

**FACTORS INFLUENCING THE INCIDENCE  
OF MEASLES IN UNDER FIVES IN  
TAMALE MUNICIPALITY.**

**BY**

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**DECLARATION**

I declare that this dissertation is the result of my own research and no one else can be held accountable for the ideas and augments presented. All sources cited have been duly acknowledged. Further, this dissertation has not been presented in whole or part to any educational institution for a degree.

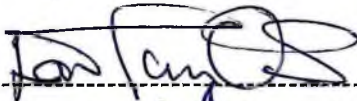
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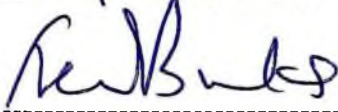
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## **DEDICATION**

**Dedicated to my mom who financed my primary, secondary and tertiary education.**

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Lastly, but certainly not the least, my thanks go to the Municipal Assembly, for providing some fund for the research and to all the people in the Northern Region who in divers ways have provided some form of assistance during the field work.

All errors that may be found in this work are however, entirely mine.

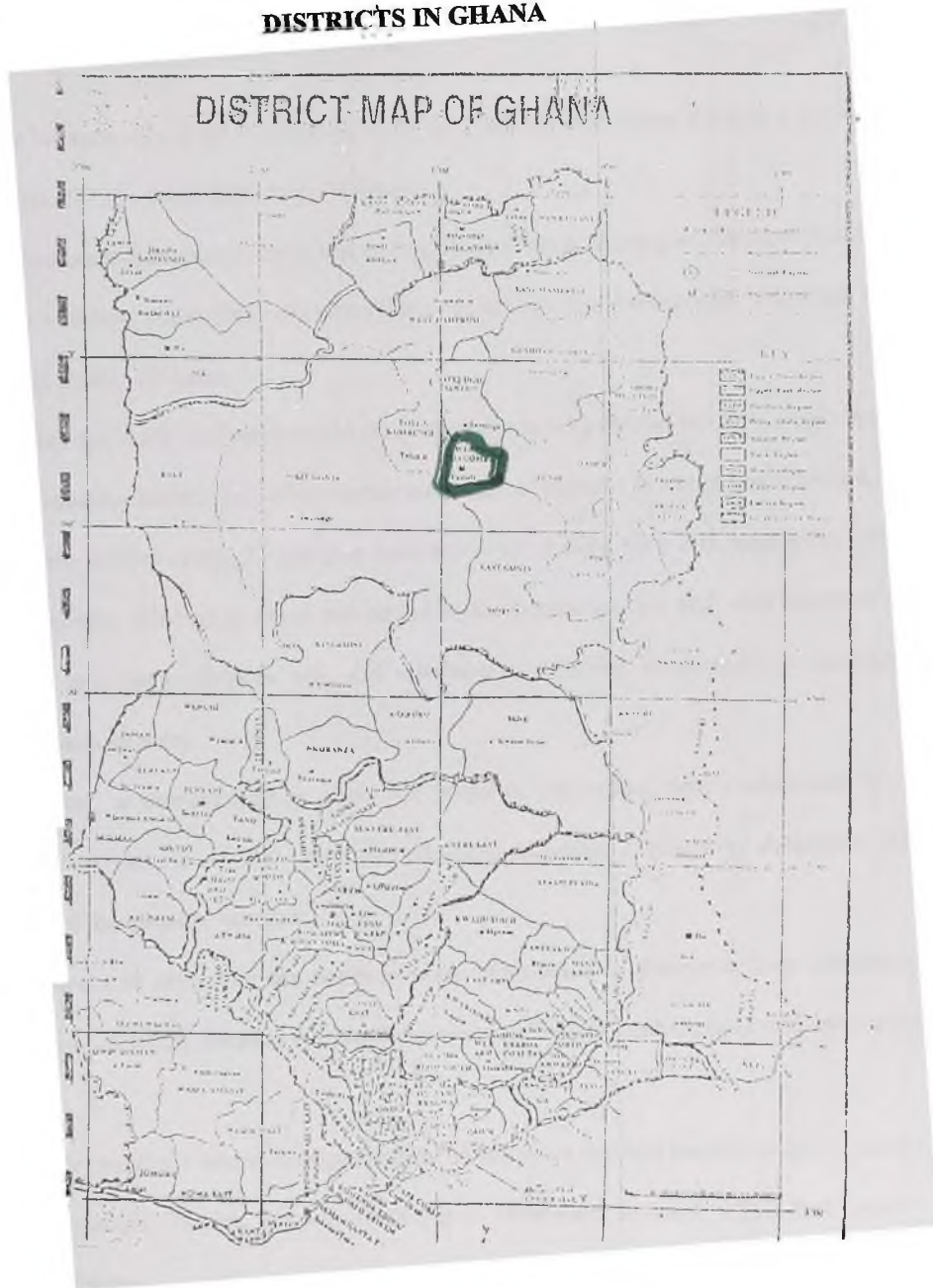
## **LIST OF ABBREVIATIONS**

<b>CHN</b>	<b>-</b>	<b>COMMUNITY HEALTH NURSE</b>
<b>CWC</b>	<b>-</b>	<b>CHILD WELFARE CLINIC</b>
<b>DDHS</b>	<b>-</b>	<b>DISTRICT DIRECTOR OF HEALTH SERVICES</b>
<b>DHMT</b>	<b>-</b>	<b>DISTRICT HEALTH MANAGEMENT TEAM</b>
<b>MDHS</b>	<b>-</b>	<b>MUNICIPAL DIRECTOR OF HEALTH SERVICES</b>
<b>MHA</b>		<b>MUNICIPAL HEALTH ADMINISTRATION</b>
<b>MHMT</b>	<b>-</b>	<b>MUNICIPAL HEALTH MANAGEMENT TEAM</b>
<b>EPI</b>		<b>EXPANDED PROGRAMME ON IMMUNIZATION</b>
<b>JSS</b>		<b>JUNIOR SECONDARY SCHOOL</b>
<b>MOH</b>	<b>-</b>	<b>MINISTRY OF HEALTH</b>
<b>PHC</b>	<b>-</b>	<b>PRIMARY HEALTH CARE</b>
<b>OR</b>	<b>-</b>	<b>ODD'S RATIO</b>
<b>PHN</b>	<b>-</b>	<b>PUBLIC HEALTH NURSE</b>
<b>SPH</b>	<b>-</b>	<b>SCHOOL OF PUBLIC HEALTH</b>
<b>SSS</b>	<b>-</b>	<b>SENIOR SECONDARY SCHOOL.</b>

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# MAP 1: LOCATION OF TAMALE MUNICIPALITY RELATIVE TO OTHER DISTRICTS IN GHANA



## **ABSTRACT**

Tamale Municipality is the smallest of the 13 districts in the Northern Region. It serves as the capital of both the Region and the district.

