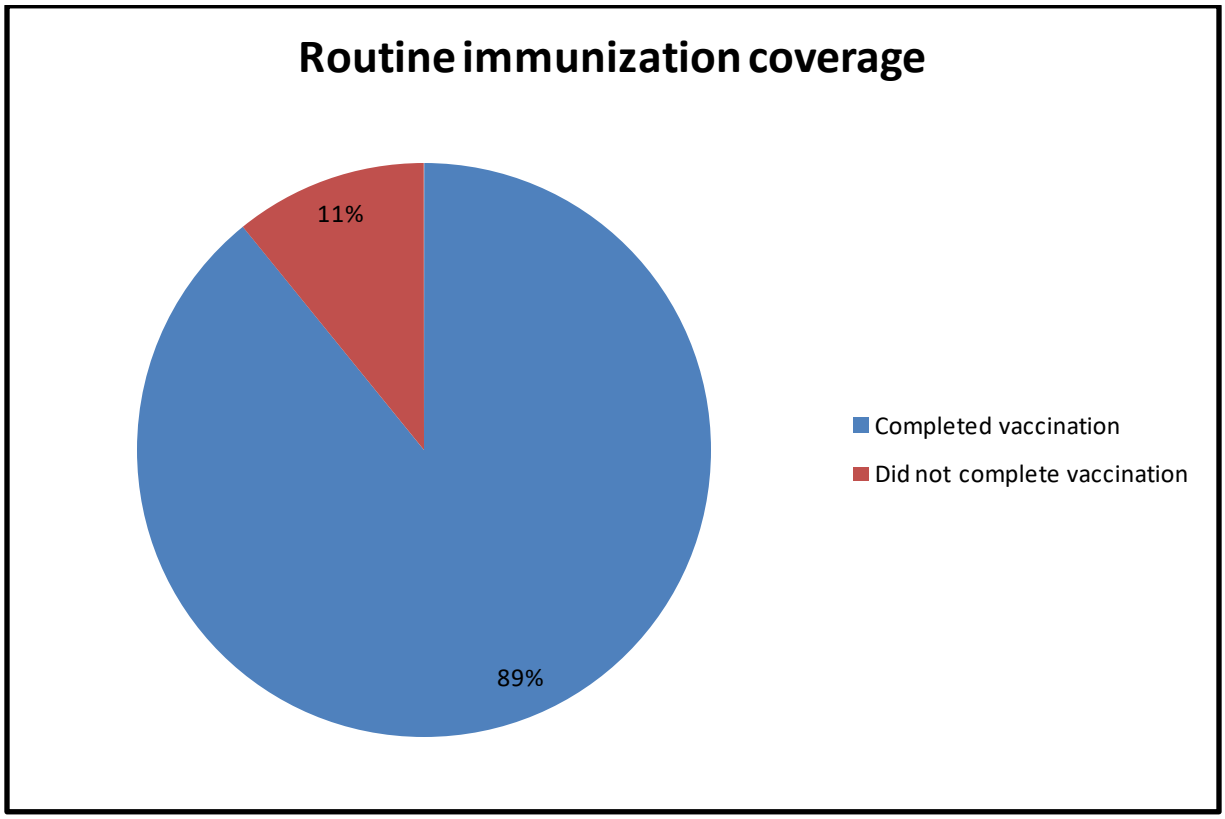


Figure 4: Routine immunization coverage

4.2.2 Immunization coverage by individual vaccines

Vaccines such as BCG, OPV0, OPV1, OPV2, OPV3, Penta1, and Penta 2 had 100% uptake among the children. Only one child (0.26%) missed HBV while 33 children (8.73%) did not get PCV3 (Table 4).

Table 4: Coverage by individual vaccines

Vaccine	Completed	
	Frequency	Percent (%)
BCG	378	100
HBV	377	99.74
OPV0	378	100
OPV1	378	100
OPV2	378	100
OPV3	378	100
Penta1	378	100
Penta2	378	100
Penta3	362	95.77
PCV1	364	96.30
PCV2	363	96.03
PCV3	345	91.27
Measles	370	97.88
Yellow fever	364	96.30

BCG: Bacille Calmette Guerin;
HBV: hepatitis B vaccine
OPV0, OPV1, OPV2, and OPV3: the first, second, third and fourth doses of the oral polio vaccines, respectively
Penta1, penta2 and penta3: the first, second and third doses of the pentavalent vaccine
PCV1, PCV2, PCV3: the first, second and third doses of the pneumococcal conjugate vaccine, respectively.

4.2.3 Vaccine dropout rates

Figure 5 show the dropout rates for the different vaccine types. PCV1/PCV3 had the highest rates of 5.22% followed by Penta1/Penta3 (4.23%), while BCG/measles had the least dropout rate at 2.12%

