ASSESSMENT OF IMPLEMENTATION OF CHILDHOOD ROUTINE IMMUNIZATION SERVICES IN PRIMARY HEALTH CARE CENTRES IN NIGERIA. A CASE STUDY OF EDO STATE

A thesis submitted to the Faculty of Health Sciences of CITY UNIVERSITY, CAMBODIA in partial fulfillment of the requirements for the award of Doctor of Philosophy (PhD) in Public Health.

BY

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE (PhD) IN PUBLIC HEALTH, FACULTY OF HEALTH SCIENCES, CITY UNIVERSITY, CAMBODIA

APRIL 2024

CERTIFICATION

This is to certify that this research was carried out by OGUNMAKINWA FLORENCE under my supervision and it is hereby approved.

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Prof. Francis Bamidele Date

International Coordinator of programmes.

DEDICATION

This project is dedicated to God Almighty: The Father, Son and Holy Spirit.

DECLARATION

I hereby declare that this work is original and was done under appropriate supervision. This work has not been submitted in part or in full for any other examination.

…….
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RESEARCHER

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With gladness of heart, I wish to express my heartfelt gratitude to God Almighty: The Father, Son and Holy Spirit, for His Grace, Mercy and Favour upon my life through which He chooses me among His people into the Holy order. May His name be forever praised in the name of Jesus Christ Amen

I wish to express my hearty thanks to the Vice Chancellor of City University, Cambodia; for his relentless and untiring effort and contribution to nation building through the impartation of knowledge into the lives of the upcoming ones globally. Your labour of love shall not be in vain in the name of Jesus Christ.

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ABSTRACT

Childhood routine immunization (RI) is one of the most cost-effective interventions for reducing childhood morbidity and mortality due to VPDs. The ultimate goal of immunization programs is to reduce the incidence of vaccine preventable diseases (VPDs) by attaining high levels of routine immunization coverage with potent vaccines administered at the appropriate ages, and at the right intervals. In Nigeria routine immunization services are provided through the Primary Health Care system by the government to the populace. A gap exist in the immunization services offered by the PHCs regarding the knowledge and practice of routine immunization and the PHCs readiness in terms of infrastructure and equipment to render childhood routine immunization to the population of more than 150 million in Nigeria.

The objective was to assess childhood routine immunization services in Benin City, Edo State, and the specific objectives were to ascertain the knowledgeand satisfaction regarding childhood routine immunization among mothers/caregivers attending primary health care centres, to ascertain immunization coverage and factors affecting childhood routine immunization coverage in primary health facilities, determine the level of missed opportunities in childhood routine immunization, assess the knowledge and practice of injection safety among healthcare providers in primary health care centres and ascertain the facility readiness for childhood routine immunization service delivery in the primary health care facilities in Benin City, Edo State.

This was a descriptive cross-sectional study that utilised (quantitative and qualitative methods of data collection)Mothers and caregivers were selected by systematic sampling technique while a total population of health workers involved in immunization were included in the study. Pretested-structured questionnaires were used to obtain information from mothers/caregivers and healthcare workers at the PHCs centres while key informant

interview and focus group interview guides were used for qualitative data collection. Observational checklist was also used to assess facility readiness for immunization services. Data analysis was by IBM SPSS 20.0 and level of significance was set at $p < 0.05$.

A total of 640 mothers/caregivers, 270 healthcare workers, 18 FGD participants and 7 key informants were interviewed for the purpose of the study. Almost half (48.8%) of the mothers/caregivers had good knowledge, 247 (38.6%) had poor knowledge while 81(12.6%) had fair knowledge of childhood routine immunization. About one-fifth (19.4%) of the caregivers were satisfied with the immunization services, 514 (80.3%) were indifferent while 2 (0.3%) were dissatisfied with the immunization services received.Most of the children (85.2%) were completely immunized for age while 14.8% were not completely immunized for age. The prevalence of missed opportunity for routine immunization was 16.1%. About 71.5% of the health workers had good knowledge, 27.0% had fair knowledge while 1.5% had poor knowledge of immunization.

None of the health facilities was fully ready for routine immunization services. The key informant interviewed agreed that training and re-training of health personnel was a major setback in routine immunization implementation and much needed to be done to improve the current situation.

The study showed that majority of the mother/caregivers had good knowledge of immunization with almost all the caregivers being undecided regarding satisfaction with routine immunization services. Majority of the children were completely immunized for age and prevalence of missed opportunities was high. Health workers' knowledge and practice of injection safety in routine immunization was high while health facilities were partially ready to offer childhood routine immunization services.

The State Government should enhance provision of equipment to promote readiness for the delivery of routine immunization services in PHC centres.

Keywords: Mothers/caregivers', Health workers, Primary Health Care centres

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LIST OF ABBREVIATIONS

AEFI	Adverse Events Following Immunization
ANM	Auxiliary Nurse Midwives
BCG	Bacillus Calmette Guerin
CRS	Congenital Rubella Syndrome
DF	Deep Freezer
DOR	Dropout Rate
DPT	Diphtheria-Tetanus-Pertussis
EPI	Expanded Program on Immunization
GAVI	Global Alliance for Vaccine and Immunisation
ILR	Ice lined Refrigerator
MDG	Millennium Development Goal
NPI	National Programme on immunization
OPV	Oral Polio Vaccine
PHC	Primary Health Centre
PHCW	Primary Health Care Worker
RI	Routine Immunization
SDG	Sustainable Development Goals
SIA	Supplementary Immunisation Activities
UNICEF	United Nations Children's Fund
VPD	Vaccine Preventable Disease
VVM	Vaccine Vial Monitor
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Childhood routine immunization (RI) is one of the most cost-effective interventions for reducing childhood morbidity and mortality for VPDs.[1,2]In developing countries, childhood routine immunization (RI) prevents three million child deaths and avert additional two million deaths yearly, if immunization programmes are expanded and fully implemented.[1] The ultimate goal of immunization programmes is to reduce the incidence of vaccine preventable diseases (VPDs) by attaining high levels of routine immunization coverage with potent vaccines administered at the appropriate ages, and at the right intervals.[3]Most countries have established expanded immunization programs, and in developing countries, children under five years of age are immunized in accordance with the standard World Health Organization (WHO) recommended vaccines, that currently protect against eight diseases namely,tuberculosis, diphtheria, tetanus (including neonatal tetanus through immunization of mothers), pertussis, poliomyelitis, measles, hepatitis B, and haemophilus Influenza).[4.]

In Nigeria,the Expanded Programme on Immunization (EPI) was initiated in 1979 to ensure that all children had access to routinely recommended vaccines, and re-launched in 1984.[2]This programme led to significant progress in the delivery of immunization services with 8I.5% coverage for all antigens recorded during the Universal Childhood Immunizations (UCI) days (1986-1990s).[2] However, this achievement was not sustained as periods of fluctuation in EPI performances (interludes of declines and improvements) and a significant decline in immunization coverage were noted in the 1990s. EPI was then restructured and renamed as National Programme on Immunization (NPI) in 1997, in an effort to enhance the

effectiveness of the routine immunization programme and to meet the global challenges of immunization. It was subsequently taken over by the National Primary Health Care Development Agency (NPHCDA) in May 2007for better management, organisation and improved logistics up to the ward /PHC level.[5]

In May 2012, Nigeria commenced expansion of existing children initiatives, with emphasis on polio eradication and strengthening of routine immunization with the replacement of Diphtheria, Pertussis and Tetanus (DPT) vaccine with pentavalent vaccine which contains more antigens(Hepatitis B and Haemophilus type B).[6] There was introduction of pneumococcal conjugate vaccine (PCV) in 2014, introduction of single dose of inactivated polio vaccine (IPV) in 2015 and switch from trivalent (tOPV) to bivalent OPV (bOPV) in April 2016 in the routine immunization program.[7]All these were aimed at strengthening the existing initiatives directed at the eradication of vaccine preventable childhood killer diseases.

