UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

EVALUATION OF THE EXPANDED PROGRAMME ON IMMUNIZATION COVERAGE AMONG CHILDREN AGED 12–23 MONTHS IN THE TECHIMAN MUNICIPALITY, GHANA

BENJAMIN BAGUUNE

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BY

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THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH, SCHOOL OF ALLIED HEALTH SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN COMMUNITY HEALTH AND DEVELOPMENT

FEBRUARY, 2017

DECLARATION

Student

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere:

Candidate's Signature: ..... Date: .....

Name: BENJAMIN BAGUUNE

Supervisor

I hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Supervisor's Signature: ..... date: .....

Name: Dr. MARTIN NYAABA ADOKIYA

ABSTRACT

Background: In Ghana, Expanded Programme on Immunization (EPI) routine administrative coverages are high but childhood immunization status still remains low. Most children do not receive all the recommended vaccine doses before one year of age. Coverage surveys to validate the administrative coverages and identify predictors of immunization status are also not given the desired attention. The objective of this study was to evaluate the immunization coverage among children aged 12–23 months in the Techiman Municipality, Ghana.

Methods: A cross-sectional cluster survey was conducted among 600 children aged 12–23 months in the Techiman Municipality, Ghana. Data was collected using semi-structured questionnaire through interviews. Before the main data collection, the tools were pre-tested in three communities. The mothers/caregivers were interviewed and additional information was extracted from the child immunization cards by copying from the card and observing Bacillus Calmette-Guerin (BCG) scar. In addition, key informant interview was also conducted among 18 service providers. Data was entered, cleaned and processed using Statistical Package for Service Solution SPSS version 17.0. Descriptive statistics such as frequencies, percentages and means were produced. In addition, data was exported into STATA and binary regression analysis performed to identify factors associated with immunization status of children.

Results: Binary regression was performed to determine predictors of immunization status. The following were statistically significant: formal education (OR=0.97, 95%CI 0.46-2.07; and p<0.001), married (OR=0.31; 95%CI 0.15-0.62; and p=0.001), Christianity (OR=0.27; 95%CI 0.13-0.91; and p<0.001), salary work mothers (OR=0.34, 95%CI 0.16-0.67; and p=0.041) female child (OR=0.50; 95%CI 0.26-0.91; and p=0.024) and possession of immunization card (OR=50.3; 14.40-175.92; and p<0.001) were found to be associated with immunization status.

Conclusion: Immunization status before one year of age in the Techiman Municipality remains below the 80% target as recommended by health partners. In order to improve the prevailing situation, education of mothers on the benefits of immunization, planning immunization sessions with immunization beneficiaries and creation of more outreach centers are urgently needed to maintain and enhance the current immunization coverage.

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DEDICATION

I dedicate this thesis to my beloved wife, Esther Abugri and my children, Mavis Baguune, Winifred Baguune and Janice Baguune for their inspiring encouragement and support throughout the study period.

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ACRONYMS / ABBREVIATIONS

AEFI	Adverse Effects following Immunization
ANC	Antenatal Care
BCG	Bacillus Calmette-Guerin
CHPS	Community-based Health Planning and Services
DANIDA	Dutch International Development Services
De	Design Effect
DFID	Department For International Development
DPT	Diphtheria, Pertussis and Tetanus
DPT-Hib-HeB	Diphtheria, Pertussis, Tetanus, Haemophilus Influenza type B and hepatitis B
EPI	Expanded Programme on Immunization
GAVI	Global Alliance for Vaccines and Immunization
GDHS	Ghana Demographic and Health Survey
GHS	Ghana Health Service
GSS	Ghana Statistical Service
HM	Health Manager
HW	Health Worker
IGF	Internally Generated Fund
IMR	Infant Mortality Rate
JICA	Japan International Cooperation Agency
JHS	Junior High School
KIIG	Key Informant Interview Guide
MCH	Maternal and Child Health
MDGs	Millennium Development Goals
MLSC	Middle Leaving School Certificate

NIDs	National Immunization Days
NNPC	Nigeria National Population Commission
OPV	Oral Polio Vaccine
PCV-13	Pneumococcal Vaccine
PHC	Primary Health Care
PPS	Proportion to Population Size
RAIC	Routine Administrative Immunization Coverage
RED	Reaching Every District
SDHT	Sub-District Health Team
SHS	Senior High School
SIAs	Supplemental Immunization Activities
TMDCO	Techiman Municipal Disease Control Officer
TMDHS	Techiman Municipal Director of Health Services
TMHD	Techiman Municipal Health Directorate
TMHMT	Techiman Municipal Health Management Team
TT	Tetanus Toxoid
UN	United Nations
UNICEF	United Nations International Children's Emergency Fund
VPDs	Vaccine Preventable Diseases
WHO	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Cluster: A small group that is part of a population that is being surveyed; for the purposes of this study, a cluster is defined as twenty children within a defined geographical area in the age range (12 – 23 months) being evaluated.

Household: Household is a group of people who eat from the same kitchen (cooking pot) in a house.

Design effect: A measure of variability due to selection of survey subjects by any method other than simple random sampling.

Service delivery point: A place where mothers/caregivers and their children attend immunization sessions.

Immunization: A process whereby a vaccine is injected or introduced into a child to confer immunity to the child against a specific disease. In this study, vaccination is sometime used to replace immunization.

Herd immunity: This describes the immunity of a community where majority of the people have developed immunity against a particular agent and their immunity also protects the few individuals who have not developed immunity.

Vaccine: A preparation of weakened or attenuated disease causing agent or its toxic product that can be injected to confer immunity against a specific disease.

Multi-dose vaccines: Vaccines that require that a child takes more than one dose before the child attains his/her first birth date.

Routine Administrative Immunization Coverage: Immunization coverage reported by service providers or managements using information from routine immunization activities.

Fully immunized child: A child who has received all the prescribed vaccine doses considered to protect the child from vaccine preventable diseases.

Partially immunized child: A child who missed some of the prescribed vaccine doses considered to protect the child from vaccine preventable diseases.

Not immunized child: A child who has received none of the prescribed vaccine doses considered to protect the child from vaccine preventable diseases.

Dropout rate: Percentage difference in coverage between two different doses (e.g. BCG-Measles) in sequence.

Crude immunization status: when children's immunizations are counted regardless of the time it was given.

Valid immunization status: when only children's immunizations that respect the earliest and maximum ages are counted.

Static: A fixed place, usually in a health facility where daily immunization services are provided.

Outreach: An immunization site outside the health facility where health providers will have to travel on routine basis to provide immunization services.

CHAPTER ONE

INTRODUCTION

1.1: Background of the study

Immunization is the most effective means of combating communicable diseases. Vaccines exist for a great many dangerous communicable diseases. At birth, children have protection against certain diseases, because they have received antibodies from their mothers. After birth, breastfed babies get the continued benefits of additional antibodies from breast milk. However, in both cases, the protection is only temporary and as such children need to be protected through artificial immunization (WHO, 2006). The introduction of vaccines, particularly among children, has led to significant reductions in morbidity and mortality from vaccine preventable diseases, thereby lowering the infant and under five mortality rates. However, in sub-Saharan Africa, despite the availability of these vaccines and efforts on the part of governments and their partners to make them accessible, the mortality rate for children under the age of five remains among the highest in the world (UNICEF, 2005).

Immunization is the process by which an individual is exposed to an agent (immunogen) that is designed to protect the individual against a specific disease. It is considered important for improving child survival because more than 10 million children in developing countries die every year because they do not access effective immunization that could fight common and preventable childhood illnesses (Lee, 2005). Considering that more than 130 million children are born each year worldwide and need to be immunized, over 27 million children, who live mainly in disadvantaged rural communities, are not reached by routine immunization services and significant variations in coverage exist between and within regions and countries (UNICEF, 2001).

Unless this gap is closed, 2 million children under five years of age will continue to die annually from preventable diseases for which vaccines are available or will be available in the near future. Nearly, one million adults die each year from liver cancer in part because they were not vaccinated against hepatitis B during childhood (UNICEF, 2001). Again, although about three quarters of the world's child population is reached with the required vaccines, only half of the children in Sub-Saharan Africa get access to basic immunization. Furthermore, in poorer remote areas of developing countries, only one in twenty (5%) children have access to quality immunization (UNICEF, 2001).

Immunization against vaccine preventable diseases (VPDs) through the Expanded Programme on Immunization (EPI) is one of the most economical public health interventions available that has contributed extensively toward achieving the Millennium Development Goal 4 (UNICEF 2001). The Expanded Programme on Immunization (EPI) was established by the World Health Organization in 1974 against six childhood killer diseases; Diphtheria, Pertussis, Tetanus, Polio, Tuberculosis and Measles. Four vaccines were used in this campaign; DPT vaccine against Diphtheria, Pertussis and Tetanus diseases, Oral Polio Vaccine (OPV) against Polio (poliomyelitis) disease, Bacillus Calmette-Guerin (BCG) vaccine against Tuberculosis disease and Measles vaccine against Measles disease. Later, Yellow fever vaccine was also introduced to fight against the Yellow fever disease (WHO, 2001a). In 2003, DPT3 global coverage was 78 percent with about 27 million children not covered. South Asia and sub-Sahara African countries accounted for 9.9 million and 9.6 million respectively. In most of these countries, poor functioning health service delivery system impedes the efforts to meet immunization targets. Therefore, children living in remote location and border areas are difficult to be reached. Other areas not reached are displaced

populations. Also, some people lack access to vaccination due to social barriers, lack of information or lack of inspiration to get vaccinated (WHO and UNICEF, 2002).

The Alma-Ata declaration of international conference on Primary Health Care (PHC) on September, 1978; mandated and expressed the need for urgent action by all governments to protect and promote the health of all the people of the world. It was emphasized among other things the need to promote maternal and child healthcare, including family planning and immunization against the major infectious diseases. The United Nations Millennium Development Goals (MDGs) four and five, lay specific emphasis on reducing child mortality through child survival interventions and improving maternal health in general which in turn recognizes immunization as key component in reducing vaccine preventable diseases. Failure to reach the Millennium Development Goal four (MDG 4) for child survival will result in an estimated 40 million children's lives lost by 2015 (United Nations, 2001).

Ghana launched the EPI programme in June 1978 which became operational nationwide in 1985 with four vaccines (BCG, measles, DPT and OPV) that protect children against six diseases (Tuberculosis, Diphtheria, Pertussis, Tetanus, Measles and Poliomyelitis) together with tetanus toxoid (TT) vaccination for pregnant women that seeks to prevent Neonatal Tetanus. Around that time, a national coverage of 6% was deemed a great achievement. The National EPI policy was that each child should receive one dose of BCG at birth, three doses of DPT, (at 6, 10 and 14 weeks), four doses of OPV (at birth, 6, 10 and 14 weeks), one dose of measles (at 9 months) and one dose of yellow fever (at 9 months). Every woman of childbearing age (12 - 44 years) should receive 5 doses of tetanus toxoid. In 2002, Ghana replaced DPT in the scheme with the pentavalent vaccine (DPT-Hib-HeB). The Pentavalent vaccine, apart from providing protection

against Diphtheria, Pertussis and Tetanus, also provide protection against Haemophilus influenza type B and Hepatitis B (GHS, 2010). Vaccines against Diarrhoea caused by the Rotavirus and Pneumonia diseases were also introduced in 2012, and currently, measles is repeated at 18 months to serve as booster to the first dose. The objective of the Ghana EPI programme is to reduce the incidence of vaccine preventable diseases (VPDs) that will translate into poverty reduction and the overall health system strengthening. To achieve these objectives, daily immunization services for children and pregnant women are provided through static and outreach sites. The EPI policy is now revised to cover all the newly introduced vaccines and follows the schedule in Table 1.1.

Table 1.1: New Immunization Schedule in Ghana

Vaccine/ Antigen	Dosage	Doses Required before first birth date	Minimum Interval Between Doses	Minimum Age To Start
BCG	0.05ml	1 dose	None	At birth (or first contact)
Polio	2 drops	4 doses; Birth, 6, 10 and 14 weeks	4 weeks	At birth or within the first 2 weeks
Pentavalent	0.5 ml	3 doses; 6, 10 and 14 weeks	4 weeks	At 6 weeks (or first contact after that age)
PVC-13	0.5 ml	3 doses; 6, 10 and 14 weeks	4 weeks	At 6 weeks (or first contact after that age)
Rotarix *	1.2 ml	2 doses; 6 and 10 weeks	4 weeks	At 6 weeks (or first contact after that age)
Measles**	0.5 ml	1 dose; 9 months	None	At 9 months
Yellow fever	0.5 ml	1 dose	None	At 9 months

* Rotarix vaccine is not to be given after 6 months of age

**Measles vaccine is repeated at 18 months as a booster dose.

Source: GHS, 2013

The Expanded Programme on Immunization in Ghana has proved its place as a corner stone in the Primary Health Care (PHC) strategy. It is a cost-efficient intervention that now seeks to prevent eleven common childhood diseases - Measles, Poliomyelitis, Diphtheria, Neonatal Tetanus, Pertussis (whooping cough), Tuberculosis, Hepatitis B, Haemophilus influenza type B, Yellow fever, Rotavirus diarrhoea and Pneumococcal diseases, and also provides an entry-point into communities for other Maternal and Child Health (MCH) interventions, like vitamin A supplementation and growth promotion (GHS, 2013).

EPI programme in Ghana initially took the form of mass immunization until when the limitations of this approach came to the fore and compelled the country to revise its delivery strategies from periodic mass campaigns to routine static and outreach programmes backed with need driven mass or mop-up immunization campaigns (GHS, 2002). Immunization is now integrated with other activities at health facilities and at outreach sites. Static immunization services are held at the health facility levels whilst the scheduled outreach services are held for a cluster of communities within a designated community and involve transporting service providers into these communities.

After many years of implementation of the EPI programme, mortality levels are still high among children under five years. The Ghana Demographic and Health Survey (GDHS) of 2008 reported infant mortality rate and under five mortality rates at 50 and 80 deaths per 1000 live births respectively as compared to 64 and 111 per 1000 live births in 2003 (GDHS, 2014). Thirty-six years after the launch of EPI in Ghana, the GDHS (2014) reported that, the national childhood immunization status is 77%, but as high as 82.2% in the study region (Brong Ahafo Region). The Ministry of Health and

Ghana Health Service are committed to continue its efforts for universal coverage of quality immunization services to all communities irrespective of their geographical location and accessibility.

Conducting coverage surveys to validate administrative coverage is therefore necessary (WHO & GHS, 2002). Routine reports provide important information about administrative immunization coverage. However, immunization coverage estimates based on routine administrative report may be inaccurate or misleading. Also routine administrative immunization coverage (RAIC) provides information on the coverages for the different types of EPI vaccines and not information on how many children have received all the recommended doses before their first birth dates as the EPI policy demands. A coverage survey can validate the results of routine reports and provide additional information. An immunization coverage survey can provide important information on the proportion of children that are being reached even if the absolute number of children requiring immunization is not known. It helps to evaluate actual performance and identify ways to improve immunization activities. Immunization coverage estimates can also be used to estimate reductions in morbidity and mortality from vaccine-preventable diseases (Thordarson et al., 2005).

The Techiman Municipal Health Directorate (TMHD) is the management body that oversees the implementation and delivery of health services in the Techiman Municipal. It is at this directorate that information on service indicators including routine administrative immunization coverage report are processed and used for the planning of health services in the Municipality. Routine administrative immunization coverage from 2013 to 2015 is presented in Table 1.2.

Table 1.2: Techiman Municipal Administrative Immunization coverages, 2013-2015

Antigens	2013		2014		2015	
	NO. IMM	% COV	NO. IMM	% COV	NO. IMM	% COV
BCG	12077	254.0	10141	152.3	10677	161.0
OPV-0	10309	216.8	10744	161.3	11114	167.6
OPV-1	7259	152.7	6909	103.8	7991	120.5
OPV-2	6456	135.8	6547	98.3	7347	110.8
OPV-3	6338	133.3	6523	98.0	6753	101.8
Penta-1	7160	150.6	6707	100.7	7250	109.4
Penta-2	6459	135.9	6369	95.6	6749	101.8
Penta-3	6344	133.4	6427	96.5	6723	101.4
PCV-13-1	7475	157.2	6990	105.0	7874	118.7
PCV-13-2	6469	136.1	6570	98.7	7296	110.1
PCV-13-3	6255	131.6	6972	104.7	6851	103.3
Rota-1	7050	148.3	6856	103.0	7990	120.5
Rota-2	6647	139.8	6530	98.1	7446	112.3
Measles	6673	140.4	6467	97.1	7319	110.4
YF	7200	151.5	6619	99.4	7619	114.9

Source: TMHD report, 2016

From Table 1.2, it is indicated that, the administrative coverages for the various vaccines are not consistent and in some cases highly abnormal with high dropout rates. Dropout rate is used to assess utilization of the EPI services and is estimated using the formula;

$$\frac{\text{No. of BCG vaccines administered} - \text{No. of Measles vaccines administered}}{\text{No. Of BCG vaccines administered}} \times 100$$

Using BCG and measles as proxy vaccines for the determination of the dropout rate, the dropout rates of the immunizations in the Techiman Municipal are 44.7%, 36.2% and 31.5% for the years; 2013, 2014 and 2015 respectively. The World Health Organization and Ghana Health Service (2002) indicated that, a dropout rate of more than 10% in the EPI programme requires an action. It is against this background that this study is designed to evaluate the EPI coverage among children aged 12–23 months in the

Techiman Municipality, Ghana, to validate the routine administrative coverage report so that the appropriate recommendations can be made to improve immunization services.

1.2: Problem statement

The administrative coverage report on the various vaccines administered from 2013 to 2015 in the Techiman Municipal shows a trend of inconsistency. In the ideal situation, the highest immunization coverage that can be arrived at is 100% but there are recorded coverages far above 100%. For instance, the coverages for BCG are; 254.0%, 152.3% and 161.0% for 2013, 2014 and 2015 respectively. These coverages may be misleading or misinforming because of uncertain denominator population. Again, the acceptable maximum dropout rate for the EPI programme is 10% using BCG and measles as proxy, but, for 2013 – 2015 periods in the Techiman Municipality, the dropout rates were 44.7%, 36.2% and 31.5% respectively, which are abnormally high.

Finally, a child is said to be fully immunized if the child had received all the recommended EPI vaccines before his/her first birth date. Unfortunately, there is no information from the Techiman Municipal Health Directorate on full immunization status of the children immunized. This study is therefore designed to evaluate the Expanded Programme on Immunization (EPI) coverage among children aged 12–23 months in the Techiman Municipality, Ghana, and to provide appropriate recommendations that will help improve both coverage and quality of immunization services in the Municipality.

1.3: Research questions

1. What are the coverages of the various vaccines in the Expanded Programme on Immunization among children 12-23 months in the Techiman Municipality?
2. What is the immunization status among children 12-23 months in the Techiman Municipality?
3. What is the Expanded Programme on Immunization dropout rate among children 12-23 months in the Techiman Municipality?
4. What factors affect Immunization status among children 12-23 months in the Techiman Municipality?

1.4: Objectives of the study

1.4.1: Main objective

To evaluate the Expanded Programme on Immunization (EPI) coverage and among children aged 12–23 months in the Techiman Municipality, Ghana.

1.4.2: Specific objectives

1. To assess the Expanded Programme on Immunization vaccines coverages among children 12-23 months in the Techiman Municipality.
2. To determine the immunization status among children 12-23 months in the Techiman Municipality.
3. To determine the Expanded Programme on Immunization dropout rate among children 12-23 months in the Techiman Municipality.
4. To identify the factors affecting immunization status among children 12-23 months in the Techiman Municipality.

1.5: Conceptual framework

Conceptual framework refers to a set of concepts that are linked and described by broad generalizations which are formulated by an individual for a purpose (Rosenstock, 1974). The conceptual framework of the study is based on Health Belief Model, which is a modification of Becker & Maiman (1974) and Rosenstock (1974). Health Belief Model was adopted in this study to explain the underpinning concepts in the study because quantitative studies need to be based on existing body of knowledge or theory. The health belief model emanated from a foundation of cognitive theories of behaviour. Theorists of cognitive belief have it that behaviour is contingent upon the value that an individual places on a desired outcome, and the belief that behaviour, if performed well, will result in the desired outcome (Bandura, 1977).

The health belief model further explains that a range of health behaviours can be predicted based on information from determinants such as perceived susceptibility, perceived severity, perceived benefits/barriers and modifying factors associated with engaging in that behaviour. The application of the health belief model in this study has been outlined using the aforementioned determinants.

Perceived susceptibility - Perceived susceptibility refers to an individual's judgment of their risk of contracting a health problem. The likelihood of seeking health interventions increases as the level of perceived susceptibility increases, (Rosenstock, 1974). Perceived susceptibility may motivate parents to take their children to be vaccinated against preventable diseases. Personal susceptibility is an essential perception in prompting people to adopt healthier behaviours. Logically, when people believe that they are at risk of contracting a disease, they will be more likely to take action to

prevent this from happening. On the other hand, people who believe that they are not at any risk or that they have a low risk of susceptibility will not experience any compelling need to take any action that may prevent them from contracting the disease in question. For instance, mothers/caregivers would be more likely to seek medical attention; in this case immunization services, if they believe their children are susceptible of contracting any of the vaccine preventable diseases.

Perceived severity - Perceived severity refers to the subjective evaluation of the likelihood that a problem/ illness or disability, if contracted or left untreated, will have severe consequences such as pain, death, handicap, or reduced quality of life in general (Backer et al., 1977). In other words, the perceived severity of disease refers to the subjective feeling concerning the seriousness of disease including the medical and social consequences of the disease concerned. In the context of this study, willingness of mothers/caregivers to utilize immunization services would also depend on personal evaluation of the seriousness of the consequences associated with vaccine preventable diseases such as death through Measles or paralysis through Poliomyelitis that their children may go through if not protected.

Perceived benefits/barriers - Individuals choice of behavioural options depends on their perception of benefits and barriers. Therefore, a cost benefit analysis allows an individual to evaluate the outcome expectations and assess whether the expected benefit of a behaviour outweigh the perceived expenditure incurred by engaging in the behaviour (Rosenstock, 1974). Compliance with recommended health seeking behaviour is impeded when perceived barriers outweigh perceived benefits (Rosenstock, 1974). For example, inconveniences such as long waiting time at Child Welfare Clinics, distance to the services delivery points, inconvenience timing of immunization sessions,

unknown immunization sites, would act as barriers to the utilization of immunization services if mothers/caregivers perception about the benefits of immunization do not outweigh these barriers. Furthermore, health care workers attitude toward immunization services, inadequate resources; both material and human would all impede the uptake of immunization services by mothers/caregivers. It is essential that a person believe in the benefits of a new pattern of behaviour if the person is to adopt the new behaviour (Centers for Disease Control and Prevention, 2011). It is, thus, vital that parents receive education as regards the vaccine preventable diseases, their causes and also preventive measures, including immunization. In addition, it is recommended that information about complications which may arise from these diseases, for example, disabilities and deaths, also be included. This, in turn, should result in the parents realizing the benefits of immunization and deciding to make use of the vaccination services available.

Modifying factors - Modifying variables refer to those variables that may modify the above mentioned constructs of perception. The health belief model also recognizes such factors as determinants to the uptake and utilization of health services. Socio-cultural factors as well as demographic aspects such as age, parity, religion, educational status, marital status, occupation, past experiences of parents on immunization and health facility related problems could determine whether mothers/caregivers will make use of the available immunization services.

