UNIVERSITY FOR DEVELOPMENT STUDIES

ROUTINE INFANT IMMUNIZATION; FACTORS INFLUENCING NONCOMPLIANCE WITH THE SCHEDULE IN THE TAMALE METROPOLIS

IKLEEN SEIBIAM IBRAHIM

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BY

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THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH AND DEVELOPMENT, 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: Ikleen Seibiam Ibrahim

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. Baba Sule Mohammed (PhD)

ABSTRACT

A significant number of children do not comply with the Routine Immunization even after the health extension program was launched. This study was conducted to assess the determinants of noncompliance with the routine infant immunization schedule among residents of the Tamale Metropolis. A cross sectional survey involving 406 caregiver/child pair and also selected officials of the health services in Tamale was conducted. The rates for each scheduled date were 15.5% for Polio Zero, 41.1% for BCG; 5.7% for schedule two, 35.5 % for schedule Three; 43.3% for schedule Four; 50.0 for schedule Five; 83.3% for schedule Six (Measles Two). With respect to caregivers, higher level of education, being a mother, older age, higher income, high number of children, residence in rural area, high knowledge on immunisation and good attitude towards immunisation all led to a decrease in noncompliance with all the scheduled immunizations. With the child, increasing age, decreasing birth order and delivery out of hospital lead to increasing noncompliance with all the scheduled immunisations. In conclusion, the rate of noncompliance increases with increasing scheduled immunisation date. Both caregiver and child factors affected noncompliance with routine immunisation.

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Finally, I would like to honour all the members of my family, especially my Mom and Dad for believing and supporting me and for continuing to invest in my education. Words cannot express how much you mean to me.

DEDICATION

To my parents, Mr. Ibrahim Shaibu and Mrs. Ajara Hamidu

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OPERATIONAL DEFINITIONS

For the purpose of this research a number of definitions were adopted.

Noncompliance with Government recommended routine immunization schedule refers to a situation where for any of the dates that a child is scheduled to be immunized, that child either missed being immunized completely or was immunized on a different date. Children who are incompletely immunised, immunization dropout children, missed opportunity, immunization non completeness or children who have completed immunization but not according to the recommended immunization schedule all fall under noncompliance in this study.

First born child refers to the oldest among a caregiver's children

Second born child refers the child born immediately after the first born child

Third born child refers to a child born immediately after the second born child

Fourth and later born child refers to a child born after the third born child.

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ACRONYMS

MDG: Millennium Development Goals

WHO: World Health Organization

MOH: Ministry of Health

UNICEF: United Nations Children Emergency Fund

EPI: Expanded Program on Immunization

TMHD: Tamale Metropolitan Health Directorate

CHIPS: Community-Based Health Planning and Services

CHPW: Child Health Promotion Week

NHIS: National Health Insurance Scheme

NGO: None Governmental Organization

NID: National Immunization Day

VPD: Vaccine Preventable Diseases

GDHS: Ghana Demographic and Health Survey

UNDP: United Nations Development Program

BCG: Bacillus Calmette Guerin

CDC: Centre for Disease control.

TT: Tetanus Toxoid

PEI: Polio Eradication Initiative

GAVI: Global Alliance for Vaccine Immunization

DFID: Department For International Development

JICA: Japan International Cooperation Agency

DANIDA: Danish International Development Agency

FGD: Focus Group Discussion

CWC: Child Welfare Clinic

NSDH Newyork State Department of Health

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Chapter One

1.0 INTRODUCTION

1.1 Background to the study

It can be agreed that over the past one hundred (100) years, immunization has been the most potent means of infectious disease prevention (Ozcirpici, et al., 2006). So far as the decline in infant illnesses and deaths caused by vaccine preventable diseases is concerned, immunization provides the 'most cost effective tool' for arresting the situation (Wiysonge, et al., 2009).

Although, for several years, immunization has been shown to be very effective and has been practised for so long, its lower coverage rates, coupled with refusal by individuals to comply with immunization schedules recommended by the World Health Organization (WHO) and governments, have made it difficult to decrease infant mortality and morbidity in many African countries, including Ghana (Falagas & Zarkadoulia, 2008). This low compliance is because immunization remains the least understood area as far as contemporary medical studies is concerned. The Millennium Development Goals (MDGs) are among a mired of interventions that have been introduced over the years to reverse this trend. The fourth of these goals sought to use immunization as the strategy to reduce the mortality of children under the age of five years by two-third by the year 2015 (UNICEF, 2001). It is important to keep good records of immunization coverage; however this has been neglected to the disadvantage of many sub Saharan African countries. "Childhood mortality is seven times higher in Africa than in Europe, and more than 50% of all child deaths are concentrated in just six countries " (WHO, 2005). It is a wonder that diseases that are easily transferred from one child to the other have been allowed to continue (Umar, 2006). While it seems that over the last decade

there has been an improvement in immunization in Ghana, there have also been a lot of differences in the coverage levels from region to region (MoH, 2011). Since the importance of immunization cannot be over stated, it is very clear the advantages that are being lost as a result of poor immunization levels due to noncompliance in some parts of the country. It is even more worrying that in places where there are high immunization coverage levels, there seem to be some level of noncompliance with the routine immunization schedule recommended by health authorities. This is also true for the Tamale Metropolis as shown in Table 1.1 which gives the EPI coverage trend for the metropolis.

Table 1.1 Trend of EPI coverage, 2010 – 2014

Indicator	2011	2012	2013	2014
BCG (%)	97.1	129.4	105.8	115.5
Measles 1(%)	67.9	86.9	59.0	60.3
MEASLES 2	0.0	9.0	20.2	30.3
GEN DOR	30.1	32.9	44.2	47.9
Penta 3(%)	74.2	84.5	64.4	80.2
P1 – P3 DOR	5.8	7.3	10.7	6.7
PCV 3	0.0	1.8	64.4	80.1
ROTA 2	0.0	11.8	65.7	83.8

Source: Ghana Tamale Metropolitan health Directorate

All the EPI targets have been met; however, high EPI defaulter rate remains a challenge (Tamale Metropolitan Health Directorate, 2014).

It is very commendable that the nation has taken to outreach services, in order to compliment the efforts made at the health centre and to correct missed opportunity, however, greater

importance given to the noncompliance with the immunization schedule could resolve the problems all together.

1.2 Problem Statement

It has been shown in other parts of the world that noncompliance with immunisation schedules is a real problem. There is a substantial gap between immunization requirements and actual compliance even though it is known that immunization compliance is a fundamental aspect of preventive healthcare (Bundt & Hsou-Mei, 2004). Goodman et al., (2000) conducted a study on compliance rates in Kern County, California and found that parents sited non-compliance as being due mainly to child's illness, procrastination, and lack of knowledge about immunizations and where to obtain services. Parve, 2004 conducted a study to identify vaccination barriers in children 12 to 24 months and found that of the parents who were surveyed, only 20% reported that their children were currently up-to-date with their immunizations. Several studies have addressed factors leading to delays in vaccination. Though the child eventually gets the immunization, this concept is important because in many cases the delay causes inadequate vaccination of the child.

A study conducted in northern part of Ghana indicates that coverage by one Bacillus Calmette Guérin (BCG) shot, three sets of polio drops, and three DPT shots reduces mortality between ages 4 and 8 months by nearly 90%. Complete coverage by all EPI antigens reduces mortality between ages 9 and 59 months by 70%. BCG, polio, and DPT vaccines without measles vaccination reduce mortality by 40 percent. The independent reduction in mortality associated with measles vaccination is 50% (Nyarko, et al., 2001).The Turkish Demographic Health Survey conducted in 2003, it was determined that the rate of being fully vaccinated was 48%

and 3% of the children received no vaccine at all until the age of one. The same survey pointed out to several socio-demographic and economic indicators that were associated with the low level of immunization uptake. Living in a rural region, living in the eastern part of Turkey, having a non- educated mother and having a high birth order was related to the low likelihood of being vaccinated. Other surveys carried out in different parts of the country also determined low rates of coverage and similar factors associated with low rates of immunization uptake. As pointed out in these surveys, improving socio-demographic and economic indicators as well as providing better services are essential in achieving higher levels of immunization coverage. Still it is also important to evaluate low coverage rates through understanding the cultural context, personal decision-making processes, and perceptions of immunization services by utilizing both qualitative and quantitative methods (WHO, 2005).

The attitude and perception of individuals often influence uptake of health services. Some of the vaccine preventable diseases are among the leading causes of morbidity and mortality among children less than 5 years of age in many African countries, with more than 3 million deaths per year.One major way to reduce child morbidity and mortality from common Vaccine Preventable Diseases (VPDs) is immunization. VPDs have caused more than 20 per cent of death for children under five (Lee, 2005). For most of these diseases a single suspected case represents the alert threshold and a single confirmed case is considered as the action/ epidemic threshold because of the tremendous potential havoc that their occurrence can bring. (Ghana Statistical Service, 2015)

Ghana's latest Demographic and Health Survey (GDHS) conducted in 2014 and released in 2015 has seen the country making giant strides in many priority maternal and child health

indicators but with worrying regional, age, rural-urban variations in performance. According to the United Nations Development Programme (UNDP), infant and child mortality rates are basic indicators of a country's socioeconomic situation and quality of life. With the exception of neonatal mortality rate where the country recorded marginal declines in the 2008 rate of 33 deaths per 1000 live births to the current rate of 29, post neonatal, infant, and under-five mortality rates all saw very encouraging declines in mortality rates. Post neonatal mortality rates declined by 38 per cent, reducing from 21 deaths per 1000 live births to 13. Infant mortality rate, a measure of the probability of dying before the first birthday, also declined by 18% from 50 deaths per 1000 deaths recorded in 2008. Under five mortality, also a measure of the probability of dying between birth and the fifth birthday also reduced by 25 % declining from the 2008 figure of 80 deaths to 60 deaths in the 2014 DHS. Overall, the 2014 GDHS documents a pattern of decreasing under-five mortality during the 15 years prior to the survey (WHO, 2005).

Ghana However did not improve on the percentage of children that received all the basic immunizations (BCG, measles, and three doses each of pentavalent and polio vaccine) with the 2008 figure of 79% actually reducing to 77%. According to the DHS report, "The percentage of children with full immunization coverage ranges from a high of 91% in the Upper West Region to a low of 69% each in the Western and Northern regions." Lessons around leadership and management, technical delivery, rigour of programme implementation, adaptations and innovations etc. all need to be learnt for purposes of speeding up the spread of best practices in order to move from islands of excellence to truly transformed health systems.

The Northern Regions which is not showing improvement on these key indicators may be in need of some focused attention in order to address any bottlenecks impeding improved

maternal and child health outcomes. It is for this reason that the researcher seeks to address the problem by identifying the causal factors and make recommendations.

The government recommended routine immunization schedule for children must therefore be complied with in order to prevent the occurrence of these diseases. Incomplete immunization, alternative immunization schedules, delayed immunization either intentionally or unintentionally have no benefits and only puts a child at risk since this presents a period of susceptibility with little or no immunity (Haelle, 2014).

In Ghana the practice of reporting immunization dropout rates is common across most district and regional health directorate reports, these dropout rates are a measure of the number of children who are incompletely immunised or fail to comply with the routine immunization schedule. In the Tamale metropolis, high routine immunization dropout rate according to the Tamale Metropolitan Health Directorate (2014) report remains one of the challenges facing the Tamale metropolis. This problem of noncompliance with routine immunization is easily seen in results of this study

Caregivers make the decision as to whether to comply with the routine immunization schedule, by promptly taking the child to the child welfare clinics from the time of birth (0 months old) until the 18th month when the child is given the second measles vaccine. Failure to comply with the schedule may lead to infant mortality or morbidity which has a negative toll on parents, families, the health care system, and society in general. The problem of noncompliance with routine infant immunization arises due to caregivers/child pair and health facilities attributes as well as the society in general. The Health directorate, through enforced

education and innovation can also influence this problem of noncompliance with the routine immunization schedule.

If the problem is solved and all caregiver/child pair comply with the routine immunization schedule the possibility of a child getting any of the vaccine preventable diseases will be greatly minimised or eliminated altogether. This will lead to reduction in infant mortality within the Tamale metropolis and the northern region at large. However, if it is not solved the rate of noncompliance with the immunization schedule will continue to be high among caregiver/child pair and this could lead to outbreak of diseases, which will put a huge burden on the already overburdened health system within the metropolis.

1.3 Research questions

In order to achieve the objectives of this study, the following research questions will be addressed:

1. What is the rate of noncompliance with the infant routine immunization schedule for children, 18 to 59 months old?

2. What are the child characteristics that influence noncompliance with the routine immunization schedule for children, 18 to 59 months old?

3. What are the caregiver (socio demographic and socio cultural) characteristics that influence noncompliance with the infant routine immunization schedule for children, 18 to 59 months old?

4. How does Caregiver immunization related knowledge and attitude influence infant routine immunization schedule noncompliance for children, 18 to 59 months old?

5. What are the institutional factors that influence noncompliance with the infant routine immunization schedule for children within the first 18 months of birth?

1.4 Objectives of the study

The overall objective of this study was to determine the factors associated with noncompliance with the infant routine immunization schedule in the Tamale Metropolis.

The specific objectives of the study were therefore to determine:

1. The rate of noncompliance with the infant routine immunization schedule for children, 18 to 59 months old.

2. Child characteristics that influence noncompliance with the infant routine immunization schedule for children, 18 to 59 months old.

3. Caregiver socio demographic and socio cultural characteristics that influence noncompliance with the infant routine immunization schedule for children, 18 to 59 months old.

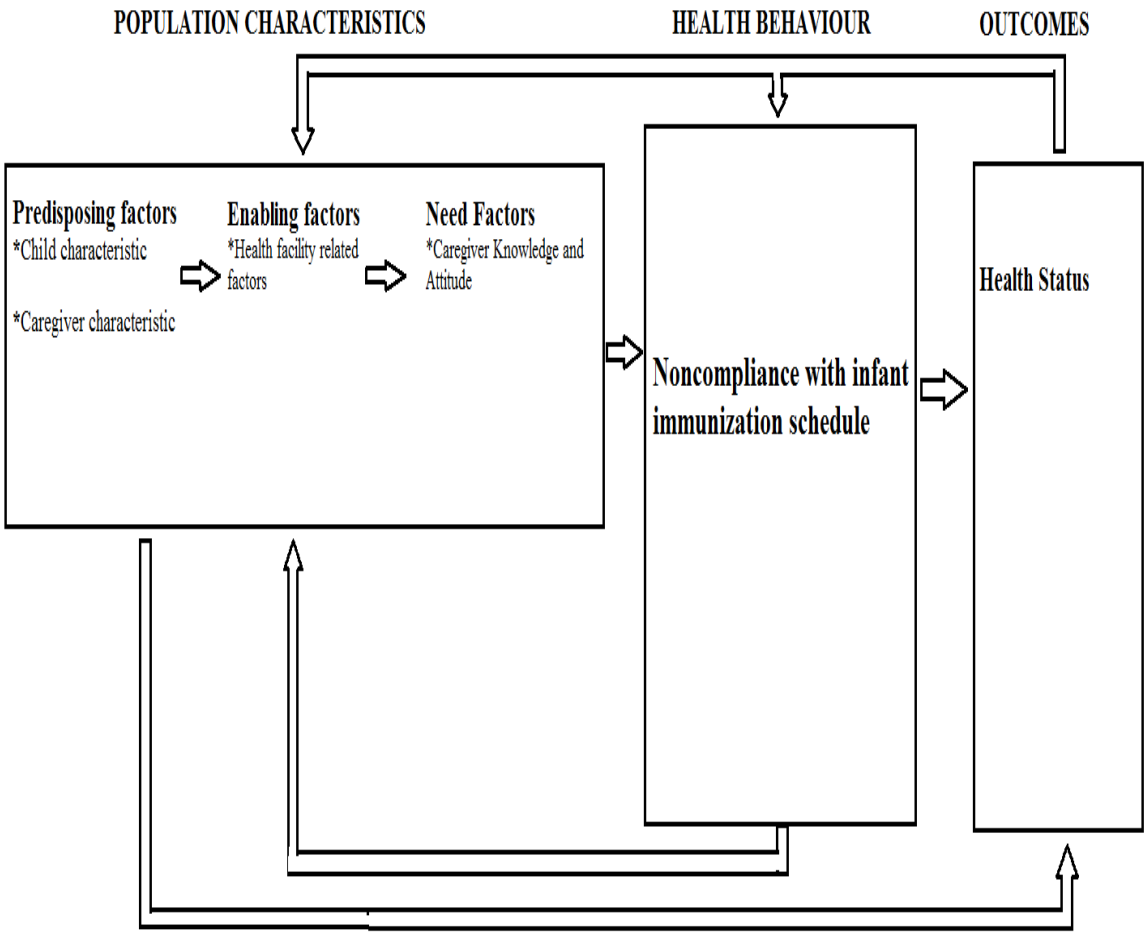
4. How Caregiver immunization related knowledge and attitude influence noncompliance with immunization schedule for children, 18 to 59 months old.

5. The institutional factor that influence noncompliance with the infant routine immunization schedule for children within the first 18 months of birth.

1.5 Conceptual Model

The conceptual framework employed in this research (Figure 1.1) is based on the behavioral model of the health services' which in the late 1960's was developed, to among other things, give a deeper insight into health service uptake by families.

Figure 1.1 Conceptual framework



Initially families were the main focus of analysis and this stemmed from the assumption that a person's health care need and pursuance is based on the social setting the person finds him or herself in, the financial and economic situation of their family and the cultural and moral persuasions of the family. However as time went by, the focus turned to individuals as the unit of analysis.

The model as it was proposed originally, stipulated that a person was predisposed to use a health service, based on conditions that deter or enabled the use as well as the health care need of the person (Mechanic, 1979 ; Rundall, 1981). According to Andersen (1995), revisiting the model shows a causal relationship between all components, even though individually these components sufficiently predict health care utilization. Predisposed factors such as demographics might require that other enabling factors be available for use of health care to take place, at the same time these predisposing factors and enabling conditions might in turn require the existence of need factors for a person to actually use a health care service. Andersen (1968) Hypothesized that the type of service that was being examined is what would determine the extent to which predisposing enabling and need factors could explain use. And indeed there could be variation in the extent to which each one explained use of the service in question.

According to Andersen (1968), the various stages the model has been through have led to the inclusion of other notable things. Health care system and national health policy were added in the second phase of the development of this model. Physical, political, and economic components are considered as external environmental factors and characterize the third phase of the evolution of the model. The fourth phase of the Behavioral Model of health services use

goes on to inculcate health status outcomes capturing the way health services utilization has changed over the years. (Evans & Stoddart, 1990; Patric et al., 1988)

The feedback loops employed in the fourth phase expose how perceived need and predisposing factors are related to health service outcome subsequently (Andersen, 1968).

1.5.1 Predisposing factors

It is thought that a person is bound to utilize one form of health service or the other, based on gender, age and other demographic factors, which then serve as the predisposing characteristics that will determine a person's need for particular health services (Hulka & Wheat, 1985).

Social structure and health beliefs are subsets of predisposing factors and of social networks, social interactions, and culture concepts rightfully fit into the social structure component. Social networks, social interactions, and culture concepts fall under social structure component, which according to Andersen (1995) together with health belief are considered as predisposing factors. Andersen (1995) as well as Becker & Maiman (1983) also do not place much value in the importance of the health believes in predicting health service use, this is a sharp departure from the call by social psychologists, who believe that health believes have not been adequately quantified and explored in the much of the research into the behavioral model. The inclusion of mental dysfunction as a unique predisposing factor, that makes up the psychological characteristics of individuals is attributable to (Rivnya, et al., 1989).

1.5.2 Enabling characteristics

According to Gilbert et al., (1993), it is not enough to focus on community related enabling factors, rather personal enabling factors must be available, individuals will utilize health services if they are health personnel available, and they also have the knowledge of the availability of the services. Attention must be given to the institutional factors that determine use of health service since this forms part of the problem with enabling factors.

1.5.3 Need characteristics

In modeling health service utilization, it is very important for us to know that people's perception of their state of health may inform their choices, however of great value are the way they experience ill health and if they feel that in their state they really need to obtain the service. (Andersen, 1995). Most Research that has used the behavioral model to predict use has been criticized for the focus and importance placed on the need factors, (Wolinsky & Johnson, 1991).

The components of Predisposing and enabling factors are said by Hulka & Wheat (1985) to be so many, hence Andersen et al., (1975) hold that the need component of the behavior model adequately covers them. And this can be used in analyzing a person's resolve to obtaining help or health care. Indeed it is expected that the need factors as it is perceived by a person should be able to help us understand the type of health service that is sought and the extent to which a person goes in utilizing that service.

1.5.4 Mutability

In all this a variable should be mutable, so that by changing policy it can be altered to have influence on the behavior of individuals. Since we cannot alter demographic factors such as age and gender, along with social structure its mutability is said to be low. We can however to a greater extent induce change in a person's health beliefs, therefore health beliefs is said to have a medium mutability (Andersen, 1995).

In the adaptation of the model for this study therefore, noncompliance with the infant immunization schedule is viewed as a function of predisposed factors e.g. Age, gender and other demographic factor relating to both the caregiver and the child, enabling factors e.g. Outreach services by health facilities, availability of immunization services, availability of logistics, availability of trained health personnel and other health facility related services, as well as need factors e.g. the caregiver knowledge and attitude towards immunization services.The figure shows a causal relationship between all components. Even though individually caregiver and child socio-demographic characteristics, health facility related factors and caregiver knowledge and attitude sufficiently predict noncompliance with the routine infant immunization service, at the same time caregiver and child socio demographic characteristics may require some health facility related factors for noncompliance to occur. Also the caregiver and child socio-demographic characteristics as well as health facility related factors might require various levels of caregiver knowledge, attitude, and perception for noncompliance with the infant immunization schedule to occur. Noncompliance with the routine infant immunization schedule may then lead to various health outcomes and implication, just as some predisposing, enabling and need characteristics may directly lead to some of these health outcomes.