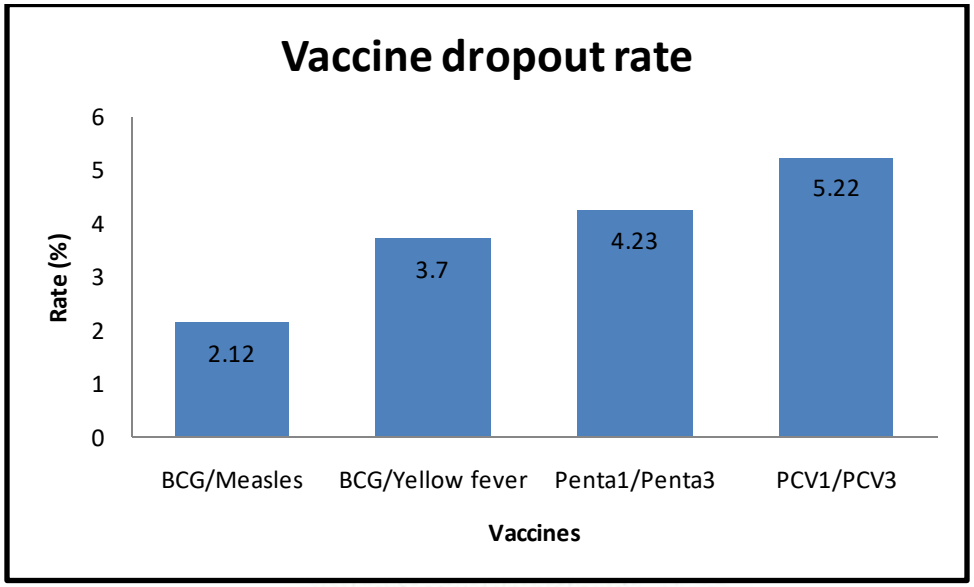


Figure 5: Dropout rate of selected vaccines

4.3 Demographic associations of immunization coverage

4.3.1 Summary presentation of the demographic variables

Table 5 is a summarized presentation of the demographic variables in the study participants as used in the test of associations.

Table 5: Summary of the demographic characteristics of the population

Characteristic	Number (N)	Percent (%)	Characteristic	Number (N)	Percent (%)
Gender			**Mother's employment status**		
Male	210	56	Senior	161	42.6
Female	168	44	Junior	217	57.4
Birth Order			**Knowledge of vaccine**		
First born	171	45.2	Adequate	282	74.6
Second born and older	207	54.8	Poor	96	25.4
Mother's age			**Social class**		
<= 30	161	42.6	Higher	264	69.8
>30	217	57.4	Lower	114	30.2
Mother's educational level			**Family income**		
Graduate	282	74.6	₦100000 and below	196	51.9
Non graduate	96	25.4	Above ₦100000	182	48.1

4.3.2 Distribution of demographic associations of complete and incomplete immunization

Table 6 shows the bivariate analysis of possible factors associated with completion and non completion of immunization in the sample. Nearly 12% percent of the female children did not complete their routine vaccinations compared to 10% of the males. This difference was however not statistically significant (P = 0.554). Similarly, family income did not significantly influence vaccine completion. Almost the same number of children who did not complete their vaccinations was born to mothers aged 30 years or less as did the children whose mothers were over 30 years of age. Maternal education did not significantly influence vaccine completion; however, among children whose mothers were graduates, almost 10% did not complete their routine vaccinations compared to the nearly 15% for children born to non graduates.

By proportion, more children whose family social class was designated Lower (14.04%) failed to complete their vaccination than children from Higher social class (9.47%). Children whose mothers had 'poor' knowledge of vaccines (10.28%) had a lower vaccine completion rate than those whose mother's knowledge was designated 'adequate' (12.50%). Nearly an equal percentage of children whose mothers had senior job status (10.56%) and junior job status (11.06%) did not complete their vaccinations.

The differences in social class, knowledge of vaccines, maternal job status were not statistically significant (P<0.05). In contrast, a significantly greater number of first-born children failed to receive the complete schedule of routine vaccinations than non first-born children (p = 0.032).

Table 6: Bivariate analysis of immunization status

Variable	Completed vaccination N (%)	Did not complete vaccination N (%)	Odds Ratio (95% CI)	X^2 value	P-value
Gender					
Female	148 (88.1)	20 (11.9)	0.822 (0.429 -		
Male	189 (90.0)	21 (10.0)	1.573)	0.349	0.554
Birth Order					
First born	146 (85.38)	25 (14.62)	0.489 (0.252 –		
Second born and above	191 (92.27)	16 (7.73)	0.949)	4.585	**0.032**
Place of birth					
Hospital	279 (90.29)	30 (9.71)	1.763 (0.836 –		
Maternity	58 (84.06)	11 (15.94)	3.721)	2.260	0.132
Mother's age					
<=30 years	141 (87.58)	20 (12.42)	0.755 (0.394 –		
>30 years	196 (90.32)	21 (9.68)	1.446)	0.7183	0.396
Mother's educational level					
Graduate	255 (90.43)	27 (9.57)	1.612 (0.807 –		
Non graduate	82 (85.42)	14 (14.58)	3.220)	1.853	0.173
Mother's job status					
Senior employee	144 (89.44)	17 (10.56)			
Junior employee	193 (88.94)	24 (11.06)	1.053 (0.545 – 2.033)	0.023	0.877
Knowledge of vaccine					
Adequate	253 (89.72)	29 (10.28)	1.246 (0.608 –		
Poor	84 (87.50)	12 (12.50)	2.551)	0.362	0.546
SES					
Higher	239 (90.53)	25 (9.47)	1.560 (0.798 –		
Lower	98 (85.96)	16 (14.04)	3.050)	1.711	0.190
Family income					
₦100000 and below	170 (86.73)	26 (13.27)	0.587 (0.300 –		
Above ₦100000	167 (91.76)	15 (8.24)	1.148)	2.456	0.117

Following the test of association, only birth order showed a statistically significant association with vaccine completion. Considering that the two potential confounders of both immunization status and birth order in the study (maternal age and place of birth) were not associated with immunization status (p = 0.396; p = 0.132, respectively), multivariate analysis will not add further value, and hence was not done.

4.4 Reasons for incomplete immunization

4.4.1 Distribution of reasons for incomplete vaccination

Table 7 shows a breakdown of the reasons why some children did not complete their vaccinations. Unavailability of vaccines constituted the most reasons among the healthcare factors. Among factors other than health services factors, the most cited excuse for not completing vaccinations was mothers being too busy.

Table 7: Details of reasons for incomplete vaccination

Health services factors	**Number**	**Total**
Health workers not available	2	
Strikes	3	
Vaccines not available	9	**14**
Other factors	**Number**	**Total**
Mother too busy	10	
Mother unaware of vaccine	4	
Fear of side effects	6	
Home too far from health centre	3	
No reason	4	**27**

4.4.2 Summary of reasons for incomplete immunization

In Figure 6, a summary of the reasons for incomplete immunization are shown. Health services factors accounted for 34%, while factors that do not directly relate to health services made up the rest of the reasons for incomplete immunization.