The incidence of measles in Tamale is among the highest in the region. Most of the cases were in children under five. Despite efforts to control the disease, the incidence has remained almost the same.

A case control study and seroprevalence study were jointly carried out as a single study to determine the factors that influence the incidence of measles in under five children.

In the case control study, 75 children between 0-60 months who had measles in 2000 were randomly selected as cases and traced to their communities and were paired with controls, who were children who did not have any history of measles in the same communities as cases.

In addition, a seroprevalence study of measles antibodies was undertaken in a convenience sample of 100 preschool children between 2-5years to determine the efficacy of the measles vaccine.

The mothers of cases and the controls were interviewed to determine their children's immunization status, socioeconomic characteristics, beliefs and practices with respect to measles.

The study found out that sixty-eight percent of the cases that had measles was vaccinated against measles. Twelve percent of the cases developed measles before they were 9 months old.

All the cases recovered from measles. The immunization status of those who had measles and those who did not were different ( $p < 0.05$ ). Significant number of controls completed their immunization against childhood diseases before one year of age than cases ( $p < 0.05$ ). Completion of immunization schedules by one year of age was important in reducing measles incidence among the children studied.

Adverse effects of immunizations did not deter mothers from immunizing their children and was not important in influencing the incidence of measles in the study

The background characteristics of the mothers/caregivers of the cases and controls were similar in terms of education, marital status, religion, occupation and income level. Most of the respondents of cases and controls were poor in that they earned less than ₱100,000 per month and live in poor houses. These factors are not significant in determining the incidence of measles in the Tamale Municipality.

In the seroprevalence study of 67% of the preschool children examined, had protective antibody levels for measles. The seroconversion rate in the vaccinated day nursery children was 72.6%. This is lower than 95% that was expected.

# **CHAPTER ONE**

## **1.1 INTRODUCTION**

Measles is acute highly contagious disease affecting humans with considerable mortality and morbidity in children particularly in developing countries. The pattern of measles infection has changed from a sporadic epidemics with all ages involved to one of endemicity, predominantly affecting the under fives (1).

### **1.1.1 Causative Agent**

Measles is a viral infection caused by a single stranded RNA virus of the family paramyxoviridae and genus morbillivirus. There is only one antigenic type of the virus and infection confers a lifelong immunity (2).

### **1.1.2 Route Of Infection**

It is spread by droplets or by direct contact with nasal or throat secretions of infected persons, less commonly by airborne spread or by articles freshly soiled with secretions of nose and throat (3). Measles is one of the most readily transmitted communicable diseases. The incubation period is about 10 days varying from 8 – 13 days from the time of exposure.

### **1.1.3 Clinical Features**

The early signs and symptoms of a measles infection typically include fever, cough, coryza, and conjunctivitis. Small whitish specks on reddened areas of the mucosal lining of the mouth known as kopliks spots appear. This continues for 3 – 7 days, followed by

characteristic rash, which starts from the head and spreads over all the body. This lasts for 4 – 7 days and if uncomplicated, the signs and symptoms begin to recede. Viral replication and bacterial superinfection normally cause complications, which include otitis media, pneumonia, diarrhoea, and laryngotracheobronchitis. Diagnosis is made usually on clinical and epidemiological grounds, although laboratory confirmation is preferred (4).

#### **1.1.4 The World**

On the global front, before the introduction of measles vaccine, virtually all children contracted measles, with an estimated 130 millions cases and around 7-8 million deaths each year. The activities of the Expanded Programme on Immunization (EPI) have resulted in a dramatic increase in immunization coverage and reduction in both measles morbidity and mortality. In addition, improved treatment has saved the lives of many children with life threatening complications of measles (5).

In 1996, it was estimated that 36.5 million children contracted measles with nearly one million dying because of the disease. About half of the measles deaths each year occur in Africa. There has been a decline in the number of reported measles cases from 4.2 million in 1980 to 0.8 million in 1996. The number of reported cases, however, does not accurately reflect the true scale of the problem. Measles still accounts for 10% of the global mortality attributable to all causes among children less than five years of age (6).

#### **1.1.5 Africa**

In Africa between 1980 and 1996, there has been decline in reported measles cases with increasing reports of measles immunization coverage and corresponding decline of around 60% in reported measles morbidity. West Africa is responsible for most of the measles morbidity (145 cases per 100,000 head of population). Rates now stand at 120 cases per

100,000 in Central Africa, 60 cases per 100,000 in Eastern Africa and 74 cases per 100,000 for Southern Africa. Measles mortality is much higher in West Africa and in large countries currently in difficult situations (Angola, Democratic republic of Congo and Ethiopia). The estimates of measles deaths cannot always be relied on to give an accurate picture of the local situation because rates of reported community based and hospital Case Fatality Rate (CFR) vary enormously, from 3 – 22% within the same country (7).

#### **1.1.6 Ghana**

WHO annual regional report on Ghana in 1997 indicated that 36,968 cases of measles were reported with 52 deaths. Case fatality from measles appears to be on decline. Presently, cases of measles are not confirmed by laboratory diagnosis and there is no comprehensive surveillance in place.

#### **1.1.7 Measles Vaccine**

Research leading to the development of measles vaccines began as early as 1911. In 1954 Enders and Pebbles isolated the measles virus and by 1958, a vaccine had been produced. After field trials the first vaccine consisting of an attenuated measles virus, was licensed for general use in 1963 in the USA.