1.6 Profile of the study area

The Northern Region is the largest area of the ten (10) regions of Ghana. As of 2014, it is divided into 26 districts. The region's capital is Tamale and the region covers a landmass of 70,384 square kilometres and accounting for 29.5 per cent of the total land area of Ghana. It shares boundaries with the Upper East and the Upper West Regions to the north, the Brong Ahafo and the Volta Regions to the south, and two neighbouring countries, the Republic of Togo to the east, and La Cote d' Ivoire to the west (Ghana Statistical Service, 2013; Tamale Metropolitan Health Directorate, 2014).

The land is mostly low lying except in the north-eastern corner with the Gambaga escarpment and along the western corridor. The region is drained by the Black and white Volta and their tributaries, Rivers Nasia, Daka, etc. (Ghana Statistical Service, 2014). The Tamale Metropolis is one of the 26 districts in the Northern Region. It is located in the central part of the Region and shares boundaries with the Sagnarigu District to the west and north, Mion District to the east, East Gonja to the south and Central Gonja to the south-west. The Metropolis has a total estimated land size of 646.90180 sqkm (Ghana Statistical Service, 2012). Ghana's latest Demographic and Health Survey (GDHS) conducted in 2014 saw the country making giant strides in facilitating demographic predictors in its quest to attain a higher complete immunization rate as per the millennium development goal but with worrying regional, age, and rural-urban variations in performance especially in the Northern sector of the country.

This project is aimed at the investigation of determinants of routine infant immunization schedule noncompliance in the Tamale Metropolis. The research design of this project was the "blue print" and framework that was created to seek answers to the research questions of the study. With a population of 233,257 according to the 2010 Population and Housing Census

representing 9.4 per cent of the region's population, it was impossible to examine the whole population, the researcher narrowed it down to a targeted population of selected communities within the Tamale Metropolis. The health care services and system in the Metropolis, however, are managed at three levels; from the metropolitan health administration level to the sub-district level and finally the community levels.

1.7 Scope of the study

The study focused on the nature of noncompliance with the routine immunization schedule for infants. This implies that the study covered all vaccines on the infant immunization schedule. It determined the proportions of caregiver/child pair who are either not immunized or are immunized on dates different from the scheduled dates. Specifically, factors that were likely to cause participants not to comply with the recommended schedule were assessed.

The research was a cross sectional observational study that randomly sampled several caregiver and child pair aged 18 to 59 months who attend the various health facilities in the Tamale Metropolis. Approximately 106 respondents were chosen from each of four sub-districts identified. These were Bilpela Sub-district, Nyohini Sub-district, Tamale Central Sub-district and Vittin Sub-district. Information collected included socio demographic variables of each caregiver and their respective child pair, immunization history of the child considering the various vaccines that had been administered to them already, different levels of knowledge and perception regarding immunization among the caregivers as well as perceived barriers to immunization in the study locale. The second part of the study used a focus group discussion, in which selected staffs of the selected health facilities were asked a set 10 open ended question within a one hour period.

1.8 Significance of the study

The Aim of this research was to contribute to the improvement of the health status of infants within the first five years of their birth, in the Tamale metropolis, the northern region and the entire country as a whole.

Noncompliance with the routine infant immunization schedule often means that caregivers start with the immunization of their children but somewhere in the course of the schedule, fail to continue till the eighteenth month when the last vaccine is given, or they continue to take the child for immunization, but not in accordance with the immunization schedule as prescribed and elaborated in the child health record book given to them.

This study attempted to identify reasons for which caregivers in the tamale metropolis, of the northern region do not comply with the infant routine immunization schedule. It is hoped that the findings will help fashion out policies that would give a greater consideration to determinants that were hitherto unknown to be relevant in enhancing compliance with immunisation. For instance demographic predictors of noncompliance with the infant routine immunization schedule by people within the metropolis will be tackled in a bespoke manner for efficient immunisation programmes. Furthermore, the information gathered could be used by stakeholders as bases for evaluation of their commitment efforts. With the study haven covered institutional factors that influence noncompliance, the findings could help bring out the relevant changes that can be made at the health care centres to make sure that there is an improvement in the delivery of the infant immunization services at these facilities.

The valuable information gathered in this study if used will provide helpful insights to Ghana

Health Service, The Tamale Metropolitan health directorate, the Health Directorate within region and other Non-Governmental Agencies when dealing with ways to address future occurrences of the same or similar problems. The study will also serve as a reference point for students, other researchers and Academic institutions when dealing with the demographic predictors of immunization schedule noncompliance.

1.9 Purpose of the study

Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease. Surveys elsewhere have pointed out socio demographic, socio cultural and institutional factors to influence noncompliance with recommended immunisation schedules (Abdulraheem, et al., 2011). There are no studies in Tamale metropolis that have assessed the nature of the factors that cause noncompliance with the routine infant immunization schedule. Therefore, the aim of this mixed method study was to understand the behaviours of people concerning immunization in the Tamale metropolis of Northern Ghana. The study assessed predictors of immunization defaulting among children and reasons for noncompliance across socio demographic backgrounds.

Between two and three million deaths occur during each year by vaccine preventable diseases alone (WHO, 2009). To reduce this figures of mortality and morbidity, the World Health Organization (WHO) launched Expanded Program on immunization (EPI) in 1974, when less than 5% of the world's children were immunized during their first year of life against the six killer diseases; polio, diphtheria, tuberculosis, pertussis, measles and tetanus. Today, 83% of

the world's children, at age less than one year, have received these life-saving immunizations. As a result, in the World more than 2.5 million deaths of children due to vaccine preventable diseases are prevented each year alone. Increasing numbers of countries, including developing countries, are adding new and under-used vaccines, like Hepatitis B, Haemophilous influenza type b (Hib) and yellow fever vaccine to their routine infant immunization schedules (Paul, 2012).

Despite, governments' effort to improve the delivery of healthcare through posting health extension workers to communities, there is still a high number of defaulters, due to the major deterrents to achieving universal immunization, including low access to healthcare services, inadequate awareness of caregivers, missed opportunities, and high dropout rates (MoH, 2011).

1.10 Organizations of the study

This report of the research is organized into 5 chapters. As described below:

Chapter One: This chapter gives an introduction to the whole study and highlight the objectives and the significance of the study.

Chapter Two: This chapter reviews and objectively assesses evidence as contained in the literature relating to noncompliance with immunization schedule in several communities in the West African sub region, and many other locations across the world.

Chapter Three: This chapter of the thesis deals with the individual methods regarding how the study was designed, the approach used in sampling, sample size determination, administration of the questionnaires, and collection and analysis of the data for the study.

Chapter Four: This chapter analysed the data collected and presented them in a comprehensible format using table and figures where necessary.

Chapter Five: In this chapter, the results obtained from analysis of the data collected were discussed in relation to already published information.

Chapter Six: Summary, conclusions and recommendations: This chapter presents the key findings of the study and draw conclusions based on the results obtained. The chapter also contains constructive recommendations from these conclusions.

Chapter Two

2.0 LITERATURE REVIEW

This chapter presents a review of works that have been done so as to gather evidence on issues of incomplete immunization, and some relevant methods that have been employed in modelling the predictors of non-compliance with medical recommendation, including immunization schedules. The content of this chapter is organised under headings, such as Immunization and vaccine preventable diseases in Ghana, Incomplete immunization, predictors of incomplete immunization, and models for predictive factors.

2.1 Immunization

According to WHO (2016) "Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease. Immunization is a proven tool for controlling and eliminating life-threatening infectious diseases and. It is one of the most cost-effective health investments, with proven strategies that make it accessible to even the most hard-to-reach and vulnerable populations. It has clearly defined target groups; it can be delivered effectively through outreach activities; and vaccination does not require any major lifestyle change." Our immune system helps our body fight germs by producing substances to combat them. Once this happens, the immune system "remembers" the germ and can fight it again during subsequent infections. Vaccines contain germs that have been killed or weakened. When given to a healthy person, the vaccine triggers the immune system to respond and thus build immunity.

Immunization prevents us from contracting diseases like measles, mumps, rubella, hepatitis B, polio, tetanus, diphtheria, and pertussis (whooping cough). And even though the shot given during immunization may serve as a disincentive, the fact that they prevent all these diseases makes them worthwhile and highly necessary infants as well as adults. This is why the Expanded Program on Immunization (EPI) was launched in 1974 as a global program for controlling and reducing death from Vaccine Preventable Diseases (VPDs). (Forder, 2002)

What therefore will the consequences be if immunization is stopped? Diseases that are almost unknown would stage a comeback and before long we would see epidemics of diseases that are nearly under control today. More children would get sick and more would die. Over the years immunizations have thwarted epidemics of once common infectious diseases such as measles, mumps, and whooping cough. And because of immunizations we've seen the near eradication of others, such as polio and smallpox (Andrew, 2007). Hence aside the immediate benefits that we derive from immunization, we also protect our future when we get immunized. We do not immunize children just to protect them; we also protect our grandchildren and their grandchildren. Children don't have to get a disease like small pox because it has been eradicated. And they don't need to be immunized against small pox anymore because the disease no longer exists.

Before vaccines were used for immunization, people became immune only by actually getting a disease and surviving it. Immunizations are an easier and less risky way to become immune. The goal of public health is to prevent disease. It's much easier and more cost-effective to prevent a disease than to treat it (CDC, 2009). That's exactly what immunizations aim to do. Immunizations protect us from serious diseases and also prevent the spread of those diseases to others.

2.1.1 Child immunization

The mission of the immunization program in Ghana according to Martison et al., (1996) is to contribute to the overall poverty reduction goal of the government through the decrease in the magnitude of vaccine preventable diseases. This is carried out through the use of cost effective, efficacious and safe vaccines, new and under used vaccines and technologies to protect more people whilst contributing to the overall health systems strengthening in an integrated manner. Ghana has been at the forefront of showcasing immunization as the platform for health systems strengthening. 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.

According to Allan, et al., (2003) 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. Three strategies are implored for the delivery of the immunization services in the country; static, outreach and campaigns to reach out to most of the unreached populations.

In 1992, fourteen years after the launch, the government added yellow fever vaccination to the national immunization programme (NIP). The Polio Eradication Initiative (PEI) introduced in 1996 offered a major boost to the NIP through the resources offered for capacity building at all levels, funds for operational activities, adequate cold chain

logistic ,systems strengthening, partnerships, transportation facilities etc. 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, and Civil Society Organizations increased the number of antigens with two new vaccines the Hepatitis B and the Haemophilus influena type b (also known as Hib). The two new vaccines were combined with the DPT into DPT+HepB+Hib (commonly referred to as the Pentavalent vaccine) The Government of Ghana has been responsible for the total cost of traditional vaccines and injection supplies since the inception of EPI in 1978 (Gavi, 2012). It shares the cost of the Pentavalent and Yellow Fever proportionately with GAVI as agreed upon in the financial sustainability plan at the beginning of the introduction of the pentavalent vaccine in 2002 until 2007 when the country rolled on to the co-payment scheme under the bridge financing mechanism. Development Partners (DPs) provide support in various forms including campaigns. Some of the partners support needy districts with additional resources to improve on their immunization programmes. Immunization coverage has been on steady increase and as at the end of December 2007, 106 districts out of the 138 in the country, representing 84% achieved penta 3 coverage of more than 80%. Incidence of most of the childhood killer diseases in the country have declined significantly

2.1.2 Noncompliance with immunization schedule

An epidemiological study conducted in the United Studies and other parts of the world point to the fact that notwithstanding the enormous benefits that come with the immunization of children, more and more caregivers instead of complying with the recommended schedule are deciding to delay or refuse due to several concerns (Glanz, et al., 2013). Indeed in an e-mail

and mail survey of a nationally representative sample of paediatricians and family physicians in the US, 93% of them reported that it was typical of some parents of children less than 2 years to request spreading out vaccines; 21 % of these physicians reported that more than 10% of parents made this request. Although these physicians knew that there are harms associated with spreading out vaccines, they usually agree to do so (Allison, et al., 2015).

A recent national survey in the United States demonstrated that 13% of parents of young children reported using some type of alternative immunization schedule (Dempsey, et al., 2011). Such alternative schedules can lead to under immunization, which has been shown to significantly increase the risk of acquiring and transmitting vaccine-preventable diseases (Feikin, et al., 2000).

The percentage of parents who refuse all vaccines is a small subset of those who choose alternative schedules overall, (Smith, et al., 2004) with the majority choosing to delay certain vaccines, extend the interval between vaccines, or delay vaccines until a certain age (Gust, et al., 2008).

In a study based on the Health Belief Model which evaluated the association between parents' beliefs about vaccines, their decision to delay or refuse vaccines for their children, immunization coverage, and reasons given for their decision to delay or refuse immunization, it was realised that compared with parents who neither delayed nor refused vaccines, parents who delayed and refused vaccines were significantly less likely to believe that vaccines are necessary to protect the health of children, that their child might get a disease if they aren't immunized, and that vaccines are safe (Philip, et al., 2011).

There are many myths about immunization in the minds of people around the world, some of which arise from the perception that giving the vaccines for immunization too close to one another is harmful (Andrew, 2007). A number of people have claimed that a young child's immune system is not robust enough to be given multiple vaccines, and that it is safer to 'spread out' the immunization. There however is no scientific evidence for this, and there is evidence that it is safe and effective to follow the recommended schedules.

In a cohort study carried out in the US, it was found that there was "no increased risk of post immunization seizure" in infants regardless of the timing of immunization. In year 2, delaying measles mumps and rubela (MMR) vaccine past 15 months of age was even found to be associated with a higher risk of seizures (Simon, et al., 2014).

2.1.3 Effects of delayed schedule and missed opportunity

Inadequate levels of immunization against childhood diseases remain a significant public health problem in resource-poor areas of the world (Health Section of the Secretariat of the League of Nations, 2006). High levels of exemption from immunization and suboptimal immunization coverage leave children vulnerable to vaccine-preventable diseases (Ranee, et al., 2014)

It is estimated that, among children born during 1994– 2013, immunization will prevent an estimated 322 million illnesses, 21 million hospitalizations, and 732,000 deaths over the course of their lifetimes, at a net savings of $295 billion in direct costs and $1.38 trillion in total societal costs (Cynthia, et al., 2014).

The foregoing gives ample reason for all stakeholders to support the course for an enhanced immunisation, especially in resource poor nations, by paying particular attention to the reasons for incomplete immunisation. Unfortunately, these reasons for incomplete immunization and non-uptake of immunization are poorly understood (Jagrati, et al., 2008). In the United Kingdom, Germany and Sweden studies have shown that immunization of infants is highly effective against Hib disease (WHO, 2006).

The threat of death by disease isn't the only medical consequence of skipping vaccinations. An unvaccinated child faces lifelong differences that could potentially put him or her at risk. In some parts of the world, it is required that a child's immunization status be made known to the doctor or medical personnel, so that a distinct treatment can be given to the child. As a result medical personnel available may not have the skill and appropriate experience to give the child the appropriate treatment. Also when children who are not appropriately immunized fall ill, this puts others at risk, especially for special groups of people with compromised immune systems who rely on the immunized general public to reduce their risk of being infected (NSDH, 2015).

There are also social implications of not immunizing a child, from exclusion to quarantine. If sick or exposed to disease, it may become necessary to exclude a child from others, including family. If there is an outbreak in a community, a child from that community may be taken out of school and other organized activities, causing the child to miss school and special events. A child's illness or inability to go about their daily activities also may impact the parents work and household income (NSDH, 2015).

On very rear occasions when vaccine failure may lead to previously immunized individuals getting the disease for which they were immunized, the disease usually appears in a milder form than in individuals who are not immunized. In a German efficacy study of an acellular pertussis vaccine, vaccinated individuals who developed whooping cough had a significantly shorter duration of chronic cough than controls (Schmitt, et al., 1996).These findings were confirmed in another study carried out in Senegal, where (Preziosi & Halloran, 2003). Similarly milder diseases were reported in the case of individuals vaccinated with the rotavirus vaccine than unvaccinated cases. (Ruiz-Palacios, et al., 2000).

Indeed the improvements in infant and child mortality, as a result of immunization services have been very empowering for women, since they tend to opt for fewer children as the need to have many children to ensure that some will reach adulthood is reduced. As a result of this, significant health, educational, social and economic benefits have been choked (Shearley, 1999).

Poor health has been shown to stunt economic growth while good health can promote social development and economic growth. Health is fundamental to economic growth for developing countries and vaccinations form the bedrock of their public health programmes (Bloom, et al., 2005). When the conjugate pneumococcal vaccine for infants was added to the required immunization for children in the USA in 2000, "a 57% decline in invasive disease caused by penicillin-resistant strains and a 59% decline in strains resistant to multiple antibiotics by 2004 across a broad age spectrum: 81% among children under 2 years of age and 49% among persons aged 65 years and older" (Kyaw, et al., 2006).

Kyaw et al., (2006) also state that immunization, makes the use of antibiotics less common, and this ensures that resistant strain developments are reduced, thereby reducing the prevalence of diseases.

2.2 Factor influence Immunization Schedule Noncompliance

Numerous studies have been carried out in both the developed and developing worlds all in the bid to identify the factors that influence the phenomena of noncompliance with infant immunization schedules from the time of a child's birth. Among factors already identified, are institutional; relating to the health facilities and the health staff from whom the immunization services are sought. While some factors relate to caregivers and their socio-demographic as well as socio-cultural circumstances, others factors are related to the child's own characteristics. The causative factors have however varied from research to research and place to place and are discussed as follows.

2.2.1 Institutional factors

The effectiveness of immunization programs in resource-poor settings can be influenced by factors such as the coverage of the health network, the existence and quality of outreach services, the quality of the cold chain, the liaison of communities with health services, and the existence of population movements. Issues related directly to the vaccine in use, regarding its perceived quality could also influence the completion or otherwise of the immunisation. It is also important to appreciate the fact that, the relative effect of each one of the above factors may significantly vary according to the geographical areas (Carr, et al., 2000).

In a study in India by Saga et al., (2011) it was found that if health workers improved interpersonal communication it resulted in a greater likelihood for children to be fully immunized. The authors also indicated that other institutional aspects that needed strengthening for enhanced immunisation compliance were; Program management issues, immunization safety, recording and reporting practices and active tracking of beneficiaries. In another study by Larson et al., (2012) the availability of complementary services like weighing of children at the health facility and also more numbers of facilities that actually offer routine immunization services for children were found to be associated with an enhanced uptake of immunization in Cameroon. This study, reported that both weighing of children concurrently and proper reception of parents by health workers at the facility were effective ways of incentivizing caregivers to present their children for immunisation. This undoubtedly promoted complete immunization.

Advocacy campaigns among political, traditional and religious leaders, as well as creating community demand for services all form part of effective communication and social mobilization efforts which when improved upon, will encourage a community to use services. Increasing advocacy was required after most disease-control initiatives were reviewed, as well as counselling of family members and sustained community involvement. It was found that prior to the introduction of the Reaching Every District initiative; which has increased, resources for communication and social mobilization at district and community levels, the effectiveness of staff members was limited because only a few of them were dedicated to communication related issue (Arevshatian, et al., 2007).

The ability of the health system to deliver immunization services to the target groups, rather than maternal age, education, and marital status was found in the study of an urban area of Sao

Paulo in Brazil to be associated with immunization completeness, when Barreto & Rodrigues (1992) studied the reasons many children remained unimmunized. Quality of care is also known as a common factor in what informs our health seeking behaviour and for that matter Basel & Shrestha (2012) measured quality of care by five service characteristics; the precise behaviour of health workers, waiting time in the clinic, availability of the vaccine, punctuality of health workers in the EPI clinic and regularity of EPI session.

One specific reasons for not being able to complete the immunization of children as indicated by Jani et al., (2008) as associated with health service delivery was, long waiting time, while some other factors occurred when caregivers took their children for immunization service, were; no personnel at the health facility, and no vaccines available on the day among others.

2.2.2 Socio-demographic factors

Many socio-demographic factors have been found to determine the various forms that infant immunization noncompliance can take. These are factors or characteristics an individual is often predisposed to, however they may affect our uptake of health services and for that matter our health behaviour, there by influencing health outcomes.

2.2.2.1 Area of Residence

Noteworthy among socio-demographic factors is the area of residence. Payne et al., (2013) in their work; achieving comprehensive childhood immunization: an analysis of obstacles and opportunities in the Gambia showed that full immunization is higher in rural areas than urban areas, and higher in peri-urban areas than urban areas. Also according to Branco et al., (2014)

even though, some of the children were either born or lived in the rural areas of the Amazon before, the study concluded that; “each year of residency in the urban area provides an additional 29% chance of compliance with the immunization calendar for the first year of life.

Etana & Deressa, (2012) observed in their initial analysis that urban residency is significantly associated with completion of immunization, whiles with subsequent multivariate analysis they conclude that urban dwelling is not. “Mother of children from urban areas reported more correct immunization than mothers of children in rural areas, that is (79.2% and 35.9% respectively)” (Ibnouf, et al., 2007). Most of the researches therefore support the assertion that area of residence is a significant determinant of noncompliance with immunization schedule by caregiver child pairs. More so the relative effect of each one of factors like, coverage of the health network, the existence and quality of outreach services, the quality of the cold chain, the liaison of communities with health services, the existence of population movements, and several other factors that are related to the vaccines in use, to health services or to communities may significantly vary according to geographical areas (Carr, et al., 2000). Although high levels of immunization coverage by state are reassuring, immunization exemptions have been shown to cluster geographically (Omer, et al., 2008)

2.2.2.2 Ethnicity

Ethnicity is a very important factor in many aspects of life and as a result some studies have looked at its significance in this important issue of immunization noncompliance. Although studies have found no significant association between different ethnic groups and coverage of DTP 3 vaccine, clear differences are seen in the likelihood of some tribes to be completely immunized, compared to others (Payne, et al., 2014). A study in the Gambia revealed that

"children of Mandinka ethnicity are less likely to be immunized compared with those of Fula or Wolof ethnicity. The authors of this research, Payne et al., (2013) concluded that "Specifically for BCG and measles vaccines and generally for the full immunization, children of Fula ethnicity are more likely to comply with immunization services.