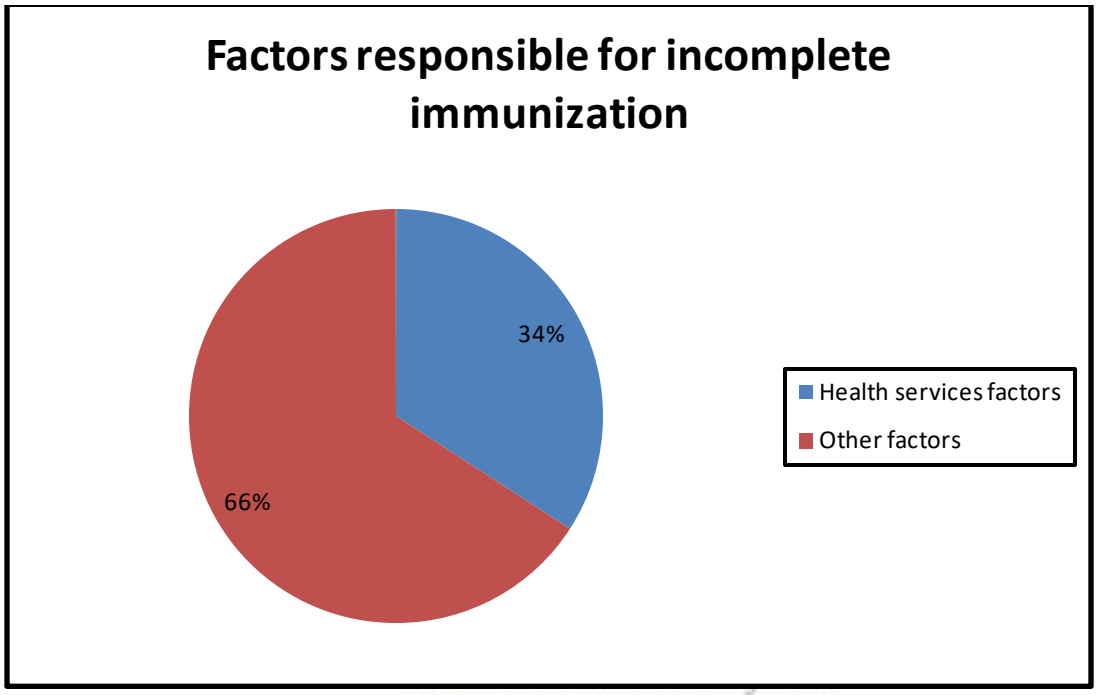


Figure 6: Reasons for incomplete immunization

CHAPTER FIVE – DISCUSSION

5.1. Discussion of findings

It is recognized that the twin factors of poverty and ignorance are major obstacles to achieving optimal immunization coverage (Mangal et al., 2014; Sibeudu, Uzochukwu and Onwujekwe, 2017). Unfortunately, these challenges are common in Africa and could therefore be significantly contributory to the low immunization coverage in many parts of Africa. Poverty is a recognized factor in poor health outcomes, being an important determinant of access to health services (Wagstaff, 2002). Poverty is also closely linked with ignorance as populations affected by poverty are also denied of health information resulting in unwholesome attitudes and practices towards their health (Ataguba, Ojo and Ichoku, 2016). It is therefore reasonable to expect that where poverty is relatively low and literacy levels high, the negative influence of poverty and ignorance will be greatly reduced. There would then be better health awareness and enhanced access to health services. Owerri is a city with a high literacy level where the residents largely embrace western medicine; it is also located in a region with the lowest poverty rates in Nigeria (UNDP, 2018). These may explain why the immunization coverage from the present study is high relative to that in many parts of Nigeria and Africa (Adebayo, 2012; Adedire et al., 2016; Gidado et al, 2014; Kiptoo et al., 2015; Tesfaye, Tesmegen and Kasa, 2018).

Although it ranks among the highest values from across the country and Africa (Tagbo et al., 2014; Adokiya, Baguune and Ndaago, 2017; Burnett et al., 2018), the coverage for one of the vaccines was only marginally higher than the target of 90% for all vaccines set by the WHO (WHO, 2014). This suggests a satisfactory coverage in the study setting, but reflects the persistence of suboptimal immunization across the continent; it also merits the continuous examination of possible factors that keep the coverage levels low in Nigeria and other countries of sub-Saharan Africa.

The coverage for the individual vaccines reflects the availability and timing of those vaccines. The increased efforts made in the past few years towards eradicating polio in Nigeria may have improved awareness and vaccine uptake. In addition, the timing of the early vaccines, being given at birth and few weeks after birth, could have benefited from the enthusiasm of new mothers to commence the vaccinations. Consequently, highest coverage was recorded with BCG

and the oral polio vaccines, which are given early in infancy, similar to findings by Tagbo et al. (2014). On the other hand, user fatigue could have adversely affected vaccines which are administered in late infancy, especially where a robust campaign is not in place, and where mothers have to spend long hours in the hospitals and health centres waiting for their turn on immunization days. Hence, relatively low coverage rates were recorded with measles and yellow fever vaccines in this study, in agreement with findings by Adebayo, Oladokun and Akinbami (2012), Tagbo et al. (2014) and Adokiya, Baguune and Ndaago (2017). This suggests that attention to immunization has to be sustained throughout the cycle of routine immunization.

Of significance is the finding of low PCV uptake, especially PCV3, compared with other vaccines given at similar times (Penta 3). Even in a setting of remarkably high coverage, PCV3 still ranked the lowest by far (Burnett et al., 2018). The low coverage associated with PCV may be connected with its relative newness to the schedule; hence, mothers are not familiar with it and may not present their children for the vaccine. It is also possible that being relatively new, the channels of supply of the vaccine were yet to be firmly established. The Penta 3 coverage is the analogue of DPT3 coverage which is regarded by the WHO as a marker of the strength of routine immunization services. The 95.7% coverage from the current study compares favourably to rates documented in different parts of Nigeria and Africa (Tagbo et al., 2014; Adedire et al., 2016; Mohamud et al., 2014; Kiptoo et al., 2015; Mukungwa, 2015; Burnett et al, 2018). With the WHO set target of 80% for the African region (WHO, 2018b), the coverage from the present study meets the minimum recommended coverage.