#### **1.1.8 Immunization**

In 1974, the World Health Assembly adopted the Expanded Programme on Immunization (EPI) with the goal of making immunization against measles, whooping cough, diphtheria, tuberculosis, poliomyelitis, and tetanus – the six killer diseases, available to all children by 1990.

Ghana was the first country in the South-Sahara Africa to adopt EPI in 1974 and it was officially launched in the country in 1978. The main objective was to control the six

targeted diseases by raising coverage of immunization in infants. In 1987 the country relaunched the EPI with mass immunization using the measles vaccine alone.

The objective of the EPI was to achieve measles immunization coverage of at least 90% of one year olds at the country, district and community levels and reduce case fatality rate to less than 10% in all countries by 1995 (7). None of these objectives have been achieved, however, measles cases and deaths have been significantly reduced globally.

### **1.1.9 Elimination of Measles**

Foege has stated that it is possible to globally eliminate measles by comparing it with small pox (8). The reasons for this has been that:

(I) There is effective and safe vaccine that has been available since 1963 and has been used widely.

(II) Measles vaccination confers life long immunity and therefore improves herd immunity.

(III) The disease has no animal reservoir and no chronic carrier state among humans.

In the world, remarkable progress has been made with regard to measles control and elimination. This has been demonstrated in the regions of the Americas, with possibility of reaching measles eradication. Measles transmission has been interrupted in major portions of the Americas, leading to all the countries of the region to set the goal of measles elimination by the year 2000 (7). This has led to a dramatic reduction in measles incidence and interruption of transmission in many areas. The USA has achieved elimination of indigenous transmission of measles.

Favouring the global target of measles elimination by 2010 was the success of polio eradication in 2000, measles elimination in the Americas and the United Kingdom, and the epidemiological changes resulting from routine measles vaccination (8,9).

## **1.2 STUDY AREA**

The Tamale Municipality is one of the 13 districts of the Northern Region of Ghana. It serves as both the regional and district capital and has the advantage of being situated central to all the other districts. It has a population of 300,931 (2000 census), with a land area of 1011 square kilometres and population density of 298 per square kilometre. It has about 170 communities. The Municipality is divided into six sub-districts namely; Bilpella, Choggu, Kamina/Taha, Tamale Central, Sagnerigu and Vittin.

The Municipality is bordered in the North by Savelugu/Nanton district, in the East by Yendi and East Gonja districts and the West by Tolon/Kumbungu and West Gonja districts.

The majority of the people in the Municipality are Dagombas and Islam is the predominant religion. The people are mainly farmers, the rest are traders and civil servants working in government establishments such as schools, banks and health facilities, and Non-governmental Organizations.

The Municipal Chief Executive is the political head, assisted by Municipal Coordinating Director. The Municipal Assembly constitutes the focal point in the decentralized administration.

Three Hospitals (namely, the Regional Hospital, Sheikina Hospital, and the Military Hospital), a health centre, 11 clinics and 3 maternity homes serve the municipality. Child welfare Clinics (CWC) provide immunizations services for the under five at static and outreach points dispersed throughout the municipality.

Community members are mobilized to form Community Based Surveillance Team who report suspected diseases to health staffs in the district for the necessary action to be taken.

During the raining season, which comes on from April to October, many of the farmers in the area migrate to neighbouring villages to farm and return during the dry season, which is experienced, from November to March. These movements may prevent some of the children from being immunized against measles and other diseases.

### 1.3 PROBLEM STATEMENT

Data obtained from Tamale Municipality have indicated that despite the efforts to control the disease there are increasing cases of measles. The prevalence of Measles in 1999 was 393 per 100,000 (total population) and 336 per 100,000 in 2000 (from analysis of CD1 forms in 1999 and 2000). Majority of measles cases was among children under five.

The prevalence in the under fives was 1,089 per 100,000 in 1999 and 1,068 per 100,000 in 2000. This accounted for 52.5% in 1999 and 53.9% in 2000 for all cases of measles reported at the municipality.

The incidence of measles in Tamale Municipality is among the highest compared to other districts in the Northern Region. Over the past two years the incidence of measles has more than quadrupled.

**Table 1.1: Incidence and Immunization Coverage of Measles**

Year	1996	1997	1998	1999	2000
Immunization coverage (%)	92	63	66	86	81
Cases of measles	707	222	203	1182	1012
Incidence per 100,000	264	80	70	393	336

Source: 1999 Annual Health Report of Tamale Municipality and 2000 figures from CD1 forms

### 1.4 RATIONALE OF THE STUDY

The trend of measles incidence in the Municipality was a worry to the Municipal Health Management Team (MHMT). The topic was therefore discussed with the Resident and

asked to undertake the study, so that the findings could be implemented to solve the problem.

## **1.5 OBJECTIVES**

### **1.5.1 General objectives**

The purpose of this study is to determine the factors that influence the incidence of measles in under fives in Tamale Municipality.

### **1.5.2 Specific objectives**

1. To determine the socio-economic and demographic characteristics of mothers with children between 0 - 60 months, who got measles in 2000 and those who did not, and to find out, if there is significant difference between them.
2. To describe the mothers knowledge, beliefs, attitude and practices about measles.
3. To determine seroprevalence of measles antibodies in preschool children in Tamale Municipality.
4. To determine the factors influencing the incidence of measles in terms of preventive health services utilization, immunization status of the children, socio-economic factors and side effects of immunizations.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

The factors influencing the incidence of measles include immunization status of susceptible, the level of immunization coverage, effectiveness of the vaccine, information dissemination, socio-cultural practices, overcrowding and acceptability of preventive health services in the communities.

### **2.1 VACCINATION**

#### **2.1.1 Measles Vaccine**

Vaccination is the most effective measure to control measles and measles vaccination is recognized as one of the most cost-effective public health measures. The introduction of measles vaccination in rural Senegal reduced the incidence in children less than 10 years of age by 69% and acute measles mortality decline by 91% (10).