Immunization can be routine or supplemental (immunization campaign). In Nigeria routine immunization services are provided largely through the primary health care system by the government to the populace.[2]Routine immunizations are nationally scheduled regular administrations of vaccine dosages to infants at specified ages and require parents/caregivers taking the children to the health facility to receive age-appropriate doses of the antigens.This is done on specific days of the week to reduce vaccine wastage since most of the vaccines are supplied in multi-dose vials.[8]

National Programme on Immunization (NPI) prescribes five visits to the health facility to receive one dose of BacilleCalmette Guerin (BCG) and Hepatitis B at birth, three doses of Oral Polio Vaccine(including one IPV), and three doses of Pentavalent vaccine, at six,ten and fourteen weeks and one dose of measles vaccine and yellow fever given at nine months of

age.[9,10] It is recommended that a child should receive all immunization at the appropriate ages and intervals in order to ensure maximal protection from vaccine preventable diseases.[11,12] The percentage of children who have receive the requisite number of vaccine doses irrespective of the age at receipt of the vaccine is used to determine vaccination coverage[13] and the third dose of pentavalent vaccine is the key indicator to measure immunization programme coverage.[14]

The National Demographic and Health Survey (NDHS), 2013 reported that, 25 percent of children were fully vaccinated while 21% of eligible children received no vaccination at all. Fifty one percent received the BCG vaccine, 42% received the measles vaccine, 51% received the first dose of the DPT vaccine, while only 38% received the third dose, reflecting a dropout rate of 25% for DPT. Overall, 21% of the children received all the recommended vaccinations before their first birthday. However in Edo State immunization coverage rate in 2013 was put at 52%.[6]

Although immunization coverage in Nigeria has improved over the past 10 years, from 13 % in 2003 to 25% in 2013, it still fell short of the increase needed to achieve the MDG target of more than 90% coverage.[6] Several factors have been implicated as responsible for the low vaccination coverage in Nigeria. These include lack of maternal knowledge of immunization, lack of political will, poor attitude and mal-orientation of health workers, poor health infrastructure, religious insurgency/terrorism, and ignorance, cultural/religious aversion to vaccine acceptance or use, fear of Adverse Effects Following Immunization (AEFI), lack of awareness about availability of vaccination services, inadequate cold chain facilities and vaccine stock-outs.[15-19]

Routine immunization (RI) against the childhood vaccine preventable diseases usually requires the child to make five prescribed visits to a static immunization clinic. At each visit

the mother or caregivers is given appointment dates (written on the child's registration card) for the next vaccination.[20]Despite this approach, knowledge, education, and religion of mothers have been reported as major contributory factors to low immunization coverage in Nigeria.[21-24].

Where accessibility and utilization of health services are low, every contact with a health facility provides an opportunity to offer immunization, particularly as these children are naturally at risk of vaccine preventable diseases.[1]Considering their naturally challenged immunity, current household food insecurity and unaffordable health care.[25] Nigeria with its low coverage should leverage and capitalize on every opportunity where mother and child presents to PHCs for health services to carry out immunization activities.[25]

The National Immunization Days (NIDs) was launched in May 2006 by National Program on Immunization, and it is an initiative that focuses mainly on increasing Oral Polio Vaccine (OPV) coverage and eradicating poliomyelitis. It is done all over the country by vaccinating eligible children 0-59 months with potent OPV alongside other routine immunizations, and carried out at fixed post or from house to house. However, in an attempt to increase the routine immunization coverage of many antigens among the children, vaccines such as (Inactivated Polio Vaccine IPV, pentavalent vaccine, Pneumococcal Conjugate Vaccine PCV) administered by injections were included in the immunization campaigns.[26]

STATEMENT OF PROBLEM

Vaccine preventable diseases (VPDs) are major contributors to child morbidity and mortality.[27]Globally, VPDs account for 17.0% of underfive mortality per year as they remain prevalent in developing countries.[14]In 2014, DPT3 coverage among infants was 86% worldwide. It ranged from 77% in African region to 96% in Western Pacific region, representing 115.2 million vaccinated children. However 18.7 million infants were not fully

vaccinated, and of this 9.3 million (50%) lived in five countries of India (22%) Nigeria (12%), Pakistan (6%), Indonesia (5%) and Ethiopia (4%).[28, 29]

Nigeria has a teeming population of over 140 million people, with an annual population growth rate of 3.2%.[6,14]Millions of these children are not fully vaccinated as one in every five children die before his/her fifth birthday, with VPDs contributing to 22.0% of such deaths, and this amounting to over 200,000 deaths yearly, exposing them to disability and premature deaths.[1, 2, 30, 31]

Although the NPI aims at delivering RI services to at least 90.0% of infants[8] inadequate levels of immunization coverage remain a significant public health challenge in Nigeria despite the fact that immunization is provided free to the people.[1,8]Unimmunized children do not only pose some risks to the immediate family, but also the community through frequent disease breaks (low herd immunity), increased financial burden to the family and early child deaths.[32]

Another important factor affecting RI is lack of community participation which has been implicated as being highly contributory to the evident ineffectiveness of child health programmes.[33]Poor community participation among other factors has been shown to contribute to low immunization coverage in Nigeria, with coverage rates for BCG, Polio, DPT, measles, Hepatitis B and Yellow fever being 61.7%, 46.1%, 42.6%, 49.2%, 34.0% and 40.4% respectively.[34,35]Low rates of immunization have also been associated with poor knowledge and attitude towards immunization.[36-39]

In Nigeria, routine immunization program is challenged by incorrect knowledge, poor attitude, and poor orientation of health workers, lack of political commitment, beaurocratic bottle-necks, poor donor interest in routine immunization and the overshadowing influence of supplemental immunization activities over routine immunization.[40]

Another major barrier to vaccination is mother's lack of knowledge of immunization.[41]Studies done in Africa[24] and Asia[42] showed that mothers' knowledge, attitudes and practices on childhood immunization were at low levels.A research in Nigeria reported that not completing vaccination was due to maternal knowledge and attitudes, while partial immunization was more linked to problems with vaccination services.[43]These factors have contributed to a fall in immunization coverage and upsurge of VPDs as well as failure to achieve the millennium development goal (MDG), further worsening the country's infant mortality rate of 69/1000 and under five mortality of 128/1000.[6]

. In many developing countries like Nigeria, vaccinators in primary health care centres represent the lowest tiers of health workers authorized to provide injections.Under such circumstances, there is task shifting of vaccine administration to community health workers or volunteers which are not appropriate.[44]Healthworkers do not also offer instruction about immunization side effects, and do not communicate pertinent information about vaccines and their importance to mothers/caregivers. This poor communication by health workers can lower adherence rate causing low immunization compliance [41]This may lead to inability of the health workers to recognise and manage Adverse Effect Following Immunization (AEFI), which on the long run lead to fear of RI by mothers and poor immunization coverage and increase incidences of VPDs and worsening child morbidity and mortality.[45]

Despite the growing skill demands for health workers, the same basic approach to immunization training has been in use for more than 30 years. This usually takes the form of short, offsite, in-service training courses, which are often delivered through cascade training by the trainers who may be experts in the subject matter but not in training techniques, or vice versa.[44]This could invariably affect the quality of routine immunization services provided in the health facilities as the quality of RI services offered is reduced.