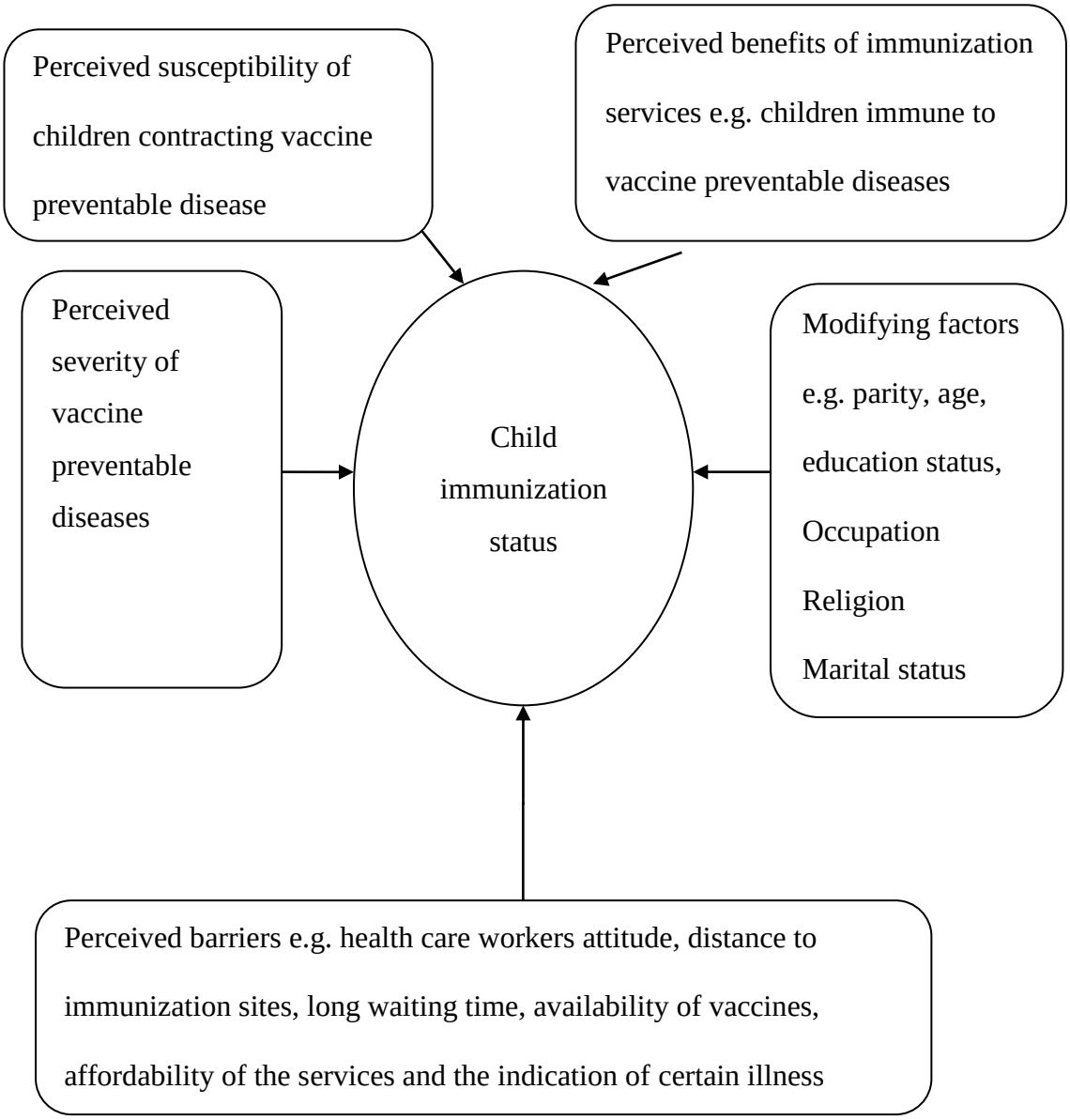

Figure 1.1: Health Belief Model (Modified from Rosenstock 1974; Maiman and Backer 1974)

1.6: Significance of the study

Most of the childhood illnesses are vaccine preventable. High coverage of quality immunization creates herd immunity and therefore necessary for the achievement of the MDG 4. It is shown that in countries where about 40% of the children are fully vaccinated with the required number of valid doses before one year of age, rates of diseases such as Poliomyelitis, Measles, Mumps, Rubella, Diphtheria, Pertussis and Haemophilus influenza type B have declined by 95 to 100% (Thordarson et al., 2005).

Reported routine administrative immunization coverage has seen an appreciable increase since the launch of the Expanded Programme on Immunization but assessment to validate these coverages has not been given the desired attention. This study was specifically designed to validate the immunization coverages and dropout rates recorded by the Techiman Municipal Health Directorate so that, the appropriate recommendations are formulated to improve immunization services.

The findings of the study will be used as a confirmatory evidence to either support previous reports given by the Municipal Health Administration on EPI or identify differences and suggest corrective measures accordingly. The study will inform the Techiman Municipal Health Management Team (TMHMT), policy makers, funding agencies and other stakeholders on the management tools to employ to improve on the EPI services and reduce defaulter rates and finally reduce the incidence of vaccine preventable diseases in our societies. The research will set the platform for which further studies can be conducted for the purposes of improving EPI service. Finally, monitoring and evaluation can be done by making reference to the outcome of this study by comparing the findings to a given standard and making inference to the entire population.

1.7: Chapter arrangement

The study involves an evaluation of the Expanded Programme on Immunization (EPI) coverage and data quality among children aged 12–23 months in the Techiman Municipality, Ghana. The report is organized into six (6) chapters, each chapter containing subheadings and details of content. The organization of the work began with an introductory chapter (chapter one), describing the background of the study, the

problem statement, research questions, general and specific objectives, conceptual framework (health belief model) and the justification of the study.

Chapter two, which is the second main heading of the report focused on the review of relevant and related literature to the topic under study. The chapter provided an overview to the review and an elaboration of what immunization entails. Literature was also reviewed on immunization Services, EPI vaccines and target diseases, immunization coverage levels, immunization status, immunization dropout rate, factor affecting childhood immunization status.

The methodology section, which is chapter three (3) of the thesis, provide an elaborate outline on how the study was conducted and is divided into several parts including; introduction, background information of study area, study population, sampling size, sampling technique, description of the main study variables, instrument for data collection and data collection procedure, quality control, pre-testing of instrument, data analysis, limitations of the study and the plan for dissemination of results.

Chapter four is the chapter that presents the results of the study. It is categorized according to the study objectives and includes; background of the study respondents, coverages of the various vaccines, immunization status, dropout rate and reasons for immunization failure. The results were then discussed in chapter five of the report, drawing important agreements and disagreements from some findings in the literature review. The final chapter, chapter six, reports the key conclusions based on the results and discussion sections of the study. This chapter also includes the recommendations that are based on the results and what need to be done.

CHAPTER TWO

LITERATURE REVIEW

2.1: Introduction

Childhood immunization has been proven to be the most cost-efficient intervention in the fight against communicable diseases and a necessary tool for the achievement of the fourth Millennium Development Goal (MDG 4) (United Nations, 2001). The study seeks to evaluate the immunization coverage and data quality in the Techiman Municipality in the Republic of Ghana. This chapter documents the review of relevant literature related to the study. The literature was reviewed from several publications including textbooks, journals, reports and internet sources using; "Immunization", "Immunization Services", "vaccine preventable diseases" "Immunization coverage level", "Immunization status", "Immunization dropout rate", "factors affecting childhood immunization status" as sub topics.

2.2: Immunization

On May 14, 1796, Edward Jenner, a British physician, performed an experiment that has revolutionized public health. He made two small cuts on the arm of an eight-year-old boy, James Phipps, and inserted material taken from a sore on a woman infected with cowpox, a mild disease common to dairy workers. Six weeks later, Jenner injected the boy with fluid from a smallpox lesion, and James did not contract smallpox. With this experiment, Jenner discovered that inoculation of a person with relatively harmless disease material could protect the person from a more dangerous disease. He called the harmless disease material "vaccine" and the process "vaccination" (USAID, 2003). Immunization is the process by which an individual is exposed (e.g. through vaccination) to an agent (e.g. vaccine) that is designed to protect the individual against a specific disease (Lee, 2005). Edward Jenner has since been recognized as the first

doctor to have given sophisticated immunization. The early years of 19th century saw widespread but haphazard use of Jenner's vaccine against smallpox. After successful vaccination campaigns throughout the 19th and the 20th centuries, the World Health Organization (WHO) has certified the eradication of vaccine preventable disease through immunization (USAID, 2003).

Global Alliance for Vaccine and Immunization (GAVI), established in the year 2000, set the immunization objective of reaching 80 percent DPT3 coverage in 80 percent of all districts in developing countries by the year 2005. Global Alliance for Vaccine and Immunization, United Nations Children Fund (UNICEF), World Health Organization (WHO), Rotary International etc. are organizations that have been very instrumental in funding, supply of logistics, monitoring, and evaluation of Expanded Programme on Immunization (EPI) activities worldwide (Eduard & Amie, 2000). The success of routine immunization programmes has been measured by the coverage achieved with the third dose of DPT among children aged 12-23 months. Immunization averts more than 2.5 million deaths every year in all age groups from Diphtheria, Tetanus, Pertussis (whooping cough), and Measles. Immunization is a health output with a strong impact on child morbidity, child mortality and permanent disability. The usefulness of immunization coverage is not simply as a direct measure of the effectiveness of one health programme, but as a proxy for the performance of the health system (Eduard & Amie, 2000).

The target group for the Expanded Programme of Immunization Services consists of the cohort of zero to one-year old children and the members of the group therefore change annually (WHO, 2003). Immunization coverage is therefore a sensitive indicator, if measured annually; it can provide timely evidence of improvement and deterioration in

current service. Measurement of immunization coverage can be relatively straightforward and inexpensive, and results in valid and verifiable information. However, issues related to the accuracy of measurements exist and need to be addressed (Eduard & Amie, 2000).

Immunization against a number of childhood diseases is a universally recommended, cost-effective public health priority, for which internationally adopted targets exists. Immunization is always part of the recommended minimum package of health interventions. Immunization coverage rates are frequently available at the sub national level, including at the district level. When data are collected at health facilities and aggregated at the district level, differences in coverage rates among districts can be readily assessed to identify which districts are lagging in achieving national goals (WHO, 2003).

As health reform frequently includes decentralization, this is an important advantage for monitoring of impact and for targeting of service delivery. According to Eduard and Amie (2000), immunization coverage rates are useful to monitor progress in expanding essential health services in adverse health settings; it helps to answer the question, “are targets being reached?”, and also as a safeguard indicator when health system reforms are changing delivery or financing of health services in settings in which immunization coverage has already achieved high levels; it helps to answer the question, “Are high levels of immunization coverage sustained?”. For these reasons, immunization coverage data can be a powerful tool to assess trends in health sector performance.

2.3: Immunization services

A number of immunization service delivery strategies have been employed depending on the physical, social, and economic access to immunization services. In the rural areas, a greater proportion of the population lives more than 14 kilometers from a health facility (Stanley & Messeret, 2005). The main EPI service delivery strategies are grouped into routine services and specially organized campaigns. The routine services are the static immunization services at health facilities (both public and private health facilities) and the outreach services to communities without immediate access to health facilities. The special campaigns immunization services includes; mass campaigns (mop ups) in high-risk populations, reaching every district (RED) approach; targeting hard-to-reach districts to attain the 80 percent coverage or even more, generalized periodic national immunization days (NIDs), supplemented immunization activities (SIAs) organized for missed opportunities and drop-outs, and defaulter tracing through home visitation (Stanley & Messeret, 2005). Any of the specified special campaign strategies could be used or sometimes two or more may be integrated alongside the routine services depending on coverages achieved, indication of re-emergence or abnormal increase in a certain vaccine preventable disease, physical or staffing problems and other area specific issues.

Each sub district health team (SDHT) provides an integrated static and outreach EPI services to the communities in their catchment areas. The team often consists of Community Health Nurses, Field Assistants and Midwives and normally supervised by a Technical Officers (Disease Control) or by a Public Health Nurse or both. The Disease Control Officers/Field Assistants often manage the district and sub district cold chain whilst vaccination is given largely by the Community Health Nurses. The static services are held at the institutional levels whilst the outreach services are held for a

cluster of communities within a designated community and involve transporting service providers into these communities. The outreach services also require good community entry skills (MOH, 2002). Through the Community-Based Health Planning and Services (CHPS), community health nurses are placed within communities especially the remote ones to bring services as near to clients as possible.

According to (MOH, 2002), the broad strategic components of EPI service delivery are; increase physical, social, and economic access to immunization services through the provision of regular static services at health facilities (public and private), regular outreach services to communities without access to health facilities (because of geographical or socio-cultural barriers), periodic catch-up campaigns targeting hard-to-reach populations (e.g., those living in "overseas" or "over bank" areas, mountainous areas, and those who are not reached due to cultural and religious barriers, periodic limited and targeted mass campaigns (mop ups) in high-risk populations (e.g., areas or populations with poor EPI vaccination coverage; high incidence of cases or outbreaks of vaccine-preventable diseases; poor surveillance information, or persons living along borders and in areas with heavy migration), generalized periodic national immunization days, placement of community health nurses within communities without access to health facilities, enforcement of the existing policy of free immunization services, and non-collection of token fees, social mobilization to increase demand for immunization and the use of surveillance information to identify and target at risk populations and to prevent epidemics.

The quality of the immunization services provision could be improved through the implementation of the national EPI policies and standards (e.g., routine screening and immunization of all women and children visiting a health facility; only true

contraindications are followed; all vaccine doses for which a child is eligible at the time of each visit are provided simultaneously), implementation and monitoring of national injection safety policies and standards, improvement in technical and communication skills of immunization service providers, improvement in motivation of immunization service providers, implementation in locally appropriate approaches for improving client satisfaction (e.g., changing service delivery times to suit the community; decreasing immunization session waiting times; etc.), tracking of defaulters and monitoring of adverse events associated with vaccination (MOH, 2002). The report also stated that, efficiency of the services could be improved through improvement in Transport availability and management, strengthening data management, reduction of missed opportunities (e.g. by the provision of daily immunizations services) and finally, forging Linkages with other sectors and stakeholders through social mobilization to increase awareness at the community level about the importance of immunization, involvement of private sector in delivery of immunization services, particularly in urban areas, involvement of Village Health Committees, District Assemblies and Unit Committees in management and monitoring of local immunization services. To this end, one may say that, if more outreach and static facilities are available, access to information on immunization services is high, absence of obstacles to immunization and motivation of providers and mothers/caregivers exit, immunization uptake could be improved.

2.4: Expanded Programme on Immunization vaccines and target diseases

Ghana launched the Expanded Programme on Immunization (EPI) in June 1978 with six antigens – BCG, measles, diphtheria-Pertussis-tetanus (DPT) and oral polio for children under one year of age together with tetanus toxoid (TT) vaccination for pregnant women. These vaccines were intended to prevent children against the six

childhood killer diseases (tuberculosis, measles, poliomyelitis, whooping cough, diphtheria and tetanus) (GHS, 2009). The launch was in response to the national health policy to reduce morbidity and mortality of vaccine preventable diseases which then contributed significantly to both infant and child mortality in the country. It was also in consonance with the immunization policy of the government which sought to ensure that all children receive these vaccines before their first birthday of life (GHS, 2009).

In 1992, fourteen years after the launch, the government added yellow fever vaccination to the national immunization programme which is to prevent children from the yellow fever disease. In January 2002, the Government of Ghana in partnership with the Global Alliance for Vaccine and Immunization (GAVI) initiative and supported by other health development partners such as WHO, UNICEF, World Bank, USAID, JICA, Rotary, DFID, DANIDA, Civil Society Organizations etc increased the number of antigens with two new vaccines; the Hepatitis B and the Haemophilus influenza type B (also known as Hib) vaccines. The two new vaccines were combined with the DPT into DPT-Hib-Hep (commonly referred to as the pentavalent vaccine). The two added vaccines seek to save children from Hepatitis B and the Haemophilus influenza type B diseases (GHS, 2013).

According to GHS (2013), Rotarix and PCV-13 vaccines were again added to the programme to fight against Diarrhoea caused by the Rotavirus and Pneumonia diseases. The Ghana Expanded Programme on Immunization currently targets eleven diseases (tuberculosis, measles, poliomyelitis, whooping cough, diphtheria, tetanus, yellow fever, Hepatitis B, Haemophilus influenza type B, Diarrhoea caused by the Rotavirus and Pneumonia).

2.5: Immunization coverage levels and immunization status

Achieving high levels of immunization coverage is by itself not a sufficient indication of the effectiveness and efficiency of a health system, as deficiencies in other areas could be widespread, however, lack of progress in moving towards high levels of immunization coverage is a strong indication of health service failure to provide essential public health services to protect the health of the most vulnerable in a population. For Diphtheria, Pertussis, Tetanus (DPT), a minimal coverage goal of 80 percent of the target group to receive three doses of DPT3 by 2005 was proposed by United Nation Children Fund and the Global Alliance for Vaccines and Immunization to be achieved in all districts in all Nations (Eduard and Amie, 2000). The number of developing countries estimated to have met the target of the UNICEF medium-term strategic plan of 80 percent coverage for DPT3 in every district increased from 42 in 2002 to 45 in 2003. Nonetheless 89 developing countries have developed strategies for reaching hard-to-reach groups with immunization through the Reaching Every District (RED) approach. Since 1985, the expanded programme on immunization (EPI) coverage has realized a worldwide increase (WHO, 2003). What is now important is to conduct regular immunization coverage surveys to determine the proportion of the immunization target group who have received all the EPI recommended vaccines before their first birth date to be sure what proportion of children are fully protected from the targeted diseases.

Incidence of diseases prevented by the Expanded Programme on Immunization varies across countries, and the use of coverage measures should take these differences into account. Measles has virtually disappeared from the Americas and periodic mass campaigns targeting young children irrespective of immunization history has become an important strategy, but in Africa and Asia, where measles remains an important cause of

child mortality, monitoring coverage levels is still essential. BCG monitoring is less frequently used, because the vaccine is delivered once, often by midwives and other birth attendants, rather than by immunization programs (Eduard & Amie, 2000).

Studies conducted in different countries revealed various differences in the performance of immunization services. A cross-sectional survey conducted in Ethiopia using the 2011 Ethiopian demographic and health survey data obtained from 1,927 mothers who have children from 12- 23 months revealed that, the prevalence of fully immunized children was 24.3%. Specific vaccination coverage for DPT3, OPV3, measles and BCG were 36.5 %, 44.3 %, 55.7 % and 66.3 %, respectively. The individual vaccine coverages were far above the fully immunized coverage of 24.3%. Health service use and access to information on maternal and child health were found to predict full immunization coverage. What this means is that most children start the service but dropout at some point. The study reported that, appropriate strategies should be devised to enhance health information and accessibility of immunization services to improve full immunization coverage by addressing the variations among regions (Lakew et al., 2015).

A study conducted in Gambia on the performance of immunization services revealed that, immunization coverage was below the target of 80% for DPT 3. The study results showed that, DPT 3 coverage was 74.4% and the proportion of the target group children who were fully immunized was 68.6%. The major primary reason given by both management and service providers for the decline in coverage was the frequent interruption of services. Services have been interrupted because of unavailability of vaccines since funding for vaccines have in the past depended heavily on external support. Intermittent supplies had led to shortages of vaccines in districts and frequent

breakdown of transport used for outreach services. This has affected the immunization services because about 60% of immunization services are delivered using the outreach services (Gambia Department of State For Health and Social Welfare, 2001).

A cross sectional survey done in the rural north India to estimate the immunization coverage rate of eligible children aged 12-23 months shows that of the 747 eligible children, 94.8% were fully immunized. The main reason for incomplete immunization was parental indifferences or migration of child or family (UNICEF, 2005). In a related development Gupta et al., (2006) found that, in Alwar district of Rajasthan state of India, less than one third (28.9%), of children aged 12-23 months were fully immunized with BCG, DPT3, OPV3 and measles vaccine. Around a quarter (26.5%), had not received even a single vaccine and a little less than half (44.5%), were found partially immunized. 55.9% of eligible children were vaccinated for BCG and 43.6% for measles. Though nearly two- thirds (66.8%) were covered with the first dose of DPT and OPV, about one third of these children dropped out of the third doses of DPT and OPV for various reasons. The main reason for dropping out or non-immunization was lack of information about the immunization programme. The findings from these Indian studies suggest that, even in a country there could be variations in the immunization coverages and as such specific area coverage survey is equally important as the National survey.

In 2005, the year set by UNICEF and GAVI to reach DPT 3 immunization coverage of 80% by all developing nations, an Expanded Program on Immunization coverage assessment was conducted in the Monkey Bay head zone, Malawi. The Immunization coverage by card or history was 97% for BCG, and 99%, 95% and 85% for DTP1, DTP2 and DTP3 respectively. Coverages of OPV1, OPV2 and OPV3 by card or history

were 99%, 93% and 85% respectively and coverage for measles by card or history was 78%. Fully immunized by card or history was 70%. Two children had not received any immunizations at all by the time of the survey. Dropout rate from DTP1 to DTP3 vaccination by immunization card or history was 14.5%, and dropout from DTP1 to Measles by card or history was 21% (Thordarson et al., 2005). This indicates that access to health services was adequate but utilization was poor. Even though there was an achievement of 85% DPT 3 coverage, children who were fully immunized with all the recommended EPI vaccines were only 70%. Again, the Expanded Programme on Immunization policy has it that, a dropout rate more than 10% is an indication of a system failure. Therefore, the 21% dropout rate (DPT 1 and Measles) suggest that, even with the 85% coverage in DPT 3, there is still the need to make effort to improve on services delivery strategies.

A cross-sectional survey conducted in Dschang Region of Cameroon using the WHO two-stage sampling procedure by Russo et al. (2015) found that, complete immunization coverage (crude immunization status) was 85.9 % according to card plus parents' recall. All children had received at least one routine vaccination, the OPV-3 (Oral Polio Vaccine) coverage was 90 %, and 73.4 % children completed the recommended vaccinations before 1-year of age (Valid immunization status). Vaccination coverage was high; however, 1 out of 7 (14.1%) children was partially vaccinated, and 12.5% did not complete timely the recommended vaccinations, thus, when this continuous for some time a pool of partially vaccinated children will be created and this will jeopardize the effort in creating herd immunity.

A study conducted in Gambia to analyse obstacles and opportunities in the expanded Programme on Immunization reported that, despite high levels of coverage of many

individual vaccines, delivery of vaccinations later in the schedule and achieving high coverage of full immunization remains a big challenge. The report indicated that, of the 7363 children included in the study, immunization coverage was 73% for measles, 86% for BCG, 79% for the third dose of DTP and 52% for full immunization status. Coverage was significantly associated with area of residence and ethnicity (Payne et al., 2013).

In 1989, a situational analysis of EPI coverage in Ghana showed that in spite of the success of the Expanded Programme on Immunization, the third dose of DPT vaccination was still low. There were only 50.7 percent coverage for DPT3 and 51.5 percent for OPV3 with dropout rate of approximately 40 percent (WHO & GHS, 2002). In 1995, the figures reported for Ghana based on a nationwide survey were; BCG -85 percent, DPT3 -71 percent, OPV3 -71 percent and Measles 68 percent and in 2002, Ghana Health Service reported that in spite of several attempts over the years to improve EPI, the national immunization coverage has been low (WHO & GHS, 2002).

According to the 2008 Ghana Demographic and Health Survey, 79% of Ghanaian children 12–23 months received all recommended vaccines at any time (not just under one year) prior to the survey; one dose of BCG and measles and three doses each of DPT and polio. The study reported that, over the past two decades, vaccination coverage has increased from 47% in 1988 to 79% in 2008 (GDHS, 2008).

The results of the 2014 GDHS was not far different from the 2008 GDHS except with the inclusion of the new vaccines. The survey used children age 12-23 months, the age by which children should have received all basic vaccinations. Eighty-eight percent of these children have a vaccination card that was seen by the interviewers. The findings

show that, overall, 77% of children have received all basic vaccinations (BCG, measles, and three doses each of pentavalent and polio vaccine). This coverage shows a reduction of 2% from the 2008 Ghana Demographic and Health Survey. Only 2% of children in Ghana have not received any vaccinations; according to the 2008 GDHS, by comparison, 1% of children were reported to have also not received any vaccinations as reported by 2014 GDHS (GDHS, 2014). The report continued to provide information on the coverages achieved with the various vaccines. With respect to specific vaccines, 97% of children each have received BCG, pentavalent 1, and OPV 1. Coverage for the pentavalent and OPV vaccinations declines with subsequent doses; only 89% of children received the recommended three doses of pentavalent (DPT-HepB-Hib) and 84% received three doses of OPV. Coverage of the measles vaccine was 89% and that of yellow fever was 88%, close to that reported in the 2008 GDHS, 90% and 89% respectively (GDHS, 2014).