Maternal or care giver: Ethnicity was found by Branco et al., (2014) to be associated with immunization completion in a study carried out in Brazil. This was however found not to be the case when the analyses were adjusted for factors such as socioeconomic or maternal education. In Nairobi Kenya, children of the Luhya, Luo and other ethnic groups were found to have lower odds compared to Kikugu children of full immunization mostly when the polio birth dose was included in immunizations (Mutua, et al., 2011) . Using the term dropout in place of noncompliance with infant immunization schedule, Basel & Shrestha (2012) reported that most of the cases of incomplete schedules were from the Magar / Gurung ethnic group, followed by the Lama ethnic group. In this instance, the, Newar ethnic group was observed to have no immunization dropouts. Their study therefore concludes that ethnicity is significantly associated with immunization status of children.

2.2.2.3 Socio Economic status and Income

Wealth of parents or care givers of children have also been researched extensively, to ascertain their association with immunization noncompliance and compliance. In a study conducted in Assis Brasil, (Branco, et al., 2014) it was found that socioeconomic conditions such as not owning a house was a strong predictor of child immunization noncompliance in that part of the world. In their research titled; Predictors of defaulting from completion of child immunization in south Ethiopia, Tadesse et al., (2009) determined that only monthly family

income was found to be a predictor of defaulting. The other socio-demographic variables such as family size, age of mother or immediate care taker, occupational status, ethnicity, religion, parity, and educational background were not associated with defaulting. Monthly family income had retained its significance after adjusting other socio-demographic characteristics Indeed bnouf et al., (2007) have claimed that socioeconomic status of the child's family goes a long way to determine their immunization status.

A contrary view has been reported however by a group of authors who conclude that no significant association exists between wealth and immunization coverage (Payne, et al., 2014). Konstantynera and others also demonstrated that per capita income below half minimum wage was not a determinant of immunization completeness (Konstantynera, et al., 2011). These authors state however that “inadequate housing also presented high risks of incomplete immunization". Interestingly Mutua et al., (2011) showed that poverty, measured as households expenditure was a predictor of full childhood immunization.

Dropout rates have also been linked with the category of work a child’s father is engaged in. Basel & Shrestha (2012) indicated that a significantly greater portion of immunization dropout children had their fathers engaged in manual hard labour, whilst the proportions were relatively lower for children whose fathers were businessmen and service holders. A study conducted by Bundt (2004) found that non-minority children with parents of higher socio-economical background were far more likely to have complete immunization.

2.2.2.4 Maternal and child health service uptake

The exploration of maternal and Child health services (ANC and PNC) Attendance as a predictor of a child's immunization status is equally important in this regard, clearly it gives an insight into the attitude of a mother towards healthcare patronage, it is little wonder therefore that this has emerged as a source of much regard in past research pertaining to the phenomena of incomplete immunization and immunization schedule compliance.

Tadesse et al., (2009) have shown that there is a significant association between utilization of postnatal care (PNC) services and completion of child immunization. Mothers are six times more likely to have defaulting children if they do not use PNC services, than those mothers who use PNC services. Postponing vaccine schedule was identified as an attitudinal factor which is an independent predictor of defaulting in immunization. (Tadesse, et al., 2009) "Children of mothers who had followed ANC during their last pregnancy and received TT immunization were more likely to be fully immunized (Etana & Deressa, 2012).

In line with this, Konstantynera et al., (2011) found that "Poor prenatal care" (mothers not attending the minimally recommended four antenatal visits) also determined immunization compliance. However, Branco and co-workers reported that as far as prenatal care consultations are concerned, neither the access nor the number of consultations had any association with a child immunization status (Branco, et al., 2014). Furthermore, both postnatal and antenatal care service attendance have been shown not to be associated with full immunization in children (Mutua, et al., 2011)

2.2.2.5 Knowledge of immunization

Another broad set of predictors that have been extensively researched so far as child immunization noncompliance is concern are the various levels of knowledge. Knowledge can be categorized to include specifics such as knowledge on the immunization schedule itself, the benefits that come with immunization, and also captured as an overall of all the specific knowledge about the immunization concerned. The issues of this collective set of knowledge might be what inform attitudes which intern result in actions that might encourage noncompliance with the child immunization schedule.

According to Tadesse et al., (2009), Mothers or immediate caretakers of children who did not have knowledge about the immunization schedule, the benefits of immunization for measles and polio, were more likely to default in completion of immunization for their children. Lawrence et al., (2004) found in their telephone interview research that most parents whose children were incompletely immunized thought vaccines were not effective in protecting their children.

A study carried out by Al-lela et al., (2014) to evaluate Arab and Iraqi parents' knowledge and practice and to determine relationship of knowledge and practice of parent variation with immunization status of children younger than two years, also found that a significant association existed between immunization compliance and adequate knowledge score. In another study regarding mother's knowledge about immunization, bivariate analysis were used to show that mothers who knew that immunization is used to prevent diseases, knew the total session needed to complete immunization, and also knew the age at which a child begins and completes immunization schedule, were more likely to have children who were had complied

with the immunization schedule (Etana & Deressa, 2012). However a mother knowing some number of vaccine preventable diseases had no association with compliance with immunization schedule by her child.

On the other hand it has been reported that understanding of the importance of immunization was not associated with complete immunization (Jani, et al., 2008). Although, mothers awareness of the purpose of immunization is seen by this research to determine correctness or completeness of immunization (Ibnouf, et al., 2007).

A study conducted in Karachi, in the Eastern Mediterranean Region of Pakistan, showed that most common primary reason for non-immunization was lack of knowledge (18.1%), The most common secondary reason for non-immunization was religious taboos (31.4%), When asked to name the disease which had been eradicated from the world due to successful immunization campaigns, only 0.8% were able to name small pox. However, more people (1.2%) were successful in naming polio as the disease that had been eradicated from all countries except three also, only 2.8% were able to fully recall EPI immunization schedule, (Asfandyar, et al., 2013).

2.2.2.6 Concerns of medical contraindication

Concerns of medical contraindication after immunization, is yet another aspect of published research that has been explored to determine its significance to the issue of incomplete immunization. In a study carried out in Nepal, “The primary reason (42.5%) for dropout was because of the child’s illness when the immunization was due” (Basel & Shrestha, 2012) even though a majority of the respondent (54.3%) said they go for immunization regardless of the

child's illness. Lawrence et al., (2004) also concluded that "A quarter of the parents give reasons that their child is unwell at the time immunizations are due, or medical recommendations against immunization" " children not fully immunized due to illness or access reasons are likely to have started the immunization schedule".

2.2.2.7 Concerns of Adverse effects

Concerns of side effects, adverse effect, and safety of immunization have also been looked at by Lawrence et al., (2004) where they found that of the 270 parents who disagreed with or were concerned about immunization, majority (70%) were concerned about vaccine side effects. In that research it was realized that of the immunization noncompliant parent/children pair, nearly half of the parents simply disagreed with immunization and that is why they have children whose immunization scheduled dates are long overdue. The authors also stated that some parent intimated that they have concerns with immunization, the sources of which concerns remained undisclosed by them. "Up to 3% of Australian parents do not immunize their children because they object or disagree with it for reasons of concerns about its safety (Lawrence, et al., 2004).

2.2.2.8 Educational Background

Educational background and Literacy level of mothers, fathers and caretakers has also been explored and reported. Level of education has been shown to have varied effects on the completion of immunization in children. For instance, Lawrence et al., (2004) state in their research that parents who disagree or are concerned about immunization are significantly more likely to be tertiary educated and to have children who did not comply with the immunization

schedule. Educational background was shown by Jani et al., (2008) in their research carried out in Mozambique, to have no significance so far as incomplete immunization is concerned.

A contrary conclusion however is again arrived at in the Sudan study by Ibnouf et al., (2007) which indicates that children of highly educated mothers are more likely to be immunized completely than those born to illiterate mothers. Another group also showed that the odds of not completing the immunization scheme increases significantly in mothers or caregivers with less than 8 years of schooling, when compared with those with more education, even when adjusted for possession of the household (Branco, et al., 2014). Maternal Education less than four years however was cited by Konstantynera et al., (2011) as not being a predictor of noncompliance with the immunization schedule.

In the work carried out by Mutua et al., (2011), maternal level of education is also determined to be a significant determinant of full immunization when Oral Polio Vaccine OPV at birth was included in analysis, with children of mothers who had completed primary education having close to one and a half times higher odds of being immunized compared to those of mothers with no education. When using bivariate analysis, literacy of a mother was significantly associated with complete immunization, however this association disappeared when other variable were including in the analysis (Etana & Deressa, 2012).

Basel & Shrestha, (2012) also indicates in their work that as the educational background of mothers increase the percentage of dropout children decreases, with majority of immunization dropout children having illiterate mothers. "Children of mothers with primary, secondary and above level of education were found to be less likely to drop out" with an associated high significance, between immunization status and mothers education. Lopreiato & Ottolini,

(1996) came to the conclusion that parental education was not associated with immunization delay when they carried out a cross-sectional survey of immunization records and demographic characteristics among parents of children presenting for acute care at seven paediatric clinics operated by the United States Department of Defence.

2.2.2.9 Maternal Age

Mutua et al., (2011) reported maternal age as a strong predictor of immunization of children with older mothers being more likely to have children who are immunized compared with mothers who are aged less than 20 years. In other studies, mother's age however showed no significant differences with respect to children who complied with the immunization schedule and those who did not (Jani, et al., 2008). An alternate view is held by Ibnouf et al., (2007), who demonstrated that children whose mothers are older were correctly immunized fully than children of younger mothers.

2.2.2.10 Distance to immunization centre

Branco et al., (2014) and Jani et al., (2008) also showed that distance between the place of residence of children and health centre where the immunization program was carried out is also a very important determinant of child immunization noncompliance, even though once adjusted for educational background of care giver/ mother the association disappears. In line with this, an association between walking time and completeness of immunization was found Sudan (Ibnouf, et al., 2007).

In other studies although, accessibility was seen to have no association with missed opportunities for immunization, spending longer than 60 minutes to reach the nearest health facility was demonstrated to have a strong negative influence in immunization uptake (Hutchins, et al., 1993).

Related to the issue of distance and accessibility is migration. The study conducted by Jani et al., (2008) revealed that factors like migration history of mother showed no significant differences with respect to children with complete and incomplete immunization. Also that mother's sickness on the day of immunization, concomitant treatment by a traditional healer and other miscellaneous reasons are also mildly associated with incomplete immunization

2.2.3 Childs characteristics as predictors

Certain factors that may be inherent traits of a child. Like; prematurely births, Birth order, sibling gap and maternal parity, nutritional status, and birth weight have also been assessed in previous studies. Konstantynera et al., (2011) reported that in Sao palo Brazil, children born prematurely are four times more likely to be incompletely immunized (Mutua, et al., 2011) in a bivariate analysis carried out revealed that compliance with immunization among caregiver/child pair is also associated with higher maternal parity while Konstantynera et al., (2011) again states that children with siblings less than 5 years of age and Children who are malnourished present a higher risk of incomplete immunization. Birth weight was found not to be a determinant of complete immunisation (Konstantynera, et al., 2011).

2.2.3.1 Place of delivery

The place of delivery of a child whether it is a health facility or home and how it determines immunization status has also been a subject of scrutiny. Mutua et al., (2011)indicated in their report that the place of birth emerges as a predictor of immunization completion, where children born in health facilities have a higher likelihood (1.3 times higher odds) of full immunization compliance compared to those not born in health facilities, this including the polio zero and BCG dose. This effect of place of birth on completion of immunisation has also been confirmed using both and multivariate regression analysis (Etana & Deressa, 2012). Incomplete immunization in a study by Jagrati et al., (2008) was found to be associated with children who were dilivered at home.

2.2.3.2 Age of child

With regard to the child's age, whiles Ibnouf et al., (2007) reported an association, Branco et al., (2014) maintained that there was no association between a child's age and incomplete immunization. Falagas & Zarkadoulia (2008), undertook a systematic review of data from 39 selected relevant articles out of 553 found that older age of a child was one of many factors that influence suboptimal compliance with immunization.

2.2.3.3 Gender of child

The study carried out by Basel & Shrestha (2012) found that although sex (gender) and immunization status are not significantly associated, female children were more likely to drop out of immunization than male children though according to Jani et al., (2008) gender of child,

shows no significant differences with respect to completeness of immunization which is in line with what Branco et al., (2014) found.

In a study examining "the role of the sex composition of surviving older siblings on gender differences in childhood nutrition and immunization", Pande (2003) identified "selective neglect of children of certain sex and birth order combinations" generally concluding that a child being of the female gender was a barrier to full immunization.

Corsi et al., (2009) when they sought to find out the effect of "India's son preference" on immunization, analysed the trends in immunization coverage across different parts of India and came to a conclusion that "Girls were found to have significantly lower immunization coverage than boys for BCG, DPT, and measles immunization". They however found that this difference, continued to reduce over the years with improving OPV coverage. In a study carried out in the same country by Bonua et al., (2003) to ascertain the effect of a 3 year government program geared toward improving immunization in the rural parts of northern India, considered the situations before and after the program. They came to the conclusion that "girls were at a disadvantage compared to boys, before and after the program.

On the contrary, an analysis of pooled data, from the Demographic and Health Survey DHS of countries across the world, showed that there was an equal likelihood of male and female children to be immunized in all countries, with a few exceptions favouring male children from "countries with known gender inequalities and son preference". The study concluded that gender disparity is not a global problem, so far as immunization is concerned.

2.2.4 Modeling methods

A great deal of research has been carried out on child immunization compliance issues, many of these have focused on using logistic regression to come out with models that capture as many useful independent predictors as can practicably be included. A lot of this research has been based on theoretical frameworks like the health believe model.

considering that no research has been done to explore the issue of dropout; leading to incomplete immunization of a large number of children, and its cause in the Parakou District of Benin, Adedemy et al., (2014) explored various socio-cultural and socio-economic variables using central tendency, prevalence ratios (PR), as well as a multivariate analysis to sort out independent factor associated with dropout rate. The prime focus of this study was the dropout between BCG and measles immunization with the immunization card being one of the sources of data.

Antai (2009) in his research, sought to unravel patterns of full immunization clusters within families and communities. He used a multilevel multivariable regression analysis and a nationally representative sample of women with children (level 1) nested within mothers (level2), who were in turn nested within communities. From his work it was seen that even though socio–economic attributes are relevant in explaining completeness of immunization, among children studied in Nigeria, at the community level there remains significant variations after controlling for both child and mother level attributes

In furtherance of his research on individual and community level characteristics, (Antai, 2010) fitted five models containing various variables of interest, grouped as follows: model 1

containing only mothers migration status as the only exposure variable; model 2 included migration status and demographic characteristics; model 3 contained migration status and socio-economic variables; model 4 containing migration status and health care utilization and finally model 5 containing community –level variables'. Fitting migration status with different categories of exposure variables against the risk of full immunization enabled a composure variable on the association between migration and the likelihood of full immunization.

Torun & Bakırc (2006) used a chi-square test and logistic regression, after using the WHO recommended cluster sampling method to analyse categorical data and statistically significant characteristics respectively. In so doing confounding factors were ruled out and in-dependent predictors of immunization status of a child were determined. Content analysis was then used in furtherance to evaluate open-ended questions about non-immunization.

Badu (2010) in his master's thesis employed the use of cross tabulations, bar graph and pie chart in a basic manner to analyse data. Noteworthy however is the employment of questionnaire, obtained from the immunization coverage cluster survey – reference manual / document (WHO / NB/ 04.23) designed by the Immunization, Vaccines and Biological Department of WHO, (WHO, 2005); and the WHO EPl questions guide to obtain key variables of the study.

Through chi square test and stratified analysis, paired t-tests and multiple logistic regression analyses, Two-tailed test of 5% statistical significance and determination of immunization status by clinic records, 'RTH' card and mothers history, various determinates of immunization status were arrived at, and the potential disadvantages of home visits or otherwise were ascertained. (Brughal & Kevany, 1996)

In a study in Nairobi Kenya, where multivariate models were used to identify the risk factors associated with incomplete immunization, 1848 children whose mothers were women from the Nairobi Urban Health and Demographic Surveillance System (NUHDSS), were enrolled. Firstly bivariate model was fitted for all covariates. The multivariate models were used to identify, risk factors associated with incomplete immunization in the study settlements. The poverty variables were computed for each village and a multilevel (random intercept model) technique was used to account for village level factors. (Mutua, et al., 2011)

In an observational, cross-sectional, questionnaire-based study conducted in Pakistan, descriptive statistics accounted for most part of the statistical analysis. Association between variables were determined by calculating P values to find their significance and value using the Chi-square test. Age as well as other continuous variables was converted into categorical ones. A p value of less than 0.05 was considered to be significant. A multivariate logistic regression model was then obtained from characteristics that were found to be significantly associated with immunization status. Immunization status was converted into a dichotomous dependent variable (vaccinated vs. under-vaccinated), which was also used to generate a regression model. (Asfandyar, et al., 2013).

Chapter Three

3.0 METHODOLOGY

3.1 Study area

The study was carried out in the Tamale metropolis. Respondents were chosen from four sub-districts namely: Bilpela Sub-district, Nyohini Sub-district, Tamale Central Sub-district and Vittin Sub-district.

3.2 Study design

This is a mixed methods study that used both quantitative and qualitative methods in a retrospective cross sectional observational study.

In the quantitative aspect of this study, data from the selected health facilities (clinics and hospitals) in the Tamale Metropolis were used to identify children aged 18 to 59 months (within first 5 years of birth) who were expected to have received all the recommended immunizations during the first 18 months after births. As a cross sectional observational survey, data was collected from caregiver-child pairs who attend the various health facilities in the Tamale Metropolis.

The qualitative part of the of the study used a focus group discussion, in which selected staffs of the selected health facilities were asked a set 10 open ended question within a one hour period and responses recorded.

3.2.1 Selecting the Health Centre

The study was conducted in the four (4) TMHD demarcated Sub- Districts in the Tamale metropolis; Each Sub-District was considered a strata containing health facilities. All the health centres in a Sub- District that carry out routine infant immunization under the EPI were listed and one was randomly drawn from that Sub-District.

3.3 Quantitative survey

3.3.1 Study Population

All Caregiver/child pair, with child being in the age range of 18-59 months (within first 5 years of birth), in the Tamale Metropolis, who as at the time of the study have been immunized at least once.

3.3.2 Study Unit and Respondents

With respect to the quantitative survey, the study units were represented by the caregiver-child pair and the respondents were either the caregivers or the mothers.

3.3.3 Sample size

A statistically representative sample size (n) of 421 caregiver-child pair was used for the quantitative part of the study. This was obtained from the formula;

$$(n_{min}) = (p)(q)\left(\frac{Z\alpha_{/2}}{\alpha}\right)^2$$

The population Standard Deviation σ was unknown, however a Confidence Level (CL) of 95% and a maximum error tolerable (E) of 5% were used, to insure high reliability.

With no sample proportions (p) available, and given p=1-q, p was assumed to be 0.5 (i.e. The value p for which the p*q is highest).

At 95% confidence interval, α = (1- 0.95),

Hence the $Z\alpha_{/2}$ = 1.96. Substituting all the above into the equation for minimum sample size;

Minimum sample size needed $(n_{min}) = (0.5)(0.5)\left(\frac{1.96}{0.05}\right)^2 = 384.16 \approx 385$

Adding a non-response rate of 10%, an estimated sample size of 421 was obtained. Divided among four sub-districts, 106 respondents were randomly selected from the EPI register (sample frame) of each selected health centre.

3.3.4 Sampling techniques

The EPI registers were obtained from the four selected facilities. This was used to prepare a sample frame of caregiver-child pair for selecting a sample of caregiver-child pair. This was done by randomly drawing 106 participants from a serialized EPI register of all children aged 0 to 59 months. This brought the total to 424 prospective respondents. Each selected caregiver-child pair was located with the help of health facility nurses using addresses as stated in the EPI register. Once located, questionnaires were administered to only caregivers and also using the Child Health Records Book, relevant portions of the questionnaire were completed.

3.4 Qualitative study

3.4.1 Study Population

The focus group discussion involved staff of health institutions in the Tamale Metropolis responsible for infant routine immunization and caregiver- child pairs who were not included in the quantitative data were

3.4.2 Study Unit and Respondents

The health centres were the study units in the focus group discussion, with the staff and caregivers being the respondents.

3.4.3 Sample size

Five staff members and five caregiver-child pair (not selected during quantitative survey) at each of the four selected facilities were selected to participate in the focus group discussion.

3.4.4 Sampling techniques

Participants were recruited based on random selection at each of the four selected health centres. The criteria for inclusion of participants were that the health facility and staff were involved in the infant routine immunization under the EPI. In selecting the participants, the names of all eligible staff in the facilities were placed in a box and 5 Names subsequently drawn from each box randomly. 5 caregivers who were not participants in the quantitative part were selected randomly in the same way and included. Once the group of viable recruits had been established, each one of the participants was contacted to confirm interest and availability. They were informed of the times and locations of the focus group discussions and verbal confirmation was secured from them. The respondents were provided with written confirmations and called on phone as a reminder, two days before the scheduled discussion. A form which included phone numbers for tracking the invitations was also developed. The times, locations and people involved for all the groups were organized as scheduled.