Measles vaccine successfully controls measles in children of immunizable age (i.e. from 9 months of age) if coverage is high enough. However, in developing countries, the early age of measles infection is a major problem for controlling the disease. One dose for the currently available measles vaccine administered below 9 months of age produces inadequate seroconversion rates, since many infants still have maternal antibodies, which may interfere with development of vaccine induced immunity. This is unfortunate, because some children under 9 months of age can and do become infected. It has been supposed that efficient immunization on community basis, using single dose of vaccine at 9 months of age would reduce the transmission of measles among older children, and hence reduce the exposure to measles of infants less than 9 months. However this effect

has not always been observed even after some years of carrying out immunization because very high coverage is needed before transmission decreases.

Maternal antibodies protect the newborn infant for the first 6 months of life but there after it becomes readily susceptible to infection with a peak around one year. Seroconversion rate is 76% at 6 months of age, 88% at 9 months, and 100% at 1 year (3) therefore giving measles vaccine at one year would produce the best conversion, but by that time, in developing countries, some 50% would already have had the disease. Giving it at 6 months will be before all, but few would have had the disease, but the seroconversion is so poor that not many will be protected. The best compromise is single vaccination at 9 months.

The live attenuated vaccine is recommended for use even though research into alternate vaccine that can be administered by aerosol is yet to be concluded.

In developed countries, such as USA, the age of vaccination ranges between 12 – 15 months, whilst in developing countries the age is 9 months. The early administration of the vaccine is to increase the protection of infants, who can contract measles, as early as 4 months of age.

In Kassena-Nankana district of the Upper East Region of Ghana, it was found that both the incidence and fatality of measles were reported in unvaccinated than vaccinated children. The same study found that low maternal education and malnutrition as significant factors influencing the high incidence of measles (11). However, the study found that Vitamin A supplementation is not a significant factor in decreasing mortality due to measles as found in other studies. It has also been found that preventing measles can also reduce the incidence of malnutrition and Vitamin A deficiency in young children (12).

### **2.1.2 Vaccine efficacy**

The World Health Organization's (WHO) recommendation for vaccination of infants against measles at 9 months of age in highly endemic areas such as Ghana is a compromise between age dependent vaccine efficacy and disease burden. In highly endemic areas, associated morbidity and mortality due to measles are more severe in infants below 9 months of age (13,14). Immunization with standard dose of Schwarz vaccine at 9 months at relatively high coverage has so far had only a modest impact on measles transmission and major epidemics still occur (15,16).

To be able to achieve high level of protection of susceptibles through vaccination against measles, the vaccination must be efficacious. Clinical efficacy of measles vaccines investigated in Niakhar, in a rural area of Senegal by Garenne M. et al, the Standard Schwarz vaccine was 97.2%, comparable to those found in developed countries (17,18).

Nkrumah et al, have demonstrated that seroresponse to standard dose of AIK-C measles vaccine administered at 6 months of age was comparable to that of the standard dose Schwarz vaccine administered at 9 months. Moreover the AIK-C vaccine provided 3 months extra protection at the most vulnerable time of the child's life (19).

### **2.1.3 Vaccination failure**

Vaccine failure can also play a role in influencing the incidence of measles. The possible causes of vaccine failures can be classified into two major categories; primary, due to lack of initial seroconversion and secondary, due to loss of immunity after initial seroconversion. It has been documented that in an outbreak of measles occurring in a high school population with vaccination level of 98%, 70% of the cases were students who had

histories of measles vaccination at 12 months of age or older and are therefore considered vaccination failures (20).

## **2.2 PREVENTIVE HEALTH SERVICES**

Health facilities providing preventive health services serve as immunization points for measles and other childhood diseases. However, their accessibility, acceptability and how the health staffs receive clients are important in increasing immunization coverage and disease prevention.

The National Vaccine Advisory Committee, on evaluating the increase in cases of measles in the United States of America in 1989 and 1990 enumerated a number of factors contributing to the incidence of measles and stated that one half of all cases have occurred in unvaccinated pre-school children mostly minorities. This was due to failure to provide vaccine to vulnerable children on schedule (21). Major reasons being health staffs missed opportunities to vaccinate children who visited their health facilities, but rather blamed the parents for the poor immunization status of their children, inadequate access to health care facility and inadequate public awareness of, and lack of public demand for immunization. Brugha and Kevany in a study in Eastern Region of Ghana, concluded that home visiting has the potential of bringing health workers into contact with individuals and groups of the community who are of ill-health and who make ineffective or little use of preventive health services (22). This will lead to higher immunization coverage towards achieving elimination of measles.

### **2.3 INFORMATION DISSEMINATION**

Information dissemination help to make parents aware of the available health services, when and where such services would be provided. This is also important when mass media is used to inform the public about immunization services.

A study by Zimicki et al in the Philippines, demonstrated with evidence that mass media information campaign was largely responsible for the improvement in vaccination coverage (23). This is a means, that health workers can employ to mobilize community members for immunization.

### **2.4 SOCIO-CULTURAL FACTORS**

There are a number of socio-economic, demographic and cultural factors that influence the incidence of measles through their positive or negative effect on public or communities use of immunization service. In Nigeria, Odebiyi and Ekong found that belief about the causes and supposed alternative source of preventing measles and literacy level of mothers influenced their acceptance or non-acceptance of vaccination (24). Other studies have confirmed this and the influence of culture and beliefs on measles have been noted worldwide. In India the disease is thought to be caused by the goddess Malta, in Bangladesh infected children undergo religious purification, among the Akambas of Kenya milk and water are withheld from the sick children. In Ghana many traditional groups have similar beliefs. Gas' think that measles is caused by the gods, Nzemas' and Ewes' believe that bathing the sick child will aggravate his/her condition. Various kinds of concoctions (including alcohol) are given to the children to supposedly hasten the eruption of the rash.

However, higher female literacy level or perhaps effective education at antenatal and under five children clinics, and improved economic status, contribute to better use of primary health care (PHC) services particularly, immunization by mothers (25).

In our bid to increase measles immunization coverage in order to control or eliminate measles, fathers of children should be brought to the fore. Evidence shows that programmes which educate and involve men, or which involve educated men, in making decisions about their children's use of preventive health services, significantly contribute to timely immunization of children (24).

## **2.5 OVERCROWDING**

Overcrowding, where siblings sleep together, increases the intensity of exposure to infection. Measles transmission is therefore facilitated by collection of susceptibles in a confined room.