The 2014 GDHS report also captured coverage information on the newly introduced vaccines (pneumococcal vaccine; three doses and Rotavirus vaccine; two doses) which were not included in the 2008 report. The findings show that 93% of children ages 12-23 months have received the first dose of pneumococcal vaccine and 84% have received the third dose. Ninety-two percent of these children have also received the first dose of the rotavirus vaccine, while 88% have received the second dose. The report, however, did not provide information on valid immunization status (percentage children who were fully immunized before their first birth date) which is an indicator of service quality. These new vaccines were excluded in the analysis of the full immunization status in the Ghana demographic and health Survey report which is not the case in this study. This study report also includes information on the valid immunization status of children in the Techiman Municipality.

2.6: Immunization dropout rate

DPT coverage rates are the most frequently used rates to monitor immunization coverage levels and trends. The World Health Organization recommended schedule for the administration of DPT vaccine varies from area to area. The developing countries in Africa, South Asia, and East Asia and the Pacific follow a three doses schedule; often given at 6, 10 and 14 weeks during the first year of life. A four-dose schedule, with a booster dose administered in the second or third year of life is typical in European countries, while a five-dose schedule with two booster doses is also typical in the Latin American region (WHO & UNICEF, 2001). The existence of schedules allows the construction of more refined monitoring indicators in addition to coverage with one, two, or three doses of DPT. The multiple dose standard also enables calculation of dropout rates, which indicate what proportion of children receive DPT 1 but not DPT 2, or DPT 2 but not DPT 3 and or DPT 1 but not DPT 3 doses of the vaccine. Dropout rates can also be used as indicators of a health system's ability to deliver services requiring multiple visits (WHO and UNICEF, 2007).

In most settings where full immunization coverage is low, most children receive at least one dose of DPT, but the proportion that received the needed second and third doses drops steeply. Moreover, most children who start with BCG at birth do not end with the measles vaccine at nine months. Dropout rates are calculated as the percentage point difference between successive doses of a vaccine, expressed as a percentage of the first dose: the dropout rate between the first and second dose of DPT is: (DPT1 coverage - DPT2 coverage)/DPT1 coverage multiply by hundred. Dropout rates may also be calculated as the difference between one vaccine and another, such as BCG and Measles (Eduard & Amie, 2000).

In many countries including Ghana, in as much as the dropout rates of the Expanded Programme on immunization can be computed between the different doses of the multi-dose vaccines, the dropout rate computed using BCG (or DPT1 in some countries) and Measles serves to measure the utilization of the whole EPI programme. Observation of the follow up of vaccination in Lagos Metropolis showed that 65.5% of 127 children who started BCG vaccination dropped out as at the time of receiving measles vaccination. Reasons advanced for failure to immunize or complete immunization of the children included obstacles; 47%, lack of information; 40.7% and lack of motivation; 11.6% (Bolagun et al., 2005).

According to Khan et *al.* (2005), routine immunization coverage in Dhaka among children 12-23 months of age by card plus history was 97% for BCG, 97% for Diphtheria, Pertussis and Tetanus (DPT 1) and Oral Polio Vaccine (OPV 1), 75% for DPT 3 and OPV 3 and 67% for measles. Sixty six percent (66%) of all children surveyed had received valid doses of all vaccines by 12 months. DPT 1 to DPT 3 and DPT 1 to measles dropout rate were 5% and 13% respectively and BCG to measles dropout rate was 30.9%. This was an indication of a system failure, and the major reason for the incomplete vaccination was lack of knowledge (46%) regarding subsequent doses. The findings revealed that access to child immunizations were good, but high dropout rate and invalid doses contributed to the low percentage of fully immunized children (66%).

According to the GDHS (2014) report, apart from OPV, the dropout rates indicators were all below 10%. Dropout rate, using BCG and measles was 8.3%. This rate tells us how mothers/caregivers utilize the immunization services in general. A dropout rate of more than 10% is an indicative of the need for agent action. With respect to the multi-

dose vaccines, the dropout rates were; pentavalent 1- pentavalent 3 – 8.3%, OPV 1 – OPV 3 – 13.4%, PCV-13 1 – PCV-13 3 – 4.4% and Rota 1- Rota 2 – 9.7%.

2.7: Factors affecting childhood immunization status

For immunization to be effective, it is important to provide good quality immunization services. Factors such as lack of information, lack of motivation and other obstacles affect the immunization service delivery. Studies carried out in three countries in Asia (Bangladesh, India, Philippines) and two countries in Africa (Ethiopia and Malawi) show that, there are a number of serious shortcomings in the quality of the routine immunization services. These shortcomings and strains at the interface of immunization service providers and immunization service beneficiaries detract from sustainability and promote growth of pools of unimmunized and partially immunized children. The findings recommend paying more attention to both quality and sustainability as a way forward to achieving the desired outcome (Streefland et al., 1999).

In Malawi, Ethiopia, India, Bangladesh, and the Philippines, a multiregional study that was done showed there was a very significant general demand for better quality of vaccination services (Streefland et al, 1999). The demand for vaccination was caused by knowledge that vaccines are good for children and/or a strong feeling of exposure to serious illness. A different perspective is that the greatest determinant of vaccination uptake is the perceived quality of vaccination services. The circumstance is likely to differ depending on the environment (Streefland et al., 1999). One thing is clear, however, when parents refuse to take their children for immunization, it is because they want to protect their children from being harmed (Streefland, 2001). In 2003, political and religious leaders in three Nigerian states shunned a polio vaccination campaign by the World Health Organization saying that the vaccine caused infertility and AIDS

(Jegede, 2007). Also, groups in India (certain Hindu and Muslim) have believed that vaccination is a concealed method of family planning, primarily targeting Muslims (Nitcher, 1995).

In 2012, WHO in collaboration with IMMUNIZATION-Basics analyzed 126 documents from the global grey literature to identify reasons why eligible children are partially or not immunized. The main reasons for under-vaccination were related to immunization services and to parental knowledge and attitudes. The most frequently cited factors were: access to services, health staff attitudes and practices, reliability of services, false contraindications, and parents' practical knowledge of vaccination, fear of side effects, conflicting priorities and parental beliefs. Some family demographic characteristics were strong, but only as underlying risk factors for under-vaccination (Favin et al., 2012).

Cutts & Smiths (1994) reported that, Cameroon could not attain its target of 80% coverage due to poor immunization system that lacked a method for identifying unimmunized children, inadequate information about immunization services, poor socio-economic factors coupled with bad experiences with immunizations. In Ethiopia, poor health infrastructure, low number of trained work force, high turnover of staff and lack of donor funding continue to affect the EPI programme (Gedlu & Tesemma, 1997).

A research conducted by Department of Child Health, College of Medical Sciences, University of Benin, revealed that, immunization defaulter rate among children attending a static immunization clinic in Benin City, was 26.7%. The commonest reason for defaulting immunization clinic appointment according to the study was the child's ill-health, 37.5% of all cases (Hari & Mizan, 2004). This explains the fact that reaching

mothers at their homes could be more convenient than just being at a static point where misconceptions and socio-economic factors can easily influence their decision of attending an immunization session.

A coverage survey among children aged 12-23 months in the urban slums of Lucknow district in India indicate that, the major reason for partial immunization of children, according to the respondents, was the unavailability of both parents, 17.2%. Thus, if children are left in the hands of caregivers, their immunization may be compromised. Another reason given by some respondents for partial immunization was that parents had gone either to a village or a native place during the scheduled date for immunization or had been residing in the area for more than 6 months but had not yet acquired the necessary information regarding the details of immunization services in that area, 14.7%. Sickness of child or sibling resulting from immunization failure was 11.7% and lack of knowledge regarding the subsequent immunization was 10.4% (Nath et al., 2007).

Feyisetan and Adeokun, (1992) found that, the extent to which modern methods like immunization services are adopted may depend on the people's conviction of the causes of ill-health and on their level of conviction about the efficacy of such modern health measures. This explains that people's perception of causality influence their health seeking behaviour. A related study by Freeman et al. (2012) also found that, beliefs about the causes and supposed alternative source of preventing diseases, and the literacy level of mothers influence their acceptance or non acceptance of vaccination. The authors concluded that as long as people defined health within the super natural context, they would be reluctant to use scientific measures to prevent and/or manage it.

A Nationwide survey in Cameroon found that 37% and 34% of children were fully immunized in 1998 and 2000. These results correlated with both the mother's level of education and the household's economic status. It was noticed that, maternal educational level was a stronger predictor of positive immunization status than is relative economic status. Children of mothers with secondary education or higher education were three times more likely to be fully immunized than children whose mothers had not completed primary education (WHO, 2001b).

According to Gedlu and Tesemma, (1997), children of mothers in rural Ethiopia lack immunization or are incompletely immunized because of lack of knowledge, unawareness of the need for second and third doses, and a belief that disease is better than immunization. Other reasons were social problems and lack of time. In a later study, Berhane *et al.*, (2005) also revealed that 98% of mothers had knowledge on immunization. Coverage based on immunization card, however, was as low as 37%, indicating a discrepancy between the high levels of knowledge with the observed low immunization coverage. The father's education and the mother's experience of an EPI-targeted disease in the family emerged as significant predictors of complete immunization of their child. The father's involvement and the mother's ability to cite signs of severity of EPI disease were associated with the child's immunization status in the high coverage zone.

The annual report from UNICEF, 2003 showed that more than 30 million children are not immunized because vaccines are unavailable, health-care facilities are poor or nonexistent, or families are uninformed or misinformed about immunization services (UNICEF, 2005). An earlier report by the World Health Organization recognized a decline in the uptake of immunization services since 1992 and attributed the possible

reasons for the decline as inadequate resources and managerial capacities at different levels, low accessibility to health services, and the eruption of social and political conflicts (WHO, 2003).

In a related development, Eduard & Amie (2000) concluded in their study that, the major factors hindering attendance to Expanded Programme on Immunization services were; poor knowledge about immunization services, lack of suitable venues and furniture at outreach clinics, financial difficulty, long waiting times, transport difficulties, poorly motivated service providers and like of intersectoral collaboration. It was observed that involving fathers especially those with high educational level improves the chances of completing child immunization. The report of GHS, (2002) indicated those barriers such as inadequate understanding of immunization and insufficient demand for immunization services by families and communities; limited access to immunization services for communities in hard-to-reach areas; and inadequate numbers of health staff to provide services to very large and scattered communities have hampered the delivery of services to many target populations.

The World Health Organization cluster sampling survey in Alwar District, Rajasthan State of India, conducted among 26 rural and 4 urban clusters showed that fully immunized children were more in urban areas, 82.1% as compared to rural areas of 45%. BCG and measles coverages were higher in urban areas, 89.3% and 85.7% than 69.61% and 52.2% in rural areas respectively. High dropout rate was found for DPT, 25.3% and OPV, 23.2% in rural areas as compared to 7.7% each in urban areas. Failure of immunization in rural areas was mainly due to unawareness of need for immunization (35.4%), mother too busy (16.8%), place and time not known (9.7%), place of immunization too far (8.8%) and 7.1% each for unaware of need to return for

subsequent doses and Fear of side reactions. Vaccinator absent was also cited by few respondents as reasons for the failure (Gupta et al., 2006). Also, rural–urban inequities in immunization coverage are certainly linked to supply-related factors, e.g. accessibility to vaccination facilities, provision of childhood immunization services, and demand-related factors, such as the knowledge and attitude of mothers (Antai, 2011).

Also, in Italy, a study conducted to evaluate the Expended Programme on Immunization coverage using the cluster survey of regions comparing mandatory and optional immunizations services showed an increase in coverage for mandatory vaccines, which were free and cost borne by the national health office and a significant decrease in coverage for the optional vaccines which parents were made to pay a fee for cost of immunization (Salmaso et al., 1999). In this regard, payment of token fees has been a major hindrance to EPI service utilization in Italy. This can also be regarded as an immunization failure factor in other areas where such token fees are collected either legally or illegally.

Non-uptake of immunization can be a consequence of either lack of acceptance or willingness but inability to access immunization services, e.g. due to associated costs cannot be undermined. Even in a system where immunization is free, the indirect costs such as transport and opportunity costs may be a deterrent for some mothers to get their children immunized, despite general acceptance and robust provision of immunization services (Jamil et al., 1999; Canavati et al., 2011).Staff attitude according to Jared and Omolo, (2007) is one of the major hindrances to the uptake of immunization services in developing nations. The study reported that health workers' attitudes can significantly influence mothers' attendance, and thus, improving staff attitudes and greater

community mobilization will be the key approaches to increasing the immunization coverage.

A study conducted in Thailand to evaluate the impact of village health communications programme on the uptake of immunization services revealed that, the rate of completion of immunization by eligible children under- one year increased from 65% to 89% for mothers who received regular information from village health communications (intervention area), but remained unchanged (65%) for non-intervention areas. High immunization areas were highly correlated with high level of village health volunteers and village health knowledge about infectious diseases. Both the frequency of contact between health workers and mother's knowledge of infectious diseases and immunization were significantly correlated with immunization status (Bland and Clement 1998). Ramuson & Mark (1990) also found that, communication activity in support of immunization programmes have helped mobilize populations and increase coverage. Communication offers practical strategies for reducing both services and consumer barriers to complete coverage and for sustaining appropriate immunization in creating consumer demand for service. This means that, mobilizing and using existing community structures could help increase immunization coverages. In the case of Ghana, emphasis should be laid on the Community-based Health Planning and Services (CHPS) which already uses the community volunteer system in its operation.

A cross-sectional survey conducted in Dschang Region of Cameroon using the WHO two-stage sampling procedure by Russo et al. (2015) found in their final multilevel logistic regression model, that, factors significantly associated with incomplete immunization status were: retention of immunization card, mothers' utilization of antenatal care (ANC) services, mothers' age and parents' exposure to information on

vaccination. The study reported that, in order to improve the immunization coverage, it is necessary to strengthen ANC services, and to improve parents' information and attitude towards immunization, targeting younger parents and families living far away from immunization centers, using appropriate communication strategies

2.8: Characteristics of mother and other modifying factors

Characteristics of Mothers are the most known determinant factors of child immunization. Maternal characteristics and other modifying variables may modify the perception of mothers on childhood immunization. These variables include; level of education, age of parents, ethnicity, occupation, birth order or parity, gender of child, transport, information, motivation of parents/caretakers regarding immunization, side reactions and health facility related problems.

2.8.1: Level of education of mothers/caregiver and childhood immunization status

Several studies have found that education plays a vital role in the decision to access health services as well as the decision to immunize children in which low levels of education have been associated with lower immunization coverage. One such study was conducted in the Democratic Republic of Congo. The study indicated that the educational level of both parents were significant factors as regards the immunization of their children (Mapatano et al., 2008). Also the educational status of the parents was found to be the most significant factor as regards the immunization status of children in rural Nigeria (Odusanya, et al., 2008). A study conducted in the Opuwo district in Namibia found that low educational levels of the parents were associated with low vaccination coverage of children (Taapopi, 2002). Also in a study conducted in peri-urban Karachi in Pakistan, it was found that the educational status of parents was significantly associated with the immunization status of their children with 50% of non

immunized children being more likely to have an illiterate father only, 71% of partially immunized children being more likely to have an illiterate mother only and more than four times as likely to both an illiterate father and an illiterate mother (Siddiqi et al., 2007). A similar study conducted in Malawi revealed that the educational level of the mother is an important determinant of immunization status of the child. In 2004, 84% of the children whose mothers had a secondary and higher level of education were fully vaccinated compared to 55% of the children whose mothers had no education (Munthali, 2007). A study conducted in Mozambique found that a low educational level on the part of mothers was strongly associated with low vaccine uptake (Jani, et al., 2008). Another study conducted in Nairobi, Kenya found that the mothers' level of education was associated with vaccination of their children with mothers of primary or higher level education being more likely to have children who were fully vaccinated than uneducated mother (Mutua et al., 2011). Jared and Omolo, (2007) observed maternal education as the strongest independent factor for protection against childhood mortality**.** Jamil et al. (1999) also found that mothers who completed at least primary level of education were 1.7 times more likely to have their children fully immunized compared to those who had no education. Educational background has also been found to be a factor in non-African countries and, in India, it was reported that most of the non-immunized children were the sons and daughters of illiterate mothers (Sharma et al., 2008). In Japan, Matsumura et al. (2005) found that the mothers of non-immunized children possessed insufficient knowledge about immunization of children while a study conducted in Austria indicated that low measles vaccination coverage is directly associated with the educational level of the parents (Stronegger & Freidl, 2009). Thus, the specific implication of these findings is that the better educated the parents, the better the immunization status of their children. Education empowers a woman to access relevant health services, interact effectively and assimilate information relating to

prenatal care, childhood immunizations and nutritional needs better than those other who are not educated (Becker et al., 1993).

2.8.2: Age of mothers/caregiver and childhood immunization status

Age of the mother is also found in several studies to be associated with infant immunization status. A study conducted in Nigeria by Babalola, (2009) found that both mother's age and the age of the child have influence on immunization status of the child. Also a study conducted by Mutua et al. (2011) found that in Nairobi, Kenya, maternal age was a strong predictor of the vaccination status of children with older mothers being more likely to have children who were vaccinated as compared to mothers who were aged less than 20 years. In contrast to the above findings, a study conducted in Kinshasa, Democratic Republic of Congo, found that the age of the mother, whether young or old, did not influence the immunization status of the child (Mapatano et al., 2008). It was also indicated that children whose mothers were aged less than 30 years were 2.26 times more likely to be fully immunized than those whose mothers were more than 30 years (Olumuyiwa et al., 2008). A study conducted in the Opuwo Health District found that the age of mothers, guardians or caretakers did not significantly influence the vaccination status of the children as there was no apparent difference between those children who were fully vaccinated and those who were either partially vaccinated or not vaccinated (Taapopi, 2002). In Japan it was found that the main characteristics of mothers of unvaccinated children included the mothers being aged younger than 30 years, working and concerned about the adverse events of the vaccine (Matsumura et al., 2005).

2.8.3: Occupation of mothers/caregivers and childhood immunization status

Occupation has a direct link to the socio-economic status (wealth status) of individuals which strongly controls the behaviour of individuals and thereby controls health-seeking behaviour and ultimately child survival (Becker et al., 1993). In addition, better occupation and higher socio-economic status is associated with better health (Lynch et al., 1996; Antai, 2011). The 2008 National Demographic and Health Survey data in Nigeria revealed that, about 53% of children in the wealthiest households and 5% in the poorest household were immunized (NNPC, 2008). Some studies have shown that socioeconomic status of the family is an important factor that can influence vaccination compliance with higher socio-economic status being associated with higher uptake of vaccination (Topuzoglu et al., 2005; Cui & Gofin, 2007). In Bangladesh, children of relatively better-off households had an 80% higher chance of being fully immunized compared to the economically disadvantaged group (Jamil et al., 1999). This may be due to the fact that children who are from poor homes find it difficult to be reached by the health services and parents may encounter barriers to reach health facility compared to those of better socio-economic status. Other studies have found no difference in vaccination rates with respect to socio-economic status (Pande, 2003). With regards to occupation studies have found that in households were mothers or caregivers are not formally employed, other employed members can influence childhood immunizations. A study conducted in Kinshasa, Democratic Republic of Congo, found that the father's involvement was associated with the child's vaccination status in the high coverage zone with employed fathers either providing transport fare or accompanying the mothers to the vaccination sites (Mapatano et al., 2008). In Mozambique, Jani et al. (2008) found that mothers were often motivated in children's immunization, they understood the benefits of immunization and they were willing to walk long distances to access health care. In view of the fact that the majority of the mothers in the study were

peasant mothers with no formal income, the money for the travelling costs must have come from other family members or alternative sources. The study also found that the level of incomplete vaccination status was high as a result of the difficulties experienced in accessing the health facility as the population settlements were more dispersed (Jani et al., 2008). A study conducted in Pakistan found that, in many cases, poverty constituted a barrier to vaccination as the parents were often not able to afford the costs of the supposedly "free" immunizations with the travel costs, opportunity costs, and demands for unofficial payments (Cockcroft et al., 2009). A study conducted in Nairobi in Kenya revealed that financial barriers among the socio-economically disadvantaged groups were significantly associated with the vaccination status of children (Mutua et al., 2011).

2.8.4: Religion of mother/caregiver and childhood immunization status

Various studies have also linked religion to full childhood immunization. One such study was the study of Nitcher, (1995) who found that, in India, certain Muslim have believed that vaccination is a concealed method of family planning, primarily targeting Muslims, thus, affecting the uptake of childhood immunizations by Muslims. Religion is another factor that is likely to determine full childhood immunization in Nigeria (Jegede, 2007). In northern Nigeria in 2003, the political and religious leaders of Kano, Zamfara, and Kaduna States made efforts to stop immunization campaign by discouraging parents from allowing their children to be immunized. This is because they had misconception that it is a plan by outsiders (enemies of Islam) to reduce the Muslim population through fortification of vaccine. Also they thought it was another strategy to transmit HIV virus, which would reduce the population of Muslims. This led to decrease in immunization uptake in Northern Nigeria in 2003 (NNPC, 2008).

2.8.5: Ethnicity of mothers/caregivers and immunization status

The ethnic group of mothers may also be a factor associated with the immunization status of children. A study conducted in the Opuwo Health District in the Kunene region by Taapopi (2002) found that more children in the Himba tribe were either partially vaccinated or not vaccinated, as compared to the children in other tribes such as the Hereros, Vambos and Zembas. The Himba community is a traditionally nomadic tribe in Namibia and similar to the nomadic population in the Henan province of China. A study conducted in China found that immunization coverage of children of a nomadic population was less than 60% while the overall coverage with four kinds of vaccines was 32% only (Guo & Feng, 2000). Another study conducted in Nairobi, Kenya found that ethnicity was significantly associated with the vaccination status of children with the children from the Luhya, Luo and other ethnic groups having a lower likelihood of vaccination as compared to Kikuyu children (Mutua et al., 2011).

2.8.6: Birth order or parity and childhood immunization status

Researchers have also found that birth order or parity of the mother may be one of the factors affecting the immunization status of children. In other countries it has been shown that there is a strong association between immunization status and birth order with children born into larger families having a low immunization uptake. It was also reported in the study that, first born children being more likely to be immunized on time than second-born children thus, mother with lower parity are more likely to have their children fully immunized than those with higher parity. According to NNPC, (2008), vaccination coverage decreases as birth order increases, 27% of first-born children have been fully immunized, compared with 14% of birth order six and above. A study conducted in Malawi found that the vaccination coverage among parity one mothers was higher than those with more than parity one. Seventy nine percent of the first-born

children (parity one mothers) aged 12 to 23 months had been fully vaccinated as compared to 58% of the children who were sixth or above in the birth order (Munthali, 2007). Matsumura et al. (2005) reported the same findings in Japan, saying that, children who had not been vaccinated were often not the first born. These findings have been recorded in settings very different to the Techiman Municipal in particular, and Ghana in general. Accordingly, this study seeks to establish whether the effect of birth order or parity, as proved elsewhere, is same in this study area.

2.8.7: Sex of the child and immunization status

Sex of the child can predict the immunization status of the child in societies where gender inequality is prevalent. For instance in Bangladesh, females are 0.84 times less likely to be fully vaccinated than male children (WHO, 2001b). Jamil et al., (1999), in spite of almost universal access to immunization services, sex discrimination against female children exists in seeking full immunization coverage in rural areas of Bangladesh. Also in a study conducted in Chandigarh in India indicated that immunization coverage is lower in female children than in male children – 56% versus 63.5%. The study indicated that, as a result of cultural beliefs that males are more important than females; female children were not taken care of in the way that male children were (Sharma et al., 2008). In the studies conducted in North India and Nepal, male children were twice as likely to have received immunization as female (Jared and Omolo, 2007). In contrast to these findings, other studies found that female children are more likely to be fully immunized than their male counterparts. A study conducted in India, found that the sex of the child was associated with child immunization because, when the two genders were compared, the proportion of fully immunized children was higher in females (27%) than in males (23%). However, a study conducted in Malawi revealed that there was no difference between the vaccination coverage of male children

and the vaccination coverage of female children (Munthali, 2007). In addition, a study conducted in a rural setting in Mozambique by Jani et *al.* (2008) did not find any significant difference in the gender of children with respect to children with either complete or incomplete vaccination status. Also, a study done in Nigeria in 2009, there was no significant relationship between sex of child and full immunization status (Antai, 2011). In 2006, the Ethiopian Expanded Programme on Immunization survey also showed that no statistically significant difference between girls and boys with regard to their immunization status (Kidane et al., 2008). According to the Ghana Demographic and Health Survey (2014), basic vaccination coverage does not differ by the sex of the child or urban-rural residence. However, full vaccination coverage generally increases with increasing education. In view of the fact that studies conducted in both African and non-African countries have shown different association of the sex of the child with the immunization status, this study intends to establish whether sex is a factor in full childhood immunization in the Techiman Municipality.