Dissatisfaction with primary health care services may lead people to turn to expatriate or higher level hospitals for routine immunization services.[20]

In many parts of Nigeria, there is shortage of qualified personnel in PHC facilities. This has resulted in unavailability of 24 hour services in many PHC facilities.Poor utilization of PHC facilities in favour of unskilled health practitioners has largely contributed to the poor health indices in the country. Utilization of PHC services is directly affected by the readiness of PHC facilities to deliver health services in terms of adequate staffing and equipment. This low level of facility readiness in PHCs has contributed to poor utilization of PHC services by mothers.[44]

Resources allocated for the RI logistics are most times diverted for other uses. In addition, maintaining vaccines at proper temperatures has become more complex than in the past as some new vaccines are inactivated by exposure to freezing while other vaccines (those that have been in use for decades) are damaged by heat exposure. With the unit cost of newer vaccines far more expensive than those of the original complement of EPI vaccines, poor vaccine-handling practices would have large financial consequences.[44]These circumstances may lead to unreliable delivery of supplies and vaccine stock-outs, poor health indices and limited achievement of the Sustainable Development Goals (SDGs).

JUSTIFICATION OF THE STUDY

Primary Health Care (PHC) centre are key points of service delivery for implementing routine immunization program, as they are the first point of contact and closest to the people.[44]This study will help identify strengths and weaknesses, in terms of training of health workers, supervision of immunization sessions, at the PHC level for implementing routine immunization program, improve the quality of service delivery at the PHC level for better

management of routine immunization program and to make recommendations to the appropriate authorities on needed improvements in service delivery.

Mothers' knowledge of immunization has been shown to be a determinant of immunization coverage.[17, 25] This study will help to identify factors contributing to mothers/ caregivers knowledge of immunization and find out areas needing attention and serve as a basis for effective intervention to improve maternal knowledge and attitude towards immunization which on the long run will improve RI and PHC services utilization and subsequent protection of children from infectious disease. It will also help to identify the gaps in the mother/caregivers knowledge and practices of routine immunization and serve as an awareness tool, to emphasize the importance of immunization of children to mothers.

Amongst the interventions for child survival strategies across the world, childhood routine immunization is the most appropriate and effective technology utilized in combating VPDs. It is thus important that improvement in routine immunization services offered in PHCs should include caregivers knowledge and satisfaction with immunization services and health care workers knowledge and good practice of RI be periodically assessed. This should include the immunization chain at the core levels (PHCs) to maintain efficiency and good RI coverage.[41]Determination of the degree of client satisfaction will provide evidence as to whether or not the right immunization services are being provided at the right time, in the right place, in the right way and by the right personnel.[46]This will provide baseline data for assessment of quality improvement strategies which will culminate in an increase in immunization coverage in the country.

Some reasons for low routine immunization coverage are, missed opportunities, late reporting for immunization, non- administration of simultaneous antigens, and longer interval between pentavalent and measles vaccine (three and a half months) compared to that between the

other vaccines in the schedule (four weeks).[13]It is anticipated that this study will help to find out reasons for missed immunisation opportunities, and estimate the magnitude of this opportunity. It will thus help proffer solutions that will improve immunization coverage and ultimately reduce childhood morbidity and mortalities due to VPDs, because if the diseases are not prevented it could affect the herd immunity of the community and lead to increase spread of diseases.

Improving childhood immunization coverage is critical on several systemic factors and underlying factors, one of which may be the mother not immunizing the child. This study will measure and determine immunization coverage in Benin City PHCs facilities and provide relevant data for policy makers, program implementers and immunization service providers during planning and evaluation and serve as a baseline for further studies.

Health workers are important agents in the implementation of immunization programs, therefore poor knowledge of RI could affect their practice and lead to reduce potency of the vaccines and increased adverse effects following immunization (AEFI).[47]This study will help to find out their knowledge and practices of safe injection use in RI. Observed gaps will help to formulate and develop training manual guidelines and modalities for HCW and PHCs.

Expanded Programme on Immunization (EPI) evaluations have focused more on population coverage, and few studies have assessed facility and routine immunization at the point of service provision.[48]It is expected that findings from the study will help encourage research and provide information on facility readiness for routine immunization in primary health care centre.The study will provide a baseline for tracking progress in subsequent implementation of immunization services over time. Effective monitoring and evaluation of childhood immunization programmes are necessary as in their absence, vaccination rates may dwindle unnoticed for some time before increased incidence of target diseases are observed.

OBJECTIVES

1.5.1 General objectives.

To assess the implementation of childhood routine immunization services in Benin City, Edo State, with a view to making recommendations for service improvement.

1.5.2 Specific objectives:

1) To assess the knowledgeand satisfaction regarding childhood routine immunization among mothers/caregivers attending primary health care centres in Benin City, Edo State.
2) To assess immunization coverage and factors affecting childhood routine immunization coverage in primary health facilities in Benin City, Edo State.
3) To determine the level of missed opportunities in childhood routine immunization in Benin City, Edo State.
4) To assess the knowledge and practice of injection safety among healthcare providers in primary health care centres in Benin City.
5) To assess the facility readiness for childhood routine immunization service delivery in the primary health care facilities in Benin City, Edo State.

RESEARCH QUESTIONS

1) What is the knowledge and satisfaction level of mothers/caregivers regarding childhood routine immunization services in Benin City, Edo State?
2) What is the extent of missed opportunity in childhood routine immunization in Benin City Edo State?
3) How knowledgeable are the healthcare providers on injection safety in Primary Health Care facilities in Benin City, Edo State?
4) What are the practices of injection safety by health workers in primary health facilities in Benin City Edo State?
5) What is the immunization coverage for primary health care facilities in Benin City, Edo State?
6) How ready are the PHC facilities in Benin City for immunization service delivery?

RESEARCH HYPOTHESIS

H1. There is significant correlation between the knowledge and satisfaction level of mothers/caregivers regarding childhood routine immunization services in Benin City, Edo State.

H0. There is no significant correlation between the knowledge and satisfaction level of mothers/caregivers regarding childhood routine immunization services in Benin City, Edo State.

H2. There is significant difference between the available healthcare facilities in Edo state and childhood immunization coverage.

H0. There is no significant difference between the available healthcare facilities in Edo state and childhood immunization coverage.

LIMITATION OF THE STUDY

This research work is largely limited by insufficient funding, time constraint and very poor road network in Edo state which is the study area.

SCOPE OF THE STUDY

This research covers the assessment of implementation of childhood routine immunization across healthcare centres in Nigeria taking Edo state as case study.

SYNOPSIS OF CHAPTERS

Chapter one covers the background of study, statement of problem, research questions, research objectives, research hypothesis, significance of the study and the limitation of the study. Chapter two deals with theoretical framework, conceptual framework and the empirical framework. Chapter three covers the research methodologies. Chapter four covers data analysis while Chapter five covers findings, summary, conclusion and the recommendations made by the researcher.

CHAPTER FIVE

FINDINDS

The results revealed that more than a third of the children were less than 2 months of age and more than half of the index children were males. These findings are comparable to those found in a study done in Ethiopia[17] where 51% of the children were males. In contrast, studies done in Nigeria[52] and Libya[107] revealed females' preponderance (male to female ratio of 1:1.5). The gender of the child has been shown to be a determinant of childhood routine immunization as there is a discriminatory preference for immunization of male children compared to female children.[107] In some societies with cultural discrimination against female children, boys have a greater chance of being vaccinated. The implication of this is that gender barrier will reduce the chances of the female children getting vaccinated and lead to low immunization coverage.