The focus group discussion was scheduled to take place over an hour's duration, and participants were informed of this. Participants were allowed 10 minutes to complete necessary paper work, having a snack and settling into groups before the start of the discussions. The focus group was conducted by a trained moderator and an assistant moderator. The moderator facilitated the discussion while the assistant took notes and run an

audio recording of the session. The assistant moderator was trained to run a tape recorder during the session, take notes, just in case the audio recording failed or turned out to be inaudible, note body language or other subtle but relevant clues. Participants were identified with numbers written largely in front for anonymous identification of individuals as they made comments. All participants completed a consent form (Appendix C). Demographic information was collected with a form (Appendix D) (short half page form that required no more than two or three minutes to complete) from participants before the focus group begun. Once consent forms and demographic data were collected and reviewed for completeness, the questioning started. The moderator used a prepared script to welcome participants, remind them of the purpose of the group and ground rules. Before asking the first focus group question, an icebreaker question was posed. The moderator in each focus group discussion, made sure all 10 questions were adequately covered within the one hour period allotted, all participants talked and fully explain their answers. Long, complex or ambiguous comments were paraphrased and summarized. The moderator remained neutral, refrained from nodding, raising eyebrows, agreeing/disagreeing, or praising/denigrating any comment made. When the focus group was complete the moderator thanked all participants. Immediately after all participants left, the moderator and assistant moderator debrief while still recording, and named the audio files and notes with the date, time and health centre of the group.

3.5 Definition of study variables.

The variables used in the study were defined and measured independently. The primary outcome measure was noncompliance with the routine immunization status. This was categorical data that measured by determining from the child health records book of the child if the child had been immunized on the scheduled date, other date or even if the child had been

immunized at all. Children who were not immunized at all and those who had been immunized on other dates were classified as noncompliant while children who were immunized on the scheduled date were classified as compliant. Caregiver and child characteristics were measured.

3.5.1 Caregiver socio-demographic characteristics

The Caregiver biological relationship (for instance mother, father, sister, grandparent, with the child was one of the independent variables included in this study, the responses were categorized in a form of nominal, categorical data, which was obtained by way of response from the Caregiver. The Caregivers age was also obtained by asking the caregiver and recorded as a point age in months. This was a discrete numerical value that was obtained from word of mouth of the caregiver. Marital status of the Caregiver was also an independent, nominal variable that was with three categories. Caregivers were classified into married, divorced and unmarried. Another independent nominal categorical variable included in the study was the religion a caregiver belonged to. The categories of interest here were whether a caregiver was Christian, Muslim, or other religion.

A Caregivers educational background was also an independent variable of interest. This was however ordinal categorical data, that was sought from the caregivers word of mouth. A caregiver was asked whether they were illiterate, had been educated to primary, secondary or tertiary level. The monthly income of the caregiver, another independent variable was estimated by asking how much a caregiver earned in month. This was a discrete numerical value measured in Ghana cedis. The employment status of the caregiver was defined as employed and unemployed when the caregiver was engaged in any form of employment or

not, respectively. This categorical data was obtained by the Caregiver's word of mouth and was also considered an independent variable. For caregivers who are married, the type of marriage they were involved in, whether monogamy or polygamy was recorded. It was a nominal categorical variable, obtained from the Caregivers' word of mouth.

The caregiver was also asked if they sometimes sought medical help from traditional medical sources. The data obtained here was in the form of categorical data as well. The number of children the caregiver has; a discrete, numeric variable was also recorded for each caregiver. The caregiver was then asked if they thought their religious denomination preached against immunization, they either confirmed with a yes or denied with a no. Caregivers were categorised into those who were resident in urban areas and those resident in rural areas. They were also asked a series of twenty questions which were scored and used to measure their overall knowledge of immunization issues and another series of five questions, which was scored and used to determine their perception on immunization.

3.5.2 Child's characteristics

The gender of the child involved in the study was recorded and treated as an independent variable in the analysis. This categorical data was determined by asking caregivers to answer by word of mouth and then verified by interviewer from the child's health record card. The place of birth of the child was also determined and recorded as binary variable; here the responses were expected to be in either one of two categories; at a hospital/ health centre or other place. The age of the child in months and birth order were also recorded. The age data was discrete numerical, while the birth order was categorical data. Table 3.1below shows how the variables were coded during data entry.

Table 3.1: variables and their codes

Variable	Codes
Noncompliance	Yes (0) No (1)
Caregiver relationship with child	Mother (1) Father (2) Grandparent (3) Sister (4) Other (5)
Age of caregiver	
Marital status	Married (0) Divorced (1) Unmarried (2)

Religion	Christian (0) Muslim (1) Other (2)
Educational background	Illiterate (0) Primary (1) Secondary (2) Tertiary (3)
Monthly income..... Gh¢	
Employment status	Employed (1) Unemployed (0)
Marriage type	Monogamy (0) Polygamy (1)
medical help from traditional sources	Yes (1) No (0)
Number of children caregiver has	
Area of residence	Urban (1) Rural (0)
Religion against immunization	Yes (0) No (1)
Caregiver Knowledge Scored	
Caregiver Attitude Scored	
Gender of child	Male (1) Female (2)
Child born in Hospital or health centre	Yes (1) No (2)
Age of child (in months).	
Birth Order of child	1st born (1) 2nd born (2) 3rd born (3) 4th and latter born (4)

3.6 Data collection and Study Instrument

Details of the research participants were collected during a visit by the researchers to the health facilities and all immunization data were also obtained from immunization cards during visits to households, as well as by recall from caregivers. The respondents were selected randomly and upon their informed consent, the questionnaires were administered to them. Each caregiver-child pair was involved in the research for an average of 10 minutes. Information sought included socio demographic variables of the each caregiver and their respective child pair, immunization history of the child considering the various vaccines that had been administered to them already, different levels of knowledge and perception regarding immunization among the caregivers as well as perceived barriers to immunization in the study locale. Data were collected using pretested interviewer administered structured questionnaire.

An interviewer-administered questionnaire (Appendix B) was used to obtain data. This questionnaire sought for socio-demographic information (gender of the child, income of caregiver, Area of Residence, Caregiver education, Caregiver employment status, maternal religion and residences etc.) of the caregiver and the child, knowledge, and perception of immunization schedule and vaccine-preventable diseases, immunization history of the child and reasons for incomplete immunization and noncompliance with the routine infant immunization schedule. Most of the questions on the survey questionnaire were close-ended. It took the researcher fourteen (14) days to collect the data. The questionnaires were prepared in English and a guide was provided for translation to the local language when administering it. A test of the questionnaires reliability using SPSS, showed a cronbach's alpha (α) value of 0.84 for the questionnaire, indicating its high reliability.

In addition, Health facility staff-related data were collected using a structured interview guide developed within the context of the existing literature. Information about the institutional factors that influenced noncompliance with the schedule was obtained using structured and carefully predetermined questions in the focused group discussions. The FGD interview guide (Appendix E) explored the beliefs and attitudes towards immunization, the decision-making, the perceived barriers, and the enabling factors to access the services.

3.9 Data analysis and presentation methods

Data analysis was done by a computer, using Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM Corporation, Illinois USA) software and presented in frequencies using charts, tables and graphs. Descriptive analysis was used to show the characteristics of the participants in the study thus the percentage distribution of noncompliant child status by selected caregiver and child characteristics to satisfy the first objective of the study. Also to satisfy the second, third, and fourth objectives of this study, binomial logistic regression was used to identify the predictors of noncompliance with the infant routine immunization schedule for children.

Focus group discussions and were transcribed verbatim. Key themes were identified and a coding frame was developed. The comments of the mothers were referenced with the generated themes. Results were presented in pros with direct and indirect quotations from focus group participants.

3.10 Quality Control

Interviewers were properly trained to ensure that good quality data are collected for an acceptable level of the overall quality control of the research. The interviewers were first introduced to the process of survey research through a general training, in which fundamental concepts such as basic interviewing techniques, obtaining cooperation, and maintaining respondent confidentiality were discussed with them. This was especially important to ensure that they understood the primary outcome measure of noncompliance in the context of this research. The researcher who is also a resident of Tamale used 2 days to explore and further familiarize with the Sub-Districts in the Tamale Metropolis, especially their health centres. This ensured that data collection during the focused group discussion was carried out without any hitches.

The final questionnaire used in the research was developed after an initial draft was prepared and pretested on 5% of the sample size outside the study area. This led to the identification of potential problems that could arise during the actual data collection period and corrections and adjustments were made. Completeness, accuracy and consistency of the collected data were checked on daily bases during data collection by interviewers and the principal investigator. The data were collected after thoroughly explaining the objectives of the study to each respondent and informed consent was obtained. Additionally, during the coding process, the researcher entered the data collected twice separately to ensure reliability. The questionnaires were serialised to ensure that during data entry and analysis any error could easily be traced to the particular questionnaire that contained that error. Random sampling was used.

3.11 Ethical Consideration

Approval to conduct the research was obtained from the Tamale Metropolitan Health Directorate, after an application was made with the study document including the summary study proposal, participant information sheet (Appendix D) and the questionnaire (Appendix A), Consent form for participants (Appendix A).

3.11.1 Informed consent

The purpose of the study, data collection method and the extent of participation needed from the respondents were explained to them. The respondents were informed in writing that participation was voluntary and they could withdraw from the study without fear of being penalised by the researcher or the University. A self-written letter was in hand to inform the mothers/caretakers about the purpose, anticipated benefits and harms/discomforts of the research project. The respondents were also informed that their name were not used and confidentiality of information was kept, participation in the study was absolutely based on their free will and that they had the full right to refuse, withdraw at any time from participation. After doing so, study participants were asked if they had understood the whole research study. Informed consent was obtained for their willingness to participate (Appendix A and Appendix C).

3.11.2 Confidentiality and anonymity

To ensure anonymity neither respondents' nor institutions' names were required on the questionnaire. To ensure confidentiality, the respondents were reassured that the

information would be treated confidentially. Although a research study report would be made available to other researchers, it would only contain figures, percentages and facts obtained from analysing and interpreting the responses from the completed questionnaires. No person, and no institution, would be identified in the research report.

3.11.3 Benefits

The participants were informed that they would receive no monetary benefits from participating in the study. The researcher explained to the respondents that the findings could benefit them and the Metropolis in terms of providing inputs for improving competencies of immunization programmes which would be organised in the near future in the Metropolis.

3.12 Limitations of the study

Although methodology employed in the study enabled sufficient investigation of the research questions, the study would have been superior without a few unavoidable limitations. First because of the limitation of time, this research adopted a retrospective approach in data gathering. This retrospective element has the tendency of introducing a level of inaccuracy when it comes to recall of information by respondents. This could have been resolved if the study had been experimental and prospective, with case and control groups that could have been observed over an 18 months period.

Secondly the assessment of the pre-test questionnaires was conducted by the author and supervisor themselves; hence it is unavoidable that in this study, certain degree of subjectivity can be found. In fact, it would have been better if it had been decided by two or three other

people who were not affiliated with this study. Thirdly, some of the respondents delayed in answering the questionnaires which lead to a slow data collection. Additionally a number of respondents, as always happens among populations who do not appreciate research, refused to give information unless they were convinced beyond reasonable doubts that the findings of the project was for academic purposes. Despite these limitations, this study uses adequate sample size coupled with regular and intensive continuous supervision during questionnaire administration.

3.13 Plans for dissemination of results

Dissemination of the results found in this study is very important, in order to make the results accessible to participants and stakeholders. First, staff at the selected health centres where the FGDs took place will be informed once a copy of this report is given the TMHD subsequently a brief presentation of the key findings in this report will be made on a day immunization services will be held; this will be done in the full glare f caregivers, health facility staff and the general public. Effort will be made to publish the findings of this study in a number of international scientific and peer review journals. Opportunities to present the findings at conferences and seminars in any part of the world will be pursued. Lastly, the report will be displayed in the University for Development Studies Library, for interested people who may want to make reference to the findings therein.

Chapter Four

4.0 RESULTS

This chapter presents the results of the analysis of the data and its interpretation in relation to already published works.

4.1 Demographics of Study Participants

In all four hundred and six (406) caregiver-child pairs who were randomly sampled from the Tamale Metropolis were analysed. The demographics of the study subjects are presented in Table 4.1 and Table 4.2

Table 4.1 Socio-demographic characteristics of caregivers included in the study (N= 406)

		Proportion	
Characteristics		**Frequency**	**%**
Age			
	Less than 20 years	54	13.3
	20 -24 years	63	15.5
	25-29 years	140	34.5
	30-39 years	122	30.0
	40 years and older	27	6.7
Caregiver Relationship with Child			
	Mother	289	71.2
	Father	13	3.2
	Grandparent	23	5.7
	Sister	45	11.1
	Other	36	8.9
Marital Status			
	Married	253	62.3
	Divorced	108	26.6

	Never married	45	11.1
Religion			
	Christian	126	31.0
	Muslim	203	50.0
	Other	77	19.0
Educational Background			
	Illiterate	108	26.6
	Primary	144	35.5
	Secondary	86	21.2
	Tertiary	68	16.7
Monthly Income (GHS)			
	0-100	122	30.0
	100-200	184	45.3
	200-300	68	16.7
	300-400	23	5.7
	400+	9	2.2
Employment Status			
	Employed	352	86.7
	Unemployed	54	13.3
Marriage Type			
	Monogamy	59	14.5
	Polygamy	194	47.8
	Not married	153	37.7
Traditional medical help			
	Yes	266	65.5
	No	140	34.5
Number of Children			
	1	50	12.3
	2	104	25.6
	3	131	32.3
	4	63	15.5
	Above 4	58	14.3
Area of residence			
	Urban	266	65.5
	Rural	140	34.5
Religion against immunization			
	Yes	41	10.1
	No	365	89.9

Out of the 406 participant caregivers in the study, 13.3 % (54/406) were less than 20 years, 15.5 % (63/406) were found to be between the ages 20 and 24 years, 30 % (122/406) were between 30 and 39 years and 6.7 % (27/406) were 40 years and older (Table 4.1). Majority of respondents; 34.5 % (140/406) were observed to be between the ages 25-29 years.

Data collected also indicate that caregivers were mainly mothers; 71.2 % (289/406), the remaining caregivers were sisters; 11.1 % (45/406), grandparents; 5.7 % (23/406), and others; 8.9% (36/406); (Table 4.1). About 62.3 % (253/406) of respondents were married, 26.6 % (108/406) were divorced and 11.1 % (45/406) were not married. Half, 50% (203/406) of the respondents said they were Muslims and 31.0 % (126/406) indicated that they were Christians, seventy seven out of the 406 respondents (19.0% i.e. 77/406) said they practiced other forms of religion.

Furthermore, data collected from the field showed that majority of respondents; 35.5 % (144/406) had primary education as their highest level of education; this was followed by 21.2 % (86/406) of respondents who had secondary education as their highest level of education and 16.7 % (68/406) who had the tertiary level as their highest level of education, Table 4.1. This means that most of the caregivers were literate, though at varying levels of the education ladder. Whiles just 26.6% (108/406) were illiterate. The estimated monthly income of majority of respondents were found to be between GH¢ 100 and GH¢200 (45.3 %; n = 184/406), suggesting the extent of poverty that may be prevailing in Tamale.

From Table 4.1 above, it can also be observed that majority of respondents were employed, 352 out of the 406 respondents sampled were employed, representing 86.7%, the rest (54 respondents) were unemployed. Majority of respondents; 194 out of 406 representing 47.8%

were involved in a polygamous marriage; whilst 14.5% (59/406) said their marriage was of monogamous nature, the rest were not married.

Regarding seeking medical help, majority (65.5% i.e. 266/406) indicated that they do sometimes seek medical help from traditional sources. However just a few (34.5% i.e. 140/406) indicated that they consulted a traditionalist for medical attention.

When respondents were asked about the number of children they had, a majority, 32.3% (131/406) said they had three children this was followed by 104 respondents who professed to having two children; this represents 25.6% (104/406). There were 58 respondents who had more than four children; 63 of them had exactly four children, and 50 respondents had just one child. There were 266 respondents; representing 65.55% (266/406) who were found to reside in urban areas, while the rest were found to be resident in rural areas. A large proportion of the respondents answered that their religious denomination did not preach against immunization, this was 89.9% (365/406) of all the respondents, whiles the remaining 10.1% (41/406) claimed that their religious denomination preached against immunization.

Table 4.2 Characteristics of child participants in the study

Characteristics	Proportion	
	Frequency	% Frequency
Child Characteristics		
Gender		
Male	185	45.6
Female	221	54.4
Delivered in Hospital		
Yes	325	80.0
No	81	20.0
Age (in months)		
18 -24	54	13.3
25-36	131	32.2
37-48	113	27.8
49-59	108	26.7
Birth Order		
1st born	72	17.8
2nd born	95	23.3
3rd born	104	25.6
4th and latter born	135	33.3

When gender distribution of the children were analysed, it turned out that majority; 54.4% (221/406) of the children were female.

Most; 80% (325/406) of the children in this sample were born in a hospital or other health centres whiles just 20% (81/406) were not. There was however a nearly even distribution of age ranges of the children. The results showed that 13.3% (52/406) of the respondents were aged from 18 months to 24 months, whereas 32.2% (131/406) were aged from 25 months to 36 months, 27.8% (113/406) were aged from 37 months to 48 months, 26.7% (108/406) were aged from 49 months to 59 months.

It was also realised that 72 out of the 406 children were first-born children, 95 were second-born children, 104 were third born, and 135 were forth and later born of their mothers.

Table 4.3 Representing Caregiver Knowledge and Attitude score

		Proportion	
Characteristics		**Frequency**	**% Frequency**
Caregiver Immunization Knowledge Score			
	(15-20)	68	16.7
	(10-15	72	17.8
	(5-10)	140	34.4
	(0-5)	126	31.1
Caregiver Attitude Score			
	5	81	20.0
	4	135	33.3
	3	136	33.5
	2	45	11.1
	1	9	2.2
	0	0	0.0

Caregivers' knowledge of immunization was measured with a series of 20 questions, whiles five questions were asked to determine the attitude of caregivers towards immunization. Both knowledge and attitude sections were scored, with the highest knowledge score being 20, and the lowest being zero (0). Attitude scores also started with a low score of 0 to the highest score of 5. As shown in Table 4.3, fewer proportions of respondents scored higher in the knowledge part, with 31.1% (126/406) of caregivers with scores from 0 to 5. On the other hand, 34.4% (140/406) of respondents had scores from 6 to 10, 17.8% (72/406) of respondents had scores from 11 to 15, 16.7% (68/406) of respondents had scores ranging from 16 to 20. Large proportions of the respondents had a high attitude scores regardless, none of the respondents

scored 0, but 2.2% (9/406) of respondents scored just 1. Only 11.1% (45/406) of respondents had a score of 2, 136 (33.5%) respondents had a score of 3, 33.3% (135/406) of respondents had a score of 4, 20% (81/406) of respondents had a score of 5.

4.2 Rate of Noncompliance with the Routine Immunization Schedule

Rate of Noncompliance with the scheduled date for each vaccine was determined by summing the respondents who were not immunized at all with those who were immunized on any other date which was not the scheduled date. Since children were usually immunized with a number of different vaccine types during most visits to health centres, ie. BCG and Polio 0 at birth, Polio 1, Penta 1, Pneumococcal 1, and Rota 1 at six weeks old, Polio 2, Penta 2, Pneumococcal 2, and Rota 2 at ten weeks old, Polio 3, Penta 3, Pneumococcal 3 at fourteen weeks old, Measles 1 and Yello Fever at nine months old, and lastly Measles 2 at eighteen months old.

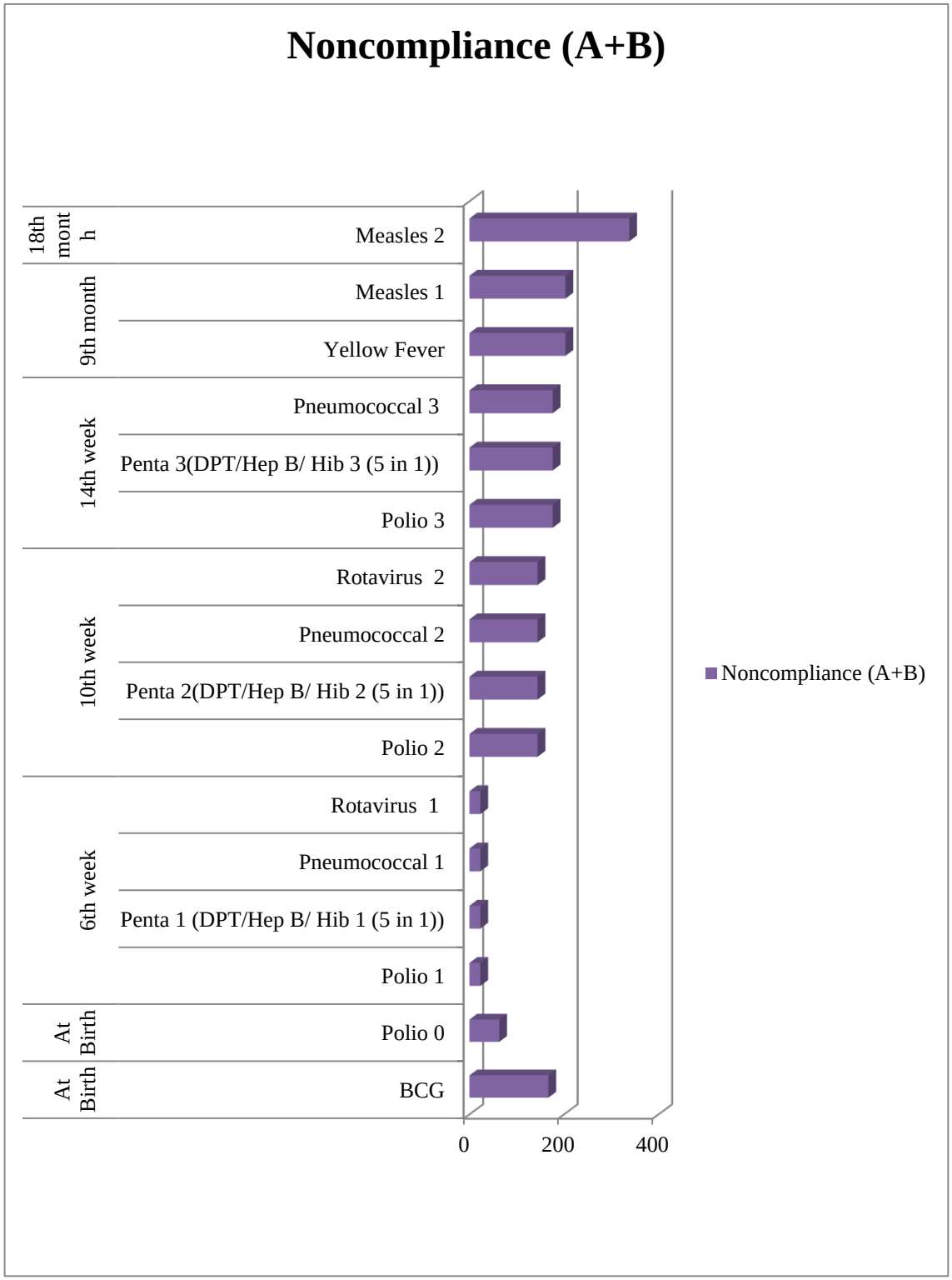
The Measles 2 immunization, registered the highest noncompliance rate of 83.3%, this was followed by the measles 1 immunization with a rate of 50%.