The dropout rates for the various vaccines are low. Vaccine dropout rate is an indicator of the continuity of the vaccine programme. The dropout rates in the current study are lower than the maximum accepted dropout rate of 10% by UNICEF (UNICEF, 1999). This means that most children who start immunization go on to complete them; it also supports the relatively high immunization coverage in the sample population.

There appears to be no agreement on gender predominance in the usage of vaccine services across Africa. Although the present study showed male dominance among the fully immunized children, in line with findings by Adedire et al. (2016), many workers across Africa documented contrasting results, with more female children being fully immunized than their male counterparts (Adebayo, Oladokun and Akinbami, 2012; Antai, 2012; Adokiya, Baguune and

Ndaago, 2017; Mukungwa, 2015). These surprising findings with respect to gender may reflect the narrowing gender inequalities in parts of Africa unlike what obtained in the past when male children had preference. Traditional societies were partial to the male child and devoted resources to its survival and well being.

There is a widespread expectation that a first time mother will not take chances with her first-born child. Therefore, issues relating to such children's health including immunization are attended to dutifully. However, other considerations may equally be important in determining which child gets fully immunized. Although Ntenda (2017) and Adebayo, Oladokun and Akinbami (2002) documented higher rates of vaccine completion in first-born children than subsequent children, the present study and that by Sheikh et al. (2016) found that second-born and successive children were more likely to complete their immunization. This may be that subsequent to the first child, mothers are more able to persevere and complete their children's immunizations. It is equally possible that mothers whose children completed their vaccines as first born may go on to ensure vaccine completion for their subsequent children, showing a pattern of personal commitment. However, the present study did not assess the likelihood of complete immunization in a child if the preceding sibling had full immunization. The findings from this study could also be due to the fact that the more experienced mothers may be better equipped to handle the challenges that mothers frequently face as they visit the immunization clinics. Some of these challenges relate to vaccine unavailability, long waiting times and health worker strikes. Mothers who have learned to overcome these challenges may therefore persist to complete the immunization for their children.

Maternal attributes are known to influence health outcomes of children as mothers are intimately connected to the everyday welfare of their children. In the present study, more children of older mothers (above 30 years) completed their immunization than children whose mothers were younger. Similar to the present study, research in Nigeria, Cameroon, Ghana, Ethiopia and the United States (Adedire et al., 2016 and Olugbenga-Bello et al., 2017; Russo, 2015; Adokiya, Baguune and Ndaago, 2017; Etana and Deressa, 2012; Salmon et al, 2009) found that older maternal age was associated with better rates of immunization coverage. Older mothers are probably more experienced in child care and might have been more exposed to the messages and information relating to the benefits of immunization. Besides, older mothers are more likely than

younger ones, especially teenage mothers, to enjoy social and family support that can foster complete immunization.

The literacy rate in the study location is generally high, so the benefits of female education are almost universal. Despite this, the present study showed that higher education of the mothers conferred some advantage in vaccine completion. This finding is in line with results from Adedire et al (2016), Gidado et al. (2010), Adebayo, Oladokun and Akinbami (2012), Russo (2015), Tagbo et al. (2014) and Mohamud et al. (2014). Female education, which is a child survival strategy, helps mothers to understand the importance of disease prevention policies as well as empowers them to take decisions regarding their children's health. This trend may however be unique to low and middle income countries. In the West, where education is almost universal, there is a trend towards vaccine skepticism leading to the resurgence of previously eliminated diseases like measles (Phadke et al., 2016). Although the reasons for vaccine refusal may be multifactorial as indicated by Harmsen et al. (2013), maternal literacy does not seem to enhance vaccine uptake in those countries.

Education tends to determine occupation to a large extent. Therefore, it is anticipated that they will both affect health outcomes in a similar manner. However, the present study did not show any significant difference between mothers in senior job positions and those in more junior positions as it relates to the immunization coverage of their children. Although available studies do not seem to focus on the type of jobs mothers do, being employed has been documented to enhance vaccination uptake (Olugbenga-Bello et al., 2017). The advantage which better education could have conferred on mothers who work in senior positions could have been reduced by the demanding nature of their jobs; therefore, such mothers may not have as much time for their children's needs including immunization. The result from this study suggests that a high level of awareness which cuts across occupational groups probably existed in the community. Maintaining such high level of consciousness is possibly key to sustaining and even improving immunization coverage in Owerri.

In the absence of any significant difference in immunization coverage between children whose mothers had adequate knowledge of vaccines and those whose mothers had poor knowledge, the role of vaccine knowledge comes under scrutiny. Although some other workers demonstrated more likelihood of completing immunization where maternal knowledge of vaccines was higher

(Odusanya et al., 2008; Etana and Deressa, 2012; Tagbo et al., 2014), the present study suggests that in-depth knowledge of vaccines is not a strong determinant of immunization status. Rather, other factors in the community might be more important as up to a quarter of the mothers surveyed had poor knowledge of vaccines, yet only about a tenth of the children did not complete their immunizations.

Given the stated positive influence of wealth on health seeking behaviour and standard of living, situations of enhanced family income should foster the uptake of routine immunization. In such a setting, the distractions occasioned by poverty will be minimal or even absent. In line with findings from other studies (Ashish et al., 2017; Restrepo-Mendez et al., 2016; Heaton et al., 2016), the current study showed that higher income and wealth status was associated with better immunization coverage. An enhanced family income will help to overcome the oft-stated challenges of lack of transport money to hospitals and health centres and lack of funds to register for hospital services, thereby enhancing access to health services.