About three quarter of the index children were delivered in health facilities. This figure is higher than that found in a study done in 2009 in Burkina Faso, [108] where only a third of the children were delivered in health facilities. This is further emphasized from the qualitative finding where health workers reported that mothers preferred to continue immunization in their place of delivery. Facility based delivery is one of the most important preventive measures against poor maternal and child health outcomes, and also an important determinant of full immunization.[52] This could be as a result of the fact that mothers who deliver at health facilities receive improved health education on the importance of immunization. It may also be that mothers who give birth at health facilities are closer to health Centre and would prefer to continue the immunization of the children there haven taken the first dose at place of birth

All mothers/caregivers had heard about routine childhood vaccines under the national immunization schedule. This finding is in tandem with the observation in a study done in

Lagos, where also high maternal awareness of immunization was recorded.[52] However the current finding is in contrast with that contained in a study done in Ambo, Ethiopia [56]where the awarenessof immunization was poor. This disparitybetween findings in this study and the Ethiopian study may be due to the differences in information, education and communication (IEC) programmes of the two countries or due to the location and accessibility of the mothers to health care services. Majority of the respondents in the Ethiopian study were in the rural areas while this study was made up of respondents from both urban and rural areas.

All mothers/caregivers knew about BCG and OPV vaccines. This level of awareness for these vaccines noted in this study is higher than the level of awareness of OPV reported from Niger·[109] but comparable to the high level of awareness of same vaccines in in Nairobi, Kenya.[110] This finding can be attributable to the National Supplementary Immunization plus days which is aimed at improving coverage for OPV and eradicating the polio disease from the Integrated Diseases, Surveillance and Response (IDSR). The constant jingles being aired on television and radio to improve utilization of immunization and also proximity of the time of delivery to the vaccine scheduled early in the NPI schedule may also have contributed to the high level of awareness for OPV. Awareness level for recently introduced vaccines, such as pentavalent vaccine, pneumococcal conjugate vaccine, and those given at the end of the immunization schedule (measles and yellow fever vaccines), were slightly lower compared to the other vaccines in the routine immunization schedule. This observation could be as a result of time lag between the two sets of vaccines which could cause mothers to forget the measles vaccine and dropout or not follow through with subsequent doses.

Just as the vast majority of the people have been sensitized with regards to OPV, other vaccines should also be given similar have treatment. Such enlightenment requires health promotion in the form of health education where persuasive communications are utilized in passing the information on to the people. The message in such a manner that the content is

comprehended and accepted by the people with the effect that mothers are urged to present their wards for immunization including those given late in the NPI schedule.

This high level of caregiver's awareness of immunization could have resulted from the aggressive health education carried out by health workers in health care centres, to peer group influence and general community participation in routine immunization. This is corroborated by the finding that healthcare practitioners were the commonest source of information followed by the mass media and friends. The current finding is consistent with the study done in Addis Ababa where health workers were also the main source of information.[56] This trend may be attributed to the fact that vaccination information are usually given to mothers by healthcare professional just before giving vaccines to the children during each immunization sessions and postnatal visits. The finding is further substantiated by findings noted in studies done in Nigeria[52, 71] and Saudi Arabia.[72.] Friends and family members were also noted as important sources of information on immunization but their knowledge of immunization needs to be strengthened. More than three quarters of the caregivers received information on immunization from the media (television, radio, internet and newspapers). Television is an important source of health information because it is availablein most homes and it is more convenient for caregivers to watch medical programmes than use the internet or obtain information by reading

The study revealed good knowledge of immunization among the caregivers with regards to true purpose of immunization and age of completion of vaccination. This values noted in this study are higher than those obtained in a study involving a rural Nigeria community[13] and Ethiopia[56] where only half of the mothers mentioned correctly the time of completing immunization (at nine months or before the first birth day). The variation in these findings noted between this study and others may be due to the difference in characteristics of the study participants 'particularly educational attainment since about 70% of mothers included

in the study in rural Nigeria were illiterates, higher than the illiteracy rates in the this study. Most of the caregivers in the other study had at least primary school education. Despite the fact that caregivers had good knowledge of the age and time of completion of vaccination, few caregivers felt that routine immunization improves the growth and intelligence of children. A similar find has been noted among mothers involved in the rural Nigeria study [13] where it was observed that less than a quarter of the respondents correctly stated the purpose of immunization but in contrast with findings from an Enugu based study[1], where majority of the respondents mentioned the purpose of immunization correctly.The implication of this is that though some had incorrect knowledge of immunization they nevertheless regarded immunization to be beneficial. Health workers could leverage on the observed trend to educate the mothers on the true essence of immunization and its added benefits through the correct use of information, education, and communication materials available on immunization as a rationale for immunization rather than use only images of children known to have suffered from vaccine preventable diseases/ historic images relating to disease outbreaks.[110]

Over half of the mothers/caregivers were unaware of the full range of vaccines routinely administered to children in Nigeria. This observation is worrisome as it may suggest that immunization campaigns are suboptimal inspite of the WHO 2010 plan to improve massive cross regional vaccination campaigns.[111]There could therefore be some knowledge gaps warranting the need for improved health education during ant-postnatal care and immunization activities, perhaps using improved community participation, mass mobilization, and retraining of community health workers.

The significantly higher level of knowledge found amongst mothers/caregivers with secondary and higher level of education is expected as they are better placed to understand relevant health information more readily than those with lower level of education. An

optimal female literacy level is desirable as this could lead to comprehension of exposure to other social and cultural factors that influence utilization of routine immunization services. Higher educational level was also associated with enhanced knowledge of routine immunization as noted in this study. This may partly be attributed to the quality of information provided to mothers at the health facilities (both during antenatal and immunization clinics by health workers) comphrended better by this cohort of mothers/ caregivers.

All the caregivers reported vaccinating the index child and presented their vaccination cards. Most of the index children were completely immunized for age with an immunization coverage of eight five percent. Similar rates had been reported in India [113]and Ethiopia[56] where majority of the children were completely immunized for age. The current finding is however at variance with the lower immunization rates of less than twenty five percent obtained from some Nigeria studies[114,115] and another carried out in Ethiopia.[17]The discrepancy in coverage rates may be due to social and cultural factors. Nonetheless the high coveragerate noted among the children in this study is in excess of the goals of the Global Immunization Vision and Strategy (GIVS) which set at least 80% vaccination coverage in every district.[115] The coverage rate of 85% noted in this study is different from values obtained in a study carried out in Edo State where immunization coverage according to the NDHS 2013, was 52% and other studies conducted in the Southern part of Nigeria that also fell short of the GIVS goal.[52]The disparity in immunization coverage within the country may reflect the variation in effectiveness of immunization campaign in various localities .outside other influences as vaccine supplies, level of literacy, employment and poverty.

High immunization coverage rates were recorded for BCG, Pentavalent, OPV3, PCV3, Yellow fever, and measles vaccines in this survey, and these rates are comparable to those obtained in a previous study in Benin City thatalso had high coverage rates for BCG,

OPV3/DPT3, measles, and Yellow fever.[52] The coverage rates for BCG, OPV1, PENTA1 and PCV1 was above 80% with progressive reduction in rates with subsequent doses of OPV, PENTA and PCV. The coverage rates in this study are comparable to the 2015 immunization coverage goals of the Nigeria comprehensive multi-year plan of eighty seven percent for infants for all antigens in the routine schedule[116] and the WHO-UNICEF estimates for Nigeria for BCG, DPT3, OPV3, and measles.[117] Nigeria is among the twelve countries at risk of yellow fever[115] therefore this low coverage rates for yellow fever vaccination could spell potential danger of large scale outbreaks of the disease in the country.