BCG immunization also appeared to have a high noncompliance rate of 41.1%, however this was mainly due to children being immunized frequently on other dates, even though all the sampled children had been immunized with this vaccine, 167 out of them were not immunized at birth.

The Polio 1, Pneumococcal 1 and Rotavirus 1 immunizations had the lowest rate of noncompliance at 5.7 %, mainly since all three took place just six weeks after birth. Sixth

week immunization (Polio 1, Penta 1, Pneumococcal 1, and Rota 1) had a noncompliance rate of 5.7%, tenth week immunization (Polio 2, Penta 2, Pneumococcal 2, and Rota 2) had a noncompliance rate of 35.5% , fourteenth week immunization (Polio 3, Penta 3, Pneumococcal 3) had a noncompliance rate of 43.3%, ninth month immunization (Measles 1 and Yello Fever), had a noncompliance rate of 50%, and eighteenth month immunization (Measle 2) had a noncompliance rate of 83.3%.

Figure 4.1: Graph showing noncompliance



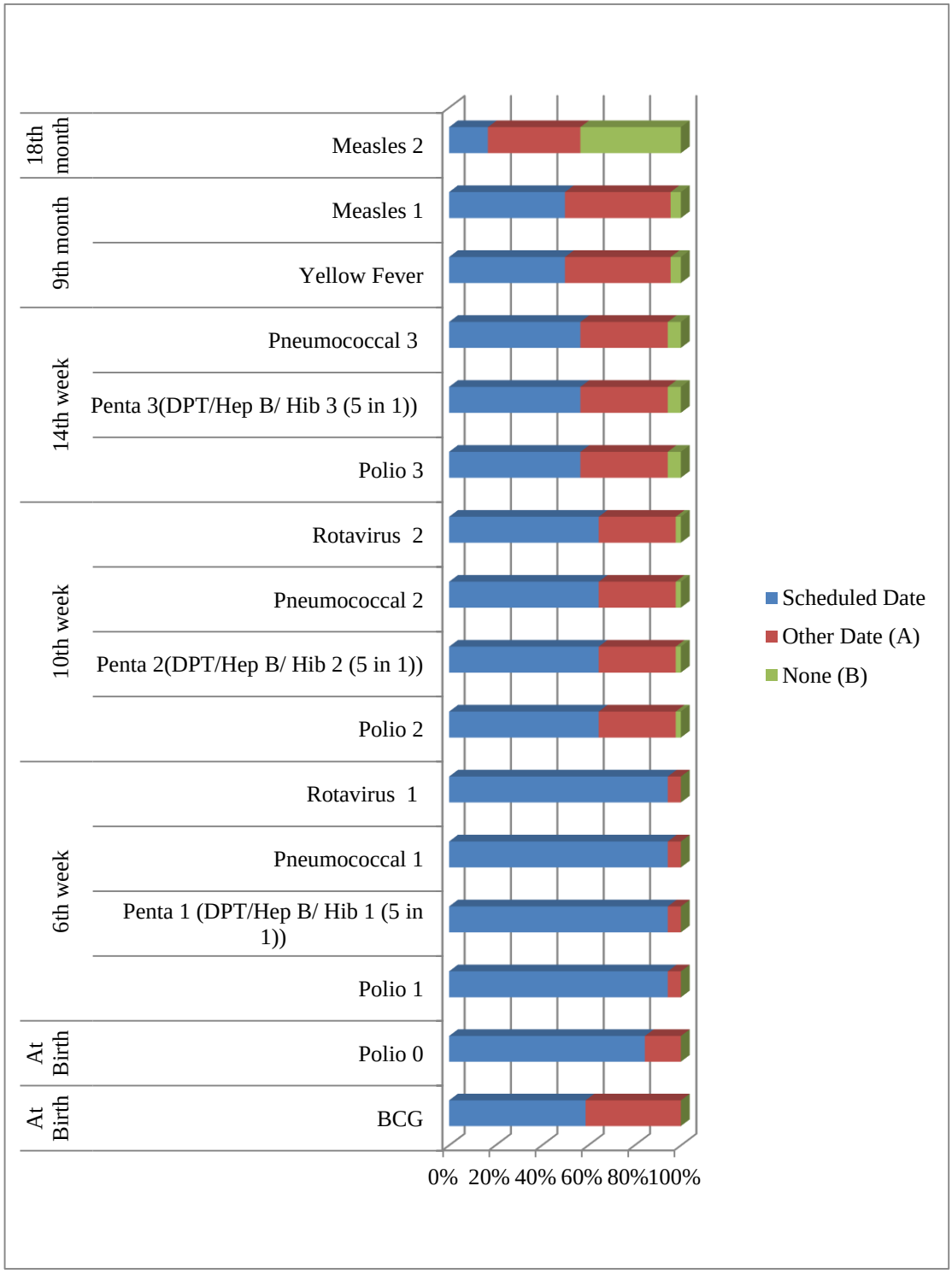
*A =partial noncompliance *B= absolute noncompliance

Table 4.4 Rate of Noncompliance with Scheduled Date, with respect to each Vaccine

				Rate of Non compliance	
Vaccine	**Scheduled Date**	**Other Date (A)**	**None (B)**	**Frequency (A+B)**	**% Frequency**
BCG	239	167	0	167	41.1
Polio 0	343	63	0	63	15.5
Polio 1	383	23	0	23	5.7
Polio 2	262	135	9	144	35.5
Polio 3	230	153	23	176	43.3
DPT/Hep B/ Hib 1 (5 in 1)	383	23	0	23	5.7
DPT/Hep B/ Hib 2 (5 in 1)	262	135	9	144	35.5
DPT/Hep B/ Hib 3 (5 in 1)	230	153	23	176	43.3
Pneumococcal 1	383	23	0	23	5.7
Pneumococcal 2	262	135	9	144	35.5
Pneumococcal 3	230	153	23	176	43.3
Rotavirus 1	383	23	0	23	5.7
Rotavirus 2	262	135	9	144	35.5
Yellow Fever	203	185	18	203	50.0
Measles 1	203	185	18	203	50.0
Measles 2	68	162	176	338	83.3

Rate of Noncompliance with Scheduled Date, with respect to each Vaccine

Figure 4.2 Graph showing components of noncompliance



*A =partial noncompliance *B= absolute noncompliance

4.3 Influence of Caregiver and child characteristics on noncompliance

This was analysed using the logistic regression technique, where noncompliance was treated as the dependent variable. The results are presented in Tables (Table 4.5 to Table 4.11)

4.3.1 Caregiver and child noncompliance at Birth (BCG)

Although BCG and Polio zero immunizations were carried out at birth, they had different rates of noncompliance. Hence the results were analyzed and presented separately in order see identify what may have caused the difference. The following table analyses, noncompliance with the BCG immunization scheduled for birth.

Table 4.5 Immunisation at birth (BCG)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	1.00	(0.44–2.14)	0.34
Grandparent	1.01	(0.42–1.86)	0.54
Sister	1.03	(0.53-2.02)	0.76
Other	1.00	(0.53-2.18)	0.66
Age	1.12	(0.53–1.54)	0.54
Marital status			
Married	-	-	-
Divorced	1.05	(0.51–2.34)	0.86
Unmarried	1.03	(0.64–2.01)	0.34

Religion			
Christian	-	-	-
Muslim	0.98	(0.19–1.34)	0.43
Other	1.03	(0.31–1.85)	0.96
Educational Background			
Illiterate	1.24	(0.66–2.43)	0.000
Primary	1.16	(0.45-2.35)	0.003
Secondary	1.05	(0.62-2.25)	0.78
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.65	0.34 -3.87	0.000
Employment status			
Employed	-	-	-
Unemployed	1.51	0.57- 2.32	0.002
Marriage type			
Monogamy	-	-	-
Polygamy	1.76	0.67-2.86	0.46
Seek medical help from traditional medical sources			
Yes	-	-	-
No	0. 87	0.24-1.35	0.35
Number of children	0.92	(0.24-1.68)	0.52
Area of residence			
Urban	-	-	-
Rural	1.47	0.87-2.63	0.002
Religious denomination against immunization			
Yes	1.21	0.77-2.25	0.27
No	-	-	-
Caregiver knowledge, attitude and perception			
Knowledge Score	0.76	0.46-1.67	0.64
Attitude Score	0.69	0.26-1.64	0.55

Child Characteristics			
Gender			
Male	0.96	0.26-2.54	0.63
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.13	0.38-2.46	0.000
Age (in months).	0.78	0.46-2.63	0.52
Birth Order			
1st born	1.72	0.24-1.98	0.62
2nd born	1.26	0.32-1.76	0.96
3rd born	1.15	0.47-1.36	0.53
4th and latter born	-	-	-

For BCG immunization scheduled taken at birth, the only socio-demographic characteristics that were significant were, the caregivers level of education, caregivers estimated monthly income, caregiver employment status, caregivers Area of residence and whether a child was born in hospital/health centre or not. Age of caregiver, number of children a caregiver had and caregiver biological relationship did not significantly affect compliance with the BCG immunization. As shown in Table 4.5 above, educational background significantly affected the rate of non-compliance with BCG immunisation. Illiterate (OR 1.24, CI 0.66-2.43), Primary (OR 1.16, CI 0.45-2.35), and secondary (OR 1.24, CI 0.62-2.25) level educated caregivers were 24%, 16% and 5% respectively more likely not to comply with the immunization schedule than caregivers who had a tertiary level education. Income status determined the rate of noncompliance with immunization. In this case the results showed that for a unit increase in caregiver's monthly income there was a 35% decreased likelihood of noncompliance with the BCG immunization schedule date.

Caregiver employment status was a determinant of noncompliance as; unemployed caregivers (OR 1.51, CI 0.57-2.32) were 51% more likely not to comply with the BCG immunization schedule date. Also caregivers who were resident in urban areas (OR 1.47, 0.87-2.63) were 47% more likely not to comply with the immunization scheduled date than caregivers who were resident in rural areas.

Caregivers' knowledge and attitude as well as child's characteristics were statistically insignificant so far as noncompliance with BCG immunization at birth is concerned.

Place of birth as to whether a child was born in the hospital or not affected compliance. From the results, children, not born in a hospital or health centre (OR 1.13, CI 0.38-2.46) was 13% more likely not to comply with the BCG schedule, compared with one born at the hospital.

The age of the child and birth order of the child were not significant predictors of noncompliance with the BCG immunization at birth.

4.3.2 Caregiver and child noncompliance at Birth (Polio Zero)

The following table analyses noncompliance with the Polio zero immunization schedule date.

Table 4.6 Immunization at birth (Polio Zero)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	1.39	(0.25–2.64)	0.42
Grandparent	1.29	(0.54–1.79)	0.60
Sister	1.07	(0.34-2.19)	0.77
Other	1.42	(0.67-2.42)	0.29
Age	0.84	(0.28–1.37)	0.07
Marital status			
Married	-	-	-
Divorced	1.12	(0.61–2.07)	0.68
Unmarried	0.77	(0.15–2.34)	0.40
Religion			
Christian	-	-	-
Muslim	0.86	(0.19–1.94)	0.62
Other	1.06	(0.13–1.85)	0.79
Level of education			
Illiterate	1.75	(0.81–2.37)	0.001
Primary	1.63	(0.56-2.17)	0.003
Secondary	1.20	(0.46-2.34)	0.38
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.83	0.12 -3.84	0.002
Employment status			
Employed	-	-	-
Unemployed	1.25	0.46- 2.67	0.003
Marriage type			
Monogamy	-	-	-
Polygamy	1.90	0.65-2.78	0.61
Seek medical help from traditional medical sources			
Yes	-	-	-
No	0. 96	0.13-1.35	0.42
Number of children	0.91	(0.19-1.46)	0.35

Area of residence			
Urban	-	-	-
Rural	1.90	0.56-2.48	0.000
Religious denomination against immunization			
Yes	1.50	0.73-2.12	0.16
No	-	-	-
Caregiver knowledge, attitude and perception			
Knowledge Score	0.61	0.38-1.52	0.51
Attitude Score	0.54	0.19-1.73	0.68
Child Characteristics			
Gender			
Male	0.98	0.19-2.42	0.5
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.45	0.68-2.33	0.000
Age (in months).	0.98	0.25-2.27	0.27
Birth Order			
1st born	1.95	0.13-2.06	0.53
2nd born	1.39	0.17-1.67	0.82
3rd born	1.20	0.29-1.73	0.69
4th and latter born	-	-	-

Polio 0 immunization at birth had a similar trend as BCG immunization, also with the caregivers level of education, caregivers estimated monthly income, caregiver employment status, caregivers Area of residence and whether a child was born in hospital/health centre or not being the only socio-demographic factors that were significant predictors. Here again as depicted in

Table 4.6 with Illiterate caregivers (OR 1.24, CI 0.19-1.34), caregivers with primary level education (OR 1.16, CI 0.45-2.35) and caregivers with secondary level education (OR 1.20, CI 0.46-2.34) having a 75%, 63% and 20% more likelihood of noncompliance than caregivers with tertiary level education.

Also a 17% decrease in likelihood of non-compliance with polio 0 schedule date for every unit increase in monthly income of a caregiver and unemployed caregivers (OR 1.25, CI 0.46-2.67), 25% more likely not to comply with the schedule date than caregivers who were employed.

Caregivers resident in rural areas (OR 1.47, CI 0.87-2.63) had a 47% increased likelihood of noncompliance with the scheduled date compared to caregivers' resident in urban area. Children not born in a hospital or health centre (OR 1.45, CI 0.68-2.33) had a 45% greater likelihood of noncompliance, which was significant with the Polio O immunization schedule date. Caregivers' knowledge and attitude, caregiver's age, number of children caretaker had, child age, and birth order of the child were statistically insignificant so far as noncompliance with Polio 0 immunization at birth is concerned.

4.3.3 Caregiver and child noncompliance at the 6th week

The following table shows how noncompliance at the sixth week immunization scheduled dates is determined by caregiver, and child characteristics.

Table 4.7 Immunisation at the 6th week (Polio 1, Penta 1, Pneumo 1, Rota 1)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	1.72	(0.52–3.70)	0.003
Grandparent	1.41	(0.50–2.60)	0.000
Sister	1.07	(0.26-2.30)	0.07
Other	1.63	(0.10-1.68)	0.001
Age	0.83	0.13–1.57	0.003
Marital status			
Married	-	-	-
Divorced	1.11	(0.38–3.27)	0.08
Unmarried	0.67	(0.23–1.81)	0.06
Religion			
Christian	-	-	-
Muslim	1.10	(0.37–3.26)	0.83
Other	0.98	(0.24–1.80)	0.14
Educational Background			
Illiterate	1.89	(0.59–2.62)	0.000
Primary	1.76	(0.33-2.31)	0.004
Secondary	1.43	(0.14-1.65)	0.21
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.91	0.60 -5.20	0.001
Employment status			
Employed	-	-	-
Unemployed	1.06	0.56- 2.27	0.062
Marriage type			
Monogamy	-	-	-
Polygamy	1.98	0.84-2.26	0.2
Seek medical help from traditional medical sources			
Yes	-	-	-
No	1.05	0.97-1.69	0.071
Number of children	0.88	(0.17-2.10)	0.000

Area of residence			
Urban	-	-	-
Rural	1.89	0.76-2.58	0.001
Religious denomination against immunization			
Yes	1.81	0.93-3.07	0.083
No	-	-	-
Caregiver knowledge, attitude and perception			
Knowledge Score	0.64	0.13-1.49	0.000
Attitude Score	0.37	0.11-2.01	0.001
Child Characteristics			
Gender			
Male	0.97	0.48-2.01	0.093
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.60	0.77-2.311	0.001
Age (in months).	1.09	0.16-1.51	0.071
Birth Order			
1st born	1.99	0.19-2.29	0.000
2nd born	1.65	0.14-1.92	0.000
3rd born	1.23	0.12-1.61	0.002
4th and latter born	-	-	-

Results of the multivariate analysis

Table 4.7) Results of multivariate analysis indicated that a caregiver's relationship with the child was significantly associated with noncompliance with immunization at the Sixth week (Polio 1, Penta 1, Pneumo 1, Rota 1).Here caregivers who were fathers (OR 1.72, CI 0.52-3.70) were more likely (72%) not to comply with the schedule compared with caregivers who were mothers.

At six weeks old of child's life, caregivers are expected to take children for the Polio 1, Penta 1, pneumo 1, and Rota 1 immunization. Caregivers relationship with the child, caregivers age, caregivers level of formal education, caregivers monthly income, Number of children caregiver had, caregivers knowledge of immunization, caregivers attitude toward immunization, caregivers area of residence, whether child was born in a hospital or health centre, the child's age and the birth order of the child were the caregiver and child related factors (characteristics) that significantly determined noncompliance with scheduled immunization. All other variables tested did not significantly determine the rate of noncompliance.

Caregiver relationship with child

In the sixth week, caregivers who were grandparents to children were 41% (OR 1.4, CI 0.50–2.60) more likely not to comply with the scheduled dates than caregivers who were mothers.

Caregivers whose relationships with the children was of other forms besides, mother, father, grandparent or sister were also significantly more likely i.e. 63% (OR 1.63, CI 0.10-1.68), not to comply with 6th week, immunization scheduled dates. However, being a sister did influence the rate of noncompliance.

Caregiver Age

A 17% decreased likelihood of noncompliance with the sixth week (Polio 1, Penta 1, Pneumo 1 and Rota 1) immunization schedule date was observed for every unit increase in age of caregivers (OR 0.83, CI 0.13-1.57).

Educational Background

Another factor that affected noncompliance was the level of formal education obtained by caregivers. Illiterate (OR 1.81, CI 0.59-2.62), Primary level (OR 1.76, CI 0.33-2.31) educated and secondary level (OR 1.43, CI 0.1-1.65) educated caregivers had an 89%, 76% and 43% respective greater likelihood of not complying with their 6^{th} week immunization schedule dates compared with those who had tertiary education.

Monthly income

The estimated monthly income also turned out to be a significant factor in this research. A unit increase in estimated monthly income (OR 0.91, CI 0.60 -5.20) of a caregiver presented a 9% decreased likelihood of caregivers' noncompliance with the sixth week immunization (Polio 1, Penta 1, Pneumo 1, Rota 1) schedule date.

Number of children

Another significant factor found in this study was the number of children a caregiver had. Here it was seen that for caregivers with more children there was a decreased likelihood of noncompliance with almost all the scheduled immunization dates. A 12% decreased likelihood

of caregiver noncompliance with 6th week immunization schedule is seen when there is a unit increase in the number of children a caregiver has (OR 0.88, CI 0.17-2.10).

Residence

Significant rural/urban contrast was also observed in this study so far as noncompliance with the immunization schedule for the entire immunization schedule was concerned. Caregivers who were resident in rural areas (OR 1.89, CI 0.76-2.58) had an 89% increased likelihood of not complying with the 6th week immunization scheduled date compared to caregivers who were resident in urban areas.

Knowledge and attitude

Caregivers' knowledge and attitude scores were factors that also significantly influenced the noncompliance with the immunisation schedule. Here whiles a unit increase in the knowledge score (OR 0.64, CI 0.13-1.49) corresponded to a 36% decreased likelihood of caregiver noncompliance with sixth week immunization schedule dates, a unit increase in caregiver attitude score (OR 0.37, CI 0.11-2.01) corresponded to a 63% decreased likelihood of caregiver noncompliance with same.

Delivered in hospital

Earlier it was seen that for immunization taken at birth children who were not born in a Hospital or Health centre appeared to have an increased likelihood of noncompliance with the scheduled immunization date. This seems to be the same situation even for the 6th week immunization schedules. With a 60% increased likelihood, children who were not born in a

hospital or health centre (OR 1.60, CI 0.77-2.311) stand a greater chance of not complying with the 6th week immunization schedule, than children born in hospital or health care.

Birth order

Children who were first born (OR 1.99, CI 0.19-2.29) second born (OR 1.65, CI 0.14-1.92), and third born (OR 1.23, CI 0.12-1.61) had 99%, 65% and 23% respective increased likelihood of noncompliance with the 6th week immunization schedule date compared to children who were forth and latter born.