Wealth index is a common measure of socio-economic status (SES) and has been correlated with immunization rates. Studies across Nigeria have shown that better wealth index was significantly associated with completion of immunization (Oleribe et al., 2017; Ataguba, Ojo and Ichoku, 2016). In the present study, social class was defined on the basis of mother's level of education and father's occupation. Thus, social class in this study essentially reflected these two indices. Although different variables have been used as measures of socio-economic status, the indices used for the present study are accepted (Oyedeji, 1985; Marks, et al, 2000; Ataguba, Ojo and Ichoku, 2016). Socio-economic status did not significantly affect immunization status in this study. However, more children from the higher socio-economic status were fully immunized than children from the lower social status. Similarly, Sibeudu, Uzochukwu and Onwujekwe (2017) and Kiptoo et al (2015) demonstrated that families from high SES utilized immunization services more than those from lower SES. High SES usually translates to an enhanced capacity to pay for services including transport fares, so removing a known obstacle to accessing immunization services. In addition, individuals from high SES are better exposed to health information than those from the low SES; thus, they are more likely to be informed about immunization.

The study showed a variety of reasons why some children did not complete their immunization. Among these are reasons related to the health services provided at the hospitals and health centres as well as reasons that are connected to the individual families. The latter reasons account for about two-thirds of the excuses given.

The Nigerian health sector has been plagued by numerous strikes in the past decade. These strikes, which sometimes take users of hospital services unawares, disrupt immunization services as well. Clients are then forced to get vaccinations elsewhere, leading to missed or delayed doses. In the current study, these frequent health worker strikes, which made it unpredictable that health workers will be at their duty posts, were cited by mothers as being contributory to their children missing some of the routine vaccines. Furthermore, the funding of vaccines in Nigeria is predominantly by external partners, thus the availability of vaccines is subject to the regularity of funding by these partners which may not always be guaranteed. Therefore, it is not surprising that unavailability of vaccines was among the chief reasons adduced by mothers for incomplete immunization of their children, similar to the findings by Adebayo, Oladokun and Akinbami (2012),

When health issues such as immunization are not given priority or when there is insufficient health information regarding the safety of vaccines in order to reassure users, there is a tendency for mothers to find reasons not to immunize their children. This seems to be the case in the study location as mothers commonly admitted being too busy, cited 'no reasons' and expressed fear of side effects. Similar findings were documented by Adebayo, Oladokun and Akinbami (2012). The need to create proper awareness is underscored by the finding that a few mothers claimed not to be aware of the pneumococcal conjugate vaccine (PCV). This is a relatively new vaccine in the routine schedule and those mothers may not have realized that it was in the schedule, and hence not made efforts to have their children receive it. Again, this makes a case for mobilizing every effort to raise and sustain the awareness of immunization.

5.2 Generalisability

The study setting is a tertiary hospital which attracts a variety of clientele. Therefore, the results of this study may only be generalizable to a population with similar demographic profile. However, the findings could be relevant to the larger Owerri community and to settings with comparable demographic composition.

5.3 Limitations

The study utilized history in addition to the immunization card as means of assessing immunization coverage. Although history, alongside card, is among the standard survey indicators approved by the World Health Organization (WHO, 2018), there is still a risk of recall bias. However, using mothers' recall in this study was inevitable because mothers do not routinely bring their cards to the outpatient clinic.

Also, some mothers admitted to not knowing their husband's accurate income, and thus gave estimates. This could have resulted in overestimation or underestimation of family income. In addition, the cross-sectional design of the study means that causal relationships could not be determined.

5.4 Conclusions

The results of this study show that immunization coverage among children presenting to the Federal Medical Centre Owerri is high. Although the coverage is higher than that required for herd immunity for most vaccines, there is still room for improvement.

Being second-born or higher is significantly associated with the likelihood of completing routine immunizations than being a first-born. Although not statistically significant, male gender, older maternal age, higher maternal education, mothers being in senior job descriptions, higher family income and higher SES are linked with better immunization outcomes.

Vaccines given later than 10 weeks of age are prone to be missed unlike the vaccines given earlier in infancy. In addition, unavailability of vaccines and mothers being too busy are common reasons for incomplete immunization.

5.5 Recommendations

- Enhance the education of mothers on immunization programmes, especially the new vaccines on the schedule
- Implement advocacy campaigns towards getting the tiers of government to be more committed to funding vaccine procurement in order to ensure the regular availability of vaccines.

- Create a system of prompts and reminders for mothers particularly for first time mothers.
- Support industrial harmony in the health sector to discourage strikes which negatively affect vaccine coverage.

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Appendix A

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

INFORMATION SHEET

Project Title: **Routine immunization status and its socioeconomic determinants among children attending the Federal Medical Centre, Owerri, Nigeria.**

This is a research project being conducted by **Dr. Francis Uche Iregbu** at the University of the Western Cape. We are inviting you to participate in this research project because you have a child aged between 12 months and 23 months. The purpose of this research project is to determine the possible reasons why some children do not complete their routine immunization.

You will be asked to provide details concerning you child's age, your child's position among your children, the vaccines he/she has received. You will also be asked about your own age, the general location of your residence, you and your spouse's level of education and occupation as well as your past experiences with vaccines. The study will be conducted at the Children's clinic of the Federal Medical Centre, Owerri, and will last for about 45 minutes

The researchers undertake to protect your identity and the nature of your contribution. To ensure your anonymity, your name will not be included on the surveys and other collected data; a code will be placed on the survey and other collected data, and through an identification key, the researcher will be able to link your survey to your identity, and only the researcher will have access to the identification key.

To ensure your confidentiality, the information generated will be locked in a secure cupboard while the electronic copy will be secured in a password-protected computer file. In addition, only identification codes will be put on the data forms. If we write a report or article about this research project, your identity will be protected.