In reviewing the literature, the factors that influence the incidence of measles, vary considerably from one geographic area to the other and studying these factors in relation to ones location and socio-economic circumstances will pave the way of understanding in detail these factors.

## **CHAPTER THREE**

### **3.0 METHODS**

I carried out a case control study and seroprevalence study jointly as a single study to determine the risk factors that influence the incidence of measles in Tamale Municipality.

### **3.1 STUDY DESIGN**

The study involved a case control study in the community and seroprevalence study of measles antibodies in preschool children in Tamale Municipality.

### **3.2 DEFINITION OF CASES AND CONTROLS**

Cases were children between 0-60 months who got measles in 2000 reported to Tamale Municipal Health Administration. Controls were selected with ages between 0-60 months to match with cases in the same communities but with no previous history of measles.

### **3.3 SAMPLE SIZE**

A sample size of 150 was estimated using EPI INFO version 6.04 computer programme, consisting of 75 cases and 75 controls at 95% confidence interval, power of 80% and estimated prevalence of measles among controls as 10%.

A convenience sample size of 100 preschool children between 2-5 years in day nurseries in Tamale municipality was used for the seroprevalence study.

### **3.4 SAMPLE SELECTION**

A list of measles cases between 0-60 months reported on CD1 forms at the Municipal Health Administration (MHA) in 2000 was compiled to form a sampling frame for cases. Out of this a sample of 75 cases of children under five years were selected using random

numbers. The cases were traced using the addresses on the CD1 forms. For each case, one control was selected from a house facing the house of a case and where, no control was found, the next house nearest this one was chosen but within a 500 meter radius from a house of a case.

### **3.5 SEROPREVALENCE STUDIES**

The seroprevalence study was carried out to determine the efficacy of measles vaccine. It was suspected that, the vaccine efficacy would substantially contribute to explain the epidemics of measles occurring in the Municipality.

For the seroprevalence study, a total of 100 pupils between 2-5 years were selected in Tamale Municipality. Twenty-five of the pupils were selected from each of the four zones of schools. Each of the pupils selected has his/her Road to Health card provided by his/her mother indicating her immunization status against measles. Those who could not provide their immunization cards were not included in the study. Initially 4 schools were selected from a list of 136 day nurseries, with one from each zone (A, B, C and D) by balloting. In each school, 25 pupils who qualify for the study were selected by systematic random sampling. In a school where, the pupils selected were not up to 25, the next school in the same zone was selected to make up the number.

### **3.6 ETHICAL CONSIDERATIONS**

Ethical clearance was obtained from the Northern Regional Director of Health Services. In addition, the purpose of the study was explained to both the parents of the pupils and the teachers of the schools, and their consent was also sought before the blood samples were taken.

### **3.7 ENZYME IMMUNOASSAY FOR ANTIBODIES AGAINST MEASLES**

About 1-2ml of venous blood was taken from each of the pupils. This was centrifuged and stored at -40C at the Northern Regional Public Health Reference Laboratory in Tamale. When the required 100 samples were obtained, the samples were transported in a cold box to Noguchi Memorial Institute for Medical Research (NMIMR) at University of Ghana, Legon for measurement of antibody levels.

A sensitive enzyme immunoassay (EIA) for measles antibody was used, to quantify antibodies against measles virus. Immunoglobulin G (Ig G) antibodies were measured by this method at NMIMR.

### **3.8 VARIABLES**

The study measured independent variables such as distance from the nearest health facility, immunization status, and mothers' perception of measles, number of siblings who have had measles and number of people sleeping in the same room with the child. The dependent variable was the incidence of measles.

### **3.9 DATA COLLECTION TECHNIQUES**

Structured questionnaires were administered to mothers' of children with measles in 2000 within the ages of 0 - 60 months and selected controls. A short semi-structured questionnaire was used to group the preschool children in the seroprevalence study under vaccinated and unvaccinated.

The study also determined background variables including educational level, occupation, religion and monthly income, some of which may be confounding.

### **3.10 TRAINING/PRE-TESTING**

Three Community Based Surveillance Volunteers (CBVS) were selected from the sub-districts where the cases were to be traced. They were selected based on their long experience of working in the communities, being able to speak and write English, and also could translate English into Dagbani and vice versa. The Resident provided the training with a member from the Disease Control Unit (DCU). This involved a review of the questions in English and practised translation into Dagbani.

Pre-testing was done the next day in one of the Child Welfare Clinics (CWC) in the Municipality. The questionnaires were reviewed after the training sessions and data collection was started.

### **3.11 DATA ENTRY/ANALYSIS**

Data entry and analysis were carried out using EPI INFO version 6.04 computer programme. Vaccination status of children was analyzed using two by two tables. The background variables were cross tabulated against vaccination status and measles incidence to understand their influence on the incidence of measles.

### **3.12 QUALITY CONTROL**

To be sure that the quality of data collected is good, the questionnaire was made simple, data edited on the field and simple frequencies were ran on all the variables and any inconsistencies observed were corrected.

### **3.13 LIMITATIONS/CONSTRAINTS OF THE STUDY**

The main limitation of the study was that the measles cases studied were not confirmed by laboratory tests.

Cases whose addresses were not adequate and therefore could not be traced were not included in the study. These cases may have special characteristics that may be significant. Some of the mothers denied that their children ever had measles despite evidence from the records.