4.3.4 Caregiver and child noncompliance at the 10th week

The following table shows how noncompliance at the tenth week immunization scheduled dates is determined by caregiver, child characteristics.

Table 4.8 Immunisation at the 10th week (Polio 2, Penta 2, Pneumo 2, Rota 2)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	1.72	(0.49–3.21)	0.002
Grandparent	1.46	(0.98–2.51)	0.000
Sister	1.12	(0.36-2.34)	0.07
Other	1.63	(0.16-1.39)	0.001
Age	0.73	0.10–1.48	0.003
Marital status			
Married	-	-	-
Divorced	1.20	(0.51–3.11)	0.08
Unmarried	0.62	(0.24–1.76)	0.06
Religion			
Christian	-	-	-
Muslim	0.96	(0.37–2.81)	0.83
Other	1.18	(0.69–1.53)	0.14
Educational Background			
Illiterate	2.14	(0.57–2.39)	0.000
Primary	1.93	(0.94-2.54)	0.004
Secondary	1.13	(0.68-1.97)	0.091
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.92	0.58 -5.43	0.001
Employment status			
Employed	-	-	-
Unemployed	1.18	0.32- 1.59	0.062

Marriage type			
Monogamy	-	-	-
Polygamy	1.98	0.87-2.15	0.2
Seek medical help from traditional medical sources			
Yes	-	-	-
No	0.98	0.15-1.69	0.071
Number of children			
	0.94	(0.20-2.19)	0.002
Area of residence			
Urban	-	-	-
Rural	2.35	1.12-2.81	0.000
Religious denomination against immunization			
Yes	1.48	0.92-3.07	0.083
No	-	-	-
Caregiver knowledge and attitude			
Knowledge Score	0.44	0.13-1.39	0.003
Attitude Score	0.57	0.21-1.98	0.000
Child Characteristics			
Gender			
Male	1.03	0.53-2.29	0.093
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.63	0.55-2.11	0.001
Age (in months).	1.08	0.27-1.38	0.2
Birth Order			
1st born	1.93	0.28-2.11	0.000
2nd born	1.66	0.15-1.83	0.000
3rd born	1.31	0.12-1.50	0.002
4th and latter born	-	-	-

With Regards to tenth week immunization (Polio 2, Penta 2 Pneumo 2, Role 2), results of the multivariate analysis (Table 4.8) indicated that a caregivers relationship with the child was significantly associated with noncompliance. Fathers, grandparents and sisters were

respectively 72% (OR 0.49–3.21), 46% (OR 0.98–2.51) and 12% (OR 0.36-2.34) more likely not to comply with the immunization schedule when compared with mothers.

Caregiver Age

The analysis showed that, there was a 17% significant decrease in the likelihood of noncompliance with the scheduled at the 10th week of immunisation for a unit increase in the age of a caregiver (OR 0.73, CI 0.10–1.48).

Educational Background

Educational background was another factor that determined noncompliance with immunisation schedule at the 10th month. Here illiterate caregivers (OR 2.14 CI 0.57-2.39) were a little over two times (114%) more likely not to comply with the scheduled immunization date than caregivers who had a tertiary level education, whiles caregivers with primary (OR 1.93, CI 0.94-2.54) and secondary (OR 1.13, CI 0.68-1.97) level education were 93% and 13%, respectively more likely not to comply with the scheduled date for immunization.

Monthly income

A unit increase in estimated monthly income (OR 0.92, CI 0.58 -5.43), resulted in 8% significant decreased likelihood of noncompliance with the immunization schedule date.

Number of children

Also a unit increase in the number of children a caregiver had resulted in 6% (OR 0.94, CI 0.20-2.19) decreased likelihood of noncompliance with scheduled immunization at the 10th week.

Residence

The place of residence of caregiver-child pair, to wit in rural or urban area, influenced compliance with the immunisation schedule at the 10th week. There was an increased likelihood of caregivers resident in rural areas (OR 2.35, CI 1.12-2.81) not to comply compared to caregivers resident in urban areas. Caregivers resident in rural areas are 135% significantly more likely not to complying with immunization scheduled date compared to caregivers resident in urban areas

Knowledge and attitude

High knowledge scores were associated with decreased noncompliance for 10th week immunization scheduled date. With each unit of an increase in caregiver knowledge score, there was 56% significant decreased likelihood of noncompliance with the immunization schedule (OR 0.44, CI 0.13-1.39). For each unit increase in caregivers attitude score there was a 43%, (OR 0.57, CI, 0.21-1.98).significant decrease likelihood of noncompliance with the schedule immunization dates for the 10th week schedule.

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Delivered in hospital

Also for 10th week immunization children who were not born in a Hospital or health centre (OR 1.63, CI 0.55-2.11) had a 63% significant increased likelihood of not complying with the immunization schedule date compared with children who were born in a hospital or health centre.

Birth order

It was found that for the 10th week immunization schedule, whiles first-born children had a 93% increased likelihood of noncompliance with the schedule compared with 4th and later-borns, second and third borns had a 66% and 31% increased likelihood of noncompliance with the immunization schedule compared with 4th and later born.

4.3.5 Caregiver and child noncompliance at the 14th week

The following table shows how noncompliance at the 14 week immunization scheduled dates is determined by caregiver and child characteristics

Table 4.9 Immunisation at the 14 weeks (Polio 3, Penta 3, Pneumo 3)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	2.02	(0.67–3.15)	0.002
Grandparent	1.42	(0.72–2.10)	0.000
Sister	1.17	(0.49-2.37)	0.07
Other	1.72	(0.31-1.84)	0.000
Age	0.92	0.15–1.86	0.003

Marital status			
Married	-	-	-
Divorced	1.43	(0.55–3.11)	0.08
Unmarried	0.71	(0.30–1.86)	0.06
Religion			
Christian	-	-	-
Muslim	0.81	(0.31–2.54)	0.83
Other	1.12	(0.86–1.62)	0.14
Educational Background			
Illiterate	1.97	(0.93–2.37)	0.000
Primary	1.73	(0.83-2.22)	0.002
Secondary	1.10	(0.55-2.07)	0.091
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.85	0.47 -4.01	0.001
Employment status			
Employed	-	-	-
Unemployed	1.46	0.38- 1.74	0.062
Marriage type			
Monogamy	-	-	-
Polygamy	1.83	0.64-2.21	0.2
Seek medical help from traditional medical sources			
Yes	-	-	-
No	0.84	0.21-1.84	0.071
Number of children	0.79	(0.61-2.65)	0.001
Area of residence			
Urban	-	-	-
Rural	1.93	1.27-2.34	0.000
Religious denomination against immunization			
Yes	1.12	0.68-2.86	0.083
No	-	-	-
Caregiver knowledge, attitude and perception			
Knowledge Score	0.38	0.15-1.34	0.000
Attitude Score	0.54	0.31-2.01	0.000

Child Characteristics			
Gender			
Male	1.23	0.59-2.23	0.087
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.53	0.55-2.21	0.000
Age (in months).	1.06	0.23-1.37	0.09
Birth Order			
1st born	1.87	0.24-2.19	0.002
2nd born	1.27	0.13-1.45	0.000
3rd born	1.14	0.17-1.28	0.000
4th and latter born	-	-	-

With regards to the 14th week immunization (Table 4.9), caregiver relationship with the child was significantly associated with noncompliance with immunization at the fourteen week. Here fathers were 102% (OR 2.02, CI 0.67–3.15) more likely not to comply with the schedule than mothers. Also caregivers who were grandparents to children, were 42% (OR 1.42, CI, 0.72-2.10), more likely not to comply with the scheduled dates than caregivers who were mothers.

Analysis of the data also showed that caregivers who were sisters were 17% more likely not to comply with 14th week, immunization schedule date, than caregivers who were mothers. This effect was however statistically insignificant. Caregivers whose relationships with the children was of other forms besides, mother, father, grandparent or sister were 72% (OR 1.72, CI 0.31-1.84) were significantly more likely not to comply with 14th week, immunization scheduled dates.

Caregiver Age

For the child immunization scheduled for the 14th week, A unit increase in the age of the caregiver (OR 0.92, CI 0.15–1.86) corresponded to an 8% decreased likelihood of noncompliance with the immunization schedule date.

Educational Background

Illiterate caregivers (OR 1.97, CI 0.93-2.37), Primary level educated (OR 1.73, CI 0.83-2.22), and secondary level educated (OR 1.10, CI 0.55-2.07) caregivers had 97%, 73% and 10%, respective increased likelihood of noncompliance with the 14th week immunization scheduled dates, than caregivers who had obtained a tertiary level education.

Monthly income

A unit increase in estimated monthly income (OR 0.85, CI 0.47 -4.01) also resulted in a 15% decreased likelihood of noncompliance with the scheduled immunization date on the 14th week.

Number of children

Also a unit increase in the number of children a caregiver had resulted in 21% (OR 0.79, CI 0.61-2.65) decreased likelihood of noncompliance with 4th week scheduled immunization dates.

Residence

There was a 93% (OR 1.93, CI 1.27-2.34), increased likelihood of caregivers resident in rural areas not to complying with the 14th week immunization scheduled date compared to caregivers resident in urban areas.

Knowledge and attitude

High knowledge scores were associated mainly with decreased noncompliance for 14th week immunization schedule dates where there was 62% decrease in noncompliance with the immunization schedule per unit increase in caregivers knowledge score (OR 0.38, CI 0.15-1.34). Also for the same (14th week)immunization scheduled dates there was 46% decreased likelihood of noncompliance, per unit increase in caregivers attitude score(OR 0.54 , CI0.31-2.01).

Delivered in hospital

Children who were not delivered in a health centre (OR 1.53, CI 0.55-2.21) had a 53% increased likelihood of not complying with the 14th week immunization (Polio 3, Pneumo 3) schedule compared to children who were delivered in a hospital or health centre.

Birth order

At the 14th week, 1stborns, 2ndborns and 3rdborns had a 87%, 27% and 14% respective increased likelihood of noncompliance with the immunization schedule, compared with the 4th and later-borns.

4.3.6 Caregiver and child noncompliance at the 9th month

The following table shows how noncompliance at the 9th month immunization scheduled dates is determined by caregiver and child characteristics

Table 4.10 Immunisation at the 9 month (measles 1, Yellow Fever)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	1.87	(0.57–3.11)	0.002
Grandparent	1.44	(0.86–2.01)	0.001
Sister	1.16	(0.81-2.22)	0.07
Other	1.88	(0.44-1.96)	0.003
Age	0.81	0.19–1.76	0.001
Marital status			
Married	-	-	-
Divorced	1.65	(0.55–3.24)	0.07
Unmarried	0.74	(0.42–2.02)	0.09
Religion			
Christian	-	-	-
Muslim	0.68	(0.19–1.87)	0.53
Other	1.32	(0.59–1.75)	0.22
Educational Background			
Illiterate	1.76	(0.75–2.12)	0.000
Primary	1.61	(0.84-2.32)	0.000
Secondary	1.10	(0.48-2.55)	0.091
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.79	0.29 -4.16	0.002

Employment status			
Employed	-	-	-
Unemployed	1.52	0.67- 1.86	0.081
Marriage type			
Monogamy	-	-	-
Polygamy	1.76	0.83-2.05	0.2
Seek medical help from traditional medical sources			
Yes	-	-	-
No	0. 65	0.10-1.52	0.078
Number of children			
	0.82	(0.35-1.42)	0.001
Area of residence			
Urban	-	-	-
Rural	1.87	1.24-2.51	0.002
Religious denomination against immunization			
Yes	1.13	0.75-2.25	0.083
No	-	-	-
Caregiver knowledge, attitude and perception			
Knowledge Score	0.41	0.30-1.29	0.000
Attitude Score	0.51	0.29-1.30	0.003
Child Characteristics			
Gender			
Male	1.43	0.36-2.44	0.087
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.35	0.21-2.34	0.000
Age (in months).	1.13	0.39-1.41	0.3
Birth Order			
1st born	1.79	0.21-2.05	0.002
2nd born	1.47	0.16-1.84	0.000
3rd born	1.32	0.35-1.66	0.001
4th and latter born	-	-	-

Results of the multivariate binary logistic regression analysis (child characteristics Table 4.10) indicated that a caregiver's relationship with the child (father, mother, grandparents) was significantly associated with noncompliance with immunization at the ninth

month (measles 1, yellow fever).Fathers were 87% (OR 1.87, CI 0.57–3.11) more likely not to comply with the schedule than mothers. Also caregivers who were grandparents to children, were 44% (OR 1.44, CI 0.86-2.01) more likely not to comply with the scheduled dates, compared with mothers. Sisters were 16% (OR 1.6, CI 0.81-2.22) more likely not to comply with the immunization schedule, than mothers. However this effect was statistically insignificant. Caregivers who related to the child in other forms besides, mother, father, grandparent or sister were 88% (OR 1.88, CI 0.44-1.96) more likely not to comply with 9th month immunization scheduled dates.

Caregiver Age

With regards to age, a unit increase in age of the caregiver had a 19% (OR 0.81, CI 0.19–1.76) decreased likelihood of noncompliance with the 9th month measles 1 and yellow fever immunizations schedule.

Educational background

At the 9th month immunization, illiterate caregivers (OR 1.76, CI 0.75-2.12) and Primary level educated (OR 1.61, CI 0.84-2.32) caregivers had 76% and 61% respective increased likelihoods of noncompliance with the immunization scheduled, than caregivers who had obtained a tertiary level education. Secondary level education did not significantly determine compliance with the immunisation schedule (OR 1.10, CI 0.48-2.55; p = 0.091)

Monthly income

A unit increase in caregivers estimated monthly income resulted in a 21% (OR 0.79, CI 0.29 - 4.16) decreased likelihood of noncompliance with measles 1 and yellow fever immunization scheduled date on the 9th month.

Number of children

A unit increase in the number of children a caregiver had resulted in 18% (OR 0.82, CI 0.35-1.42) decreased likelihood of noncompliance with the 9th month scheduled immunization dates.

Residence

For the 9th month immunization schedule, there was 87% (OR 1.87, CI 1.24-2.51) increased likelihood of caregivers resident in rural areas not complying with immunization scheduled date compared to caregivers resident in urban areas,

Knowledge and attitude

High knowledge scores were associated mainly with decreased noncompliance for 9th month immunization schedule dates, where there was 59% decrease in noncompliance with the immunization schedule per unit increase in caregivers knowledge score (OR 0.41, CI 0.30-1.29). Also for the same immunization scheduled dates, there was 49% decreased likelihood of noncompliance with the schedule immunization dates, per unit increase in caregivers attitude score (OR 0.51, CI 0.29-1.30).

Delivered in hospital

Children who were not delivered in a hospital or health centre (OR 1.35, CI 0.21-2.34) had a 35% increased likelihood of not complying with the 9th month immunization date compared to children who were delivered in a hospital or health centre.

Birth order

For the 9th month immunization (measles 1 and yellow fever) 1st born, 2nd born, and 3rd born had a significant 79%, 47% and 32% increased likelihood of not complying with the immunization schedule compared to the 4th and latter born children.

4.3.7 Caregiver and child noncompliance at the 18th month

The following table shows how noncompliance at the 18th month immunization scheduled dates is determined by caregiver and child characteristics.

Table 4.11 Immunisation at the 18 months (Measles 2)

Variable *(Independent variable)	OR	CI (95%)	P value
Caregiver Socio demographic and socio cultural Characteristics			
Relationship with child			
Mother	-	-	-
Father	2.87	(1.49–3.54)	0.001
Grandparent	1.65	(1.12–2.34)	0.001
Sister	1.29	(0.55-2.98)	0.002
Other	1.80	(0.37-2.38)	0.000
Age	0.53	0.35–1.81	0.000

Marital status			
Married	-	-	-
Divorced	1.43	(0.61–2.74)	0.07
Unmarried	0.91	(0.21–2.36)	0.09
Religion			
Christian	-	-	-
Muslim	1.03	(0.63–2.07)	0.49
Other	1.31	(0.81–1.89)	0.34

Educational Background			
Illiterate	2.07	(1.15–2.68)	0.003
Primary	1.61	(0.68-2.41)	0.000
Secondary	1.01	(0.35-2.24)	0.18
Tertiary	-	-	-
Estimated monthly income (Gh¢)	0.91	0.29 -4.41	0.000
Employment status			
Employed	-	-	-
Unemployed	3.12	2.81- 3.97	0.000
Marriage type			
Monogamy	-	-	-
Polygamy	1.37	0.69-2.13	0.094
Seek medical help from traditional medical sources			
Yes	-	-	-
No	0.98	0.33-1.94	0.068
Number of children	1.01	(0.61-1.77)	0.001
Area of residence			
Urban	-	-	-
Rural	2.87	2.21-3.15	0.000
Religious denomination against immunization			
Yes	1.01	0.27-1.86	0.085
No	-	-	-
Caregiver knowledge, attitude and perception			
Knowledge Score	0.28	0.10-1.14	0.002
Attitude Score	0.43	0.21-1.64	0.003
Child Characteristics			
Gender			
Male	0.94	0.37-2.04	0.16
Female	-	-	-
Delivered in hospital			
Yes	-	-	-
No	1.97	1.16-2.42	0.001
Age (in months).	1.64	0.49-1.88	0.000

Birth Order			
1st born	1.81	0.41-2.79	0.000
2nd born	1.29	0.23-1.84	0.000
3rd born	1.12	0.18-1.35	0.000
4th and latter born	-	-	-

Caregiver's relationship with the child was significantly associated with noncompliance with immunization at the 18th month (Measles 2). With regards to the eighteenth month immunization, fathers were respectively 187% more likely not to comply with the schedule than mothers.

Also for caregivers who were grandparents to child, they were 65 % (OR 1.65, CI 1.12-2.34) more likely not to comply with the scheduled dates than mothers.

Analysis of the data (Table 4.11) also showed that caregivers who were sisters were 29% significantly more likely not to comply with the schedule dates, than mothers. Caregivers whose relationships with the children was of other forms besides, mother, father, grandparent or sister were also significantly, 80% (OR 1.80, CI 0.37-2.38) more likely not to comply with the 18 month immunization scheduled dates.

Caregiver Age

For the Measles 2 immunization schedule, which is at the 18th month of the child's age, noncompliance with the scheduled date decreased by 47% for every unit increase in the age of the caregiver (OR 0.53, CI 0.35–1.81).

Educational background

Illiterate caregivers (OR 2.07, CI 1.15-2.68) were again twice (107%) more likely not to comply with the scheduled immunization date than tertiary educated caregivers; primary level educated caregivers had a 61% (OR 1.61, CI 0.68-2.41) increased likelihood of noncompliance with the 18th month immunization scheduled date compared to caregivers who had a tertiary level education. Secondary level educated caregiver show ever did not influence compliance ((OR 1.01, CI 0.35-2.24; p= 0.18)

Monthly income

There was a 9% decreased likely hood of noncompliance with the Measles 2 immunization date scheduled for each unit increase in a caregiver's income (OR 0.91, CI 0.29 -4.41).

Number of children

Another significant factor found in this study was the number of children a caregiver had. Here it was seen that there seem to be an equal likelihood for noncompliance no matter the number of children a caregiver had (OR 1.01, CI 0.61-1.77).

Residence

For the Measles 2 immunization scheduled caregiver being resident in a rural area had 87% increased likelihood of not complying with the immunization scheduled date compared with a caregiver who was an urban resident.

Knowledge and attitude

High knowledge scores were associated mainly with decreased noncompliance for 18th month immunization schedule dates, where there was a 72% decrease in noncompliance with the immunization schedule per unit increase in caregivers knowledge score (OR 0.28, CI 0.10-1.14). Also for same immunization scheduled dates (18th month) there was a 57% decreased likelihood of noncompliance with the schedule immunization dates, per unit increase in caregivers attitude score (OR 0.43, CI 0.21-1.64).

Delivered in hospital

The 18th month immunization schedule date, had children who were not born in a hospital or health centre (OR 1.97, CI 1.16-2.42) getting a 97% increased likelihood of not complying with the schedule compared to children who were born in a hospital or health centre.

Child age

The Childs age was found to be significantly associated with noncompliance only for the 18th week measles 2 immunization schedule date. Here a unit increase in the children's age resulted in a 64% (OR 1.64, CI 0.49-1.88) increased likelihood of noncompliance.

Birth order

Finally for measles immunization scheduled for the 18th month 1st borns, 2nd born, and 3rd born children had a 81%, 29% and 12% increased likelihood of not complying with the immunization schedule compared with children who were 4th born and later.

4.4 Institutional factors affecting immunization noncompliance

Health facility related factors that influenced noncompliance with the immunization schedule were determined by mean of a focused group discussion (FGDs). During attendance at Child Welfare Clinic (CWC), caregivers are usually given nutritional supplements which include a packaged cereal corn soya blend which they prepare porridge for their children with. The cereal encourages CWC attendance and the fact that scheduled immunizations are carried out during the CWC attendance means that it encourages caregivers to comply with the scheduled immunization dates. A mother; during the FGD said "they should continue giving us the porridge, it makes my child look nice, plump, and healthy. Whenever it finishes fast, I usually pray for the next CWC date so that I can get another one."

Caregivers complained that when they take children for immunization, the lack of enough benches and furniture that result from the overcrowding during CWC, meant that they sometime had to stand in the queue waiting for their turn. This was very inconveniencing to them and their children. A mother put it this way; " You will see that I will be standing whiles trying to breastfeed the crying baby" the staff also confirmed this, a nurse said "I have even seen a woman turn and start to go back home, thank God I was able to stop her, what about those we don’t see, who return home just because they can't get a bench to sit on."