Oral polio vaccine coverage was slightly higher than the coverage rate for pentavalent vaccines. From first to subsequentdoses there were reductions in coverage rate for these vaccines this could be due to mothers/caregivers non-compliance with immunization and also the long time interval between the doses may cause mothers to forget the subsequent doses. The dropout rate (Penta-1 to Penta-3) was ten percent, Penta-1 to measles nineteen percent and overall BCG to measles dropout rate was twenty six percent. These figures are higher than the WHO international dropout rate goal set at ten percent.[118] The figure in this study is however less than the thirty three percent Penta-1 to Penta-3 dropout rate obtained in an Ethiopian study.[119] High coverage rate for the first doses of multi dose vaccines may indicate good utilization of primary health care facilities while the high dropout rate between the early and final doses of the vaccine series may be attributable to health system barriers to re-attendance, failure to educate mothers of the need to return, or inadequate tracking of children registered at the health facility. This could be indication that healthcare interventions need to focus not only on initiating immunization, but also concentrating on motivating mothers to complete the immunization schedule. One of such effective ways of improving routine immunization coverage rates is the immunization reminder/recall system which involves following up the caregivers through phone calls/text messages.[120] The improvement can also

be achieved through the Reach Every Ward (REW) approach which is expected to develop the capacity of health workers at PHCs to identify and reduce dropouts by ensuring quality and un-interrupted immunization services at fixed outreach and mobile sites.[116]

In this study the routine administrative immunization coverage in the health facilities revealed that immunization coverage in some vaccines were greater than 100% and reduction in the immunization coverage of subsequent vaccines given at the end of the NPI schedule. This trend could be due to underestimation of children qualified to receive immunization, paucity of data available for planning immunization sessions, amid-year change in target age groups, inclusion of children outside the target age group in the numerator, and also non-compliance with the established protocol due to poor training and supervision.

The national immunization policy recommends that all vaccines be made available at immunization centres every day, but this was not the case as observed in this study. About a tenth of the index children surveyed at the health facilities were not vaccinated. This was due to non-availability of immunization services, facilities restriction of administration of certain antigens to certain days and limitation of the number of persons attended to during an immunization session. Similar findings have also been reported in a Nigerian study[121] where about a tenth of the children were not vaccinated due non-availability of vaccines. The implications of frequent non-availability and stock-outs of vaccines in PHCs are delayed vaccination, missed opportunities and incomplete immunization of children.Most outstanding reason for missing scheduled immunization in this study was lack of vaccine, this was also the most reported reason given for missed opportunity in studies carried out in Benin City.[12]and Ibadan[120]. The lack of vaccines may be due to the fact that supplies were not available to the health facilities occasioned by logistic problems (transportation, poor distribution networks) and reduced motivation on the part of the health workers in the PHCs who may be owed salaries. Other reasons would includeinability of the health workers to

properly forecast the vaccine needs of the health centre, since there was no report of vaccine shortage in the country during the period of the study as long waiting time and visit on the wrong day were the other reasons given for missed opportunity for immunization in this study

The prevalence of missed opportunity in this study was 16.1%, and this finding is similar to that noted in a study from Anambra state, Nigeria where missed opportunity for immunization was given sixteen percent,[65] the sixteen percent prevalence noted in this study is low compared to twenty eight and thirty nine percent reported in studies carried in Benin City[122] and Calabar[123] The low rate of missed opportunity noted in this study, may be an indication of the improved knowledge and quality of immunization services offered at the PHCs, which the mothers perceived as good in the study locale.

More than a quarter of the index children missed vaccination twice and PCV1 was the vaccine mostly implicated followed by PCV2 and PENTA2. This observation is in contrast to findings contained in a study from Anambra, State in 2012, [65] where the most common vaccines missed were BCG, OPV0, OPV1, HBV1 and DPT1and Calabar in 2006 were measles vaccine given at nine months of age was the commonest vaccinemissed.[110] The variations in trend between this study and others could be due to the differences in the years the studies were carried outas the vaccines missed in this study are the newest additions to the immunization schedule. The low rate of missed opportunities for immunization in these PHCs may be indication of effective routine immunization services. This could be further improved upon by exploiting visits for curative care to fully immunize the children chances provided and increasing the immunization coverage of the vaccines. There may also be need for healthworkers in curative health care centres to be more involved in checking the vaccination cards and sending incompletely vaccinated children to immunization sessions of the health facilities. Involvement of community and religious leaders in routine immunization

may also be required to scale up immunization coverage by supplementing the scarce human resources and optimizing co-ordination of different activities at fixed health stations and in mobile teams.

Socio-demographic factors that significantly influenced missed opportunityfor immunization in this study included the level of education of the mother/caregiver, age and place of delivery of the child. Children aged less than 4 months were found to be completely immunized for age compared to those aged 4 months and above. This finding is consistent with that found in a study conducted in Ethiopia, where the child's age was a strong predictor for incomplete immunization.[124] It could be stipulated that older children run a greater risk of becoming unvaccinated due to the fact that their caregivers fail in complying with multidose vaccine series they increase in age. They therefore tend to fall behind on receipt of vaccines that are administered in the second half of infancy. In this study, a significant proportion of children aged 2 months had missed opportunities for vaccine doses that they should have received. The inability to receive follows up doses of such vaccines that were found in older infants. Missed opportunities worsen the multi dose vaccines, such pentavalent vaccine compared to the incidence of missed opportunities in single-dose vaccines. The greater incidence of missed opportunity with multi-dose vaccines may suggest that parents and healthcare professionals perceive such immunization as less important for older children. This is corroborated by findings in some studies that have shown a greater risk for non-vaccination and missed opportunities among older children, presumably due to the complacency and inadequate attention paid to vaccination in this age group of the children and complacency.[68,125]

This study revealed that the caregivers' level of education and socioeconomic status had no significant influence on the immunization status of children. This finding is at variance with observation noted in a study done in Nigeria which found mother's education as a

determinant on the child immunization.[126]The discrepancy in finding between the two studies may be due to the improved access to immunization and enhancedsocial mobilization by the health workers which may have helped in tackling barriers to immunization that hitherto existed, such as illiteracy. The study however demonstrated no significant association between the caregivers' knowledge of immunization and the completion of immunization in the index child. This observation is contrary to that noted in a study done in Karachi, India which found caregivers knowledge to be a major factor positive in the appropriate vaccination of children.[127]The role of maternal knowledge as an important determinant of vaccination coverage has been reported by several studies in Nigeria, Japan and Istanbul[128-130] possible explanation of this association include the fact that mothers with low level of education may readily see the benefits of immunization and may also have poor health seeking as a result of superstitious beliefs, which could on the long run result in increased child morbidity and mortality indices and up surge of vaccine preventable diseases.

The place of delivery of the index children in this study was also a significant predictor of routine immunization as children born in health facilities were more likely to be completely immunized compared to those born in homes.In this study children born in health facilities were 17 times more likely to be completely immunized compared to those born elsewhere. Children born at home or TBA's place were more likely to default in completing vaccination compared to children born at health facilities. These findings are in tandem with those noted in other studies carried out inEthiopia,[17]Nigeria,[91] and Mozambique[64] where children delivered at home were less likely to complete immunization but different fromfindings from a study conducted in Malaysia.[131] were majority of the children who defaulted immunization were children born in health facilities. An explanation for the observed trend in this study is to the effect that delivery in the health facilities affords mothers the enhanced opportunities to

receive health education and other preventive health care services particularly routine immunization before discharge.