## **CHAPTER FOUR**

### **4.0 RESULTS.**

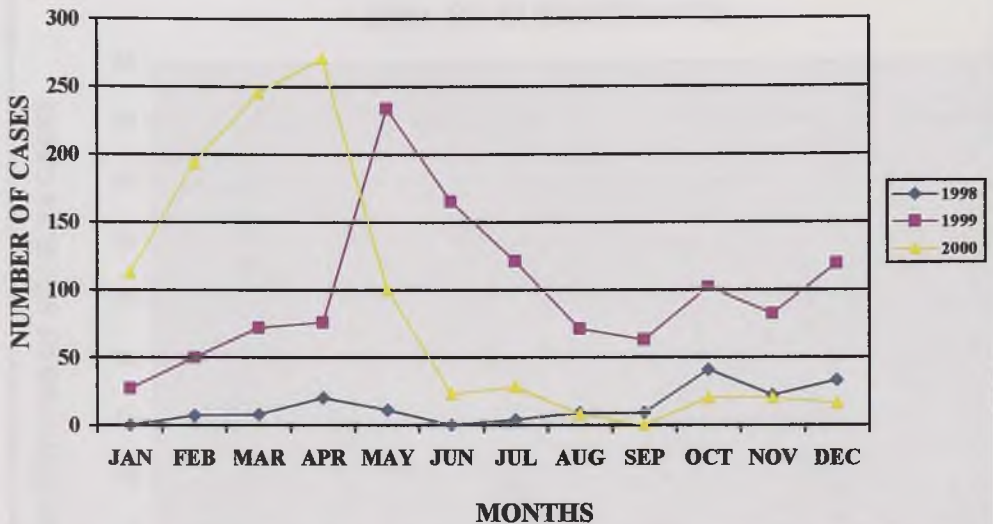
The results of the findings of the case control and seroprevalence study carried out on measles are presented in this chapter. The findings of the case control study are presented first before that of the seroprevalence study.

### **4.1 PREVALENCE OF MEASLES**

Review of records on measles reported to the Municipal Health Administration from 1998 to 2000, shows that measles epidemics occurred in 1999 and 2000 in Tamale Municipality. The level of reporting could not be determined because a line listing was not used for reporting of the cases but rather a monthly reporting was used using CD1 forms. However, the reports indicated a monthly reporting of 100%.

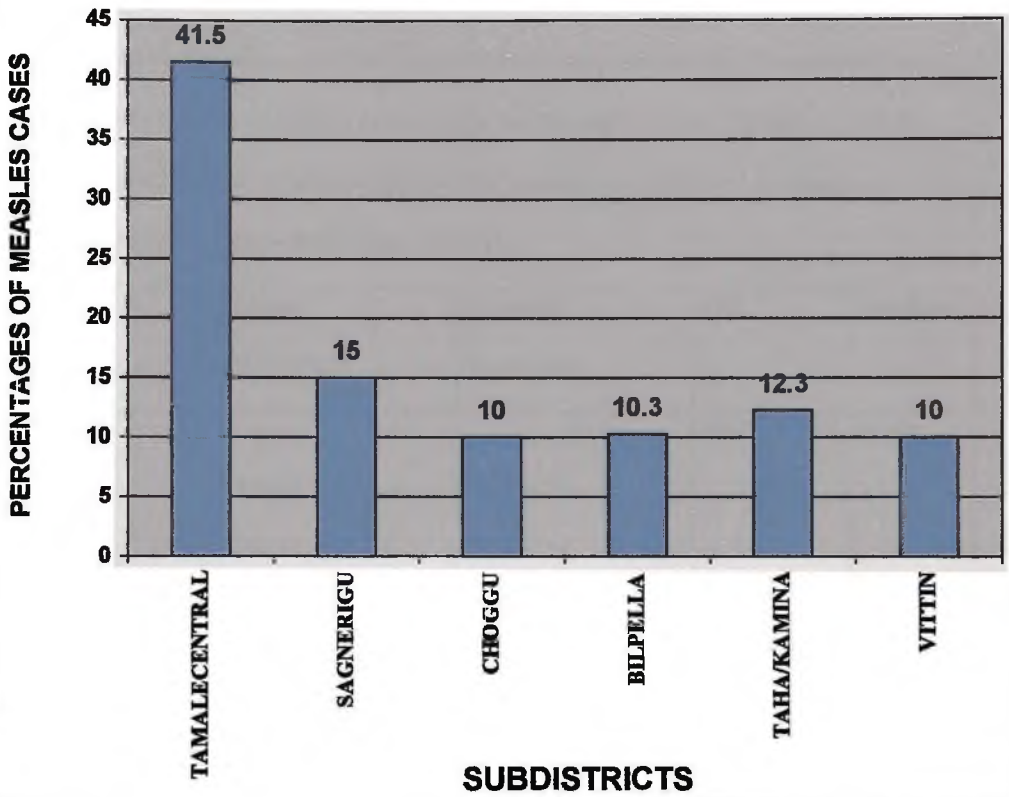
In 2000 the majority of the cases occurred from January to May, with peak incidence in April. Whereas in 1999, the peak incidence was in May, with most of the cases occurring from May to July and then from November to December. The number of reported cases from 1998-2000 is shown in figure 4.1 on page 20.

**FIGURE 4.1 MEASLES CASES IN TAMALE MUNICIPALITY BY MONTH FROM 1998-2000**



Majority of the cases that occurred in 2000 was found mainly in Tamale Central sub-district, which accounted for 41.5% of all the cases that were reported. The distribution of the cases by sub-districts is represented in figure 4.2 on page 21. The rest of the cases occurred in Sagnerigu (15.0%), Taha/Kamina (12.3 %), Choggu (10.9%), Bilpella (10.3%), and Vittin (10.0%) sub-district.

**FIGURE 4.2: DISTRIBUTION OF MEASLES CASES IN 2000 BY SUBDISTRICTS**



#### 4.2.0 CHARACTERISTICS OF THE STUDY CHILDREN

Out of the measles cases that occurred in 2000, 75 of them were selected and traced to their various communities in the municipality and paired with controls in the same communities.

The results that were obtained are presented here.

The characteristics of the children of the cases and the control in terms of sex, age and their distribution by sub-districts and type of community is presented below. The ages at which the cases developed measles are also included. These are shown in Table 4.1 on page 22.