2.8.8: Transport and childhood immunization status

The transportation to health facilities by immunization service beneficiaries, and to outreach sites by service providers is one of the factors associated with low immunization coverage. A study conducted in the Opuwo Health District by Taapopi (2002) found that accessibility to health facilities was associated with immunization status of children. The study found that 21% of the mothers whose children were partially vaccinated and 17% of the mothers whose children were not vaccinated lived far from health facilities and had no access to transport. Another study conducted in difficult to reach areas in the Lagos metropolis found that obstacles such as the nature of the mothers' busy work schedules, the long distances to outreach clinics and the unavailability of transport to access vaccination centers were associated with low

immunization coverage. The study revealed that, the effect of these factors resulted in 48% of non-immunized children at the time of the study (Adeiga et al., 2005). Another study conducted in rural Mozambique showed that distance to health facility and spending more than hour to reach the nearest health facility had a negative influence on the immunization uptake with 52% mothers interviewed during the survey living far away from the nearest health facility (Jani et al., 2008). The findings added that, apart from transport affecting movement by mothers or caregivers, it also affects the movement of the service providers in sending the services to the doorsteps of the beneficiaries.

2.8.9: Lack of information and childhood immunization status

Lack of information about immunization may also be a factor affecting the immunization coverage. Mothers and caretakers may be unaware of the need for follow up visits and also unaware of the need for their children to be vaccinated. A study conducted in the Opuwo Health District identified the lack of information as one of the factors associated with child vaccination (Taapopi, 2002). Also, a study conducted in the hard to reach areas of the metropolis of Lagos revealed that lack of information about the details of vaccination programmes contributed to approximately 41% of the failures either to receive or complete the required vaccinations (Adeiga et al., 2005). Still in Nigeria, a study conducted in rural Nigeria showed that there was a significant correlation between the mothers' knowledge of immunization and the rate of full immunization (Odusanya et al., 2008). Lack of knowledge regarding the subsequent vaccinations was also found to be one of the reasons for the partial immunization of 10% of children in the Lucknow district in India (Nath et al., 2007). In Karachi, Pakistan, it was found that approximately 14% of the mothers had children who had not been vaccinated appropriately as a result of the fact that the mothers possessed

inadequate knowledge of the immunization schedules and the need for subsequence immunizations after haven been immunized once (Siddiqi et al., 2007). Trivedi et al. (2009) reported that a lack of information (place, time, date, etc) among the parents in Surat, India was one of the major causes of dropouts from the vaccination programme. The study further reported that an unawareness regarding the need for routine immunization was the main reason for children not being vaccinated.

In both the Democratic Republic of Congo and Mozambique, most mothers recognize the health workers as the major source of information about immunization and mothers trust these health workers (Mapatano et al., 2008; Jani et al., 2008). This means that, if health workers fail in their duty to provide these mothers with the desired information, can affect the immunization status of their children.

2.8.10: Lack of motivation and childhood immunization status

Lack of motivation as regards immunization as one of the factors associated with the immunization status of children is discussed here. A study conducted by Siddiqi et al. (2007), found that mothers in peri-urban Karachi in Pakistan had refused to allow their children to be vaccinated as a result of a lack of motivation with 33% of mothers perceiving vaccination as unnecessary, 26% reporting child sickness on the due date, 26% maintaining that the vaccine made their children sick and 10% considering that their children were too weak to be vaccinated. A study conducted in the Opuwo district found that 54% of children were partially vaccinated and 30% were not vaccinated as a result of lack of motivation. Mothers and caretakers were willing to have their children vaccinated but, in view of the fact that they did not understand the benefits of vaccination, they tended to postpone taking their children for vaccinations and, thus, the children's opportunity to be vaccinated was lost (Taapopi, 2002). Adeiga et al. (2005)

reported that lack of motivation was one of the reasons advanced by mothers in Lagos, Nigeria, for their failure either to vaccinate or complete the immunization of their children with a lack of motivation accounting for 12% of the reasons for failing to immunize. Children missed being vaccinated because mothers had not being educated about the importance of immunization during the antenatal period. In the Lucknow district in India it was found that 16% of mothers had no faith in the effectiveness of vaccination and were often apprehensive as a result of illness of the child or any family member (Nath et al., 2007).

2.8.11: Vaccination side reaction and childhood immunization status

Side reaction following immunization can also affect the willingness for mothers to take their children out for immunization services. Both qualitative and quantitative studies conducted in Pakistan cited fear of the adverse effects of vaccination as a reason for children not being vaccinated. Among those mothers (43%) who had heard of possible bad effects, many mentioned the actual side effects of vaccination, including fever and also pain and swelling at the vaccination site, while others mentioned fears and misconceptions about the side effects including the fact that the child may either die or become sterile as a result of having been vaccinated (Cockcroft et al., 2009). An earlier study conducted by Taapopi (2002) found that another contributing factor to low immunization coverage was the possible reaction of children to vaccinations, including fever, pain and irritability. However, adverse reactions may discourage mothers from immunizing their children simply as a result of a lack of understanding. In other countries such as Malawi, Ethiopia, Bangladesh, the Philippines, India and the Democratic Republic of Congo it emerged that mothers understood the side effects of immunization. Some mothers viewed side effects as a normal occurrence, some

expecting them to disappear spontaneously and others believing that, it is a sign that, the vaccine was working (Mapatano et al., 2008).

2.8.12: Health facility related problems and childhood immunization status

The factors affecting immunization status that emerged from some of the older studies tended to be more logistic and administrative in nature. More recent studies, however, have also continued to support the findings that logistic and administrative problems may prevent an optimum immunization status in children. In this regard, a study conducted in the Democratic Republic of Congo indicated that health system factors such as health services barriers have a detrimental effect on immunization programmes (Mapatano et al., 2008). A study conducted in the Opuwo district found that health facility related problems influenced immunization. Some children were brought to clinics but were not vaccinated either because the clinics were closed or because there was no vaccine available at the clinic. On the other hand, other children were brought to the clinics for treatment but their child health records were not inspected by the health workers and, thus, they missed the opportunity to be vaccinated (Taapopi, 2002). A study conducted in rural Mozambique identified reasons for incomplete vaccination that were associated with health services delivery as the following: long waiting times for vaccination, no personnel on duty at the health facilities, no vaccines available on the days required, no information about the correct days for vaccination, and vaccinations not given as a result of the children being ill (Jani et al., 2008). In response to the existing and anticipated challenges to immunization services and the call for comprehensive policy guidance on vaccine preventable diseases, the World Health Organization and United Nations Children's Fund drafted a 10-year plan (2006-2015); the global immunization vision and strategies, to curtail these challenges.

2.9: Summary of literature

The literature reviewed shows that, there are differences in immunization coverages across the globe. Also, differences exist in the dropout rates and childhood immunization status among the literature reviewed. Again, according to the literature, immunization performance in different geographic areas are affected by different reasons and predicting factors. Unfortunately, the Techiman Municipal specific immunization coverage information and factors affecting immunization services are not available. It is in the light of this gap that this study sought to determine the Techiman specific information on childhood immunization coverages, immunization dropout rate, childhood immunization status and factors affecting immunization services and make it available for effective programme planning.

CHAPTER THREE

METHODOLOGY

3.1: Introduction

This chapter embodies the methodological approach to the conduct of the study. The chapter provides information about the area of study, research design and study population, sample and sampling method, method of data collection, dependent and independent variables under the study, pre-testing and ethical consideration, quality control, data analysis procedure, limitations of the study and how the study report will be disseminated.

3.2: Study area

The study was carried out in the Techiman Municipality of Brong-Ahafo Region, in the Republic of Ghana. Ghana is a tropical country situated in the west coast of Africa and located between latitudes 4° and 11º N of the equator. Ghana shares common borders with neighbouring Togo to the east, Burkina Faso to the north, and Cote d'Ivoire to the west. The South is bounded by the Gulf of Guinea. The 2010 National Housing and Population Census estimated Ghana's population as 24,658,823 with a national growth rate of 2.5%. For administrative and political purposes, Ghana is divided into 10 Regions and 216 Metropolitans/ Municipals/ District Assemblies (MMDAs) (GSS, 2013).

The Brong Ahafo Region is one of the ten Regions in the Republic of Ghana. The Region was created on 4th April 1959 out of the then Western-Ashanti Region. Brong Ahafo is the second largest region of Ghana in terms of landmass with a territorial size of 39,557.08sq.kms. The region is bordered to the north by the Northern Region, Ashanti and Western on the South, Eastern and Volta on the Southeast and east

respectively, and the Republic of La Cote d'Ivoire to the west. According to the 2010 population census, the Brong Ahafo Region has a population of about 2,310,983 with an average growth rate of 3.1 % (GSS, 2013). The Region is divided into 27 administrative units; 8 Municipalities and 19 Districts assemblies.

The Techiman Municipal Assembly is one of the 27 Municipalities/Districts in the Brong-Ahafo Region of the Republic of Ghana. The Techiman Municipality is situated in the central part of the Brong-Ahafo Region. It shares common boundaries with Techiman North District to the North, Akumadan District to the south, Nkronza North and South Districts to the East, and Wenchi Municipal and Sunyani west to the West. The Techiman Municipality has a land surface area of 649.0714sqkm. The population of the Municipality is estimated to be 166,497 projected from the 2010 population census with a growth rate of 2.3%. The Municipal population is about 6.4 percent of the Regional total population and has the highest population density of 256.5 people per square kilometer. Males constitute 48.5 percent and females represent 51.5 percent. A greater percentage of the population (64.5%) lives in urban areas as compared with 35.5 percent in the rural areas. The population of the Municipality is youthful. Settlements in the Municipality are well linked by highways and feeder roads which facilitate socio-economic activities. The Municipality has five radio stations (ASTA Fm, Winners Fm, Classic Fm, Adepa Fm, and Agyenkwa Fm) and as a result of geographical position receives MHz signals from other districts and Municipality sharing its (GSS, 2014).

In terms of social services, the Municipality is endowed with educational institutions for all the levels (basic, secondary and tertiary). There are 107 schools, 34 private and 73 public in the Municipality. There are over 200 basic schools (40% located in the urban areas while 60% are in the rural areas); 9 Senior High Schools (SHSs), six of which are

private and three are public schools (secondary technical/vocational/business colleges); two nursing training colleges and; two universities, Valley View University and University College of Education, Winneba, Techiman campus (TMHD, 2015). Health services are also provided to the inhabitants of the Municipality from a blend of health facilities in both the public and private sectors. The facilities range from health centers, Community-based Health Planning and Services Compounds (CHPS), clinics and maternity homes. In line with the ongoing decentralization of the health system, the Municipality has been demarcated into 7 sub-municipals to facilitate health services delivery. The distribution of healthcare facilities are as follows: eight (8) CHPS, five (5) Maternity Homes/Clinics, four (4) Health Centers, two (2) Private Clinics, two (2) Private Hospitals and two (2) Mission Hospitals. There is no Government Hospital in the Municipality. This means, majority of the clinical services are provided by the private and Mission Hospitals/Clinics (TMHD, 2015).

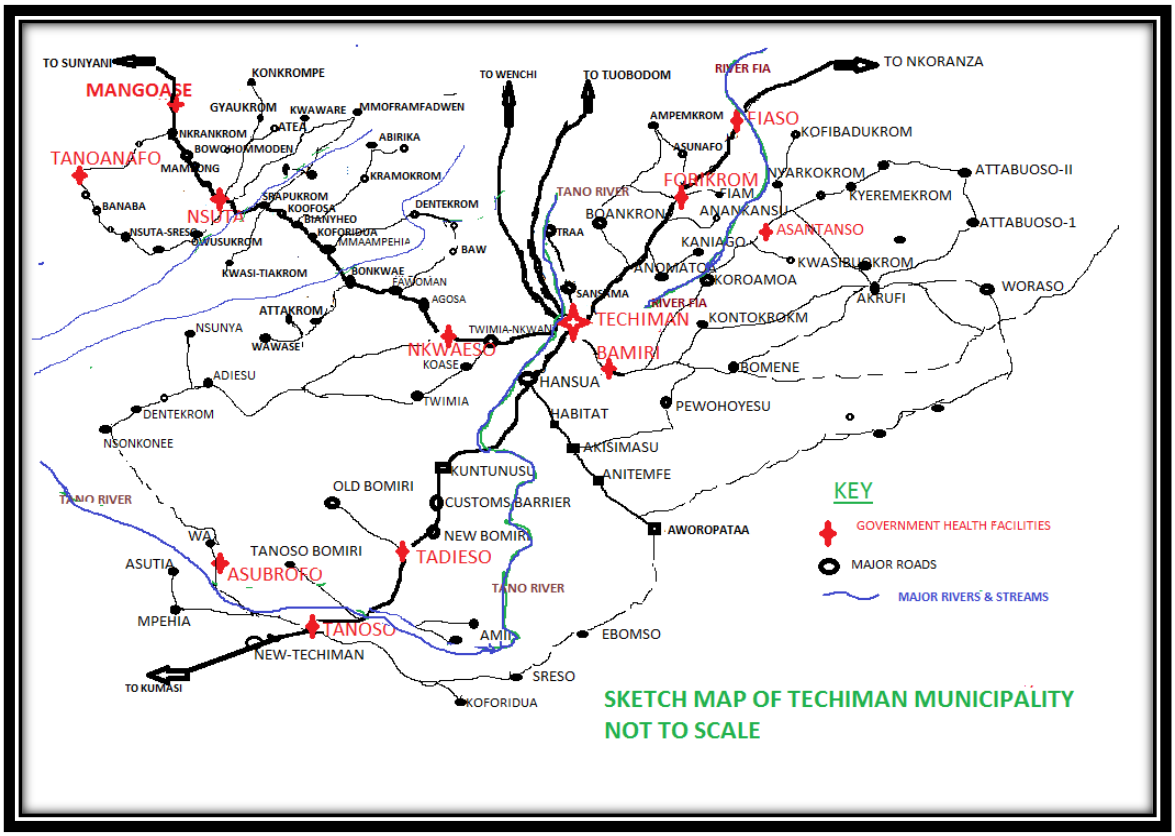

Figure 3.1: Map of Techiman Municipal

3.3: Study design

The study was a descriptive cross-sectional survey that made use of both quantitative and qualitative methods of data collection. The research design follows directly from the research questions and is also based on the actual purpose of the study. The research design refers to the set of logical steps taken by the researcher to answer the research question (Brink, 2009). This design was chosen because of its suitability in non cause-effect one time studies. The motivation for this choice of research design was based on the following; a cross-sectional analytical approach allows for the measurement of exposure and effects simultaneously (Bonita, et al., 2006). Also, the cross-sectional studies are observational in nature and are known as descriptive research. This design allows the researcher to record the information that emerges from a specific population without manipulating the variables. Accordingly, this type of research may be used to describe the characteristics that exist in a population (Trochim, 2006). Finally, the cross-sectional study design was employed in this study as it also provides a quick assessment of the strength of the relationship between a factor and a health outcome associated with the specific factor as the relationship exists within a specified population at a particular time. A cross-sectional approach represents the simplest variety of descriptive epidemiology that may be conducted on representative samples of a population.

A questionnaire was used to gather quantitative information from mothers/caregivers and the child health record cards. The presence or absence of BCG scar was also observed and recorded accordingly on the interview guide. For the qualitative data, a key Informant Interview Guide (KIIG) was used to gather information from health workers in the study area.

3.4: Study population

Study population is the entire group of persons or objects that is of interest to the researcher and which meet the criteria which the researcher wishes to investigate (Brink, 2009). It includes all members of a defined group that one is studying or collecting information on for data driven decisions. The population of the study was children from aged 12-23 months but the information was gathered from mothers/caregivers and children (BCG scar). This is in line with the WHO-EPI cluster survey recommendation that, children aged 12-23 months should be used for evaluating immunization coverage among children against vaccine-preventable diseases if the last immunization is due at nine months of age (WHO, 2005). In the case of Ghana, the last immunization according to the EPI policy is at nine months when the child receives Measles and Yellow fever vaccines.

3.5: Study Unit

The study was a household study where mothers/caregivers were the subjects for the questionnaire administration. Inclusion of mothers/caregivers in the study was done through the selection of their children who were qualified according to their age, for the study. The study was designed to unearth information about the immunization status of children and factors affecting immunization services, and since mothers/caregivers are key actors in infant immunization services, they were selected to respond to the questions on behalf of their children.

3.6: Sample size

A sample size of 600 children age 12-23 months was used for the study. This was determined through the WHO-EPI cluster sample size estimation method. The sample size was estimated using the following assumptions:

- National immunization coverage of 77% (GDHS, 2014)
- Level of statistical confidence of the estimate of 95%
- Desired precision of the estimate of ±5%
- Magnitude of differences of coverage among and within the clusters of 2. This is the standard for the WHO-EPI sample size estimation procedure.

With reference to these assumptions, the sample size was calculated using the formula:

$$N = De \times \frac{Z^2 \times p\,(1-p)}{d^2}$$

Where:

N = sample size

De = design effect, the ratio between the variance from the cluster design to the variance that would be obtained from a simple random sampling

Z = the certainty wanted expressed in the percentage point of normal distribution corresponding to the 2-sided level of significant

P = immunization coverage

d = the desired width of the confidence interval

Assuming a design effect of 2 (De = 2), confidence level of 95% with an alpha level of 5%, then Z = 1.96, immunization coverage 77% (p = 0.77) and a desired width of the confidence interval of ±5 (d = 0.05), the sample size was calculated as follows:

$$N = 2 \times \frac{(1.96)^2 \times 0.77(1-0.77)}{(0.05)^2} \qquad N = 2 \times \frac{3.8416 \times 0.77 \times 0.23}{0.0025}$$

$$N = 2 \times \frac{0.68034736}{0.0025} \qquad N = 2 \times 272.1 \qquad N = 544.2 \approx 545$$

Non response rate of 10% (0.10 × 545) = 54.5 ≈ 55.

Therefore; N = 545 + 55 = 600

Since thirty clusters were used for the study, the sample size for each cluster was;

600/30 = 20

3.7: Sampling technique

Sampling is a technical accounting device which is used to rationalize the collection of information and to choose, in an appropriate way, the restricted set of objects, persons or events, known as the sample, from which the actual information will be drawn. Sampling is a practical way in which to collect data when the population is either infinite or else extremely large, thus rendering a study of all the elements of the population impossible (Bless & Higson-Smith, 1995). The purpose of sampling is to enable a researcher to determine the characteristics of a population by directly observing a portion (or sample) of the population only.

The sampling technique used for the study was the WHO-EPI two-stage cluster sampling method. The first stage involved sampling the thirty clusters, and the second stage involved sampling the first and subsequent houses to enter in each cluster. Cluster probability proportionate to size (PPS) sampling technique was used to select the thirty clusters within which the 600 respondents were drawn for the study. This was done by first collecting list of communities and their corresponding population from the statistical department of the Techiman Municipal Assembly (TMA) to constitute the cluster sampling frame. The populations of the communities were used to generate cumulative population table called cluster identification form. A sampling interval of 5550 (a number that was used to systematically select clusters from the sampling frame) was calculated by dividing the total population (166,497) of the study communities by

the number of clusters (30), and rounded off to the nearest whole number. A random number of 4113 which is less than and had the same number of digits as the sampling interval (5550) was selected using table of random numbers.

The community in which cluster one was located was identified by locating the community in which the corresponding cumulative population first exceeded the random number. By this, the first cluster was located in wangara-line with a population of 5257. One (1) was written beside Wangara-line in the column entitled cluster number in the cluster identification form to indicate that, Wangara-line was selected as cluster number one for the study. Cluster two (2) was identified by adding the sampling interval (5550) to the random number (4113) to arrive at a figure of 9663. This figure, 9663, was used to locate Gyarko community as cluster number two the same way as 4113 was used to locate cluster number one. The third and subsequence clusters were identified by adding the sampling interval to the figure that was used to locate the previous clusters. This exercise was done systematically until all the thirty clusters were identified. At the end of this exercise, two cluster where located in Abuoso community due to its relatively high population. This community is already divided into two census clusters (Abuoso A and Abuoso B) by the statistical department for the purpose of demographic and Health Surveys. These two census clusters were assigned as the two cluster located in Abuoso community for the study.

The second stage was the selection of the first houses to enter in each cluster. Selection of starting household in each cluster was done by selecting a central location in each cluster. Directions were selected randomly by spinning a pen from the central location in each cluster. Houses lying along the directional lines where the pen was pointed in each cluster to the edge of the community were counted and numbered. A random

number from one (1) to the total number of houses counted was selected in each cluster. These were the first houses entered in each cluster. All household in each house took part in the study. Houses whose front doors were closest to the front door of the houses that have just been visited were selected until the twenty (20) children aged from 12-23 months were identified in that cluster.

In households with only one child age 12-23 months, these children automatically qualified for the study, but in households where the number of children were more than one, the WHO-EPI cluster survey recommend that, the younger child was considered for the study. This was because the records of the younger child will be more current than the others and in case of any recall, this will provide shorter duration. In few cases where there were twins, one was randomly selected to participate in the study.

Purposive sampling method was also used to sample 18 (4 management staff and 14 field workers) health staff for the qualitative key informant interview. These participants were selected because of their active role in the implementation of the Expanded Programme on Immunization in the Municipality.

3.8: Data source

Data on immunization was collected from households using child health record cards and in cases where these cards were not available or a vaccination was not recorded in the card, the mother's/caregiver's recall of vaccination was accepted. In cases of immunization failure, the reasons were gathered from mothers/caregivers. For BCG, the presence or absence of a visible scar was also used as source of information. Qualitative data was also gathered from members of the Municipal Health Management team and health staff who are providing immunization services at the sub metro levels.

3.9: Study variables

Table 3.1: Key study variable

VARIABLE	DEFINITION/CATEGORIES	MEASUREMENT SCALE
DEPENDENT VARIABLE		
Immunization status	Number of the recommended vaccines received before the age of one year (a dose of BCG, four doses of OPV, three doses each of Pentavalent and PCV-13, two doses of Rotavirus vaccine and one dose each of measles and yellow fever vaccines). This will be gotten by merging all the variables on vaccines received by children aged 12-23 months old. Categories: 1 Not immunized 2 Partially immunized 3 Fully immunized	Ordinal
INDEPENDENT VARIABLES **1. Reasons for immunization failure**		
Reasons for non-immunization	The single most important reason provided by mother/caregiver.	Nominal
2. Characteristics of child		
Sex of child	1 Male 2 Female	Nominal
3. Characteristics of mother/caregiver		
Parity	Number of children ever born: 1 1-2 2 3-4 3 5-6 4 7+	Nominal
Education	Highest educational level: 1 No formal education 2 Primary 3 JHS/MLSC 4 SHS/Technical/Vocational 5 Tertiary	Nominal
Age	Current Age in 10 year groups: 1 <19 2 20-29 3 30-39 4 40-49	Nominal

	5 50+	
Marital status	Current marital status: 1 Never married 2 Married 3 Divorce 4 separated 5 Widowed	Nominal
Ethnicity	1 Akan 2 Dagaati 3 Frafra 4 Kusaasi 5 Ewe 6 Others (specify): ……	Nominal
Religion	1 Islam 2 Christianity 3 Traditionalist 4 No religion 5 Others (specify): ……	Nominal
Occupation	Type of employment: 1 Salary worker 2 Trader 3 Farmer 4 Artisan 5 Others (specify).....	Nominal

3.10: Instrument for data collection

The World Health Organization EPI standardized semi-structured questionnaire was adopted and modified for the data collection. The questionnaire was structured to include the following; background information of children (Age and Sex), background information of mothers/caregivers (Age, Parity, Education, Ethnicity, Religion, Occupation and Marital status), and vaccination records of children, presence or absence of BCG scar and reasons for non-vaccination/partial vaccination. The instrument was reviewed and adapted according to the objectives of the study for the data collection. Key Informant Interview guide (KIIG) was also developed for the collection of qualitative data.