There may be some risks from participating in this research study such as embarrassment arising from some questions that of a personal nature which I will pose to you. All human interactions and talking about self or others carry some amount of risks. We will nevertheless minimize such

risks and act promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

The benefits to you include determining whether there are vaccines which your child should have taken that he has not yet received. You will also benefit by being promptly referred to the immunization clinic and supported to ensure that your child is fully protected.

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

This research is being conducted by **Francis Uche Iregbu** of the **Department of Public Health** at the University of the Western Cape. If you have any questions about the research study itself, please contact Francis Uche Iregbu at Paediatrics Department, Federal Medical Centre, Owerri, 08035450607. Should you have any question regarding this study and your rights as a research participant or if you wish to repost any problems you have experienced related to the study, please contact:

Prof Uta Lehmann

School of Public Health Head of Department

University of the Western Cape

Private Bag X17

Bellville 7535

soph-comm@uwc.ac.za

Prof Anthea Rhoda
Acting Dean of the Faculty of Community and Health Sciences
University of the Western Cape

Private Bag X17
Bellville 7535
chs-deansoffice@uwc.ac.za

Appendix B

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

INFORMATION SHEET (AKWUKWO NKOWA)

Isi okwu mmemme nchoputa**: Onodu ogwu mgbochi na ka ogo aku-na-uba nke mmadu si metuta ya n'umuaka ndi na-abia na Federal Medical Centre, Owerri, Nigeria.**

Nke a bu ihe nchoputa nke **Francis Uche Iregbu** na-eme n'University of the Western Cape. Anyi na-asi gi bia sonye n'ihe nchoputa a maka na i nwere nwa gbara onwe iri and abuo rue onwa iri abou na ato. Ihe e bu n'uche eme nchoputa a bu ka a mara ihe kpatara ufodu umuaka a naghi agbazu ogwu ngbochi ha.

A ga-aju gi ajuju gbasara ogo nwa gi, onodu ya n'umu gi, ogwu mgbochi ndi o gbarala. A ga-ajukwa gi maka afo ole I gbara, ebe unu bi, ebe gi na di gi gururu n' akwukwo, ihe unu na-aru na ihe unu hutara gabsara ogwu mgbochi. A ga-eme ihe nchoputa a nebe a na-ahu umu ntakiri na Federal Medical Centre, Owerri. Ihe omume a ga-ew ihe dika nkeji iri ano na ise.

Ndi na-eme nchoputa a ga ekpuchi gi na ihe ndi I mere na nchoputa a. I ji chekwaa gi, a gaghi etinye aha gi n' akwukwo e ji mee nchopta a; a ga-eji ihe nzuzo nochie aha gi. Kama, onye isi nchopta a nwekwara ike isi n' ihe nzuzo a weputa aha gi ma odi na mkpa. O bu naani onye isi nchoputa a nwere ike ime nke a.

I jika zoo onye I bu, ihe nchoputa ndi e mere ga-ano n'igbe ebe a ga-agbachi ya nke oma. A ga-ejikwa ihe nzuzo wee chekwaa ndi nke no n'ikuku. O buru na a ga-ede edemede gbasara ihe nchoputa a, a ga-ekpuchi onye i bu.

E nwere ike inwe ihe oghom ga-eso ihe nchoputa a dika ihe ihere nwere ike iso udi ajuju ufodu anyi ga-aju. Mmekorita mmadu na ibe ya obula na mmadu ikwu maka onwe ya na-enwe ihe oghom na-eso ya. Na agbanyeghi nke a, anyi ga-agba mbo ime ka o diri gi mfe, nyekwa gi nkwado mgbe obula I zutere ihe nghia-ahu ka I na-eso n'ihe nchoputa a. O di na mkpa, a ga-akpofe gin a nke onye okachamara nke ga-enyere gi udi aka I choro.

Ihe nrite ga-abiara gi gunyere I mata ma nwa gi o gbazuela ogwu mgbochi ya. I ga-enwetakwa uru site na iwere nwa gi nyefee n'aka ndi ogwu mgbochi ozugbo, hukwa na nwa gi nwetere nchedo nke ziri ezi.

Nsonye gi n'ihe nchoputa a di n'aka naani gi. O masi gi, I nwere ike hapu isonye. O buru na I kwere iso, I nwere ike ikwusi iso mgbe obula masirir gi. O buru na I choghi iso ma o bu kwusi iso mgbe I bidorola, o nweghi ihe oghom ma o bu ihe ntaram-ahuhu ga-eso gi. A gaghikwa anara gi oke ruuru gi.

Ihe nchoputa a bu **Francis Uche Iregbu** nke **Department of Public Health** n' University of the Western Cape na-eme ya. I nwee ajuju gbasara ihe nchoputa a, biko kpoturu Francis Uche Iregbu na Paediatrics Department, Federal Medical Centre, Owerri, 08035450607. I nwee ajuju gbasara nchoputa a ma o bu oke ruuru gi dika onye na-eso na nchoputa ma o bun a I choro ikwuputa nsogbu obula I nwere gbasara nchoputa a, biko kpoturu:

Prof Uta Lehmann

School of Public Health

Head of Department

University of the Western Cape

Private Bag X17

Bellville 7535

soph-comm@uwc.ac.za

Prof Anthea Rhoda

Acting Dean of the Faculty of Community and Health Sciences

University of the Western Cape

Private Bag X17

Bellville 7535

chs-deansoffice@uwc.ac.za

Appendix C

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

CONSENT FORM

Title of Research Project: Routine immunization status and its socioeconomic determinants among children attending the Federal Medical Centre, Owerri, Nigeria.

The study has been described to me in language that I understand. My questions about the study have been answered. I understand what my participation will involve and I agree to participate of my own choice and free will. I understand that my identity will not be disclosed to anyone. I understand that I may withdraw from the study at any time without giving a reason and without fear of negative consequences or loss of benefits.

Participants' name……

Participant's signature……..

Date…….