**Table 4.1: The characteristics of the study children**

<b>Characteristics</b>	<b>Cases N=75 (%)</b>	<b>Controls N=75 (%)</b>	<b>OR</b>	<b>p-value</b>
<b>Sex:</b>			<b>0.62</b>	<b>0.14</b>
<b>Males</b>	<b>35 (46.7)</b>	<b>44 (58.7)</b>		
<b>Females</b>	<b>40 (53.3)</b>	<b>31 (41.3)</b>		
<b><u>Age group (months)</u></b>				
<b>Mean age</b>	<b>40.8</b>	<b>31.7</b>		
<b>3-11</b>	<b>1 (1.3)</b>	<b>5 (6.7)</b>		
<b>12-24</b>	<b>11 (14.7)</b>	<b>28 (37.3)</b>		
<b>25-71</b>	<b>63 (84.0)</b>	<b>42 (56.0)</b>		

#### **4.2.1 Sex distribution of the children**

Thirty-five (46.7%) of the cases and 44 (58.7%) of the controls were males and females were 40 (53.3%) cases and 31 (41.3%) controls. The cases and controls were comparable in terms of sex

#### **4.2.2 Age distribution of the children**

The ages of the children range from 3-71 months. The mean age of the cases was 40.8 months and that of the controls was 31.9 months. Most of the children were aged 25 months and above and this consists of 63 (84.0%) of cases and 42 (56.0%) of the controls. The cases and the controls were different with regards to their ages ( $\chi^2$  is 14.28,  $df=4$  and  $p=0.007$ ).

#### **4.2.3 Distribution of the children by Sub-Districts**

As many as 56 (74.7%) of the cases and 57 (76.0%) of controls are found in Tamale Central sub-district. Whilst 6 (8.0%) of both cases and controls live in Bilpella and 13 (17.3%) and 16.0% (12) of cases and controls respectively are seen in Sagnerigu sub-districts. The cases and controls were similar with respect to the sub-districts they came from.

Sixty (80.0 %) of the cases and 44 (58.7%) of the controls live in urban communities whilst only 6 (8.0%) of cases and 5 (6.7%) of controls live in rural settlements. The rest of 9 (12.0%) and 26 (34.7%) of cases and control respectively were in peri-urban areas. The cases and controls were found living in different types of communities. This was due to the selection of controls within a 500 meter radius from a house of a case and the fact that, in Tamale the communities share close borders and therefore controls to be paired with cases may be found in different communities.

#### 4.2.4 Ages at which children developed measles

The ages at which the cases had measles were examined. This was to ascertain when the disease occurred in the cases in the study population.

**Table 4.2: Age at which measles was developed by cases**

Age/months	Cases
	N=75 (%)
Mean age	27.2
4-8	9 (12.0)
9-60	66 (88.0)

The cases developed measles at the mean age of 27.2 months. The youngest child who had measles was aged 4 months. The children who had measles before and at 9 months of age were 9 (12.0%). About 29.3% had measles before they were one year old. Twenty-nine (38.7%) of the children had measles when they were older than 25 months and 22 (29.3%) were between 12 - 24 months. Among the measles cases 56 (74.7%) of their mothers said the children are vaccinated against measles. Out of these 51 had evidence of vaccination as indicated in their Road to Health Cards. The mean age at vaccination was 14.5 months. All the children recovered from measles without any mortality or disability.

#### 4.3.0 CHARACTERISTICS OF THE MOTHERS/CARE GIVERS

The background characteristics of mothers of cases and controls, with regards to their educational level, religion, marital status and occupations were examined, to determine their potential contribution to a child's immunization status or incidence of measles. The background characteristics of the mothers are indicated in table 4.3 on page 25.

**Table 4.3: Characteristics of mothers/care givers**

<b>Characteristics</b>	<b>Cases N=75 (%)</b>	<b>Controls N=75 (%)</b>	<b>OR</b>	<b>p-value</b>
<b>Age/Years:</b>				
<b>Mean age</b>	<b>40.8</b>	<b>31.7</b>		
<b>15-24</b>	<b>19 (25.3)</b>	<b>16 (21.3)</b>		
<b>25-34</b>	<b>33 (44.1)</b>	<b>35 (46.7)</b>		
<b>35-44</b>	<b>16 (21.3)</b>	<b>22 (29.3)</b>		
<b>45+</b>	<b>7 (9.3)</b>	<b>2 (2.7)</b>		
<b>Education:</b>			<b>0.86</b>	<b>0.702</b>
<b>Some</b>	<b>17 (22.7)</b>	<b>19 (25.3)</b>		
<b>None</b>	<b>58 (77.3)</b>	<b>56 (74.7)</b>		
<b>Educational level (N=17)</b>				
<b>Primary</b>	<b>5</b>	<b>10</b>		
<b>Middle/JSS</b>	<b>8</b>	<b>7</b>		
<b>Secondary/SSS</b>	<b>2</b>	<b>2</b>		
<b>Marital status:</b>			<b>0.41</b>	<b>0.148</b>
<b>Married</b>	<b>66 (88.0)</b>	<b>71 (94.7)</b>		
<b>Single</b>	<b>7 (9.3)</b>	<b>1 (1.3)</b>		
<b>Divorced</b>	<b>2 (2.7)</b>	<b>3 (4.0)</b>		
<b>Religion:</b>			<b>0.24</b>	<b>0.183</b>
<b>Moslem</b>	<b>71 (94.7)</b>	<b>74 (98.7)</b>		
<b>Christian</b>	<b>4 (5.3)</b>	<b>1 (1.3)</b>		
<b>Occupation:</b>				
<b>Traders</b>	<b>56 (74.7)</b>	<b>57 (76.1)</b>		
<b>Housewives</b>	<b>12 (16.0)</b>	<b>12 (16.0)</b>		
<b>Others</b>	<b>7 (9.3)</b>	<b>6 (7.9)</b>		

#### **4.3.1 Age of mothers/care givers**

The mean age of the mothers of the cases was 30.9 years and that of the controls, 30.3 years. Majority of the mothers was in the age group 25 – 34 years for both cases (44.0%) and controls (46.7%), whilst minority of the mothers of cases (8.0%) and controls (2.7%) were in the age group 45 years and above. The mothers/care givers of both cases and controls were in similar age groups.

#### **4.3.2 Education level of the mothers/care givers**

Of all the 150 mothers who were interviewed, only 36 (24.0%) had some education. Among the mothers/care givers of cases that had some education were 22.7% and controls were 25.3%. There were no difference between the cases and controls in terms of their education level.

For those mothers who were educated, 4 (11.1%) had attained secondary level of education, whilst most of the mothers had primary (41.7%) and middle school or Junior secondary school education (41.4%). Majority of the mothers of cases (8/17) had either middle or junior secondary school education, whilst the mothers of the control group (10/19) had primary education. It appears that the level of education of the mothers does not influence the development of measles.