Discussing the waiting time when caregivers took their children for immunization services, a caregiver complained "Sometimes when the nurses are not enough you have to wait for up to 2 hours before it is your turn, it's so annoying"

Caregivers thought that the outreach services although, very useful in ensuring that they complied with the schedule, needed to give them sufficient notice before coming to their homes, especially during the farming seasons. The traders among them sometimes go to other towns to attend market days. "I know that they will be coming, I can even leave my child home when attending the market day in some other town." The health staff however said they sometimes counted on the traditional system to make announcements. Even though they admitted that it could be better to use radio, "we announce impending visits through radio stations, but where will the money for that come from? There is no money o!" was a remark given by one public health nurse.

In line with this, health facility staffs also complained of the lack of adequate transportation which will enable them make the outreach services more frequent and intensively to cover a wider area. "We should be given more motorbikes which are appropriately fuelled, it will enable more and more of us to be able to go for these outreach services and you will see the huge improvement that will come." They also thought that generally motivation by the provision of transport, salary increase and regular supply of vaccines and equipment, would make them carry out their duties with greater conviction, which they believed would help reduce noncompliance with the immunization schedule.

"Even though the immunization services are free, it is not only just that, if you live far from the the facility you will have to pay to transport yourself and also at least look decent. It takes money to do all that". This was the remark by one caregiver when the issue of finance and noncompliance was discussed during the FGD.

Caregivers spoke about side effects and contraindication after the children had been immunized, even though they said it was disturbing especially when the child cries allot and develops a slight fever, they recognized this as being normal since they had been educated on these side effects many time. This did not cause them not to comply with the immunization schedule. As for crying, swelling, and even fever it happens but it is normal. I give the child some medicine and it stops. It is only the father that sometimes gets worried and complains".

While some caregivers complained about the attitude of health facility staff whenever they came for immunization services, others said it was sometimes their own fault that the nurses would treat them harshly. They all however agreed that it sometimes discouraged them from coming for the immunization services. Some remarks were "sometimes the nurses shout on us", "some of the nurses don't treat us with much respect". "For me I had a bad encounter with one nurse at my previous clinic that is why I started attending this clinic. Here the reception is better".

The health facility staff also recognized the need for more collaboration between all key stake holders if noncompliance was to be tackled," we can even have a situation where the child health record books will be inspected before a child is given admission to start school. School fees subsidies could then be given for children who complied with all the scheduled immunizations, all in the bid to discourage noncompliance with immunization schedule".

Chapter Five

5.0 DISCUSSION OF RESULTS

The Expanded Programme on Immunization (WHO, 2005) has targeted a 90 % coverage of immunisation for control of infections in developing countries. However, available literature suggests that 95 % immunization coverage is crucial if vaccine preventable diseases are to be kept under control (Glenda et al., 2004; Abdulraheem et al., 2011). The measurement of immunization coverage does not take into consideration the age at which the child received the vaccine; instead it only gives, in percentage, the number of children who have received the recommended vaccines (Luman et al., 2005). This form of measurement is inadequate, since it is necessary that a child receives all the recommended vaccines at the right time as per the recommended schedule, where the child can be said to have complied with the schedule. This is what will give the child the optimal protection from vaccine preventable diseases (Glauber, 2003). Indeed "Receipt of vaccines at recommended ages and interval ensures that the child is adequately protected from target diseases at all times" (Abdulraheem et al., 2011). It is no surprise then that noncompliance with the recommended immunization schedule which may be in the form of incomplete immunization or taking vaccine at other dates to make up for missed opportunity is a great source of worry in public health (Mayinbe et al., 2005). This is really worrying considering the fact that about 2.5 million infants are said to be lost yearly because of vaccine preventable diseases (WHO, 2005). This study therefore aimed to analyse the factors that determine noncompliance with the routine immunization schedule in the Tamale Metropolis.

5.1 Demographics of Study Participants

In this study, it was observed that majority of respondents (80%) were above 20 years but less than 40 years, implying that the age range, 20-39 years may be the most active age group in which women in Tamale Metropolis give birth. This agrees in some way with findings from a similar study by Abdulraheem et al., (2011) in which the ages of majority of caregivers (90.5 %) were between 18 and 39 years. Also caregivers were mostly mothers, Even though some others were sisters and fathers. Both the health facility staff and the caregivers during the FGD confirmed this fact. During one of the FGDs, where four of the caregivers were mothers to the children whiles just one was a sister to the child, a mother said "eii! In this part of the country it is very rare for a man to volunteer to send the child for immunization whiles the woman stays home. Even if he will go, he will go with the woman". This is not surprising considering the fact that mothers play a crucial role in the upbringing of children, and this include ensuring the immunization of their children (Abdulraheem et al., 2011).

The results showed a low proportion (11.1%, n = 10) of unmarried respondents in the metropolis. This may be due to the prevalence of polygamy in the area, and also the dominance of the Islamic religion which allows a man to marry more than one wife. This observation is in line with data from the 2010 Population and Housing Census which states that the Tamale Metropolis was dominated by the Islamic region (Ghana Statistical Service, 2013).

In the current study, majority of the respondents were literate, although at varying levels on the literacy educational ladder. This is in line with the Ghana Statistical Service (2014), report

which indicated that more than 50 % of the population in the metropolis was literate. Against the foregoing backdrop, there seems to be a high literacy rate in Tamale.

The study being reported also shows that majority of respondents were employed. However, the estimated monthly income of majority of respondents was found to be between GH¢ 100 and GH¢ 200, suggesting the extent of poverty that may be prevailing in Tamale. Majority of respondents i.e. 194 out of 406 representing were involved in a polygamous marriage; whilst 59 out of 406 said their marriage was of monogamous nature, the rest were not married.

Regarding seeking medical help, majority indicated that they do sometimes seek medical help from traditional sources. This is understandable considering the fact that Tamale is a metropolis steeped in tradition and so sometimes inhabitants may feel the urge to go back to their traditional way of doing things. This is why in their study of traditional teachings and health practices for child health in northern Ghana, Engmann et al., (2013) identified a pluralistic health care to be an important healing system in the north. The pluralistic health care is where traditional health care is aligned with formal health care in order to address the believes and traditions associated with mother and child health. The authors arrived at this conclusion after their study found a mixture of traditional and conventional health seeking behaviour among mother.

Most respondents (about 48%) had three children, and was followed by 25.6% of respondents who had two children. This is in line with the Northern Regional Analytical Report of the 2010 Population and Housing Census which estimates that on average a woman in the northern region of Ghana will give birth to 3 children in her lifetime (Ghana Statistical Service, 2013). It is however lower than the Total Fertility Rate (TFR) of Ghana that was

reported in the 2014 Ghana Demographic and Health Survey as 4.2. The survey however puts the TFR of the rural and urban parts of the country at 5.2 and 3.4 children respectively (Ghana Statistical Service, 2015). The fact that in this research majority 65.55% of respondents were urban dwellers explains why majority of them had three children.

A large proportion of the respondents answered that their religious denomination did not preach against immunization, this was 89.9% (365/406) of all the respondents, whiles the remaining 10.1% (41/406) claimed that their religious denomination preached against immunization. This agrees with a study by Antai (2009), which sought to find out the effect of a mother's religious affiliation on infant immunization. The authors demonstrated that religion was not significantly associated with the risk of a child being partially immunized

When gender distribution of the children were analysed, it turned out that majority; 54.4% (221/406) of the children were female. This appeared to be in line with the Ghana Statistical Service, (2013) Northern Regional Analytical Report which indicated that the Tamale metropolis is one of the few districts within the northern region with more females than males. Even though the report attributes this to migration of males within the metropolis, it is most likely a result of more female children being born compared to male children, as the age for migration would be above the range within which immunisation is conducted.

Fewer proportions of respondents had higher knowledge scores, with 31.1% of caregivers scoring from 0 to 5. This is supported by Angadi et al., (2013) who concluded in their study that mothers had a limited knowledge of immunization. It has been found out that although most caregivers had some knowledge of immunization, when more information was demanded

from them such as name of some disease, fewer caregivers could exhibit deep knowledge in this regard. (Angadi et al. 2013; Manjunath & Pareek, 2003).

Although the knowledge of participants on immunisation was not commendable, a large proportion of the respondents had a high attitude score indicating that they had a good attitude toward immunization. None of the respondents scored 0, while over 55 % of respondents had a score of 4 or above. Consequently, as in a study reported by Awodele et al., (2010), the participants' good attitude towards immunisation was confirmed when almost all of them responded in the affirmative to whether they would recommend immunization to other caregivers.

5.2 Rate of Noncompliance with the Routine Immunization.

In this study, although, noncompliance was defined to capture both individuals who were not immunized at all and individuals who were immunized but not on the scheduled dates, majority of noncompliance was as a result of the latter. This conforms to the Smith et al., (2004) observation that percentage of parents who refuse all vaccines is a small subset of those who choose alternative schedules overall. Furthermore, Gust et al., (2008) intimates that majority of caregivers choose to delay certain vaccines, extend the interval between vaccines, or delay vaccines until a certain age. The exception to this was however the measles 2 immunizations, which participants of the focused group discussions confirmed has been a huge challenge to the Tamale metropolis. Indeed with the measles 2 immunization, majority (176 respondents) of noncompliance resulted from individuals not being immunized at all.

The Measles 2 immunization, registered the highest noncompliance rate of 83.3%, this was due to the fact that these vaccines were scheduled for a later date; as much as nine months after the first measles immunization. The focused group discussions revealed that some caregivers forget about the measles 2 immunization while others felt reluctant to take their children to health centre, because they no longer see the need to. This was followed by the measles 1 immunization with a comparatively lower rate of 50%.

BCG immunization also appeared to have a high noncompliance rate of 41.1%, however this was due to children being immunized on other dates rather than scheduled dates. Though all the sampled children had eventually been immunized with this vaccine, 167 out of them were not immunized at birth as per the immunization schedule. The focused group discussions disclosed that, each BCG vaccine vial contained 20 doses and once opened and reconstituted the vial had to be used up immediately or stored at an appropriate temperature for a six hour period, else the vaccine would have to be discarded. This challenge often lead to large quantity of this vaccine being discarded and hence a shortage of this vaccine is common at the exact time the it is needed, and mostly has to be taken at other dates when it is available or when there is a sufficient number of children for immunization for whom a vial can be opened and reconstituted.

The sixth week Polio 1, Pneumococcal 1 and Rotavirus 1 immunizations had the lowest rate of noncompliance, since all three took place just six weeks after birth. Sixth week immunization had a noncompliance rate of 5.7%, tenth week immunization (Polio 2, Penta 2, Pneumococcal 2, and Rota 2) had a noncompliance rate of 35.5% , fourteenth week immunization (Polio 3, Penta 3, Pneumococcal 3) had a noncompliance rate of 43.3%, ninth month immunization (Measles 1 and Yello Fever), had a noncompliance rate of 50%, and eighteenth month

immunization (Measle 2) had a noncompliance rate of 83.3%, indicating an increase in noncompliance with time. The focus group discussions concluded that mothers were often very eager to ensure the well-being of their children at this early stage and hence would be very prompt in accessing the immunization services at this stage. It is seen that as time goes by however they become relaxed and adopt a more lukewarm attitude towards subsequent immunization scheduled dates as it was observed that the rate of noncompliance generally increased with the passing of time. This time effect on noncompliance however has not been previously reported; possibly because the analysis of noncompliance has until now not been considered on the bases of time within immunisation schedules.

5.3 Influence of caregiver and child characteristics on noncompliance

Results of the multivariate analysis indicated that a caregivers relationship with the child was significantly associated with noncompliance with immunization at the Sixth week (Polio 1, Penta 1, Pneumo 1, Rota 1), immunization at the Tenth week (Polol 2, Penta 2 Pneumo 2, Role 2), immunization at the fourteen week (Polio 3, Penta 3, Pneumo 2,), immunization at the ninth month (measles 1, yellow fever), and immunization at the 18^{th} month (measles 2).

For BCG and Polio 0 immunization scheduled to be taken at birth, the only socio-demographic factors that were significant were the caregivers level of education, caregivers estimated monthly income, caregiver employment status, caregivers area of residence and whether a child was born in hospital/health centre or not. All the other characteristics of the caregiver and child were not significant determinants of noncompliance with immunization at birth, since a large number (80%) of the sample children were delivered at the hospital or health facility. At birth the children would have been immunized with both BCG and polio

zero no matter their socio-demographic background. Even though marital status of caregiver, religious denomination of caregiver, employment status, marriage type a caregiver was involved in, gender of the child, whether caregiver seeks traditional medical attention and whether caregiver's religion preached against immunization showed varying proportions of likelihood with noncompliance, these factors were insignificant. This agrees with Basel & Shrestha (2012) who observed that there was no significant association between gender and compliance with immunization scheduled dates.

Caregiver Relationship with child

Caregiver relationship with the child was found to be a significant determinant of noncompliance for the 6th week, 10th week, 14th week, and 9th month immunization; with caregivers who were not mothers being more prone to noncompliance on these schedule dates. Caregivers who were sister were the only exception to this. For the polio 0 and BCG immunization however, caregiver's relationship with the child was found not to be a significant determinant of noncompliance.

The findings were not so surprising since it is natural for a mother to be more devoted to the well-being of her child than other caregivers who are not mothers to a child. Results of the focused group discussions supported these results. One focused group participant said "mothers have more interest in a child's well-being than others." This finding is in line with a study by Craig (2006) which came to the conclusion that "compared to fathering, mothering involved more overall time commitment, more time alone with children, and more overall responsibility for managing care".

Caregiver Age

Contrary to Jani et al., (2008) who observed that caregiver's age showed no significant differences with respect to children with incomplete immunization and immunization schedule noncompliance status, analysis of results from this study showed that for most of the scheduled immunization dates noncompliance tended to increase with younger caregivers. Only Polio 0 and BCG immunizations at birth did not have caregivers age as a significant determinant of immunization noncompliance.

In this study some caregivers were found to be as young as 20 years and below. These younger caregivers may not be mature and experienced enough to know the importance of immunization, with aging comes more maturity and hence older caregivers tended to comply with immunization services more. Also due to younger caregivers being financially worse off; they may not have been able to afford the transportation cost to go for immunization in a prompt fashion, where ever the service may be. Comment during focused group discussions like "older caregivers are more mature" and "The older they are the more careful they are" support this fact.

In their study carried out on the waiting rooms of local health departments in Georgia by Fields et al., (2007) the authors found that there was no correlation between a caregivers' age and noncompliance with the immunization schedule.

Formal education status

Another significant determinant of noncompliance with all immunization scheduled dates was the Educational background of the caregivers. Results here show that caregivers with lower education level were more likely not to comply with most of the immunization dates on the schedule, compared to caregivers with high educational background. The difference between secondary educated caregiver and tertiary educated caregiver noncompliance was however not significant.

This is in conformity with research by Basel & Shrestha (2012) who indicate in their work that as the educational background of mothers increased the percentage of immunization dropout children decreases. Additionally, this was backed by the results of the focused group discussions carried out as part of this study. “some mothers are educated even to university level so we don’t need to tell them how important immunization services are and yet they hardly miss a vaccine and they also come exactly on the scheduled date” is one of the comments that came out of the focus groups, another person said “our problem is the illiterate caregivers, we sometimes have to chase them to immunize their own children”.

In a study on compliance with immunization schedule by Dombkowski et al., (2004) Low parental education level was found to lead todelay in immunization and causes "inadequate" immunization of the child.

Monthly income

The estimated monthly income also turned out to be a significant determinant of noncompliance in this research. At all dates of the immunization schedule increased monthly income was associated with a decreased likelihood of noncompliance. This agrees with findings by Ibnouf et al., (2007) who stated in their study that socioeconomic status of a child's family goes a long way to determine the childs immunization status. Focus group discussions also came to a similar conclusion. It was stated for instance that if a caregiver was well-of economically they were more likely to be able to access immunization services no matter how much it cost to transport them to the immunization centre.

"Higher pay level" was found to be associated with high immunization rate when Fielding et al., (1994) investigated the immunization status of children of employees in large companies. Obviously because a high monthly income means that caregivers were able to satisfy most of their needs, so that even if immunization of their children was not high on their list of priorities, a high income would afford them enough disposable income to be able to transport themselves to immunization centers. A lower income would have caused caregivers to spend most of their time in persuance of more income either in their farms or market places, making them forget immunization schedules or even postpone immunization of their children because they simply cannot get the time. It is no surprise that caregivers socioeconomic status was also found by Tadesse et al., (2009) to be a determinant of immunization defaulting.

Employment status

Employment status was found to be a significant determinant of noncompliance with BCG and polio zero immunization at birth as well as the 18th month measles 2 immunizations. It was however not a significant determinant of immunization noncompliance for all other scheduled dates. Although some studies found no significant association between caregiver employment status and child immunization status, some others found that noncompliance with immunization was significantly associated with caregiver unemployment (Fatiregun & Okoro, 2012).

Most employed women are mostly financially better off and find it easier to seek health care including, delivering their children at health facilities. Since BCG and polio zero immunizations are administered at birth, employed women are often more likely to comply with them than women who are not employed. According to Wood et al., (1993) data on Los Angeles in the United States indicate that employment status of caregivers is an important determinant of a child's immunization status. Awasthi et al., (2014) observed in their study of urban slums in Varanasi, India, that employed caregivers were more likely to have their children fully immunized compared to unemployed caregivers. Some studies that supported this finding attributed it to the employed caregivers being in the position to afford any cost that may arise when they seek immunization services for their children (Mindlin, et al., 2009).

Number of children

Another significant factor found in this study was the number of children a caregiver had. Here it was seen that for caregivers with more children there was a decreased likelihood of noncompliance with all the scheduled immunization dates aside polio zero and BCG

immunization at birth. This could have been because caregivers, who have realized the benefits of complying with immunization schedules after their first births, tend to comply more with the schedules after subsequent births.

The only exception was measles 2 immunization scheduled for the 18th month, where there seem to be an equal likelihood for noncompliance no matter the number of children a caregiver had. This is not surprising considering the revelations during the focus group discussions which made it clear that the noncompliance with the measles 2 immunization was extremely high among all groups. Some comments were; “as for the second measles immunization (measles 2), we only get a lot of the children to immunize during our outreach programs", "They don’t come for the measles 2 immunizations at all" and “caregivers feel the child is now ok so they don’t care about the measles 2 immunization”.

Residence

Significant Rural/Urban contrast was also observed in this study so far as noncompliance with the immunization schedule for the entire immunization schedule was concerned. Caregivers who were resident in rural areas had an increased likelihood of not complying with the immunization scheduled date compared to caregivers who were resident in urban areas. This assertion is in line with many studies done on immunization in which rural and urban dwellings were compared. Monguno, (2013) saw in his study in Borno State, Nigeria that living in urban area was one of the factors that was protective against defaulting in immunization for children.

Living in urban areas bring many advantages, which makes it more likely that people would take advantage of immunization services to ensure that their children are healthy, unlike rural

settings where immunization services are not easily accessed, misconceptions about immunization, lack of awareness of immunization issues, and low educational background are prevalent. Naeem et al., (2011) reported immunization coverage rates of 76.5% and 48.8% respectively for urban and rural areas of Peshawar.

Knowledge and attitude

As mentioned earlier, the caregivers' knowledge and attitude scores were of significant effect on noncompliance with immunisation.

High caregivers' knowledge and attitude scores were associated mainly with decreased noncompliance with immunization schedule. Focused group discussions show that most of the health workers agreed that intensive education on immunization would increase the knowledge of caregivers and hence noncompliance could be reduced. One focused group discussion participant put it better when she said “when we teach them and they know more about immunization they tend to come exactly on scheduled dates”. This is clear from the Results of the data analysis.

Caregivers' knowledge and attitude were however statistically insignificant so far as noncompliance with BCG and Polio 0 immunization at birth is concerned

Delivery in hospital

Children who were not born in a hospital or health facility had an increased likelihood of not complying with the schedule compared to children who were born in a hospital or health centre. This could be due to the fact that after delivery at the hospital, staff would have

sensitized a caregiver on the importance of complying with the schedule. This was especially the case for the 18th month measles 2 immunizations, where children who were not born in the hospital were almost two times as like not to comply with the immunization schedule as children who were born in the hospital.

Focus group discussions also revealed that, when a child is delivered at the health facility, caregivers would often get the opportunity to interact with other, caregivers in the wards. These interactions may serve as a source of positive peer pressure as they discuss the next stage of giving adequate care to the children. The interactions at this stage serve as a source of additional influence that could motivate caregivers to comply with immunization schedules. In view of this, Etana & Deressa (2012) and Jagrati et al., (2008) found in their studies that the place of child delivery was a determinant of defaulting and noncompliance with immunisation schedules. Similarly, Mutua et al., (2011) discoverd that caregivers who were delivered of their children at a hospital or health facility were more likely to comply with immunization schedule than those who had their delivered at home..

Child age

The child's age was found to be significantly associated with noncompliance only for the 18th week measles 2 immunization schedule date, where a unit increase in the child's age resulted in a 64% increased likelihood of noncompliance with the 18th week measles 2 immunization schedule date. The data here showed that older children were most likely not to have complied with the measles 2 vaccines date. However focused group discussion revealed that the measles 2 immunizations which occurs during the 18 month was introduced in the year 2012, hence some caregiver/children pair (older children) sampled in this study might have stopped

attending the child Healthcare clinic by then. This also partly accounts for the high number children on Table 4.4 who were not given the measles 2 immunization.

Birth order

In this study, noncompliance was observed to be more common among children born earlier (older children). This could be because as the years have gone by, immunization services and compliance have improved with the increasing efforts of the Tamale Metropolitan health Directorate towards increasing outreach services, and immunization education. Birth order was however not a significant determinant of BCG and Polio zero immunizations at birth. Again this is attributable to the fact that children are immunized at birth in health facilities once they are born.