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office

New Arts Building

C-Block, Top Floor, Room 28

University of the Western Cape

Private Bag X17 Bellville 7535

Appendix D

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959 2809, Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

CONSENT FORM (Igbo Translation)

Isi okwu mmemme nchoputa: Onodu ogwu mgbochi na ka ogo aku-na-uba nke mmadu si metuta ya n'umuaka ndi na-abia na Federal Medical Centre, Owerri, Nigeria.

A kowaarala m ihe nchoputa a n' asusu m na-aghota. A zaala ajuju m nwere gbasara ihe nchoputa a. A ghotara m ihe di na isonye n' ihe omume a, na-ekwe na eji m obi m nile wee kwekorita. A ghotara m na agaghi ekwe ka onye o bula mata onye m bu. A ghotakwara m na e nwere m ike ikwusi isonye n'ihe nchoputa nke a oge obula o masiri m, n' enyeghi nkowa obula, ma o bu itu ujo ihe oghom ga-eso ya.

Aha onye na-eso……

Akara onye na-eso……..

Ubochi…….

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office

New Arts Building

C-Block, Top Floor, Room 28

University of the Western Cape

Private Bag X17 Bellville 7535

Appendix E

QUESTIONNAIRE

Serial Number:_____

CHILD

Age (last completed, in months): ***12 -15 [ ]. > 15-18 [ ].***

> 18-21 [ ]. > 21-23 [ ]

Sex: *Male*_____ *Female*_____

Number of children in the family: *1 [ ] 2-4 [ ] Above 5 [ ]*

Birth Order: *1 [ ]. 2-4 [ ]. ≥ 5 [ ]*

Place of birth: ***Home*** _____ *Maternity*_____ *Hospital*_____

Vaccines Received: {tick all that apply}

BCG [ ] HBV [ ]

OPV0 [ ] OPV1[ ] OPV2 [ ] OPV3 [ ]

Pentavalent vaccines: 1[ ] 2[ ] 3[ ]

Pneumococcal conjugate vaccines: 1[ ]2 [ ] 3 [ ]

Measles [ ]

Yellow Fever [ ]

Source of vaccinations information: *Card [ ]. History [ ]. Card and History [ ]*

Reasons for incomplete vaccinations (tick all that apply)

*Home is far from health centre*_____

Child was sick and sent home from health centre _____ (Nature of sickness): fever___, cough_____, diarrhoea_____

*Sibling had serious sickness from vaccines*_____

*Mother was too busy*_____

*Father refused further vaccinations*_____

*Health workers not available (strikes)*_____

*Health workers reported too few candidates for vaccines*_____

*Did not know that further vaccinations were needed*_____

Fear of side effects _____

*Religious beliefs*_____

MOTHER

Age (at last birthday {in years}): < 20 [ ]. 20-30 [ ]. 31-40 [ ]. > 40 [ ].

Highest level of education:

University Graduate /Equivalent [ ]

School Certificate Holder with Professional Training [ ]

School Certificate or its Equivalent [ ]

Modern Junior Secondary 3 and Primary 6 Certificate Holder [ ]

No formal education [ ]

Occupation:

Senior Public Servant [ ]

Professional/ Manager/ Large Scale Trader, Intermediate

Grade Public Servant/Senior School Teacher [ ]

Junior School Teacher/ Drivers/ Artisan [ ]

Petty Trader/ Labourer/ Messenger [ ]

Unemployed/ Full Time Housewife/ Student [ ]

Marital status: Never married [ ]. Currently married [ ]. Previously married [ ]

Parity: 1 [ ]. 2-5 [ ]. 6+ [ ]

Religion: Catholic [ ]. Non-Catholic Christian [ ]. Muslim [ ]. Traditional/Other [ ].

Knowledge of vaccines:

Names of vaccine-preventable diseases ___, ____, ____, ____, _____, _____, _____, ____, ___

Names of vaccines in the routine schedule:___, ___, ___, ___, ____, ____, ____, ____, _____

When should vaccination start? *At birth*_____ *At one week*_____ *Later than one week*_____

When should routine vaccinations end? At six months [ ]. One year [ ]. Two years [ ]

FATHER

Age (at last birthday {in years}): < 20 [ ]. 20-30 [ ]. 31-40 [ ]. > 40 [ ].

Highest level of education:

University Graduate /Equivalent [ ]

School Certificate Holder with Professional Training [ ]

School Certificate or its Equivalent [ ]

Modern Junior Secondary 3 and Primary 6 Certificate Holder [ ]

No formal education [ ]

Occupation

Senior Public Servant [ ]

Professional/ Manager/ Large Scale Trader, Intermediate

Grade Public Servant/Senior School Teacher [ ]

Junior School Teachers/ Drivers/ Artisans [ ]

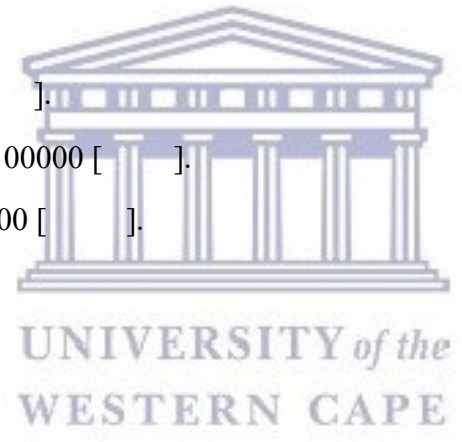
Petty Trader/ Labourer/ Messenger [ ]

Unemployed/ Student [ ]

Family Income: < ₦30000 [ ].

₦30,000 - ₦100000 [ ].

Above ₦100000 [ ].



Appendix F.