3.11: Instrument administration procedure

Three research teams went to the selected clusters (ten clusters per a research team) to introduce themselves to the community members and to collect the data. Upon entering the community, the researchers sought consent to conduct the study from the opinion leaders in the various clusters. The researcher moved from house to house in order to collect information. Upon entering the specific household, the researchers sought permission to conduct the interview from household head, as well as the informed consent of the individual respondents before conducting the interviews. The researchers interviewed 600 mothers/caregivers of both immunized and non-immunized children aged between 12 and 23 months. The face-to-face method of data collection was employed for the study. Information was gathered in four ways;

1. Recording vaccinations received by children. The dates when children receive vaccinations are normally recorded in the child's health record cards. These dates were transferred onto the data collection instrument. In cases where dates were not available on the cards but mothers/caregivers were able to recall that, the particular vaccine was given, the symbol, (+) was recorded onto the data collection instrument to indicate that, the information on that vaccination was gotten through history from mother/caregiver. The symbol (0) was recorded when the child had missed a particular vaccine.

   For crude immunization status, the child was considered fully immunized if the child had received fifteen doses of the EPI vaccines (one dose each of BCG, measles and yellow fever vaccines, two doses of Rotavirus vaccine, three doses each of Pentavalent PVC-13 vaccines and four doses of Polio vaccine) by the time of the study. Those who had missed any vaccine out of the fifteen vaccines were described as partially immunized and those children who had not received any vaccine were

defined as not immunized. On the other hand, a child's immunization status was described as valid immunization status if the child had receive all the fifteen vaccine doses before attaining his/her first birth date.

2. Observing child's right-upper arm for the presence or absence of BCG scar.
3. Interviewing mothers/caregivers on background information and when there is an immunization failure, elicit reasons from mothers/caregivers. The primary respondent was the mother of the child and in cases where the mothers were absence, the one directly taking care of the child acted as the respondent.
4. Lastly, Key Informant Interviews were conducted with health staff (both management and field workers) on implementation and assessment of the EPI programme in the Municipality.

3.12: Data analysis and presentation of results

After completing all portions of the data collection tools, data was entered into the SPSS version 17.0 software for analysis. Data entry, cleaning, processing, preliminary analysis was done by the researcher with assistance from a statistician and the final write-up done by the researcher. The SPSS software was used to generate frequency tables after the data entry to check for mission data and other wrong entries for data cleaning purpose. All identified irregularities were corrected. Another frequency tables were generated to confirm that, the data cleaning process was complete.

Data was analyzed according to the background of study participants and the various objectives of the study. With regards to the background of the study participants, tables and pie charts were used to present the information according to characteristics of mothers/caregivers, characteristics of children and characteristics of health staff. A small narration about each table or graph was used to highlight key findings from the

study. With regards to the objectives of the study, tables were used to present data on objective one (EPI vaccines coverages among children 12-23 months in the Techiman Municipality) and objective two (immunization status among children 12-23 months in the Techiman Municipality). Bar chart was also used to present the information on objective three (dropout rate among children 12-23 months in the Techiman Municipality).

Frequency table and binary regression analysis were used for objective four (factors affecting immunization status among children 12-23 months in the Techiman Municipality). Possible reasons for immunization failure were itemized and categorized under three broad categories; lack of information, lack of motivation and other obstacles. Findings from mothers/caregiver recall were analyzed using the SPSS software version 17.0 and presented using a simple frequency table.

The immunization status of children was dichotomized (fully immunized and not fully immunized; where the not fully immunized include partially immunized and not immunized). The socio-demographic characteristics of respondent were also recorded as binary variables. The data was then imported into STATA for the binary regression analysis. The P-value that was considered to indicate statistical significant was <0.05.

3.13: Training

Six data collection staff were recruited and trained for data collection. The data collectors were second year students of the Environmental Health Training School, Tamale who reside in the study area. The theoretical aspect of the training took a whole day (27/01/2016) and the next day (28/01/2016) was used for practical. Samples of child health records cards were used for the practical training. The training was

conducted for data collectors to familiarize themselves with the data collection tool and also to standardize data collection procedure. The training content broadly included; understanding the data collection tool, community entry/exit skills, selection of households, selection of study subjects, interview and recording skills and lastly, proper handling of completed data.

3:14: Quality control

It is the aim of every researcher to produce quality research and to obtain research results that are meaningful, that reflect reality as accurately as possible and which are replicable (Brink, 2009). Thus, in this study, the researcher employed specific measures to ensure the validity of the data collection instrument. The validity test seeks to assess the degree to which the instrument covers the scope and range of information that it sought. Existing literature were reviewed to guide the construction of the instrument. The instrument was submitted to two colleagues of the researcher and also the research supervisor for them to evaluate the questions in relation to the objectives of the study. Their input ensured that the questions did actually assess the test characteristics which the researcher had identified.

The six data collectors were put into three groups of two persons each. This was to allow one to do the entries while the other watches out for any opportunity of data collection or entry errors. The completed data collection tools were immediately handed over to the researcher at the completion of each cluster. The researcher immediately checked for completeness and consistency of information recorded. This was done to check for missing data, and correct any possible mistakes, in order to avoid deviations and errors in the data collected. Portions left for completion by the researcher were also completed immediately. The completed data collection tools were kept by the

researcher, ready for data entry, processing and analysis. Data entry started immediately after the thirty clusters were completed.

One of the quality issues of this research is also built in the sample size used. According to the WHO-EPI cluster survey methodology, which is the gold Standard for the immunization coverage evaluation survey, the required sample size usually taken is 210 (assume immunization coverage of 50% and a precision ±10); but this study took a precision of ±5% instead of the ±10 and a coverage of 77% (GDHS, 2014) instead of the 50% to achieve a sufficient large sample size of 600 respondents.

3.15: Pre-testing

Pre-testing was done on the 29th of January, 2016 (a day after the practical training session). The data collectors were put in three groups of two persons each to pre-test the data collection procedure. After the exercise, some interpretations were further clarified. The pre-test also helped to determine approximately how long it will take to interview a respondent. The pre-testing was done in three communities (Twimia, Koofoso and Site) in the study setting which were not parts of the clusters drawn for the actual study. The pre-test communities were chosen in this way so as to avoid bias which may arise in case same respondents who participated in the pre-testing are re-sampled in the actual study. The sample size for the pre-test was fifteen (15); thus, 5 for each of the three groups.

3.16: Ethical Considerations

A research project is a process which has ethical implications. However, the researcher conducted this research taking into consideration the ethical issues. The following three

fundamental ethical principles guided the researcher; respect for persons, respect for beneficence and respect for justice. These principles are based on the human rights that must be protected during any research project, including the right to self-determination, privacy, anonymity, confidentiality, fair treatment and protection from discomfort and harm. In this study the research participants were all informed that they had right to withdraw from the study at any time, the right to refuse to provide information and the right to ask for clarification regarding the study.

An introductory letter (Appendix III) was obtained from the University for Development Studies. This letter was presented to the Techiman Municipal director of Health Services. The Municipal director of Health services upon receipt of the introductory letter also wrote a letter (Appendix IV) to grant the researcher permission to undertake the study. Verbal consents were obtained from the chiefs in the study communities and finally informed consent was sought from the study respondents before administration of the data tool. In order to ensure confidentiality, the researcher made sure that no information provided by a participant during the course of the study was either divulged or made available to any person other than the supervisor of the study. In addition, the completed dissertation did not mention any of the participant's names.

1.17: Limitations of the study

In the data collection process, mothers/caregivers to children who defaulted were asked to give reason for the default, thus, recall bias was possible in the study. It was assumed that all the respondents would understand and answer the questions correctly, but since questions were interpreted by different data collectors, homogeneity in understanding

and responding the same way could not be granted. Finally, the results of the study cannot be generalized due to geographical and managerial differences.

1.18: Plan for dissemination of results

Dissemination of findings/ results is a key component of the study. This will ensure that, the findings become available and accessible to everybody especially the Techiman Municipal Health Directorate and the academic community for the implementation of the recommendations and as a source of literature for further studies. The final thesis is provided to the Techiman Municipal health directorate and a copy put in the library of the University for Development Studies. With assistance from the research supervisor, the final thesis is considered for writing manuscript(s) for publication in recognized scientific journals. The findings are also to be presented at meetings and seminars, conference and events as and when necessary in other that it benefits all stakeholders.

CHAPTER FOUR

RESULTS

4.1: Introduction

This chapter reports on the key findings from the study. The study data was gathered from the 30/01/2016 – 20/02/2016 among 600 children aged 12 - 23 months. Also, key informant interviews were conducted among 18 health staff (4 management and 14 health workers).

Information on immunization coverage was obtained in two ways; from children immunization cards and from mothers'/caregivers' verbal reports. All mothers/caregivers were asked to show the interviewer the child health record card on which immunization dates are recorded. If the card was available, the interviewer then recorded from the card the dates of each immunization received. In cases in which the immunization card indicated the child had not received all vaccinations, the mother/caregiver was then asked whether the child had received other vaccinations that were not recorded on the card, and, if so, they too were recorded. If there was no immunization card, or if the mother/caregiver was unable to show the card to the interviewer, the child's immunization information was based on the mother's/caregiver's recall. The results are organized according to the study objectives.

4.2: Socio-demographic characteristics of respondents

This section reports on the characteristics of respondents involved in the data collection. The section is subdivided into three sections comprising characteristics of mothers/caregivers, characteristics of children and characteristics of health staff.

4.2.1: Characteristics of mothers/caregivers

The study sought to establish what proportion of respondents were the biological mothers of study sampled children. The information gathered is presented in Figure 4.1. As depicted in Figure 4.1, majority of the respondents were the biological mothers of the sampled children where as just a few (10%, n = 60) were caregivers.

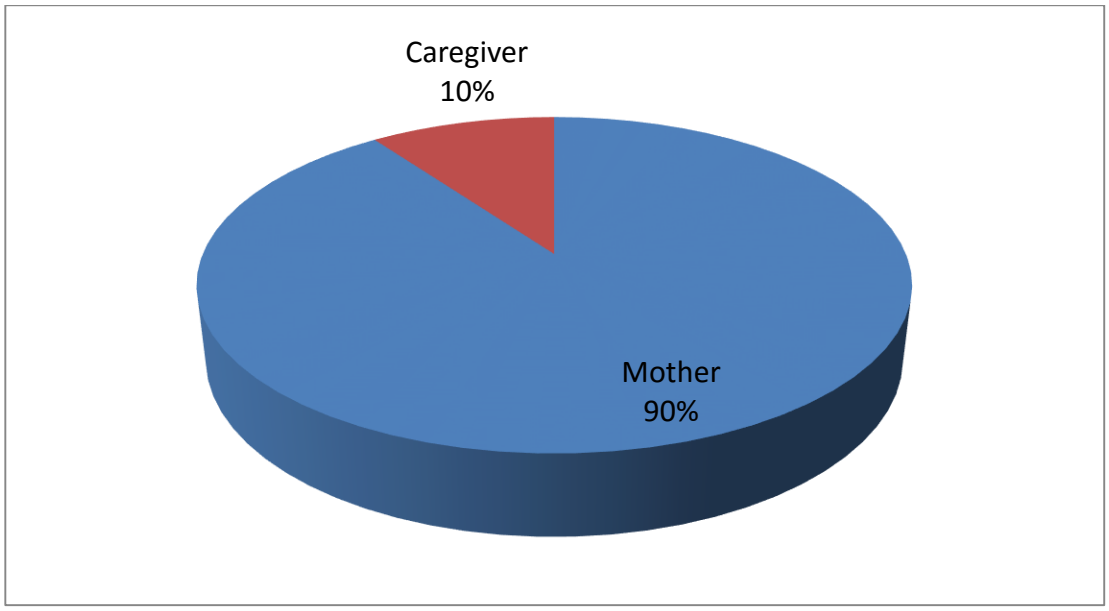

Figure 4.1: Relationship between respondents and children (12-23 months) in the Techiman Municipality, 2016

Parity (children ever born) of mothers is presented in Figure 4.2. Figure 4.2 indicates that, majority of the respondents have ever given birth one or two (1-2) times followed by mothers who have ever given birth three or four (3-4) times. The result also shows that, few respondents have ever given birth to seven or more children.

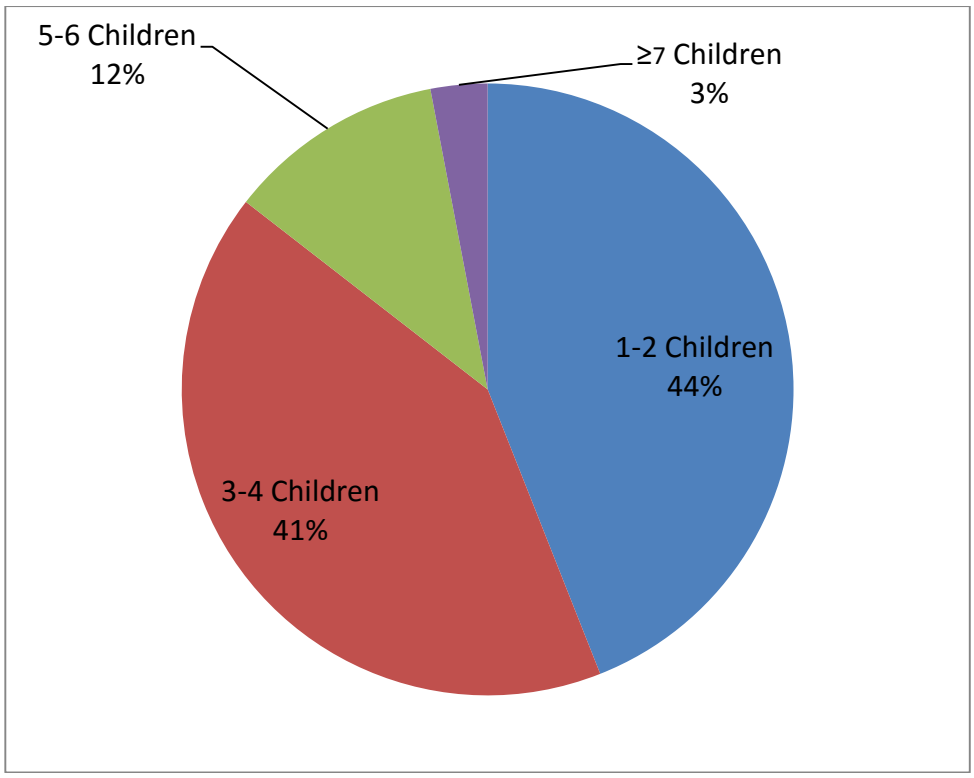

Figure 4.2: Parity of mothers in the Techiman Municipality, 2016

Other socio-demographic characteristics of mothers/caregivers are presented in Table 4.1. Table 4.1 represents educational level (highest level ever attained), age in completed years, marital status, ethnicity, religious affiliation and occupation of the respondents.

Table 4.1 shows that, majority of the study participants had attained JSS or middle school as their highest education followed by respondents who attained the primary school as their highest education. A sizable proportion of the respondents never had any formal education but few respondents were able to attain SHS and tertiary levels. In the age group categorization, majority of the respondents were within the age group of 20-29 years and closely followed by respondents within the age group of 30-39. The age group that recorded the least respondents was 50 and above (≥50).

Majority of the respondents were married and staying together but an appreciable proportion was never married women. Close to 1/5 of the respondents reported married but separated from their spouses. Few respondents were divorced mothers and only three were widows. With regards to ethnicity, majority of the respondents were Akans followed by Dagaati, Kusaasi and then Frafra. Ewe and Dagomba had the same representations. The category labeled others (Gurisi - 4, Krobo – 3, Wangara – 3, Sisaala – 3, Gruma – 1 and Fulani – 1) represented the least respondents' category.

About 67% of the respondents were Christians followed by Muslims. Only 1% of the study participants are Traditionalists. Six percent of the respondents also reported not to have any religion. Close to about half of the respondents were traders and a little above 1/5 was farmers. The category that recorded the least respondents was housewife followed by salary workers.

Table 4.1: Other socio-demographic characteristics of mothers/caregivers in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Education	No formal education	111	18.5
	Primary school	126	21.0
	JSS/Middle school	252	42.0
	SHS	66	11.0
	Tertiary	45	7.5
	Total	**600**	**100.0**
Age	<19 years	57	9.5
	20-29 years	225	37.5
	30-39 years	219	36.5
	40-49 years	66	11.0
	≥50	33	5.5
	Total	**600**	**100.0**
Marital status	Never married	144	24.0
	Married	312	52.0
	Divorce	27	4.5
	Separated	114	19.0
	Widowed	3	0.5
	Total	**600**	**100.0**
Ethnicity	Akan	282	47.0
	Dagaati	102	17.0
	Frafra	57	9.5
	Kusaasi	66	11.0
	Ewe	39	6.5
	Dagomba	39	6.5
	Others*	15	2.5
	Total	**600**	**100.0**
Religion	Islam	153	25.5
	Christianity	405	67.5
	Traditionalist	6	1.0
	No Religion	36	6.0
	Total	**600**	**100.0**
Occupation	Salary worker	63	10.5
	Trader	258	43.0
	Farmer	132	22.0
	Artisan	99	16.5
	Housewife	48	8.0
	Total	**600**	**100.0**

Others* = (Gurisi - 4, Krobo – 3, Wangara – 3, Sisaala – 3, Gruma – 1 and Fulani – 1)

In the data collection process, respondents were asked to show their child's health record card to the data collection staff. The data gathered was analyzed into two categories; those who possess the card and those who don't. The information is represented in Figure 4.3. The information in Figure 4.3 depicts that, majority of the respondents possess the card and presented for data collection but just some few (3%, n = 18) could not produce the children's immunization cards but provided recall of child immunization history.

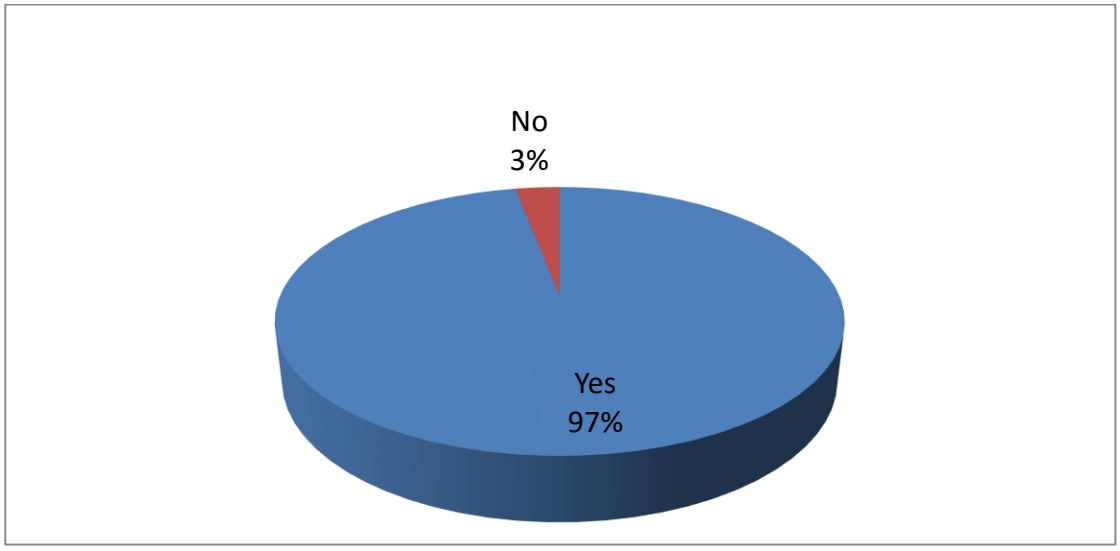

Figure 4.3: Possession of immunization card in the Techiman Municipality, 2016

4.2.2: Characteristics of children 12-23 months

Background characteristics data on sex and age of survey children were collected and analyzed. Information on the sex of sampled children is presented in Figure 4.4. Figure 4.4 shows that, sex composition of the study children was almost the same with the male just 1% above the females.

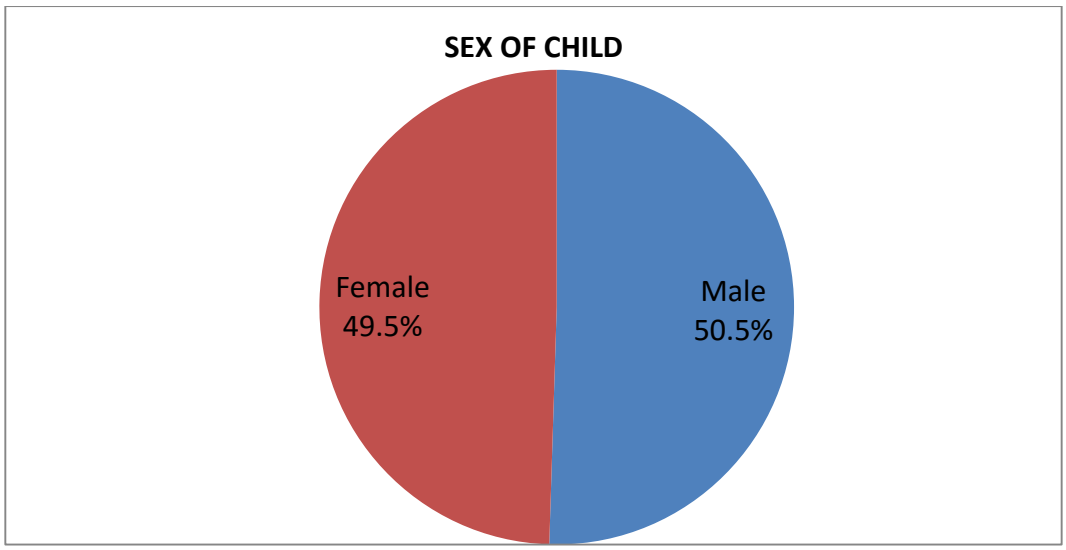

Figure 4.4: Sex of children (12-23 months) in the Techiman Municipality, 2016

The study group comprise of children aged 12 – 23 months. The results on age of children was analyzed according to age in completed months and presented in Table 4.2. As shown in Table 4.2, majority of the children were within the age group 18-20 months whiles about 17% of the children were within the age group 21-23 months.

Table 4. 2: Age of children (12-23 months) in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Age in complete months	12-14 months	158	26.3
	15-17 months	146	24.3
	18-20 months	195	32.5
	21-23months	101	16.9
	Total	**600**	**100.0**

Mean age = 17.18 and Median age = 17

4.3: Immunization coverage

Immunization coverage data was analyzed according to the various vaccines together with the place where the immunizations where provided. The immunization coverage analysis on the various vaccines provides information on coverages using only the

children's health records cards as evidence, coverages using respondent's recall (history) as evidence and coverages using card plus history. With regards to place of immunization, data was grouped into static or outreach immunization sites. Result on BCG immunization is presented in Table 4.3. BCG immunization is supposed to be given once, that is, at birth or any other time within the first year of the child's birth. Table 4.3 shows that, BCG immunization coverage based on card plus history was 97.5% with majority of the information from the immunization cards and few from recall of immunization history. About 3% of all children studied did not receive the vaccine. About 88% of children were immunized through the static immunization services. Majority of the children had evidence of BCG immunization scar on their right upper arm with some few who were not haven.

Table 4.3: BCG immunization coverage among children age 12 – 23 months in the Techiman Municipality

Variable		Frequency	Percentage (%)
BCG coverage	Card only	570	95.0
*CPH =97.5	History only	15	2.5
	Not immunized	15	2.5
	Total	**600**	**100.0**
BCG Immunization site	Static	531	88.5
	Outreach	54	9.0
	Not immunized	15	2.5
	Total	**600**	**100.0**

**CPH = Immunization coverage based on Card plus history*

The result on BCG immunization status and formation of scar was further analyzed and presented in Table 4.4. Table 4.4 indicates that, majority of the children who were immunized had proof of BCG immunization scar but just a few of them even though

immunized, did not show proof of any visible scar. All children who were not immunized with the BCG vaccine did not also have any BCG immunization scar.