Negative attitude of health care workers has been shown to be a barrier to accessing immunization services in Nigeria.[2] In this study a quarter of the caregivers were dissatisfied with the attitude of the health care workers at the health facilities even though they were satisfied with the reception and cleanliness in such health facilities.This finding is at variance with the observations in a study done in 2010 in Calabar, Nigeria[46] where respondents were not satisfied with the cleanliness and reception receivedat the health facilities and in Egypt in 2014, where maternal satisfaction for staff attitude was more profound in health facilities[20]. In such situations, mothers may perceive health workers as unfriendly and unsupportive and would anticipate further maltreatment by health workers when they lose vaccination cards or miss vaccination appointment. In such setting they would rather avoid the health workers than consult them or seek their support.[132] Mothers in such circumstances could miss out on opportunities to get help and advice regarding how their children could make up for missed opportunities. The relationship between caregivers perception of health workers, and completion immunization has been reported from developing countries such as Nigeria[133] and Ethiopia.[134,135] These problems of interpersonal relationship could be compounded by factors such as long waiting time and vaccines/supplies stock-outs in the health facilities.[13,133-135] This situation may be worsened by poor or absence of comfort measures such as absence or failure of power supply for fans, attitude and inadequate seats for the clients in the waiting room. The poor staff among health workers may be attributable due to pressure of work on the few staff available. This notwithstanding there is the need for health workers to treat caregivers and their children with decorum so that they would willingly approach health facilities subsequently for immunization.

Dissatisfaction with the waiting time and waiting areas in the health facilities were significant with an average waiting time of greater than 30 minute observed in most of the primary health centres. Long waiting time is a known major impediment to clients' satisfaction.[63]This observation is in tandem with findings from a study in Calabar, Nigeria[46] where most clients spent longer time waiting for services, while spending brief moments with the health care providers. In another Nigerian study the reasons for dissatisfaction with immunization services, were long waiting time and uncomfortable waiting areas.[63] long waiting times can discourage patronage of health facilities for immunization, particularly among people whose income are time dependent. This may lead to loss of income as the respondents may not be able appreciate the long term benefits of a program when her daily wage is at stake.long waiting time may also lead to loss of man hours and reduced productivity and drop in Gross Domestic product (GDP). In a depressed economy like Nigeria's, caregivers are likely to become impatient if they have to wait for long before they access health care, as such delays take them away from their economic pursuit. Therefore, the importance of timeliness in service delivery cannot be overemphasized.

Most of the mothers/caregivers gave an overall high rating of satisfaction for the service received. Less than one fifth were satisfied while high proportions were indifferent with the immunization services. Previous studies in Nigeria carried out in Jos,[136] Ibadan and in Egypt had also documented similarly high satisfaction figures.[137] Satisfaction may be associated with such factors as being happy with the hospital staff and the work environment of the hospital, staff attitude, cost, and waiting time.[138]

Overall, healthcare workers exhibited good knowledge of immunization. Majority of the healthcare workers knew the age of administration of all vaccines, the route of administration while a comparatively smaller proportion knew the dosages. Comparable results were obtained in a study carried out in Oman where almost all the participants knew the proper

doses and routes of administration of OPV and BCG vaccination, respectively.[139] These results are improvements on those reported in Thailand, where only three quarter of the respondents knew the proper dose and routes of administration of BCG, DPT, and HBV vaccines.[140] Most of the respondents knew VPDs in the process of eradication or elimination of some diseases. The performance of the healthworkers may be due to repeated training sessions which are carried out routinely especially before immunization-plus days, as reinforcement of such information improves knowledge of immunization.

A large proportion of the healthcare workers thought that mild fever was the most important vaccination barrier. Though fever with a temperature of ≥40.5°C is a factor to be taken into account is not however a contraindication.[141]This perception could have far reaching implications as it could contribute to prevalence of missed opportunities and incomplete immunization in Benin City as most mothers maybe afraid to bring their children for immunization due to the anticipated side effect. Inadequate knowledge of important issues such as contraindications to vaccination by healthworkers may result in transfer of false information to clients as healthcare workers are the major source of information for caregivers regarding immunization. There is therefore the need to streamline the contents of interventions provided by healthcare workers.

In this study, healthcare workers' age, designation, years of experience in immunization practice at PHC level and previous attendance of immunization training had significant influences on their knowledge of immunization. Nurses/Midwives/Public Health nursing practitioners had better knowledge compared other categories of health workers. Similar observations were made in a study carried out in Egypt.[142] This trend is probably due to the fact that nursing/midwifery qualifications have considerable public health academic content making them to be better equipped to work in the PHCs. These notwithstanding nurses/midwives who practice at PHC level may still need to seek additional exposure in

Public Health and for those in the lower cadre to seek added qualifications, so that they can be better equipped for health promotion and disease prevention services at the grass root levels where they work. There was also a significant association between training on vaccination of the healthcare workers and their knowledge of immunization. This trend has been noted in a study done in Thailand,[140] where trained healthcare workers had better knowledge compared to their untrained counterparts. To ensure optimal effectiveness, continuous training and regular supervision on NPI and the cold chain system are necessary.

The findings of this study place a lot of emphases on education by healthcare workers as their knowledge of immunization is very important. Training onimmunization are usually in-service specifically incorporated as part of national immunization campaigns. However less than a tenth of the healthcare workers in this study received training on injection safety. This is similar to findings from a Kaduna based study in 2013, where less than one fifth of the health workers attended training on safe injection practice with regards to routine immunization.[91] Contrast results were presented in a study from Bangladesh, were none of health workers in the health facilities observed, attended training on injection safety.[143]

Most of the healthcare workers studied received training on immunization with about a third being trained in the preceding four years. This finding is however in variance with the outcome of the qualitative finding in this study were health workers claimed they were constantly trained and miscued their school education as training for immunization.

Absence of regular training could be due to paucity of funds or poor political will on the part of government. Regular training on immunization is recommended as immunization training intervention significantly raises and sustains overall awareness on immunization, as studies carried out in Brazil and Canada have demonstrated knowledge decay after initial training.[144,145] Education as an intervention is likely to be effective in the short term and can

improve the performance of health care providers. However frequent training and retraining of immunization providers by the government and immunization policy makers is important to maintain the standard practice on immunization.

Only one-fifth of the healthcare workers knew the correct WHO definition of injection safety. Similar observations had been noted in a study conducted in Benin City in 2012[81] where the knowledge of injection safety among health workers was found to be poor. Almost all respondent were knowledgeable on pathogens transmitted through unsafe injection practices. In a related study done in Kaduna, Nigeria over three quarters of the HCWs could name HIV/AIDS, HBV and HCV as pathogens transmitted by unsafe injection practice.[92]Thus knowledge of specific infections that could result from unsafe injection practices especially HIV and HBV infections was high. Current finding are also consistent with observations made in another study in Ilorin, Nigeria[89] in which over half of the health workers had knowledge of diseases transmissible by unsafe injection practices. Hence, it could be said that there is higher awareness among primary HCWs regarding the risk of disease transmission by unsafe injection practices.The high level of awareness about the mode of transmission of HIV infection may be due to the fear of the disease in the society and increased health education through the mass media concerning the diseases and its mode of spread..

More than a third of the healthcare workers had good knowledge of injection safety practices while more than half had fair knowledge. This finding is comparable with similar study conducted in Benin City.[146] This finding is noteworthy considering the fact that a small proportion of healthworkers received formal training on safe injection practice. The level of knowledge of injection safety observed in this study may be explained by the fact that nurses constituted a higher proportion of PHC workers and it is likely that their training curriculum would have taught topics such as injection administration, infection control and standard precautions. Furthermore it could also be that contact practice (administration of injections)

could have improved their knowledge and the few who may not have received any organized training on injection safety may have acquired relevant knowledge through other channels such as reading about injection safety, causal observance of injection handling practices and informal lessons from more experienced colleagues.

This study showed a significant relationship between cadres, age and training of health workers on one hand and practice of injection safety protocols on the other. Health workers who received training on injection safety practices were more likely to have good knowledge of injection safety practices. This observation is in accordance with findings contained in studies carried out in Bangladesh[143]. and Benin City. [144] These relationships could provide the platform that could be leveraged upon for improved prevention and control of blood borne pathogens amongst health workers.