Method of Stratification of Social Class (Oyedeji, 1985)

1. **Father's occupation**

   Senior Public Servant ---------- I

   Professionals/ Managers/ Large Scale Trader, Intermediate

   Grade Public Servants/Senior School Teachers ---------- II

   Junior School Teachers/ Drivers/ Artisans ----------III

   Petty Traders/ Labourers/ Messengers ----------IV

   Unemployed/ Students ----------V

2. **Father's Educational Attainment**

   University Graduate /Equivalent ---------- I

   School Certificate Holder with Professional Training ----------II

   School Certificate or its Equivalent---------- III

   Modern Junior Secondary 3 and Primary 6 Certificate Holder---------- IV

   No formal education---------- V

3. **Mother's occupation**

   Senior Public Servant ---------- I

   Professionals/ Managers/ Large Scale Trader, Intermediate

   Grade Public Servants/Senior School Teachers ---------- II

   Junior School Teachers/ Drivers/ Artisans ----------III

   Petty Traders/ Labourers/ Messengers ----------IV

   Unemployed/ Full Time Housewife/ Students ----------V

4. **Mother's Educational Attainment**

   University Graduate /Equivalent ---------- I

   School Certificate Holder with Professional Training ----------II

   School Certificate or its Equivalent---------- III

   Modern Junior Secondary 3 and Primary 6 Certificate Holder---------- IV

   No formal education---------- V

Social Class is therefore calculated by the sum of parents scores divided by 4: Father's score (1+2) + Mother's score (3+4)/4*

Upper Class = I-II

Middle Class = III

Lower Class = IV-V

*When the score is not a whole number, it is approximated to the nearest whole number.

Appendix G: Further definition of categorical variables

Initial Category	Further defined category	
Birth order	"First born" (if first-born)	"Second-born and older" (if 2nd-4th and 5th and above)
Mother's Age	"Less than or equal to 30" (if 20-30)	"More than 30" (if 31-40)
Mother's educational level	"Graduate" (if university graduate or equivalent)	"Non graduate" (if below bachelor's level of education or equivalent)
Mother's employment status	"Senior" (if senior public servant, professional or manager)	"Junior" (if grade school teacher, petty trader, artisan, student or unemployed)
Knowledge of vaccines	"Adequate" (if scored average, good or excellent) equivalent to scores of 41-60, 61-75 and >75, respectively. A score of 0.2 was assigned to every correct answer and the total score was then multiplied by 25.	"Poor" (if scored poor or very poor) rated as 0-25% (very poor) and 26-40 (poor). A score of 0.2 was assigned to every correct answer and the total score was then multiplied by 25.
Social Class	"Higher" (if I or II)	"Lower" (if III, IV or V)
Family Income	"₦100000 and below" (if <₦30000 or ₦30000-₦100000)	"Above ₦100000" (if >₦100000)

Complete immunization in this study refers to the situation in which a child has received 14 vaccines in the routine schedule, namely BCG, HBV, $OPV^{0,1,2,3}$, $Penta^{1,2,3}$, $PCV^{1,2,3}$, measles and yellow fever. Incomplete immunization refers to when a child missed any of the listed vaccines.

Prior to the final analysis, variables were further defined as follows:

Birth order: "First born" (if first-born) and "Second-born and older" (if 2^{nd}-4^{th} and 5^{th} and above)

Mother's age: "Less than or equal to 30" (if 20-30) and "More than 30" (if 31-40)

Mother's educational level: "Graduate" (if university graduate or equivalent) and "Non graduate" (if below graduate level of education)

Mother's employment status: "Senior" (if senior public servant, professional or manager) and "Junior" (if grade school teacher, petty trader, artisan, student or unemployed)

Knowledge of vaccine: "Adequate" (if scored average, good or excellent) and "Poor" (if scored poor or very poor) on a scale of 20 points rated as 0-25% (very poor), 26-40 (poor), 41-60 (average), 61-75 (good) and >75 (excellent).

Social class: "Higher" (if I or II) and "Lower" (if III, IV or V), having described social class as I, II, III, IV and V (Appendix F).

Family Income: "₦100000 and below" (if <₦30000 or ₦30000-₦100000) and "Above ₦100000" (if >₦100000).

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 2988/2948
F: +27 21 959 3170
E: research-ethics@uwc.ac.za
www.uwc.ac.za

07 December 2017

Dr FU Iregbu
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM17/10/12

Project Title: Routine immunization status and its socioeconomic determinants among children attending the Federal Medical Centre, Owerri, Nigeria.

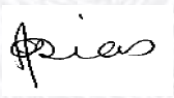
Approval Period: 07 December 2017 – 07 December 2018

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.



Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER -130416-050

APPENDIX 1: ETHICS APPROVAL (FMC)

FEDERAL MEDICAL CENTRE

P. M. B. 1010, Orlu Road Owerri, Imo State, Nigeria

Medical Director
Dr. K. I. ACHIGBU
MBBS, FWACP
Chief Consultant Paediatrician

Deputy Head of Clinical Services/Ag. HCS
DR. N.A. ODODO
MBBS (Nig.), FWACS, FACOG
Chief Consultant Obstetrician/ Gynaecologist.

Director of Administration Services
CHIMEZIE NWOGU
B.Sc. PGD, (H/R) AHAN, ASCONIAN

e-mail:hospitalfmc162@yahoo.com,
Phone: 08033269325 (MD), 08039513380 (Ag HCS), 08033192248 (DAS)

0938

FMC/OW/HREC/198 March 15, 2018

Dr. Francis U. Iregbu,
Department of Paediatrics,
Federal Medical Centre,
Owerri.

Dear Dr. Iregbu,

ETHICAL APPROVAL

RE: ROUTINE IMMUNIZATION STATUS AND ITS SOCIOECONOMIC DETERMINANTS AMONG CHILDREN ATTENDING THE FEDERAL MEDICAL CENTRE, OWERRI, NIGERIA

The Ethical Committee has considered further corrections you made on your research proposal.

Sequel to this, ethical approval is hereby given for you to carry out the above study.

Note that you are to abide strictly by your methodology as stated in the proposal.

On completion of your study you are to submit a copy of your dissertation to this Committee.

Yours Sincerely,

DR. C.M. ANYAEZE (MBBS (IB), FWACS, FICS)
Chairman Health Research Ethics Committee