Table 4.4: BCG immunization status and BCG scar among children age 12 – 23 months in the Techiman Municipality, 2016

			BCG SCAR		
			Yes	**No**	**Total**
BCG COVERAGE	Given (Card)	Count	543	27	570
		% within BCG COVERAGE	95.3%	4.7%	100.0%
	Given (History)	Count	12	3	15
		% within BCG COVERAGE	80.0%	20.0%	100.0%
	Not given	Count	0	15	15
		% within BCG COVERAGE	.0%	100.0%	100.0%
Total		**Count**	**555**	**45**	**600**
		% within BCG COVERAGE	**92.5%**	**7.5%**	**100.0%**

Data collected on children immunization status with regards to the pentavalent vaccine is presented in Table 4.5. Pentavalent vaccine is supposed to be given three consecutive times (pentavalent 1 at 6 weeks, pentavalent 2 at 10 weeks and pentavalent 3 at 14 weeks following the birth of the child) to produce the required immunity in the beneficiary children. Table 4.5 indicates that, close to hundred percent of the children were immunized with Pentavalent -1 and pentavalent -2 but Pentavalent -3 coverage on the other hand, dropped by 5% from that of the Pentavalent -1 coverage. Some few children missed the pentavalent vaccine doses 1 and 2 but 6.0% (n = 36) missed the pentavalent -3 vaccine dose. Regarding the immunization site for pentavalent immunization, majority of children who received pentavalent-1, 2 and 3, had their immunization through the outreach service delivery sites with some few of them been immunized at static points.

Table 4.5: Pentavalent Immunization coverage among children age 12 – 23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Penta 1 coverage	Card only	579	96.5
*CPH = 99.0%	History only	15	2.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
Penta1 immunization site	Static	111	18.5
	Outreach	483	80.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
Penta 2 coverage	Card only	582	97.0
*CPH = 99.0%	History only	12	2.0
	Not immunized	6	1.0
	Total	**600**	**100.0**
Penta 2 immunization site	Static	87	14.5
	Outreach	507	84.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
Penta 3 coverage	Card only	555	92.5
*CPH = 94.0%	History only	9	1.5
	Not immunized	36	6.0
	Total	**600**	**100.0**
Penta 3 immunization site	Static	63	10.5
	Outreach	501	83.5
	Not immunized	36	6.0
	Total	**600**	**100.0**

**CPH = Immunization coverage based on Card plus history*

Result of the analysis on children immunization status with regards to the OPV vaccine is presented in Table 4.6. OPV vaccine is supposed to be given four consecutive times (OPV 0 at birth or within the two weeks after birth, OPV 1at 6 weeks, OPV 2 at 10 weeks and OPV 3 at14 weeks following the birth of the child) to produce the required immunity in the beneficiary children. Table 4.6 shows that, the highest coverage was recorded by OPV- 1 and OPV- 2 followed by OPV- 0. OPV- 3 dropped from OPV- 1 with a margin of 5%.

Table 4.6: OPV Immunization coverage among children age 12 – 23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
OPV 0 coverage	Card only	540	90.0
*CPH = 97.0%	History only	42	7.0
	Not immunized	18	3.0
	Total	**600**	**100.0**
OPV 0 immunization site	Static	495	82.5
	Outreach	87	14.5
	Not immunized	18	3.0
	Total	**600**	**100.0**
OPV 1coverage	Card only	579	96.5
*CHP = 99.0%	History only	15	2.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
OPV 1 immunization site	Static	117	19.5
	Outreach	477	79.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
OPV 2 coverage	Card only	582	97.0
*CPH = 99.0%	History only	12	2.0
	Not immunized	6	1.0
	Total	**600**	**100.0**
OPV 2 immunization site	Static	87	14.5
	Outreach	507	84.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
OPV 3 coverage	Card only	555	92.5
*CPH = 94.0%	History only	9	1.5
	Not immunized	36	6.0
	Total	**600**	**100.0**
OPV 3 immunization site	Static	63	10.5
	Outreach	501	83.5
	Not immunized	36	6.0
	Total	**600**	**100.0**

**CPH = Immunization coverage based on Card plus history*

Some few children missed the OPV vaccines with majority of these children defaulted in the OPV- 3 dose. Regarding the immunization site for OPV immunization, majority

of children who received OPV- 0, did so at the static centers as opposed to OPV- 1, OPV- 2 and OPV- 3, where majority of the children received their immunizations at the outreach service delivery points.

Immunization against childhood pneumonia using the PCV-13 vaccine is also supposed to be given three consecutive times (PCV-13 1 at 6 weeks, PCV-13 2 at 10 weeks and PCV-13 3 at14 weeks following the birth of the child) to produce the required immunity in the beneficiary children. The result of the PCV-13 immunization coverage is presented in Table 4.7. Table 4.7 indicates that, the coverages for both PCV-13 -1 and PCV-13 -2 were high and also indicated no dropout between them but PCV-13 -3 coverage on the other hand, dropped by 4.8% from that of the PCV-13 -1 coverage. Some few children missed the PCV-13 vaccine doses 1 and 2 but 6.3% (n = 38) missed the PCV-13 -3 vaccine dose. Regarding the immunization site for PCV-13 immunization, majority of children who received PCV-13 -1, 2 and 3, had their immunization through the outreach service delivery sites with the fewer of them been immunized at static points.

Table 4.7: PCV-13 Immunization coverage among children age 12 – 23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
PCV – 13-1 coverage	Card only	579	96.5
*CPH = 98.5%	History only	12	2.0
	Not immunized	9	1.5
	Total	**600**	**100.0**
PCV–13-1 immunization site	Static	111	18.5
	Outreach	480	80.0
	Not immunized	9	1.5
	Total	**600**	**100.0**
PCV – 13-2 coverage	Card only	582	97.0
*CPH = 98.5%	History only	9	1.5
	Not immunized	9	1.5
	Total	**600**	**100.0**
PCV–13-2 immunization site	Static	87	14.5
	Outreach	504	84.0
	Not immunized	9	1.5
	Total	**600**	**100.0**
PCV – 13-3 coverage	Card only	553	92.2
*CPH = 93.7%	History only	9	1.5
	Not immunized	38	6.3
	Total	**600**	**100.0**
PCV–13-3 immunization site	Static	63	10.5
	Outreach	499	83.2
	Not immunized	38	6.3
	Total	**600**	**100.0**

**CPH = Immunization coverage based on Card plus history*

The Expanded Programme on Immunization schedule includes two vaccine doses of Rotarix against diarrhoea caused by the Rotavirus (Rotarix 1 at 6 weeks and Rotarix 2 at 10 weeks). Immunization performance with Rotarix from the survey findings is presented in Table 4.8. Table 4.8 shows that, the immunization coverage for both Rotarix 1 and Rotarix 2 using the card plus history result is the same (99%). Children who were immunized using card only as source were a little higher in Rotarix 2 than in Rotarix 1. For both Rotarix 1 and Rotarix 2 immunizations, majority of the children

were immunized through the outreach service delivery while the other few were also immunized at static centers.

Table 4.8: Rotarix Immunization coverage among children age 12 – 23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Rotarix 1 coverage	Card only	579	96.5
*CPH = 99.0%	History only	15	2.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
Rotarix 1 immunization site	Static	114	19.0
	Outreach	480	80.0
	Not immunized	6	1.0
	Total	**600**	**100.0**
Rotarix 2 coverage	Card only	582	97.0
*CPH = 99.0%	History only	12	2.0
	Not immunized	6	1.0
	Total	**600**	**100**
Rotarix 2 immunization site	Static	87	14.5
	Outreach	507	84.5
	Not immunized	6	1.0
	Total	**600**	**100.0**

**CPH = Immunization coverage based on Card plus history*

Measles and yellow fever vaccines are both given once, that is, at the age of nine months to mark the time where a child should have receive all the fifteen recommended vaccine doses {BCG (1 dose), OPV (4 doses), Pentavalent (3 doses), PCV-13 (3 doses), Rotarix (2 doses), Measles (1dose) and Yellow fever (1 dose)} in the Expanded Programme on Immunization schedule. The immunization coverages for Measles and Yellow fever vaccines as findings from the survey are illustrated in Table 4.9. From Table 4.9, immunization coverages for both Measles and Yellow fever using information from children immunization cards and recall from mothers or caregivers were the same (92%). An appreciable number of children 8.0% (n = 48) were not immunized in both situations. In both Measles and Yellow fever immunizations,

majority of the children who were immunized did so through the outreach immunization service delivery sites.

Table 4.9: Measles and Yellow fever Immunization coverages among children age 12 – 23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Measles coverage	Card only	537	89.5
*CPH = 92.0%	History only	15	2.5
	Not immunized	48	8.0
	Total	**600**	**100.0**
Measles immunization site	Static	120	20.0
	Outreach	432	72.0
	Not immunized	48	8.0
	Total	**600**	**100.0**
Yellow fever coverage	Card only	537	89.5
*CPH = 92.0%	History only	15	2.5
	Not immunized	48	8.0
	Total	**600**	**100.0**
Yellow fever immunization site	Static	123	20.5
	Outreach	429	71.5
	Not immunized	48	8.0
	Total	**600**	**100..00**

**CPH = Immunization coverage based on Card plus history*

4.4: Immunization status

Immunization status is measured in two ways; the crude immunization status and the valid immunization status. Crude immunization status is a measure of children who have completed all the EPI scheduled vaccine doses by the time of the survey while the valid immunization status is a measure of children who have completed the EPI scheduled vaccines before their first birth date. For the crude immunization status, fully immunized means proportion of children who have receive all the EPI schedule vaccine doses by the time of the survey regardless of when it was given. Partially immunized means proportion of children who have receive some of the EPI vaccine doses but not

all by the time of the survey and finally, not immunized means proportion of children who have never receive any of the EPI vaccine doses by the time of the study. Information regarding immunization status of children is organized in Table 4.10.

With respect to the crude immunization status, Table 4.10 shows that, majority of the children were fully immunized and about 10% partially immunized. One out of hundred children never received any of the immunizations by the time of the survey. In the valid immunization status analysis, about 73% of all children surveyed were fully immunized before their first birth date while the rest were either; not immunized, partially immunized or fully immunized but after the first birth date. Seventeen percent (89.5% - 72.5% = 17.0%) of children where fully immunized after their first birth dates.

Table 4.10: Immunization status among children age 12 – 23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Crude immunization status	Fully immunized	537	89.5
	Partially immunized	57	9.5
	Not immunized	6	1.0
	Total	**600**	**100.0**
Valid immunization status	Fully immunized before one year	435	72.5
	Fully immunized after one year	102	17.0
	Not fully immunized	63	10.5
	Total	**600**	**100.0**

4.5: EPI dropout rate

The survey findings was analyzed to show the proportion of children who started the immunization with the initial vaccine doses but dropped out before completing the schedule. The results looked at the dropout rate for the entire EPI schedule by using

BCG as the entry vaccine and Measles as the exit vaccine. Further to this, the report also analyzed immunization dropout rates for the vaccines that are given more than one dose in the EPI schedule (Multi-dose vaccines). The findings of the dropout rates analysis is presented in Figure 4.5.

Figure 4.5 indicates that, OPV 0 to OPV 3 dropout rate is about 3% which is lower than the dropout rate between OPV 1 and OPV 3, but the dropout rates between OPV 1 and OPV 3 and that of Pentavalent 1 to pentavalent 3 are the same. The dropout rate for the PCV-13 vaccine (PCV-13 1 to PCV-13 3) is slightly lesser than that of the OPV and pentavalent dropout rates but Rotarix 1 and Rotarix 2 coverages indicate no dropout. For the entire EPI scheduled, about 5.6% (n = 33) children who started with BCG immunization could not end up with the Measles vaccine.

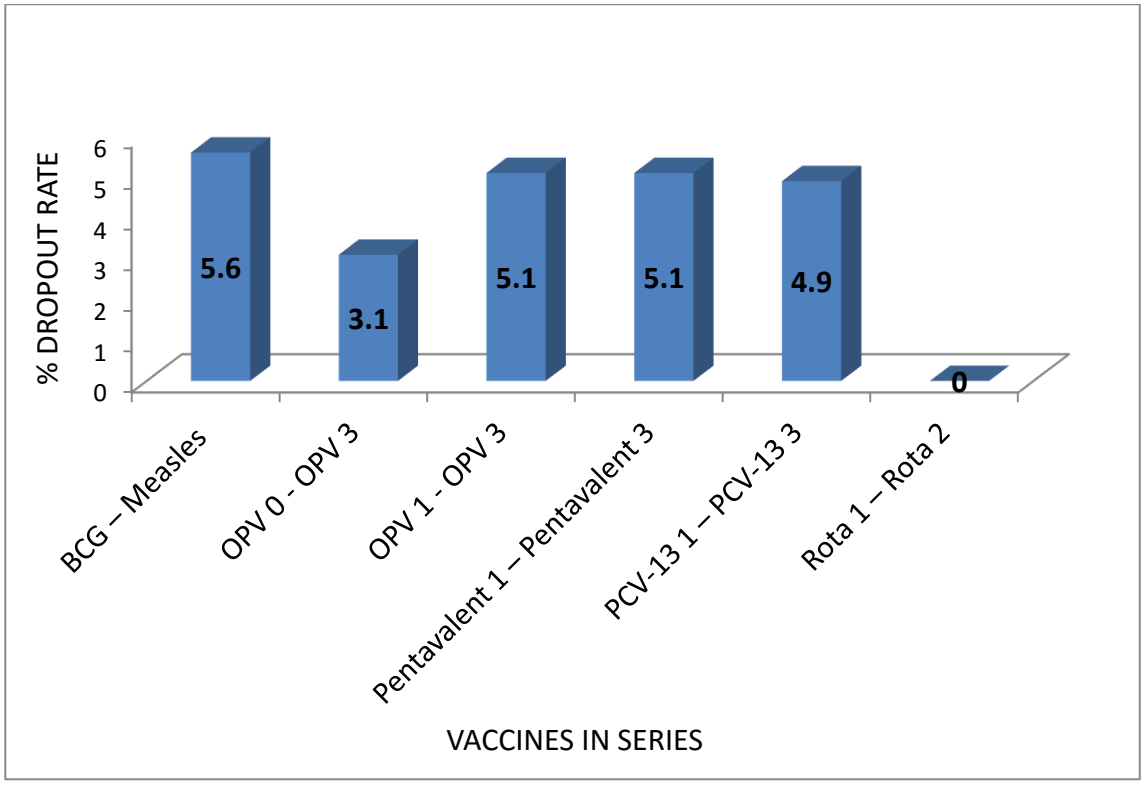

Figure 4.5: Immunization dropout rates among children 12-23 months in the Techiman Municipality, 2016

4.6: Factors affecting immunization status among children 12 – 23 months

4.6.1: Mother/Caregiver's recall

One major reason each for immunization failure was gathered from mothers or caregivers of the sixty three (63) children who defaulted (57 partially immunized and 6 not immunized) from the immunization services. Information received from mothers or caregivers is illustrated in Table 4.11. In Table 4.11, about 57% of the defaulted mothers responded that, the reason for the failure was that, the time schedule for immunization services was inconvenient. About 14% said the place of immunization was not known and those mothers or caregivers who were too busy to have taken their children to immunization services sites were also about the same 14%. The category of reasons that had the fewer respondents was vaccine not available.

Table 4.11: Reasons for immunization failure among children 12-23 months in the Techiman Municipality, 2016

Variable		Frequency	Percentage (%)
Lack of information	Place of immunization unknown	9	14.3
	Fear of side reaction	3	4.8
Obstacle	Time of immunization inconvenient	36	57.1
	Child ill	4	6.3
	Mother too busy	9	14.3
	Vaccine not available	2	3.2
Total		**63**	**100.0**

4.6.2: Regression analysis on factors that influence immunization status

Table 4.12 show predictors of immunization status in the study area. In the binary multivariate analysis, factors found to be statistically significant with immunization status were education, marital status, religion, occupation, sex of child and possession of immunization card. Children from formal educated mothers (OR=0.97, 95%CI 0.46-2.07; and p<0.001) are more likely to complete their immunization schedule than

children from no formal education mothers. Children from married mothers (OR=0.31, 95%CI 0.15-0.62; and p=0.001) are more likely to complete their immunization schedule than children from unmarried mothers. Also, children from Christian mothers (OR=0.27; 95%CI 0.13-0.91; and p<0.001) are more likely to complete their immunization schedule compared to children from non-Christian mothers. Children from salary work mothers (OR=0.34, 95%CI 0.16-0.67; and p=0.041) are more likely to complete their immunization schedule than children from non salary work mothers. Male children are less likely to complete their immunization schedule compared to female children (OR=0.05; 95%CI 0.26-0.91; and p=0.024). Children without immunization cards (OR=50.3; 14.40-175.92; and p<0.001) are less likely to complete their immunization schedule compared to those who possessed it.

Table 4.12: Binary regression of immunization status and socio-demographic characteristics of respondents

Variables	OR (Univariate) (95% CI)	P-value	OR (Multivariate) (95% CI)	P-value
Age of respondent				
≤19 years	1.0		1.0	
> 19 years	0.59 (0.27-1.27)	0.175	0.45 (0.18-1.14)	0.093
Relationship to child				
Mother	1.0		1.0	
Not mother	0.94 (0.39-2.29)	0.894	0.83 (0.32-2.17)	0.704
Parity				
1-2 children	1.0		1.0	
>2 children	1.31 (0.76-2.24)	0.319	1.38 (0.71-2.68)	0.342
Education status				
No formal education	1.0		1.0	
Formal education	0.70 (0.37-1.29)	0.073	0.97 (0.46-2.07)	**<0.001**
Marital status				
Not married	1.0		1.0	
Married	0.66 (0.39-1.12)	0.127	0.31 (0.15-0.62)	**0.001**
Ethnicity				
Akan	1.0		1.0	
Not Akan	1.21 (0.71-2.04)	0.487	0.62 (0.31-1.27)	0.192
Religion				
Not Christian	1.0		1.0	
Christian	0.49 (0.29-0.83)	**0.008**	0.27 (0.13-0.91)	**<0.001**
Occupation				
Non Salary workers	1.0		1.0	
Salary workers	0.56 (0.34-1.02)	0.127	0.34 (0.16-0.67)	**0.041**
Child sex				
Male	1.0		1.0	
Female	0.60 (0.35-1.02)	0.058	0.50 (0.26-0.91)	**0.024**
Possession of Imm. card				
Yes	1.0		1.0	
No	20.82 (7.50-57.82)	**<0.001**	50.3 (14.40-175.92)	**<0.001**

4.7: Findings from Key Informant interview

4.7.1: Characteristics of health staff interviewed

As part of the study, key informant interviews were conducted among eighteen (18) health staff. The Municipal Director of Health Services, the Municipal Public health Nurse, the Municipal Disease Control Officer and the Municipal Health Information Officer were the management staff and 14 other health workers (4 Physician Assistants, 3 Midwifes, 2 Field Technicians and 5 Community Health Nurses) was drawn for the study. Data on the background characteristics of the health staff participants was analyzed manually and presented in Table 4.13.

Table 4.13 indicates that, majority of the health staff interviewed have had more than 10 years working experience in the Ghana Health Service . Only 11.1% (n = 2) have had less than five years working experience in the Ghana health service. All the staff interviewed has had some working experience with the Expended Programme on Immunization before. Two quarters of the respondents have more than 10 years working experience with the programme. One-sixth each of the respondents has worked between 1- 4 and 5 – 9 yeas respectively with the programme. On the other hand, majority (66.7%, n = 12) of the respondents have only worked for less than five years in the Techiman Municipality with only 11.1% (n = 2) haven worked for more than 10 years in the Municipality. Majority (61.1%, n = 11) of the respondents were supervisors in the Expanded Programme of Immunization whiles the rest, a little over one quarter, were immunization services provision staff.

Table 4.13: Background characteristics of health staff

Variable		Frequency	Percentage (%)
Number of years worked in GHS	1 – 4	2	11.1
	5 – 9	3	16.7
	≥10	13	72.2
	Total	**18**	**100.00**
Number of years worked with EPI	1 – 4	3	16.7
	5 – 9	3	16.7
	≥10	12	66.7
	Total	**18**	**100**
Number of years worked in the Municipal	1 – 4	12	66.7
	5 – 9	4	22.2
	≥10	2	11.1
	Total	**18**	**100.0**
Role in EPI programme	Supervisor	11	61.1
	Service provider	7	38.9
	Total	**18**	**100.0**

4.7.2: Findings from key informant interview on immunization coverages in the Techiman Municipality

Participants in the key informant interviews were asked to give their general impression about the Expanded Programme on Immunization coverage in the Municipality. All respondents were impressed about the routine administrative coverages for the fact that most of the coverages were far above targets set for them to achieve and also the fact that there are few children in recent days who are not immunized.

"The coverage achieved by the municipal is good in that, close to 100% of the children have received, if not all but majority of the scheduled vaccines. These days hardly will you come across a child who is not immunized" (HM 2).

"The immunization programme in the Municipality has been quite successful as children no longer suffer from vaccine preventable diseases. Children are protected through the high coverages that we are achieving" (HW 11).

"I think generally, coverages are high but there are still some missed children that need to be covered. It may be very difficult for a district like ours to achieve 100% coverage because of the high immigration, but the coverages are commendable in so far as we hear little about vaccine preventable diseases" (HM 1).

"For coverages, there is no problem because our data shows that we are far above targets set and indeed immunization patronage these days is very impressive, more outreach centers are created and immunization services are now reaching everywhere" (HM 4).

As a follow up on interviewees' responses, a question was asked to determine what is accounting for the coverages they seem to be happy about. Responses from respondents show that, the support in immunization services delivery from the Private health practitioners and community members, and the strategic creation of more outreach and static service delivery sites makes the immunization programme sensitive in capturing all eligible children who found themselves in the Municipal irrespective of where they come from.

"I will say that, the major reason for our immunization coverage success is because of the strong support that we get from Community-Based Surveillance volunteers (CBS), and the fact that now the in-charges of our various clinical facilities have been sensitized to financially support outreach services. Now hardly will a community Health Officer (CHO) refuses to go for outreach services because of lack of transportation" (HM 1).

"There may be some other reasons but what is obvious is the vaccination of non residents who are drawn into the Municipal for commercial activities. A static immunization centre is created in the Techiman market that provides daily immunization services to every eligible child who is found in the market irrespective of where the child is coming from" (HM 2).

"I think this is simply because of the creation of more outreach immunization sites and the fact that, the Holy Family Hospital which is a major referral Hospital in the area conducts daily immunization services" (HW 3).

Still on the issue of coverage, key informant interview participants were asked; which of the immunization sites (static or outreach) is preferred by mothers/caregivers and why? Majority, 88.9% (n = 16) asserted that mothers/caregivers prefer outreach services because outreach immunization services are provided conveniently in their own or nearby communities. In this case, they are able to save time and money. One person said there is no special preference. Mothers or caregivers make use of immunization facilities that are closer to them, whether static or outreach. One participant also has a different view and said that; *"mothers or caregivers prefer static immunization sites*

because at there, health staff are always available and there is nothing like, you are late, come next time" (HW 8).

4.7.3: Findings from key informant interview on immunization Status of children in the Techiman Municipality

Routine administrative data cannot be used to measure immunization status of children either through the crude immunization status or the valid immunization status coverage measurements. For immunization status to be assessed, one needs to collect data for analysis. Participants of the key informant interview were asked to explain how immunization status of children in the Municipality is evaluated. Responses from respondents show that apart from estimating immunization coverages using the routine administrative data, there has not been any conscious effort by management and service providers in the Municipality to conduct any study to determine the immunization status of children.

"We have not taken the effort to find out at any point, how many children have received all the scheduled EPI vaccine doses. We depend on the individual vaccine coverages to plan our immunization services" (HM 3).

"We use the routine data to evaluate the EPI programme. From the routine data, you compare the coverages of the different vaccines to know whether some children have defaulted or not" (HM 4).

"Immunization status of children is measured using two indicators; vaccination coverages and the rate of occurrence of vaccine preventable diseases. In our case, immunization coverages are high and there have not been any reported cases of these

vaccine preventable diseases, this means that the immunization status of children is high" (HM 2).

"Dropout rate is the best indicator in measuring immunization status of children. If the dropout rate is high, it means the immunization status of children is low and if dropout rate is low, it means immunization status of children is high" (HW 1).

"Immunization status of children can be measured using the laboratory report on specimen collected from suspected cases of vaccine preventable diseases. In our case almost all specimen on suspected cases of vaccine preventable diseases sent for laboratory analysis tends to be negative meaning that our children are protected because their immunization status is high" (HM 3).