The practice of injection safety was generally fair, an observation that is tandem with findings in Kaduna State, Nigeria.[91] where about a quarter reported regular use of hand gloves, and antiseptic solution for cleaning of skin surfaces before injection.

It has been shown that the use of sterilizable injection equipment is associated with transmission of infections whereas use of single-use disposal syringes/needles results in better injection safety record in health care facilities.[136] In this study, it was found that all therapeutic injection and injectable vaccine were administered using new single use disposable syringes and auto disable syringes, respectively, taken from sealed packs. The syringes were available in sufficient quantity in all selected health care facilities. This is commendable as PHCs adherence to injection safety standards do lead to reduction in the risk of infections associated with the use of sterilizable injection equipment.

Some unsafe practices were observed among healthcare workers. One of which had to do with most of the healthcare workers cleaning the cap of multi dose vials with antiseptic

solutions. Swabbing of vial tops with an antiseptic or disinfectant is unnecessary.[136]The septum of vial must be pierced with a sterile needle and the needle should not be left in place in the septum. It was also observed in this study, that vial's septa were pierced with sterile needles but some health workers left such needle in the rubber of multi-dose vials after use. The needle left in the septum of the vial could encourage reuse of the same syringe to repeatedly draw medication, which may lead to contamination of medicament present in the vial hence transmission of pathogens. Furthermore the use of ampoules or single dose vials is preferable to multi-dose vials as multi-dose vials are prone to bacterial contamination and its use may be a potential source of infection. If multi-dose vials must be used, it should be limited to single person. However, use of multi-dose vials of vaccines appears to be promoted by government to reduce service cost.

Majority of PHCs had alternate source of power supply in case of disruption of power supply from public source. This provision is important in Nigeria because public power supply is unstable.However high running cost of generator may prevent its regular use.which may lead to temperature instability. It was also found that, most of the facilities had refrigerators and all PHCs kept different vaccines in the refrigerator, most had a temperature chart to record the temperature inside the refrigerator but only two thirds recorded temperatures regularly. These results are comparable to those recorded in a Thailand study.[141] Lack of continuous temperature loggers makes it impossible to track vaccine temperatures during non-working days and hours. Any exposure to out-of-range temperature during these periods will remain undetected, as the temperature may have returned to normal when the stores reopen.[147] Frozen vaccines usually develop hairline fractures during defrosting and contamination of such vaccine vials may occur due to bacterial entry through the cracks. Temperature sensitive alarms would be handy in these instances for informing and initiating prompting appropriate response to temperature spikes. The implication of this is that the potency of the freeze dried

vaccines could be comprised and this could affect their potency. This ultimately could lead to increase in vaccine preventable diseases.

This study revealed that about a quarter of the health facilities stored food in their refrigerator , this observation is in agreement with the study done in Nepal,[148] where vaccines were competing for space with laboratory reagents and other medicines in fridges. This however is in contrasts with observations in studies done in Oman [144]and Malaysia[148]. where refrigerators were solely for vaccine. The implication of this is that such fridges have to be opened repeatedly making the temperature unstable and excessive exposure to light. Thus could damage the vaccines leading to primary vaccine failure and contamination of food. Storing of medicines with vaccines could also lead to contamination of the vaccines should the other products spill and increase the likehood for medication errors.

The number of health care workers offering immunization services varied considerably between health centres. But most health facilities on the average had three health workers present at every visit to immunization clinics. Health workers washed their hands at different points throughout the immunization clinic. Hands were commonly washed with soap and water at a sink in the clinic room. Alternatively alcohol hand rub was used. All health workers observed washed their hands at least once per patient, usually at the end of the procedure. This observation is prone to bias, as the health worker may have carried out the practice because they were being observed. It does not necessarily mean that this is what they do typically in their everyday duty.The implication of proper hand washing practices among health workers can reduce disease transmission including nosocomial infectionsand provide safe environment for the children.

Utilization of sharp boxes was not within safety standards.This had to do with the fact that the sharp boxes were usually kept at the corner against the wall opposite the clinic room

where vaccines are prepared for administration. This has considerable risk implications, not only for the patients are attending the clinics, but also the practitioners operating within the vicinity, as they could sustain potential for injuries with infection including Hepatitis B or C and HIV. The Unit head has the responsibility to ensure there is minimal risk to children and health worker, according to professional codes of conduct.

The tendency to recap needles increases when safety boxes are kept far from the injection site (venue). In this study recapping of needles was done by half of the healthcare workers in the health facilities surveyed. Most of them did not know the correct reason for avoiding recapping. This finding is an improvement on the observation contained studies conducted in Nepal [148]Nigeria[150], and Ethiopia[151] where more than a quarter of the health workers reported recapping used needles. It is however worse than the finding in a Nigerian survey, which revealed aprevalence rate of eighty percent for needle recapping.[152] The poor performance in this study compared to the outcome of the Nigerian survey may be attributed to the fact that respondents in the current study were drawn from peripheral clinics unlike the national survey that involved respondents from tertiary centres. This finding is a reflection of poor injection safety practices that characteristic of health care practices in the study locale and the developing countries in general. Recapping of needles is extremely dangerous because it can lead to accidental puncture of the fingers or hand, which can result in potential exposure to hazardous chemicals, drugs and infectious biological agents responsible for transition of most blood borne diseases such as HIV/AIDS and Hepatitis. Thus measures to address this practice must be directed more at PHCs which are the first points of call for over 70% of people in Nigeria.

Planning routine immunization entails a continuous process of analyzing, evaluating progress, constraints and making decisions about reaching set program objectives. It was observed in this study that session plansfor routine immunizations were available in only half

of the PHCs studied. Furthermore maps of catchment areas, estimation of logistics, dropout chart which are valuable for improved planning of immunization services were not prepared in most of the PHCs. These findings are in contrast to those reported in Jamnagar district of India where all PHCs had planned immunization sessions.[27] Current findings are nonetheless improvements on those reported in another study carried out in India[94] where less than a quarter held immunization sessions. The implication of the extant finding is that poor planning of routine immunization sessions could lead to frequent vaccine stock outs, time wastage at the health centres and missed opportunity for vaccines

All health facilities areunder the supervision of the government officials but less than half of the health facilities were not visited in the last month preceding the study. This finding is an improvement on the result gotten from a Cameroonian study where none of the health facilities studied had been visited in six months prior to the study. Supervisors may prefer to visit only health facilities that are close to them, while health facilities in hard to reach areas remain unsupervised. This may partly explain the observation in this study. It may also be due to poor logistics, poor motivation of the supervisors and lack of expertise occasioned by limited funding.

Majority of the PHCs were at least partially ready for routine immunization services as noted in this study though all PHCs offered immunization services. This state of facility readiness may be due to continuous supervision and increased political will of the local government authorities and other stakeholder's commitment to the vaccination process.This finding may also be due to increase demand for routine immunization servicesby members of the community. Routine immunization is often available in most of the PHCs and it is affordable with less time spent in accessing PHC facilities than private hospitals and secondary health facilities. The partial readiness PHCs for immunization may be attributed to non-availability of equipment and facilities needed for immunization. Provision of the required

equipment/facilities in the PHCs would enhance good performances by PHC workers which will in turn encourage utilization of PHC services, with a resultant reduction in morbidity and mortality in vaccine preventable disease in children coupled with improvement in child health indices.