Contrary to the findings in the current study, Schaffer & Szilagyi (1995) in a study were they considered the period between 5 to 12 months of life, came to the conclusion that firstborn children were much more likely than their second born siblings to be immunized on time. They also found that once firstborn children were immunised later than the scheduled date, the chances became high that their sibling would also be immunized later than the scheduled date. This variance in findings cannot be readily explained. However this may be due to the differences in the ages of the mothers that were involved in the Schaffer & Szilagyi study .In many other studies, a child's birth order was found to be a risk factor for immunization status (Gavrielov-Yusim, et al., 2012). These authors also showed in their study that children born later (younger children) into larger families had lower immunization uptake.

Chapter Six

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The purpose of this study was to determine the factors that cause caregiver and child pair noncompliance with the infant routine immunization schedule in the Tamale Metropolis of the Northern Region. This would enable policy makers and key stakeholders to put in measures to consolidate the gains made in preventive health and ultimately prevent infant mortality and morbidity that could result from vaccine preventable disease. The following conclusions were reached base on the results of this study;

- The rate of noncompliance generally increases with time, with the last vaccine (measles 2) on the schedule registering the highest rate of noncompliance.

- Majority of noncompliance results from caregivers taking children for immunization on days different from the scheduled date.

- Caregivers who delivered their children at health facilities usually had their children immunized with the BCG and polio zero vaccines, and they were usually more likely to comply with the rest of the scheduled dates.

- The reasons for noncompliance differ depending on the scheduled immunization date being considered. The following however can be said to cause noncompliance with almost all the immunization scheduled dates

    - Lower educational background

- Lower Monthly income
- Caregiver not being the child's mother
- Younger caregivers
- Caregivers with fewer children
- Living in rural areas
- Low caregiver knowledge on immunization
- Child not delivered in a health facility
- Older children

- At the institutional level , noncompliance was mostly encouraged by:
  - Nutritional supplements at CWC were not forthcoming
  - Caregiver discomfort (long waiting time, insufficient chairs for sitting) at immunization centre's
  - Less frequent and impromptu outreach services, as a resort of lack of transportation, equipment, vaccines and remuneration for staff.
  - Immunization staff antagonizing caregivers

6.2 Recommendation

- The MoH, GHS, the Regional and Metropolitan Health directorates as well as the donor agencies, should ensure intense sensitization to increase knowledge and also to improve attitudes towards immunization, especially in the rural areas.

- Staff of various health centres should be sent on routine immunization compliance educational and advocacy campaigns, in order to reach women when they are at their antenatal stage. This will encourage the caregivers, build their knowledge, and improve their attitude towards immunization long before the deliver.

- During educational sessions staff should be made to focus more on caregivers with lower educational background, lower Monthly income, as well as younger caregivers, caregivers with fewer children, caregivers living in rural areas, caregivers who did not deliver at health facilities, caregivers who are not mothers to children.

- Outreach services should be organized frequently by the sub-district health centres to ensure that, immunization services are taken as close to caregivers as possible. Also caregivers should be given sufficient notice of outreach services through radio and other traditional communication methods, so that they can stay at home for these events.

- Immunization centres and staff should ensure that the caregiver does not have to wait in queue for more than 15 minutes to access their services. Even whiles waiting there should be enough benches and chairs to make caregivers feel comfortable while waiting for their turn. Finally caregivers should be spoken to politely.

- Cereal blend porridge and other food supplements given to caregivers during CWC visits should be encourage, by the nutrition departments and staff at the health centres, since it helps encourage uptake of immunization service.

- Lastly Government and all other stakeholder improve the economic conditions of the people in that Tamale metropolis, since it is a key determinant of noncompliance with the immunization schedule.

6.3 Self-evaluation and further work

One important difference between this work and others conducted on similar issues of noncompliance with immunization is the fact that it considered the primary outcome variable at each scheduled immunization date on the EPI schedule.

This study could however not have been done without certain unavoidable limitations. Owing to limitation of time, this research adopted a retrospective approach in data gathering. This retrospective element has the tendency of introducing a level of inaccuracy when it comes to recall of information by respondents. This could have been resolved if the study had been experimental and prospective, with case and control groups that could have been observed over an 18 months period. Additionally a number of respondents, as always happens among populations who do not appreciate research, refused to give information unless they were convinced beyond reasonable doubts that the findings of the project was for academic purposes. Despite these limitations, this study uses adequate sample size coupled with regular and intensive continuous supervision during questionnaire administration.

This study found that while some caregivers delayed in immunizing children on scheduled dates, others did not immunize their children at all. For the most part noncompliance was due to the former. Further research would be recommended to find out the factors that lead to noncompliance at each separate level, with the primary outcome variable of noncompliance explored with three outcomes (non-compliant, partially compliant, and compliant).

The study sampled respondents from the Tamale Metropolis. However to ensure a stronger external validity future research on the issue should consider a representative sample from the whole of the country.

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APPENDICES

Appendix A: Participant Invitation and Consent

Participant Invitation and Consent

My name is IKLEEN SEIBIAM IBRAHIM, a graduate student of the University for Development studies. I am conducting a research to examine compliance with WHO and Government Recommended Routine Immunization schedule in the Tamale Metropolis. The findings of the research are intended to help create a harmonious relationship between all health providers in the region and determine which socio demographic predictors affect the research topic. I do not need your name, your participation is entirely voluntary, and it involves consenting to complete a demographic form and answering some questions based on your agreement or disagreement to the statements.

There are no risks or discomfort associated to your participation; however, you are free to withdraw from participating if discomfort occurs. There are no tangible benefits associated to your participation. Please note that your responses will be only reviewed by my supervisors.

Thanks for your co-operation.

Yours faithfully,

I have read and understand this consent form, and voluntarily consent to participate.

Sign…….……. Date: …..…/……./2015

Appendix B: Quantitative survey questionnaire

Quantitative Survey Questionnaire

SECTION A

A (i) Caregiver or mother socio demographic characteristics

1. Caregiver relationship with child

☐ Mother
☐ Father
☐ Grandparent
☐ Sister
☐ Brother
☐ Other

2. Age of caregiver.....

3. Marital status

☐ Married
☐ Divorced
☐ Unmarried

4. Religion

☐ Christian
☐ Islam
☐ Traditional
☐ Other, please state……

5. Level of education

☐ Illiterate
☐ Primary
☐ Secondary
☐ Tertiary

6. Estimated monthly income..... Gh¢

7. Main Occupation

☐ Trading
☐ Farming
☐ Housewife
☐ Unemployed
☐ Other occupation

8. Marriage type
- ☐ Monogamy
- ☐ Polygamy

9. Do you sometimes seek medical help from traditional sources?
- ☐ Yes
- ☐ No

10. Number of children caregiver has.....

11. Do you have a card for WHO and Government recommended routine Immunization schedule?
- ☐ Yes
- ☐ Yes but I cannot locate it
- ☐ No

A (ii) Childs characteristics;

1. Gender of child
- ☐ Male
- ☐ Female

2. Place of birth
- ☐ Home
- ☐ hospital
- ☐ Other state.....

3. Age of child (in months).....

4. Birth Order of child..... St / nd / rd/ th

5. Point at which immunization schedule compliance failed (Compliance status)
- ☐ Child complied with the entire schedule
- ☐ Child completed but not according to schedule
- ☐ Incomplete vaccination

6. Area of residence?
- ☐ Rural
- ☐ Urban

7. What do you think are the reasons for noncompliance with immunization schedule?

- ☐ Concern about vaccine safety
- ☐ Long distance trekking/walking
- ☐ Long waiting time
- ☐ Lack of money
- ☐ Lack of vaccine
- ☐ Social engagement
- ☐ Others

8. Does your religious denomination preach against immunization?

- ☐ Yes
- ☐ No

9. Was the following immunization taken by child on the scheduled date or other date?

BCG Scheduled date [ ] Other Date [ ] Non [ ]

Polio 0 Scheduled date [ ] Other Date [ ] Non [ ]

Hepatitis B Scheduled date [ ] Other Date [ ] Non [ ]

Polio 1 Scheduled date [ ] Other Date [ ] Non [ ]

DPT/Hep B/ Hib 1 (5 in 1) Scheduled date [ ] Other Date [ ] Non [ ]

Pneumococcal 1 Scheduled date [ ] Other Date [ ] Non [ ]

Rotavirus Scheduled date [ ] Other Date [ ] Non [ ]

Polio 2 Scheduled date [ ] Other Date [ ] Non [ ]

DPT/Hep B/ Hib 2 (5 in 1) Scheduled date [ ] Other Date [ ] Non [ ]

Pneumococcal 2 Scheduled date [ ] Other Date [ ] Non [ ]

Rotavirus Scheduled date [ ] Other Date [ ] Non [ ]

Polio 3 Scheduled date [ ] Other Date [ ] Non [ ]

DPT/Hep B/ Hib 3 (5 in 1) Scheduled date [ ] Other Date [ ] Non [ ]

Pneumococcal 3 Scheduled date [ ] Other Date [ ] Non [ ]

Measles 1 Scheduled date [ ] Other Date [ ] Non [ ]

Yellow Fever Scheduled date [ ] Other Date [ ] Non [ ]

Measles 2 Scheduled date [ ] Other Date [ ] Non [ ]

SECTION B

This section of the questionnaire is to solicit for perception and knowledge of child vaccination under the Routine Immunization schedule. Kindly agree or disagree to the underlying statements or provide your own answers if need be.

B (i) Caregiver perception: scored over.....

1. Do you agree that immunization is beneficial?

☐ Highly agree
☐ Agree
☐ I don't know
☐ Disagree
☐ Highly disagree

2. Do you think it is important to comply with the immunization schedule religiously?

☐ Highly agree
☐ Agree
☐ I don't know
☐ Disagree
☐ Highly disagree

3. immunization is harmful

☐ Highly agree
☐ Agree
☐ I don't know
☐ Disagree
☐ Highly disagree

B (ii) Caregiver Attitude; Scored over.....

1. Would you immunize your next child?

☐ Yes
☐ No

2. Would you recommend routine immunization to others
- ☐ Yes
- ☐ No

B (iii) Caregiver Knowledge; Scored over.....

1. Which Day of the week is WHO and Government recommended Routine Immunization schedule?
- ☐ Wednesday
- ☐ Sunday

2. Age group for immunization under WHO and Government recommended Routine Immunization schedule?
- ☐ 0 to 18 months
- ☐ 0 to 15 months
- ☐ 0 to 30 months

3. Number of visits required under WHO and Government recommended Routine Immunization schedule?
- ☐ 10 visits
- ☐ 5 visits
- ☐ 7 visits

Diseases for which vaccines are available under WHO and Government recommended Routine Immunization schedule?

4. Guinea worm Yes [ ] No [ ]

5. Polio Yes [ ] No [ ]

6. the pneumococcus Yes [ ] No [ ]

7. Haemophilus Influenza type B (the bacteria that causes meningitis, pneumonia and otitis) Yes [ ] No [ ]

8. Whooping Cough (or Pertussis) Yes [ ] No [ ]

9. Tetanus Yes [ ] No [ ]

10. Hepatitis B Yes [ ] No [ ]

11. Diphtheria Yes [ ] No [ ]

12. Malaria Yes [ ] No [ ]

13. Diarrhoea disease Yes [ ] No [ ]

14. Tuberculosis (TB) Yes [ ] No [ ]

15. Measles Yes [ ] No [ ]

16. Typhoid Yes [ ] No [ ]

17. AIDS Yes [ ] No [ ]

18. Age at which measles vaccine is given?..... and..... months

19. In some health situations, vaccines should not be given.
- ☐ True
- ☐ False

20. There are different types of vaccines
- ☐ True
- ☐ False

21. At what stage is a child supposed to start receiving immunization under the schedule?
- ☐ At birth
- ☐ Depends on the type of vaccine
- ☐ Whenever the child gets sick
- ☐ Whenever I have money
- ☐ No idea

Appendix C: Focus Group Consent Form

FOCUS GROUP CONSENT FORM:

Research Study: Determinant of infant routine immunization noncompliance

Researcher Name: Ikleen Seibiam Ibrahim

Interviewer name.....

What is the Research?

You have been asked to take part in a study about noncompliance with the infant routine immunization schedule. The purpose of this study is find out the determinants of noncompliance with the immunization schedule

Why have I been asked to take part?

You are a health facility staffs who deals with infant immunization or a caregiver with a child between 18 and 59 month.

We would like you to take part in a discussion on the institutional factors that affect noncompliance with the immunization schedule.

Voluntary Participation

This discussion is *voluntary*—you do not have to take part if you do not want to.

If you do not take part, it will have no effect on you.

If any questions make you feel uncomfortable, you do not have to answer them.

You may leave the group at any time for any reason.

Risks

We do not think any risks are involved in taking part in this study.

This study may include risks that are unknown at this time.

Benefits

There are no financial benefits to you for taking part in this research. We hope to learn more about immunization noncompliance

Privacy

Your privacy will be protected.

Your name will not be used in any report that is published.

The discussion will be kept *strictly confidential*.

The other participants in the group will be asked to keep what we talk about private, but this cannot be assured.

If the tape recorder is used, it will only be used only for this research.

All research data will be stored in a locked file and the recordings will be destroyed once the talk has been studied.

Audio Recording Permission

I have been told that the discussion will be tape recorded only if all participants agree.

I have been told that I can state that I don't want the discussion to be taped and it will not be. I can ask that the tape be turned off at any time.

I agree to be audio taped ___Yes ___No

Payment

I will receive no payment for taking part in the focus group.

Questions

I have been given the opportunity to ask any questions I wish regarding this evaluation. If I have any additional questions about the evaluation, I may call _____.

If I have any questions about my rights as a research subject, I may contact the

University for Development Studies

Post Office Box TL 1350

Tamale Development Studies

or*prs@uds.edu.gh*.

I have received (or will receive) a copy of this form.

Please write your name below and check yes or no. If you want to take part Sign your name at the bottom.

_____

NAME

_____ Yes, I would like to take part in the focus group.

_____ No, I would not like to participate in the focus group.

_____

SIGNATURE

Appendix D: FGD Demographic Questionnaire

FOCUS GROUP: DEMOGRAPHIC DETAILS OUESTIONNAIRE

Please answer the following questions in the spaces provided, circle or tick the most appropriate options.

1. Age:……

2. Are you: (please tick as necessary) □ Male □ Female

3. What is your relationship with the child?

□ Mother

□ Father

□ Grandparent

□ Sister

□ Other: (please describe) _____

4. What is your educational background?

□ Illiterate

□ Primary

□ Secondary

□ Tertiary

5. What is your main occupation? _____

6. What is your Religion? _____

5. What is your estimated monthly incom? _____

Thank you for taking the time to complete this questionnaire

Appendix E: FGD Guide

FOCUS GROUP: DISCUSSION GUIDE

Facilitator's welcome, introduction, and instructions to participants

Welcome and thank you for volunteering to take part in this focus group. You have been asked to participate as your point of view is important. I realize you are busy and I appreciate your time.

Introduction: This focus group discussion is designed to assess your current thoughts and feelings about the about what causes noncompliance with the routine immunization schedule for infants. The focus group discussion will take no more one hour. I will be recording the discussion to facilitate its recollection

Anonymity: Despite being taped, I would like to assure you that the discussion will be anonymous. The tapes will be kept safely in a locked facility until they are transcribed word for word, then they will be destroyed. The transcribed notes of the focus group will contain no information that would allow individual subjects to be linked to specific statements. You should try to answer and comment as accurately and truthfully as possible. I and the other focus group participants would appreciate it if you would refrain from discussing the comments of other group members outside the focus group. If there are any questions or discussions that you do not wish to answer or participate in, you do not have to do so; however please try to answer and be as involved as possible.

Ground rules

- The most important rule is that only one person speaks at a time. There may be a temptation to jump in when someone is talking but please wait until they have finished.
- There are no right or wrong answers
- You do not have to speak in any particular order
- When you do have something to say, please do so. There are many of you in the group and it is important that I obtain the views of each of you
- You do not have to agree with the views of other people in the group
- Does anyone have any questions?
- OK, let's begin

Warm up

- First, I'd like everyone to introduce themselves. Can you tell us your name?

Introductory question

I am just going to give you a couple of minutes to think about your experience of immunization services in this facility. Is anyone happy to share his or her experience?

Guiding questions

- What are the attitudes of you and other staff toward caregivers who don't comply with the schedule?
- What do you think causes caregivers not to comply with the immunization schedule?
- On the other hand what do you think motivates other caregivers to comply with the immunization schedule
- Do you think the outreach services help? Can you please explain?

- What are some of the complaints discussed everyday about access and utilization of the infant immunization service in this facility?
- How busy are the CWC days in this facility and what do you do to ease the pressure on these days?
- Do you think the average waiting time for caregivers to attain the immunization services is a disincentive?
- How are conflicts between caregivers and staff in this facility resolved?

Concluding question

- Of all the things we've discussed today, what would you say are the most important issues you would like to express about this about noncompliance?

Conclusion

- Thank you for participating. This has been a very successful discussion
- Your opinions will be a valuable asset to the study
- We hope you have found the discussion interesting
- If there is anything you are unhappy with or wish to complain about, please speak to me later
- I would like to remind you that any comments featuring in this report will be anonymous
- Before you leave, please hand in your completed demographic questionnaire

Appendix F: Letter of introduction UDS

UNIVERSITY FOR DEVELOPMENT STUDIES

Tel: 03720-93295

Our Ref:
Your Ref:

P.O. Box 1883
Tamale, Ghana

Date: 3/09/2015

School of Allied Health Sciences

The Director,
Tamale Metropolitan Health Directorate

Dear Sir/Madam,

LETTER OF INTRODUCTION

I write to introduce to you Mr. Ikleen Seibiam Ibrahim, (UDS/CHD/01408/13),a graduate student pursuing his studies in Mphil in community health and development at the School of Allied Health Sciences, University for Development Studies.

He has been scheduled to carry out his field research in the Tamale Metropolis as partial fulfillment of his degree. His research is titled: ***"A THORN IN THE FLESH OF GLOBAL HEALTH; MODELING THE PREDICTORS OF NON COMPLIANCE WITH THE ROUTINE INFANT IMMUNIZATION SCHEDULE IN TAMALE METROPOLIS".***
The school will be very grateful if you could offer the student the necessary support to enable this student gather quality data to answer the research question.

Thank you.
Yours faithfully,

Dr. Michael Wowbeogo
(HOD, Community Health and Development)

Appendix G: Letter of Introduction RHD

GHANA HEALTH SERVICE

OUR CORE VALUES:
1. People-centered
2. Professionalism
3. Team work
4. Innovation
5. Discipline
6. Integrity

Your Health · Our Concern

Regional Health Directorate
Ghana Health Service
P.O. BOX 99
Tamale

Tel: (233) (71) 22912, 22710, 22146
Fax: (233) (71) 22941
Email: moh-nr@africaonline.com.gh

My Ref No: GHS/NR 21-1/8

Wednesday, 15 October 2014

Your Ref No: .....

LETTER OF INTRODUCTION FOR M.SC/M.PHIL COMMUNITY HEALTH AND DEVELOPMENT STUDENTS FIELD RESEARCH

This is to introduce to you an M.Sc/M.PHIL Community Health and Development programme and student from University for Development Studies (UDS).

He has been scheduled to carry out his field research in the Tamale Metropolis as partial fulfillment of his degree. His research is titled: ***"A THORN IN THE FLESH OF GLOBAL HEALTH; MODELING THE PREDICTORS OF NON COMPLIANCE WITH THE ROUTINE INFANT IMMUNIZATION SCHEDULE IN TAMALE METROPOLIS".***

I would be most grateful if you could please use your good offices to assist them in that direction

Please find attached letter from the school.

Thank you.

DR. J. Y. MAHAMA
DEPUTY DIRECTOR PUBLIC HEALTH
For. REG. DIR. OF HEALTH SERVICES

METRO/MUNICIPAL/DISTRICT DIRECTORS OF HEALTH

RHD, BOLE, BUNKPRUGU, YENDI, TOLON, SAGNERIGU, WALEWALE
SAVELUGU, GUSHEIGU, KUMBUNGU, WEST GONJA, SAWLA-TUNA- KALBA,
KARAGA, EAST GONJA, MION, NORTH GONJA, CENTRAL GONJA

Appendix H: Letter of Introduction TMHD

GHANA HEALTH SERVICE

OUR CORE VALUES
1. People - Centered
2. Professionalism
3. Team work
4. Innovation
5. Discipline
6. Integrity

METROPOLITAN HEALTH DIRECTORATE
GHANA HEALTH SERVICE
P.O. BOX TL. 1191,
TAMALE

20th OCTOBER, 2014

Tel: 233 - 71: 2376
Fax: 233 - 71: 23765

My Ref No: .....
Your Ref No: .....

THE SUB – DISTRICT HEAD
BILPEILA

LETTER OF INTRODUCTION **IKLEENS IBRAHIM**
Ikleen Seibiam Ibrahim

This is to introduce to you an M.Sc/M.PHIL Community Health and Development programme and student from University for Development Studies (UDS).

partial fulfillment of his degree. His research is titled: ***"A THORN IN THE FLESH OF GLOBAL HEALTH; MODELING THE PREDICTORS OF NON COMPLIANCE WITH THE ROUTINE INFANT IMMUNIZATION SCHEDULE IN TAMALE METROPOLIS".***

This is to enable him acquire the requisite skills. Kindly offer him the necessary guidelines.

Thank you.

DERY FAUSTINA (DDNS)
METROPOLITAN PUBLIC HEALTH SERVICES
(For: METROPOLITAN DIRECTOR OF HEALTH SERVICES)

Cc:

IKLEENS IBRAHIM

Appendix I: Map of Tamale metropolis

Source: Tamale Metropolitan Health Directorate