4.7.4: Findings from key informant interview on immunization dropout rate in the Techiman Municipality

With regards to dropout, the key informant interview seeks to determine whether all eligible cohort children who started the immunization services in 2015 were able to go through successfully without defaulting in any of the vaccine doses. With the exception of one person (5.6%) who did not have an idea about the utilization pattern, all the other respondents (94.4%) confirmed that all children who started the immunization service in 2015 could not receive all the scheduled vaccines doses at the end of the year. Some explained that, during the time of the 2015 end of year review session, it was realized that Pentavalent -3, OPV -3, PCV-13 -3, Measles and Yellow fever coverages all felt short as compared to the coverages of BCG and the starting doses of the multi-dose vaccines.

"The Municipal Disease Control Officer was even not happy about the difference in coverages between BCG and Measles in my sub metro during the end of year review session. He did not understand why children could start immunization and cannot be encouraged to end up well. So obviously, most children missed some of the vaccine doses" (HW 13).

"You know it is not possible for all children who start immunization service to end. If some don't even die, some will definitely travel and some will refuse either intentionally or un-intentionally" (HW 10).

"Since I started work here, about 7 years ago, there has been no year that coverages of the beginning vaccine doses will not exceed coverages of the ending vaccine doses. If you look at the past records, you will see it" (HW 7).

As a follow up to the above responses, the researcher asked the respondents; what would be the implication for some children either not been immunized or partially immunized? The responses pointed to the fact that, there is the need to put in effort so that children do not default in immunization services. The general responses were that, when there is a continuous defaulting in immunization services, it will lead to accumulation of unprotected children, thus, compromising herd immunity and can lead to the outbreaks of vaccine preventable diseases which will eventually increase child mortality.

"If any outbreak occurs in future, those children who have not been immunized will be attacked by the disease" (HW 13).

"Most children will not be protected as such we cannot achieve or maintain herd immunity" (HM 1).

"Infant mortality rate will increase because most children will be affected by these vaccine preventable diseases" (HM 2).

4.7.5: Findings from key informant interview about factors affecting immunization services.

It was found from the interview that some children have not been able to complete the EPI scheduled vaccine doses before attaining their first birth date. The study then sought to establish from the perspectives of health staff (management and service providers), what could be the reasons for immunization failure. Responses run through personal characteristics, lack of information, lack of motivation and some other obstacles to service provision. Majority of the respondents, 72.2% (n = 13) mentioned maternal education as a key characteristic of the mother that have influence on the uptake of immunization services. The occupation of the mother or caregiver was also highlighted as a major contributory factor (66.7%. n=12) to infant immunization failure. On the issue of lack of information, majority of the respondents claimed that education of mothers or caregivers on vaccination side reactions and the need to return for the subsequent vaccines has not been given the desired attention by service provided. Also, communication to immunization service users on change of scheduled immunization dates at certain outreach site is always deficient in reaching all the intended. The findings also show that, some mothers postpone certain immunization due their children when the date or time of the immunization services seems not to be convenient for them. But, unfortunately, most mothers turn to forget about this postponement rendering their children unimmunized. Aside the aforementioned, inconvenient timing of

immunization services, occasional vaccine shortage, mothers are too busy and occasional illness of children were also cited by the respondents as obstacles that affects immunization services.

"It is not only failing to attend immunization services, sometimes some mothers are too busy to the sense that they even forget they have children who need feeding and other basic services. The Techiman market is actually a contributory factor to immunization failure" (HM 2).

"Most women in the Techiman area use proceeds from the Techiman market to keep their family. Some of them who are not very enlightened do this to the neglect of accessing basic health care services for their children" (HW 5).

"For me, I will say the health staff are also contributory factors. They always fixed immunization dates and time to their convenience. Some mothers will like to have the services early in the morning or late in the evening but this is not for heath staff.

"When you meet some defaulted mothers after the immunization session, they will tell you they could not come because the child was not feeling well or a member of the family was not feeling well" (HM 3).

"There are some occasional situations where a service provider can run short of certain vaccines. Most often, the affected mothers are asked to go and come back the following month for the particular immunization to be given to their children. This creates some uncertainty in some mothers who will not like to waste their time again the next time" (HW 6).

4.7.6: Findings from key informant interview about the challenges facing the implementation of the EPI programme

As management and service providers, the interviewees were asked about the challenges they are faced with in the implementation of the Expanded Programme on Immunization in the Municipality. With the high administrative vaccination coverages, one might say there are little or no challenges to talk about, but this was rather the opposite. Responses highlighted on service delivery challenges as; inadequate transport facilities (vehicles and motorbikes) to convey vaccines from the regional level to the Municipal level, from the Municipal level to sub metro levels, from sub metro levels to the outreach immunization sites and also to conduct effective supportive supervision. Another factor that surfaced predominantly as a challenge was the uncertain denominator population that is been used in the estimation of immunization coverages. Lack of home visit bag with it basic content for the conduct of home visitation by Community Health Officers for the purpose of defaulter tracing was also mentioned as a key challenge. Occasional shortages of vaccines, frequent break down of cold chain facilities and inadequate orientation for service providers; all hinder the smooth progress of the implementation of the programme.

From one health worker; *"Our refrigerator developed a fault for over two months now, we have to pick vaccines from the nearby sub metro every morning before we go for outreach services and after which we have to send the remaining vaccines back for it to be refrigerated. This is an extra workload for us"* (HW 14).

From one management staff; *"at times we will schedule a supervision visit to the sub metros, but unfortunately, the time will come and no means to go. Most of the time, the*

best we can do is to call the services providers on phone to interact with them which is not helpful" (HM 2).

4.7.7: Findings from the key informant interview about recommendations to improve EPI service delivery

Study participants in the key informant interview were asked to propose some recommendations that could be implemented to improve implementation of the immunization programme in the Municipality. Hundred percent of the participants mentioned acquisition/supply of vehicles and motorbikes to ease transportation problems. Majority, (77.8%, n = 14) of the respondents also proposed that, periodic maintenance of cold chain facilities and supply of home visits logistics could go a long way to improve service delivery. Some few respondents (27.8%, n = 5) said, the schedule of immunization sessions should be re-strategizes so that, more service points will provide daily immunization services and also time of immunization session should be planned with the input of mothers so that busy mothers can access the services at their convenient time. Other recommendations that were also proposed include; organize frequent mop up activities especially in the non performing sub metros, organize periodic staff orientation especially for newly posted staff, conduct periodic supportive supervision and the conduct of monthly EPI data validation.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This section discusses the implication of the findings of the study in relation to its research objectives. The discussion is presented in line with the research results as stated in chapter four and related to the literature review in chapter two. The study evaluated the Expanded Programme on Immunization coverage among children 12 – 23 months in the Techiman Municipality, Ghana. The findings indicated that, immunization coverages among the programme scheduled vaccines doses were high (above 90%) among all doses as compared to the immunization status of children (72.5%). Thordarson et al. (2005) also reported similar findings where coverages of all the Expanded Programme on Immunization scheduled doses where all high (above 85%). Meanwhile, when all the scheduled vaccine doses were merged to determine the overall immunization status of children in the study area, it was found that, the proportion of children who were fully immunized before one year of age was below 80%. This finding is consistent with the study finding by Russo et al., (2015), who also found in a study conducted in the Dschang Region of Cameroon that, only 73.4% of the study children were fully immunized before one year of age. This finding shows that, childhood immunization status in the Municipal is still below the 80% immunization coverage set by UNICEF and implies that, there could still be outbreaks of vaccine preventable diseases in the Municipal if care is not taken.

5.2: Immunization coverage among the expanded Programme on immunization vaccines doses

The study evaluated the coverages of the seven vaccines used in the Expanded Programme on Immunization in Ghana using coverages based on card plus history. Four of the vaccines are immunized in multiple doses (OPV; 4 doses, Pentavalent; 3 doses, PCV-13; 3 doses and Rotarix; 2 doses) and the other three (BCG, Measles and Yellow fever) in single doses. The coverage information covers all these fifteen vaccines doses. The study findings revealed that, the coverages among these fifteen vaccines doses ranges from 92% (Measles and Yellow fever vaccines) to 99% (Pentavalent 1, Pentavalent 2, OPV 1, OPV 2, Rota 1 and Rota 2). In line with the UNICEF and the GAVI proposed 80% coverage in Pentavalent 3 as a proxy for good immunization coverage, immunization coverages in the Techiman Municipality is high, with all vaccines doses performing above 80%. Again findings from the 2014, Ghana Demographic and Health Survey (GDHS) report also indicates over 80% coverage in all the Expanded Programme on Immunization vaccines doses. GDHS (2014) reports that, immunization coverages in Ghana ranges from 84% (OPV 3 and PCV-13 3 doses) to 97% (BCG, Pentavalent 1 and OPV 1). High coverages in immunization services have also been reported by Thordarson et al. (2005) and Russo et al. (2015).

These high coverage levels could be attributed to some health services delivery restructuring factors such as; creation of more outreach immunization site through the Community-based Health Planning and Services (CHPS) Programme, creation of more static centers by involving the private health care providers and the sensitization of heads of the clinical health care facilities to support public health activities. The Techiman Municipal Health Directorate has adopted what is called ‘CHPS without walls’ to create a 100% Municipal wide coverage with CHPS activities. This has led to

an increase in the number of outreach sites thereby reducing walking distances to immunization sites for most immunization service beneficiaries. On the other side too, the Directorate has strategically created daily static immunization service centers in the Techiman market and Holy Family Hospital, which serves as the major referral Hospital in the Municipal. Immunization activities which are regarded as public health services to a greater extend are not funded using health facility Internally Generated Funds (IGF), but due to external funding problems, the Municipal health directorate has directed all Ghana Health Services facilities in-charges to capture the cost of outreach immunization services in their budget and report as such.

The coverage findings also shows that, BCG and OPV 0 coverages are less than the coverages of Pentavalent 1, OPV 1, PCV-13 1 and Rota 1. BCG and OPV 0 vaccines are supposed to be given immediately after birth or within two weeks after birth for OPV 0 and within one year after birth for BCG. Because some pregnant women deliver at home or place where vaccines are not available and also some of these post partum women may only access health care services after two weeks of delivery, could be the reason for the comparatively low OPV 0 coverage and the slight variation between BCG (97.5%) and OPV 0 (97%) coverages. For BCG coverage to be slightly lower than the first doses of the multi dose vaccines, one could say it is because of the nature of the BCG vaccine and also immunization service providers caution against high vaccine wastage rates. One vial (container) of the BCG vaccine contains 20 doses of the vaccine and once open must be used within 6 hours or be discarded. Some immunization providers will postpone BCG immunization for eligible children until such a time that they will be enough children so that when the BCG vaccine vial is open in a future immunization session, more children will be eligible to reduce vaccine wastage.

In general, coverages in the beginning vaccines doses (BCG, OPV 0, Pentavalent 1, Rota 1 and the first dose of PCV-13 vaccine doses) are higher than coverages in the ending vaccine doses (Measles and Yellow fever vaccine doses). Similar findings were also reported by the GDHS, 2014. Outside Ghana, a study conducted by Khan et al. (2005) in Dhaka, also found that, coverages in the ending vaccine doses indicate a drop as compared to the initial vaccine doses. Reasons for this drop are explained under factors affecting immunization services. With regards to the newly introduced vaccines (PCV-13 and Rotarix), coverage for Rotarix 1 is slightly higher than coverage of the first dose of PCV-13 as opposed to the GDHS, (2014) findings where rather coverage of the first dose of PCV-13 is higher than coverage of Rotarix 1. These vaccines doses are given on the same day according to the EPI schedule, so any difference in coverage could arise because of vaccine shortage.

BCG was also analyzed using the presence of BCG scar. Of all children (97.5%, n = 585) who received BCG immunization, 94.9% developed the BCG scar as against 5.1% who were immunized but did not develop the scar. If formation of scar is an indication of immunity, then close to 95% of all children who were vaccinated with the BCG vaccine developed immunity against the tuberculosis diseases. This would mean that, not every person who is considered vaccinated actually develops immunity. Three reasons could be advanced to explain this; in the first instance, it could be that the vaccine lost its potency before been delivered into the recipient. It was indicative in the key informant interview that, inadequate and frequent breakdown of cold chain facilities hampers the smooth implementation of the EPI programme. These breakdowns can also affect the potency of EPI vaccines. The second reason could be the introduction of insufficient (less than 0.05ml) vaccine dosage or introduction of the vaccine into the wrong site or both. In BCG immunization 0.05ml of the correctly reconstituted vaccine

is injected into the intra-dermal of the right upper arm. Less than the immunological dosage or introducing the vaccine deep into the muscle may not be able to elicit immune response that will lead to the formation of the scar. It could be against this background that, it was indicative in the key informant interview that, there is the need to conduct orientations for new staff and improve on supportive supervision so that any defect could be corrected. The third reason could be due to the immune system failure to respond to the vaccine due to immunological deficiencies.

As part of the coverage analysis, immunizations provided were also analyzed according to place of immunization; static or outreach sites. The finding indicated that, majority (more than 82%) of the children who were immunized with each of the BCG and OPV 0 vaccines doses did so at the static immunization centers. On the other hand, majority (more than 71%) of the children who were immunized with the other thirteen doses also did so through the outreach immunization sites. These findings could be because of the fact that BCG and OPV 0 vaccine doses are given at birth. The GDHS, (2014) reported 73% of deliveries occurring in health facilities and 74% of all deliveries attended to by skilled providers, thus, one would expect majority of the children born to receive the OPV 0 and BCG vaccines at the point of delivery as the maternity units are empowered to provide these services. On the other hand, because of the many outreach sites established in the Municipal, children who are discharged after birth and those delivered outside the health facilities would have easy access to the immunization services and most of them would continue or even start at these outreach sites.

Interestingly, the administrative coverages as reported by the Techiman Municipal health directorate shows that, coverages ranged from 131.6% (PCV-13 3) to 254% (BCG) and 95.6% (Pentavalent 2) to 161.3 (OPV 0) in 2013 and 2014 respectively.

Majority of the vaccines doses were reported to be more than 100% where in the survey findings, the highest coverage was less than 100%. During the key informant interview, participants also indicated they were impressed about their immunization coverages because in most instances coverages are above targets. Some possible reasons that could have accounted for these inconsistent and high coverages, probably, could be the use of incorrect denominator population for the estimation of the administrative coverages, incorrect data capturing at the service provision sites and or mistakes in entering data into the District Health Information Management System II software (DHIMS 2). The implication is that, these reported high administrative coverages may affect effective planning of immunization services targeted at reaching the unreached, hence, can lead to more children been missed out. It is to unravel some of these challenges that the importance of the periodic immunization coverage surveys cannot be over emphasized.

5.3: Immunization status among children 12 – 23 months

Immunization status is an output of immunization coverage when all immunization reports on the scheduled vaccines doses are merged. The immunization status was reported in two ways; crude immunization status (proportion fully immunized by time of survey) and valid immunization status (proportion fully immunized before one year). The study findings indicated that, 89.5% of the study children had received all the fifteen scheduled vaccines doses by the time of the survey (crude immunization status). The GDHS, (2014) also reported 79% and 77% crude immunization status for the GDHS 2008 and 2014 respectively. Still on the crude immunization status, UNICEF, (2005) reported 94.8% for rural north India and Russo et al. (2015) also reported 85.9% for the Dschang Region of Cameroon. In contrast to these relatively high coverages, Gupta et al. (2006) reported 28.9% for Alwar district of Rajasthan state of India and Lakew et al. (2015) also reported 24.3% for Ethiopia, using the 2011 Ethiopian

Demographic and Health Survey. Even though there are some disparities about these findings, one thing is common among them; all the crude coverages reported are below the coverages of the various vaccines doses used in the computation of the crude immunization coverages. What this means is that some children were not able to complete all the scheduled vaccines doses by the time of the survey. It also means that, different children missed different vaccines. This confirms the differences in coverages in the fifteen vaccines doses. This finding is a threat to the achievement of herd immunity and the implication is that, immunization coverages for various vaccines doses could be high in an area but there can still be reported cases of vaccine preventable diseases because not all children will be fully protected against all the diseases targeted.

Immunization data was further analyzed to determine what proportion of children was fully immunized before one year (valid immunization status). The study findings show that, 72.5% of sampled children actually received all the fifteen scheduled vaccines doses before their first birth day as against the 89.5% crude immunization status indicating a difference of 17% from the crude immunization status. This result can be explained to mean that, the gap that exists between the crude immunization status and the valid immunization status (17%) is the proportion of children who completed vaccines doses after one year of age. Again this finding also means that, the immunization status of children in the Municipality fall short of the UNICEF recommendation that, 80% of all children should receive valid doses of the recommended vaccines within one year of age. Drawing on existing literature, Russo et al. (2015), also found in a study conducted in the Dschang Region of Cameroon that, valid immunization status was 73.4% as against 85.9% crude immunization status, indicating a difference of 12.5%. In a related study conducted by Khan et al. (2005) in

Dhaka also found that whiles the crude immunization coverage was as high as 97%, the valid immunization coverage was only 66% meaning that 31% of the children were fully immunized after one year of age. The Expanded Programme on Immunization policy on duration for complete immunization is that, all children should receive the recommended vaccines doses before the age of one year. What this may mean is that, the vaccines are better able to trigger immune response within this age limit than when given at latter age. Therefore, for children who completed the schedule after one year are less likely to develop the desired immunity in those vaccines received after the one year than their counterparts who were able to complete all schedule vaccines within one year. Also, since the programme is supposed to have been structured in a way that all children get vaccinated within one year, this finding could be a measure of system failure to some extent. This assertion is supported by Eduard & Amie, (2000) that, lack of progress in moving towards high levels of immunization coverage is a strong indication of health service failure to provide essential public health services to protect the health of the most vulnerable in a population. One limitation of this study is that, it falls short of the reasons that make children to be fully immunized after the scheduled one year duration, but the findings remains beneficial in improving immunization services especially in the Techiman Municipality.

The study findings also indicate that, one out of hundred (1%, n = 6) children did not receive any vaccine at all and about 10% were partially immunized. Similarly, the GDHS, (2014) reported that, 1.6% of children did not receive any vaccine at all and by calculation, [100% - (77% + 1.6%) =21.4%] about 21.4% were partial immunized. In a related study conducted by Russo et al., (2015) in the Dschang Region of Cameroon found that, all children received at least one dose of the scheduled vaccines but about 14% were partially immunized. It means that, in the mist of high coverages, one can

still get children who are not fully protected, therefore, the need to keep devising strategies that will target at the unreached.

5.4: Dropout rate in immunization uptake

Dropout rates are used as a measure for the utilization of EPI services. The study results showed that, the dropout rates between the starting vaccine (BCG vaccine) and the ending vaccine (measles vaccine) was 5.6%. With the multi-dose vaccines, the dropout rates were OPV 0 to OPV 3 was 3.1%, OPV 1 to OPV 3 was 5.1%, pentavalent 1to pentavalent 3 was also 5.1%, first dose of PCV-13 to third dose of PCV-13 was 4.9% but there was no dropout among Rotarix immunization. Dropout rates in immunization services have also been reported in many studies such as; Khan et al. (2005), Bolagun et al. (2005) and the GDHS, (2014). A dropout rate of more than 10% is considered as high and need urgent attention. All the dropout rates computed were below 6% meaning that, immunization performance in the Municipal is good. Comparing these dropout rate to that of the GDHS, 2014, BCG to measles dropout rate has dropped by 2.7%, pentavalent1 to pentavalent 3 also dropped by 3.2%. OPV 1 to OPV rate also dropped by 8.3%. Both Rotarix 1 and Rotarix 2 coverages were the same in this study but in the GDHS, 2014, a dropout rate of 9.7% was reported between the two vaccine series. In general, the dropout rates as found in the GDHS, 2014 were all higher than that in this study. The reasons for the dropout and non immunization were given by defaulted mothers or caregivers and are discussed under factors affecting immunization status. It must be noted that these low dropout rates are not suggestive that all is well with the immunization services delivery in the study area, but should serve as triggers that should challenge the health system to get all children fully immunized. In contrast to these rather low dropout rates, the TMHD, (2014) report indicated that, the dropout rates between BCG and measles using routine administrative data were 44.7%, 36.2%

and 31.5% for the years; 2013, 2014 and 2015 respectively. These are far above the survey findings and could create unnecessary tension if not true. Coverage surveys are therefore necessary to validate routine administrative information and to direct the planning of immunization services. In the key informant interview, 94.4% confirmed that all children who started the immunization service in 2015 could not receive all the scheduled vaccines doses at the end of the year. This goes to confirm the study findings that indeed there are dropouts in immunization services in the Municipal. Mothers or caregivers send their children to immunization centers in the first place because of the perception that, their children are susceptible to contracting vaccine preventable disease that can even end up their life, they also belief that, immunization is a beneficial public health intervention than many other alternative interventions. It is therefore prudent for immunization service providers to put in the best strategies that will minimize dropout.

5.5: Reasons for immunization failure

The reasons provided by respondents for failing to complete their children immunization schedule are; time of immunization inconvenient, place of immunization unknown, mother too busy, child ill, fear of side reaction and vaccine not available. Among mothers whose children were not fully immunized, majority of them cited inconvenience time for providing immunization services as a reason that prevented their children from full immunization. Proper timing of preventive health care services influence uptake and as such time for most preventive health care service are usually planned in collaboration with the beneficiaries. In the case of immunization services, this is not so. One thing need to be clear, the children who are sent for immunization services are not sick in the first place, thus, some mothers will not sacrifice their precious time of some profit making activities for immunization services if the two

coincide. It is therefore essential that immunization services beneficiaries are involved in the time planning for immunization services.

The study result also found that, unknown place of immunization prevented some children from accessing immunization services. Gupta et al. (2006) also found that, in the Alwar District of Rajasthan State of India, failure of immunization in rural areas was mainly due to place of immunization unknown amount other reasons. Unknown place of immunization could arise because mothers can travel to different area and have not acquired enough information regarding immunization services. This assertion was similarly reported by Nath et al. (2007) in a study conducted in the urban slums of Lucknow district in India that, partial immunization was because parents had gone either to a village or a native place during the scheduled date for immunization or had been residing in the area for some months but had not yet acquired the necessary information regarding the details of immunization services in that area. Another reason that can lead to unknown place of immunization could also be that, service providers might have relocated the immunization services site without prior information to immunization beneficiaries.

Some of the defaulted mothers also said that, they were too busy to have taken their children for immunization services. A similar finding was reported by Gupta et al. (2006). The reason for this could be that, because Techiman is a bustling commercial business center, most women are engaged in selling and buying activities in the market. Mothers who are not very conscious about the health of their children will be carried away by these market activities to the neglect of taking proper care of their children including immunization services.

The study results also show that failure to full childhood immunization status was also partially due to illness of the child. Hari & Mizan, 2004 also reported that illness of the child was responsible for immunization failure in Benin City. Child illness again, was also reported by Nath et al. (2007) in the Lucknow district in India. Some mothers still have the belief that child ill health is a contraindication to all types of immunizations and always avoid immunization services during child's ill health. This could be the result of inadequate information on the part of immunization service providers to the beneficiaries of immunizations on contraindications and the need for the mothers to visit the immunization site with their ill children for the appropriate assessment.

Fear of side effect resulting in immunization failure surfaced as one the reasons that affect full childhood immunization status in this study. Studies conducted by Favin et al. (2012) and Gupta et al. (2006) both reported similar findings. Also, in a related study, Streefland, (2001) found that some mothers refuse immunizations services because they want to protect their children from being harmed. This fear could be because some mothers have ever had experienced of the worst form of Adverse Effect Following Immunization (AEFI). This could also mean that, there is information deficit with regards to the expected side effect that will normally follow immunizations and how to handle such side effects.

Some respondents in the study also said that at the time the child was due for the particular vaccine and sent to the immunization centre, there was no such vaccine to be given to the child. In 2005, UNICEF also reported that, more than 30 million children are not immunized because vaccines are not available. Many factors can account for vaccine shortage at a vaccination site, most prominent once are; general vaccine supply shortage, lack of proper planning and distribution that could lead to over stocking at

some places and artificial shortage at other places, health staff forgetting to add a particular vaccine for the outreach service, and cold chain breakdown. The unstable population of the Techiman Municipal due to the high influx of commercial activities could affect effective planning during vaccine requisition and distribution.