The FGD and key informant interviews carried out revealed factors that were influencing the implementation of childhood routine immunization in Benin City. A key thematic finding of this study is the lack of training and re-training for health workers in PHC facilities. This observation is similar to what was reported in a qualitative study conducted in Ghana where the respondents noted that they had not benefited from any training program since they started working but different from the qualitative finding in the study where workers reported receiving training in some health facilities but did not step down the training to other cadre of health workers. The lack of training and re-training could compromise the established functional system of exposing PHC health providers to current knowledge and skills in injection safety. Shortage of health workers was another theme that emerged. This finding corroborates the observations of the facility readiness assessment which revealed acute shortage of some cadres of health workers in most of the PHCs. The shortages may serve as impediment to achieving goals of achieving immunization coverage of 80% at ward/PHC level. Poor staff motivation was also mentioned as a factor influencing the implementation of the routine immunization. Being owed months of salaries leaves the health providers with no option other than seek ways and means to survive which could have deleterious effect on the implementation of routine immunization in PHCs.

This study revealed a system planned and earmarked to play a role in the attainment 'health for all' as declared at the Alma Ata, but burdened by weakness and challenges. There is need for identified lapses in the PHCs to be addresses if Sustainable Development Goal 3 (end preventable deaths of newborns and under-5 children by 2030) is to be met.[153, 154]Adoption

and implementation of the 2013 Nigeria Routine Immunization Strategic Plan with an accountability framework offers an appropriate platform for reducing the inequalities in access, utilization and strengthening immunization services in the country.[5]

CONCLUSION

Majority of the mother/caregivers had good knowledge of immunization with almost all the caregivers undecided regarding satisfaction with routine immunization services in PHCs in Benin City.

Majority of the children were completely immunized for age and immunization coverage was 85 percent. Socio-demographic factors that influenced immunization status included age of the index child, place of delivery and level of education of the caregiver

Prevalence of missed opportunities which was 16.1% recorded in this study, was high.

Knowledge of immunization among the health workers was good but knowledge and practice of safety injection was fair

All the PHC surveyed were partially ready for immunization services.

RECOMMENDATIONS

Based on the findings from this study, the following recommendations are made with the hope that they will go a long way in improving routine immunization services in PHCs in Benin City.

The State Government

- There should be enhanced provision of equipmente.gfurnishings for Primary Health Care facilities to promote readiness for the delivery of routine immunization services. Government could partner with corporate organisations like banks and non-governmental organisations in this regard.
- More staff, of the right calibre to man the PHC facilities should be employed. In particular more nurses, midwives and community health officers should be employed to improve on the capacity of the PHC facilities to provide routine immunization services

Local Government

- Training on injection safety for health workers should be regularly carried out to increase knowledge of immunization and injection safety. This will help improve the workers broad idea of immunization safety such as quality of vaccines, maintenance of cold chain, reconstitution of vaccine with the right diluents at the right temperature, reporting of adverse events following immunization and proper handling and disposal of injection consumables. Clinic staff should also be trained in ethical conduct of health-care delivery to enhance their relationship with mother.
- There should be provision of infrastructures and imprest to enable the health facilities run the routine immunization program effectively and carry out outreach programs to children who may not have ready access to the healthcentres

- Efforts should be made to ensure regular availability of vaccines at the health facilities to reduce the prevalence of missed opportunity for immunization.

Health workers

- Counseling of mothers on vaccination should be standardized and strengthened to address key issues, such as immunization schedules, service arrangements and commonly encountered circumstances that could prevent mothers from seeking the services.
- Mothers should be properly advised on the steps they need to take if they travelled to other locations, loose vaccination cards, children who had side effects after immunization, or missed appointment for any reason.
- Awareness should be raised to empower women and increase spouse' involvement in child immunization to improve immunization coverage of the antigens through regular campaigns by mass media and immunization health talks.
- Arrangements and coordination of immunization services need particular attention, especially in terms of coordinating static and outreach services to reduce the incidence of missed opportunities.
- Regulartracking mechanisms should be put in place to prevent missed opportunity for immunization.
- Health workers need to be supportive of mothers/caregivers and have a positive attitude towards the caregivers to help improve utilization of immunization services
- They should be encouraged to involve themselves in self-developmentprogrammes that will improve service delivery skills and help identify the danger signs of vaccine preventable diseases

The mothers/caregivers: They should be encouraged to utilize the available services in the PHC facilities as often as the need arises.

REFERENCES

1. Tagbo BN, Uleanya ND, Nwokoye IC, Eze JC, Omotowo IB. Mothers' knowledge, perception and practice of childhood immunization in Enugu. Niger J Paed. 2012;39 (3):90-96
2. Ekure EN, Esezobor CI, Balogun MR, Mukhtar-Yola M, Ojo OO, Emodi IJ. Community knowledge, attitude and practice of childhood immunization in Southwest Nigeria. Niger J Paed. 2013;40(2):106 –111.
3. Salah AA, NegaBaraki GE, Godana W. Evaluation of the quality of Expanded Program on Immunization service delivery in Primary Health Care Institutions of Jigjiga Zone Somali Region, Eastern Ethiopia. European Journal of Preventive Medicine. 2015;3(4):117-123.
4. Ronveaux O,Rickert D, Handler S, Groom H, Lloyd J, Bchir A. The immunization data audit. Verifying the quality and consistency of immunization monitoring systems. Bull world Health Org. 2005;83 (7):503-510.
5. National Primary Health Care Development Agency. National routine immunization strategic plan: 2013–2015. Abuja, Nigeria: Federal Ministry of Health. 2013:10-12.
6. National Population Commission and ICF International. Nigeria Demographic and Health Survey 2013. Abuja, Nigeria: NPC and ICF International; 2014:92-153
7. World Health Organization.Vaccines and biological available at http//www.who.int/immunization/en/. (Accessed 10/6/16)
8. Zangeneh TT, Baracco G, Al- Tawfiq JA. Impact of conjugate pneumococcal vaccines on the changing epidemiology of pneumococcal infections. Expert Rev Vaccines. 2011;10: 345-53.
9. Federal Ministry of Health. National immunization policy and standard of practice. Abuja: Federal Ministry of Health, 2009:16.

10. Scott S, Odutola A, Mackenzie G, Fulford T, Afolabi MO, Jallow YL, Jasseh M. Coverage and timing of children vaccination: An evaluation of the Expanded Programme onImmunization in the Gambia. 2014;9(9):1-9.
11. Adedire EB, Ajayi I, Fawole IO, Ajumobi O, Kassasa S, Wassawa P. Immunization coverageand its determinants among children aged 12-23 months in Atakumosa-West district Osun State Nigeria. BioMed Central Public Health. 2016;16:905
12. Sadoh AE, Eregie OC. Timeliness and Completion Rate of Immunization among Nigerian children attending a clinic-based Immunization service. J Health PopulNutr. 2009; 27(3):391-395
13. Abdulraheem I, Onajole AT, Jimoh A, Oladipo AR. Reasons for incomplete vaccination and factors for missed opportunities among rural children. Journal of Public Health and Epidemiology. 2011;3(4):194-203.
14. Matua MK, Kimani-murage E, Ngomi N, Ravn H, Mwaniki P, EchokaE.Fully immunized child; coverage, timing and sequencing of routine immunization in urban poor settlement in Nairobi, Kenya Tropical Medicine and Health.2016;44(13):1-12.
15. Paediatric Association of Nigeria (PAN). Recommended routine immunization schedule for Nigeria: PAN Advisory Committee on Immunization. Nigerian Journal of Paediatric. 2012; 39:152-158.
16. Oluwadare C. The social determinants of routine immunization in Ekiti State of Nigeria. Ethno-Medicine. 2009;3:49-56.
17. Etana B, Deressa, W. Factors associated with complete immunization coverage in children Aged 12-23 months in Ambo Woreda, Central Ethiopia. BMC Public Health.2012;12:566.
18. Munthali AC. Determinations of vaccination coverage in Malawi: Evidence from the Demographic and Health Surveys. Malawi Medical Journal. 2007;19:79-82.