5.6: Factor affecting immunization status

In the present study, predictors of immunization status included education, marital status, religion, occupation, sex of child and possession of immunization card. Children from formal educated mothers are more likely to complete their immunization compared to children from non educated mothers. Mothers with formal education are more likely to have children completely immunized than those with JHS and below. Education helps to improve health seeking behaviour of an individual. This finding is consistent with other literatures like the World Health Organization, (2001) findings, that, Children of mothers with secondary education or higher education were three times more likely to be fully immunized than children whose mothers had not completed primary education. Education as significant factor in childhood immunization uptake is reported in several studies (Mutua et al., 2011; Stronegger & Freidl, 2009; Siddiqi et al., 2007; Munthali, 2007; Taapopi, 2002). The role of maternal education as an important cause of immunization uptake has also been shown by Becker et al. (1993) that, maternal education empowers a woman to access relevant health services, interact effectively and assimilate information relating to prenatal care, childhood immunizations and nutritional needs. The Ghana Demographic and Health Survey (2014) also found that, basic vaccination coverage increases with increasing education. This finding is suggestive that, intersectoral collaboration is important in the improvement in child health indicators including immunization services.

Children from married families were more likely to complete their immunization schedule compared to unmarried. Married families are more economically stable and most likely to discuss the health needs of their children including immunization. In addition, married women often receive addition support from their husbands and they feel confidence to go out with their children for social and health programs. Unmarried mothers are unable to make healthy choices due to psychological trauma as well as hardships associated to unplanned single parenting.

Children from non-Christian families were less likely to complete their immunization schedule compared to Christians. Religion remains a major factor in decision making including health seeking behavior. Sometimes, the actions and inactions of people from certain religions denomination are influenced by their perceptions rather than reality. This is a potential explanation for the findings of this study. Similar findings have been reported in due to misconceptions by Muslim populations which negatively affected immunization up take in Northern Nigeria (Babalola, 2009). I did not verify the misconception among Muslim groups that, immunization is a deliberate strategy to reduce the Muslim population rather than prevention of diseases. The existence of such misconceptions has the potential to continue to affect immunization uptake.

This study found that more females complete their immunization than males. Though, similar relation has been reported in Ghana, males complete their immunization compared to their females (GDHS, 2014). Sex as a predictor of immunization dropout is reported in other studies (Antai, 2010). Kidane et al. (2008) found that, in spite

universal access efforts to immunization services, sex discrimination against female children continue to exist in rural areas of Bangladesh.

Salary work is a predictor of immunization outcome. The findings showed that, salary workers are more likely to have their children fully immunized than mothers in the other occupations. Similar findings have been reported in previous studies as demonstrated in the literature (Antai, 2011; Mapatano et al. 2008; Cui and Gofin, 2007; Topuzoglu et al. 2005; Pande, 2003). Salary work may provide women with more influential exposure than the other occupations. Most salary work settings are used to promote child health care survival activities that could translate in immunization uptake among these group workers. The maternal leave policy is also only applicable in the formal sector (Salary work), where mothers are given maternity leave to take good care of themselves and their babies including immunization services.

Possession of immunization card is a predictor of dropout. Children without cards have higher probability of incomplete immunization schedule. This is similar to a study conducted by Russo et al. (2015) in the Dschang Region of Cameroon Russo et al, 2015. Irregular visits to health facilities by mothers can affect possession of immunization card. However, mothers who accidentally loss these cards may feel reluctant to visit health facilities for new immunization due to perceived negative attitudes of some health workers if they are unable to provide the card. This may lead to dropout. It could also mean that certain immunizations may have been given to those children but because there are no records, mothers could easily forget and recall that no immunizations were given.

Both the management and service providers in the key informant interview also cited reasons for immunization failure that also support the findings about. Majority of the respondents, 72.2% (n = 13) mentioned maternal education as a key characteristic of the mother that have influence on the uptake of immunization services. The occupation of the mother or caregiver was also highlighted as a major contributory factor (66.7%. n=12) to infant immunization failure. On the issue of lack of information, majority of the respondents claimed that education of mothers or caregivers on vaccination side reactions and the need to return for the subsequent vaccines has not been given the desired attention by service provided. Also, communication to immunization service users on change of scheduled immunization dates at certain outreach site is always deficient in reaching all the intended. The findings also show that, some mothers postpone certain immunization due their children when the date or time of the immunization services seems not to be convenient for them, but unfortunately, most mothers turn to forget about this postponement rendering their children unimmunized. Aside the aforementioned, inconvenient timing of immunization services, occasional vaccine shortage, mothers being too busy and occasional illness of children were also cited by the respondents in the key informant interview as obstacles that affects immunization services. This means that service providers and management of immunization services are well vested in the reasons/factors affecting immunization services, what is left is putting in pragmatic effort to improve full immunization status in the area.

5.7: Expanded Programme on Immunization implementation challenges from the perspective of health staff

The key informant interview also sought to establish provider challenges in the implementation of the Expanded Programme on Immunization. With the high reported administrative vaccination coverages, one might say there are little or no challenges to talk about, but this was rather the opposite. Responses highlighted on service delivery challenges as; inadequate transport facilities (vehicles and motor bikes) to convey vaccines from the regional level to the Municipal level, from the Municipal level to sub metro levels, from sub metro levels to the outreach immunization sites and also to conduct effective supportive supervision. Eduard and Amie, (2000) also found that transportation difficulties affects immunization services. This finding means that, supervisors may not be able to get to services delivery site to actually make sure the data they receive is the correct data for decision making. Another reason that surfaced predominantly as a challenge was the uncertain denominator population that is been used in the estimation of immunization coverages. Inadequate transport facilities and uncertain denominator population can lead to the high administrative coverages. Lack of home visit bag with it basic content for the conduct of home visitation by Community Health Officers for the purpose of defaulter tracing was also mentioned as a key challenge. Occasional shortages of vaccines, frequent break down of cold chain facilities and inadequate orientation for service providers; all hinder the smooth progress of the implementation of the programme. These findings suggest that, in trying to improve on the immunization status of children, attention should not be focused on the beneficiary factors alone, but also on service provision factors.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1: Summary of findings

The study findings revealed that, the coverages among the vaccine doses studied ranges from 92% (Measles and Yellow fever vaccines) to 99% (Pentavalent 1, Pentavalent 2, OPV 1, OPV 2, Rota 1 and Rota 2). While the crude immunization status was 89.5%, the valid immunization status was 72.5%. Also, 9.5% of the study children were partially immunized as against 1% who never received any vaccine. The further revealed that, using measles and BCG as proxy vaccines, the EPI dropout rate in the study area was 5.6%. The reasons provided by respondents for failing to complete their children immunization schedule are; time of immunization inconvenient, place of immunization unknown, mother too busy, child ill, fear of side reaction and vaccine not available. Findings from regression analysis found that maternal education, marital status, religion, occupation, sex of child and possession of immunization card were significantly associated with childhood immunization status. However, the analysis did not found any significant association between childhood immunization status with age, parity, ethnicity and relationship of respondent to child. Challenges facing immunization services in the study area were; inadequate transport facilities, occasional vaccine shortages, frequent breakdown of cold chain facilities, lack of home visits bags and inadequate orientation of service providers.

6.2: Conclusion

The main purpose of the study was to evaluate EP1 coverage and data quality in the Techiman Municipality, Ghana, in order that, the Ghana Health Service, Funding

Agencies, Policy makers and other health partners can make informed decisions in their effort to improve immunization service utilization in the Techiman Municipality.

Based on the findings of the study, the following conclusions are reached;

1. The immunization coverages for the fifteen vaccines doses considered in the study were all high, above 90%. It can therefore be concluded that the Municipality has achieved herd immunity for the various vaccines based on these high coverages. Using BCG scar as a confirmation of developing immunity against tuberculosis, 94.9% of the study children who received the BCG vaccine developed immunity against the tuberculosis diseases. This confirmation further strengthens the assertion that the Municipal has achieved herd immunity for the various vaccines. These findings are however not suggestive of complaisance, as these gains can be reversed within a couple of days.
2. The results of the study showed 89.5% crude immunization status and 72.5% valid immunization status. Out of this, 17 % of the studied children completed their immunization when they were already above one year of age. In all, 9.5% of the children started with the initial vaccines doses but could not continue to complete all the fifteen doses specified in the Expanded Programme on Immunization schedule whiles one out of every hundred children never received any immunization. The conclusion therefore is that, the immunization status among children in the Municipality is fairly good but inadequate in view of the health partners' recommendation of 80% valid immunization status to be achieved by the Expanded Programme on Immunization in every district.
3. The dropout rate computed using BCG and measles, which is a proxy measure for the utilization of immunization services was 5.6%. Also, all the other dropout rates computed among the multi-dose vaccines using the first and the last doses were all

below 10%. Thus, the immunization dropout rates in the Techiman Municipal are generally low but much effort is still needed to further reduce these rates or at worst, maintain the current levels.

4. Majority, above 82% of the children started immunization with BCG and OPV 0 at the health facilities where static immunization services are delivered. On the other hand, majority (in each case, more than 71%) of children who received the other vaccines doses in the schedule had their immunizations through the outreach immunization services delivery sites. This means that, both static and outreach immunization services delivery sites are been utilized effectively for the achievement of the above coverages.
5. The immediate factors that affected the immunization status of children in the study area are: time of immunization inconvenient, place of immunization unknown, mother too busy, child ill, fear of side reaction, and vaccine not available. Further analysis pointed out that; maternal education, marital status, religion, occupation, sex of child and possession of immunization card were underlying factors that coupled with the immediate factors to affect full childhood immunization status.

6.3: Recommendations

In line with the findings and conclusions drawn, the following recommendations are proposed to enable the Ghana Health Service, Funding Agencies, Policy makers and other health partners to design and implement appropriate and relevant immunization strategies that will serve to improve EPI service utilization in the Techiman Municipality.

1. The Techiman Municipal Health Directorate in collaboration with community members and other partners should create more Community-based Health Planning

and Services compounds that will eventually translate into the creation of more outreach sites aimed at increasing access to immunization services.

2. The Techiman Municipal Health Directorate should identify, empower and build the capacity of all maternity homes, both public and private, to provide BCG and OPV immunization services.
3. The Municipal Disease Control Unit in collaboration with the Municipal CHPS coordinator should build the capacity of Community Based Surveillance Volunteers to support Community Health Officers in dissemination of information and tracing of defaulters.
4. The Government should embark on policies that will primarily focus on socio-economic empowerment, especially education of the female gender for them to be empowered in making relevant decisions concerning the health of their children.
5. Midwives and immunization services providers should embark on comprehensive routine education campaigns at both antenatal and postnatal sessions and child welfare clinics stressing the need for, and the total number of vaccines doses a child needs to complete his/her immunizations.
6. The Techiman Municipal Health Directorate should take advantage of the numerous FM stations and other channels like community durbars in the Municipal to strongly communicate health education messages so that parents understand the importance of completing the vaccination schedule on time for each child.
7. The Municipal Health Management Team should sensitized and encourage immunization service providers to take into consideration consent of immunization beneficiaries in the planning of outreach days and time.
8. Awards schemes can be instituted by the Municipal Health Management Team with support from partners to reward mothers whose children have successfully completed all the immunizations in the schedule and on time.

9. The Ghana Health Service and other partners in the immunization programme should make available adequate motor bikes and four wheel drive vehicles to the Municipal Health Directorate to enhance the movements of management and service providers for supervision and outreach services respectively.
10. The Municipal Health Directorate should conduct periodic staff orientation, especially for newly posted staff to refresh their skills in immunization service provision.
11. Further studies can be carried out to assess the potency of the vaccines used to immunize these children so that we can be sure that these coverages are at least translating into the desired immunity.

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APPENDIX I: Data collection instruments

UNIVERSITY FOR DEVELOPMENT STUDIES
SCHOOL OF ALLIED HEALTH
DEPARTMENT OF COMMUNITY HEALTH AND DEVELOPMENT

QUESTIONNAIRE

Introduction

We are working on a project concerned with immunization in which you could participate. The study is to evaluate the Expanded Program on Immunization data quality and coverage among children aged 12–23 months. The study seeks to assess what proportion of children are been immunized with the required number of valid doses and also to elicit reasons for non-immunization if any. The interview will take about 25 minutes. As part of the interview, we will also take information from the child's health record card and inspect the child's right-upper arm for BCG scar. All the information we obtain will remain strictly confidential and your answers and name will never be revealed. Also, you are not obliged to answer any question you do not want to, and you may stop the interview at any time. This is not to evaluate or criticize you, so please do not feel pressured to give a specific response and do not feel shy if you do not know the answer to a question. Feel free to answer questions at your own pace.

Do you agree to participate in this interview? Yes ___ No ___

Do you have any question before we start? (*Answer questions*).
May I start now?

Household information

Name of Community: ……..	**Name of Cluster:** ……	**Date of interview:** /……./……./……./ **(dd/mm/yy)**

Background of respondent (mother/caregiver)

1) Are you the mother of this child? (Probe)	**2) How many children do you/ (the mother of this child) have?**	**3) What is your level of education?**
1 Yes 2 No	1 1-2 2 3-4 3 5-6 4 7+	1 No formal education 2 Primary school 3 JSS/Middle school 4 Senior Secondary school 5 Tertiary

		6 Others (specify)……
4) Age of mother/ caregiver in years:	**5) Marital status:**	**6) What is your ethnicity?**
1 <19 2 20-29 3 30-39 4 40-49 5 50+	6 Never married 7 Married 8 Divorce 9 separated 10 Widowed	1 Akan 2 Dagaati 3 Frafra 4 Kusaasi 5 Ewe 6 Others (specify): ……
7) What is your religious denomination?	**8) What is your occupation?**	
6 Islam 7 Christianity 8 Traditionalist 9 No religion 10 Others (specify): ……	1 Salary worker 2 Petty trading 3 Farmer 4 Artisan 5 Others (specify): ……	

CHILD's NUMBER IN CLUSTER: ☐

SECTION B: INFANT IMMUNIZATION STATUS

Date: ___/___/2016 Range of birth dates From: ___/___/2014 Until: ___/___/2015			Name of child										Total	
													Card only	Card plus history
Child number in the cluster			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		
1) Birth date														
2) Sex (M/F)														
3) immunization card (Yes/No)														
4) BCG		Date/+/0												
		Scar: Yes/No												
		Source												
5)	Pentavalent 1	Date/+/0												
		Source												
	Pentavalent 2	Date/+/0												
		Source												
	Pentavalent 3	Date/+/0												
		Source												
6)	OPV 0	Date/+/0												
		Source												
	OPV 1	Date/+/0												
		Source												
	OPV 2	Date/+/0												
		Source												
	OPV 3	Date/+/0												
		Source												
7)	PCV-13-1	Date/+/0												
		Source												
	PCV-13-2	Date/+/0												

		Source												
	PCV-13-3	Date/+/0												
		Source												
8)	Rota-1	Date/+/0												
		Source												
	Rota-2	Date/+/0												
		Source												
9) Measles		Date/+/0												
		Source												
10) Yellow fever		Date/+/0												
		Source												
11) Immunization status	Not immunized													
	Partially immunized													
	Fully immunized													
12) Fully immunized before one year of age (Yes/No)														

Tally of households visited: _____ Total___

Date/+/0

Date = copy date from immunization Card, if available
+ = mother report immunization was given
0 = Immunization not given

Source

Out =Outreach site
Stat = Static **site**

SECTION C: REASONS FOR IMMUNIZATION FAILURE

NOTE: ASK ONLY ONE QUESTION: **why was the child not fully immunized?**

Mark **(√)** the single most important reason according to your judgment.

Child number in cluster		1	2	3	4	5	6	7	8	9	10	Total
Immunization Status	Fully immunized											
	Partially immunized											
	Not immunized											
1. Lack of information	a. Unaware of need for immunization											
	b. Unaware of need to return for 2nd and 3rd doses											
	c. Place and/or time of immunization unknown											
	d. Fear of side reactions											
	e. Wrong ideas about contraindications											
	f. Other:...											
2. Lack of motivation	a. Postpone until another time											
	b. No faith in immunization											
	c. Rumours											
	d. Other:....											
3. Obstacles	a. Place of immunization too far											
	b. Time of immunization inconvenient											
	c. Vaccinator absent											
	d. Vaccine not available											
	e. Mother too busy											
	f. Family problem, including illness of mother											
	g. Child ill – not brought											
	h. Child ill – brought but not given immunization											
	i. Long waiting time											
	j. Other:....											

This is the end of our discussion. Thank you very much for your time and involvement in the study, have a nice day/evening.

UNIVERSITY FOR DEVELOPMENT STUDIES

SCHOOL OF ALLIED HEALTH

DEPARTMENT OF COMMUNITY HEALTH AND DEVELOPMENT

KEY INFORMANT INTERVIEW GUIDE

Introduction

I am working on a project concerned with immunization in which you could participate. The study is to evaluate the Expanded Program on Immunization data quality and coverage among children aged 12–23 months. The study seeks to assess what proportion of children has been immunized with the required number of valid doses and also to elicit reasons for non-immunization if any. The interview will take about 35 minutes. All the information I will obtain will remain strictly confidential and your answers and name will never be revealed. Also, you are not obliged to answer any question you do not want to, and you may stop the interview at any time. This is not to evaluate or criticize you, so please do not feel pressured to give a specific response and do not feel shy if you do not know the answer to a question. Feel free to answer questions at your own pace.

Do you agree to participate in this interview? Yes ___ No ___

Do you have any question before I start? (*Answer questions*).

May I start now?

Respondent position: ..... Respondent Code: .....

1. How long have you been working with GHS? .....
2. How long have you been working in this municipal? .....
3. Have you heard of EPI? Yes ☐ No ☐ If yes, can you describe what you know about EPI?

   .....
4. How long have you been working with the EPI programme? .....
5. What is your role in the EPI programme? .....
6. What is your general assessment of the EPI programme in the municipal?

   .....

7. What indicators are available for measuring EPI services uptake in the municipal?
   .....
8. a. How are EPI services evaluated in this municipal?
   .....
   b. How often is this done? .....
   c. When was the last time it was done? .....
9. There is a trend of high administrative coverages of the various vaccines over the years. Could you explain what accounted for this?
   .....
10. Were all eligible children in 2015 fully immunized with all the required vaccines?
    Yes ☐ ☐
11. Could you enumerate the reasons why some children were not immunized or are partially immunized? .....
12. What would be the implication for some not been immunized or partially immunized? .....
13. What do you do to get partially immunized and non-immunized infants immunized?
    .....
14. Which of the immunization sites (static or outreach) is preferred by mothers and why? .....
15. What are the challenges faced in the implementation of the EPI programme?
    .....
16. What suggestions/strategies can be applied to improve EPI data quality and coverage in the Municipality?
    .....
17. That is the last question I have, are there any other comments you would like to add? .....

Thank you for participating in this interview today. Copies of the results of this study will be available in the UDS library and Techiman Municipal Health Directorate.

Thanks again and have a nice day/evening

APENDIX II: Cluster identification form

COMMUNITY	POPULATION	CUMMULATIVE FREQUENCY	CLUSTER
Wangara-line	5257	5257	1
Mayanka	3056	8313	
Gyarko	6333	14646	2
Abuoso	7408	22054	3, 4
Wiawso	1799	23853	
Site	1581	25434	
Tunsuase	4834	30268	5
Abanim	3370	33638	6
Konimase	1457	35095	
Mateso	1752	36847	
New Krobo	1708	38555	7
Sissalaline	1311	39866	
Diasempa	4312	44178	8
Goshen	2184	46362	
Fanti New Town	1582	47944	
Hausaline	4715	52659	9
New Aboadikro	1072	53731	
Dagombaline	2643	56374	10
Anyimana	1557	57931	
Poma-Krom	2514	60445	11
Dwomo	3585	64030	
Ahenfi	3113	67143	12
Brigade	2588	69731	
James Town	1372	71103	13
New Anyinabrim	2438	73541	
Kenten	3587	77128	14
Anynabrim	4253	81381	
Magazine	3417	84798	15
Sansama	1748	86546	
Traa	1247	87793	16
Blue Cross	1364	89157	
Sabon-Zongo	4440	93597	17
Takofiano	3846	97443	
Danso	1390	98833	18
Addai-Krom	1898	100731	
Tanoso	1518	102249	
Ntensere	3681	105930	19
Brahabebome	1071	107001	
Tanoso Tentenano	1663	108664	
Koforidua/	475	109139	
Sereso	388	109527	
New Techiman	2926	112453	20
Hansua	2664	115117	21
Tadieso	1730	116847	
Bomiri	1942	118789	
Kuntunuso	1204	119993	
Asubrofo	864	120857	22
Asutia	736	121593	
Aworopataa	932	122525	
Akisimasu	690	123215	
Forikrom	3511	126726	23
Boankrom	422	127148	
Ampemkrom	654	127802	
Asunafoo	381	128183	
Anomatoa	795	128978	
Fiaso	3667	132645	24
Anankansu	885	133530	

Wa	1827	135357	
Bomene	508	135865	
Woraso	651	136516	
Akrufi	477	136993	
Attabourso	1266	138259	25
Zongo	398	138657	
Kyeremekrom	452	139109	
Nyarkokrom	220	139329	
Kwasi-Buorkrom	427	139756	
Asantanso	568	140324	
Koroamoa	346	140670	
Atea	1103	141773	
Abirika	783	142556	
Srapukrom	438	142994	26
Koofoso	879	143873	
Kwasi Tia	208	144081	
Mmaampehia	558	144639	
Dentenkrom	393	145032	
Nsuta	4139	149171	27
Owusukrom	169	149340	
Gyawukrom	593	149933	
Mangoase	2089	152022	
Nkrankrom	729	152751	
Bowohommoden	668	153419	
Mampong	394	153813	
Gibiridu	386	154199	28
Tanonaafoo	349	154548	
Abanaba	485	155033	
Sreso	365	155398	
Kwasi Gyan	541	155939	
Koase	811	156750	
Twimia	660	157410	
Nsunya	381	157791	
Agosa	963	158754	
Bonkwae	770	159524	29
Wawase	389	159913	
Faawoman A	282	160195	
Faawoman B	407	160602	
Dentenkrom	329	160931	
Adiesu	484	161415	
Nkwaesi	1827	163242	
Twimia-Nkwanta	1969	165211	30
Jerusalem	1286	166497	
TOTAL	**166497**		

Sampling interval = 5550 **Random number = 4113**

APPENDIX III: Introductory letter

UNIVERSITY FOR DEVELOPMENT STUDIES
SCHOOL OF ALLIED HEALTH SCIENCES
TAMALE

Tel: 03720-93295

P. O. Box 1883
Tamale, Ghana

Our Ref: UDS/CHD/0177/14
Your Ref:

Date 25/01/2016

OFFICE OF THE DEAN

The Director of Health Services
Techiman Municipality
Brong Ahafo Region

Dear Sir/ Madam

LETTER OF INTRODUCTION

I write to introduce to you Mr Baguune Benjamin final year MPil. Community Health and Development student of the School of Allied Health Sciences.

As part of the requirement for the award of Master of Philosophy Community Health Development he is undertaking his Research, entitled ***"EVALUATION OF THE EXPANDED PROGRAM ON IMMUNIZATION DATA QUALITY AND COVERAGE AMONG CHILDREN AGED 12-23 MONTHS IN THE TECHIMAN MUNICIPALITY"***, and for this reason, I write to seek your assistance to enable him carry out his study.
Counting on your usual support.

Thank you

Yours faithfully

Mr Wahabu Yahaya
(Assistant Registrar)

APPENDIX IV: Permission letter

In case of reply
the number and the date of this
letter should be quoted

GHANA HEALTH SERVICE
MUNICIPAL HEALTH
DIRECTORATE
P.O. BOX 109
TECHIMAN - B/A.

28TH JANUARY, 2016

Our Ref GHS/TMHD/ADM/F.4
Your Ref .....

Benjamin Baguune
Mphil. Student
(Community Health & Dev.)
UDS

Dear Sir,

PERMISSION TO CONDUCT RESEARCH

With reference to the letter number UDS/CHD/0177/14 dated 25th January, 2016, requesting for permission to carry out a research study in this Municipality on the topic, "***evaluation of the expanded programme on immunization data quality and coverage among children aged 12-23 months in the Techiman Municipality***", I wish to inform you that, the Municipal Health Directorate has granted you the permission to carry the said study in the Municipality.

We wish you a successful study and hope that, the findings will be made available for future planning of health services.

Thank you.

Yours faithfully,

.....

Mr. George Sorry
(Municipal Health Administrator)
For: Municipal Director of Health Service
Techiman Municipality