#### **4.3.3 Marital status of mothers/care givers**

Almost all the mothers were in union (97.0%). Among these, 65 (86.7%) were mothers of cases and 71 (94.7%) that of controls. The marital status of the mothers was the same for both cases and controls. Marital status of the mother's did not show any influence on the development of measles.

#### **4.3.4 Religion of mothers/care givers**

Many of the mothers consisting of 145 (96.7%) out of the 150 were Moslems and only 5 (3.3%) were Christians. Seventy-one (94.7%) of the cases were Moslems and the rest (5.3%) were Christians. In the control group, 74 (98.7%) were Moslems and 1 (1.3%) Christian. The mothers were comparable according to their religion and therefore religion does not influence the development of measles.

#### **4.3.5 Occupation of mothers/care givers**

The mothers interviewed were mainly traders and housewives. Few were involved in dressmaking, baking and farming. Out of the 150 respondents, 75.3% were traders. Of these 56 (74.7%) are mothers of cases and 57 (76.1%) mothers of controls. About 16.0% of the mothers, consisting of 8.0% (12) each of cases and controls were housewives. The mothers of both cases and controls were in approximately the same occupations. It is therefore imperative that, occupation of the mother's/care givers' is not associated with development of measles.

#### **4.3.6 Occupation of fathers of the children**

The occupation of fathers of the children were also examined in addition to their mothers background characteristics to help understand how these together determine the vaccination status and the incidence of measles.

**Table 4.4 Occupations of the fathers of the children.**

<b>Occupations</b>	<b>Cases</b> N =75(%)	<b>Controls</b> N =75(%)
<b>Farmers</b>	<b>30 (40.0)</b>	<b>25 (33.3)</b>
<b>Artisans</b>	<b>18 (24.0)</b>	<b>15 (20.0)</b>
<b>Businessmen</b>	<b>17 (22.7)</b>	<b>15 (20.0)</b>
<b>Others</b>	<b>10 (13.3)</b>	<b>20 (26.7)</b>

Most of the fathers of the children were farmers, consisting of 30 (40.0%) of the cases and 25 (33.3%) that of the controls. Some fathers of both cases and controls were businessmen or artisans and the rest were engaged in other occupations (cases - 9.3% controls 26.7%). Three of the fathers of the cases (4.0%) were dead. The fathers of the cases and the controls were in similar occupations. Occupation of the fathers therefore appears not to have any influence on the development of measles

#### **4.4 .0 FACTORS ASSOCIATED WITH DEVELOPMENT OF MEASLES**

The factors influencing the incidence of measles include the vaccination status of individuals, the efficacy of the vaccine being used and the acceptability and accessibility of preventive health services. These factors were explored to find their association with the incidence of measles in the study population.

##### **4.4.1 Vaccination**

The Road to Health cards of the children of both cases and controls were examined to determine their vaccination status in relation to measles and other antigens covered by EPI plus. The results obtained are presented in this section.

In the study population children were generally immunized against one or more of the six-killer childhood diseases. However, only 19 (25.3%) and 32 (42.7%) of cases and controls respectively completed their immunization by one year of age. The cases and controls differed in this respect ( $\chi^2$  is 4.99 and p is 0.002). Therefore completion of the immunization schedule by one year of age is important in preventing the development of measles.

#### **4.4.2 Measles**

Fifty-one (68.0%) of the cases and 62 (82.7%) of the controls were immunized against measles. There was a significant difference between the cases and the controls in terms of their vaccination against measles (Odd's ratio=0.45, CI=0.19-1.03 and  $\chi^2$  is 4.31 and p is 0.0384). The confidence interval (CI) of the Odd's ratio of measles immunization status of the cases and the controls includes 1 and this is due to the small sample size. Immunization against measles is therefore important in preventing measles outbreak.

The mean age at which measles vaccination was given for cases was 14.5 months and 12.8 months for controls. Therefore controls were immunized earlier than cases. Of those who were immunized 25.5% (13) of cases and 16.1% (10) of the controls were immunized before 9 months. Six (11.8%) of the cases and 19 (30.6%) controls were vaccinated at 9 months. However, the majority of the vaccinees were older than 9 months, this constitutes 32 (62.7%) of cases and 33 (53.4%) of controls. The age at vaccination against measles was significantly different in the cases and the controls ( $\chi^2$  is 6.15 and p is 0.046). More of the controls were immunized on schedule (at 9 months) than cases. Therefore, immunization of children on schedule is important in reducing measles incidence.

Most of the mothers who did not immunize their children against measles said they travelled. This consists of 66.7% (16/24) of mothers of cases and 69.2% (9/13) of controls. Children who had immunizations against other childhood diseases apart from measles consist of 67 (89.3%) of cases and 71 (94.7%) of controls. Eight of the cases and 4 of the controls were not immunized against any of the other childhood diseases. There was no significant difference between the cases and the controls in terms of vaccination against other childhood diseases. Immunization against other childhood diseases therefore, does not influence the development of measles.

Children who were both immunized against measles and other childhood diseases were 68.0% for cases and 82.7% for the controls. Some of the Cases (27) and controls (4) were never immunized against any of the six killer diseases.

#### **4.4.3 BCG**

Immunization against Tuberculosis accounted for 57(76.0%) of the cases and 69(92.0%) of the controls. Among these, 78.9% of cases and 76.8% of controls were given BCG within 40 days after delivery. Whilst 21.1% of cases and 23.2% of controls received BCG between 1-5 months after delivery. The mean age at which the children were given BCG was 13 days for cases and 11 days for controls.

#### **4.4.4 POLIO**

Thirty-five of the cases and 58 of the controls received polio 0. The mean age at which Polio 0 was given was 4 days for both cases and controls.

About 57 (76.0%) of the cases and 69 (92.0%) of the controls received polio 1. The mean age at which the children received Polio 1 was 2.7 months for cases and 2.0 months for the controls.

As many as 52 (69.3%) of the cases and 66 (88.0%) of the controls received polio 2. The mean age at which polio 2 was given was 5.1 months for cases and 4.5 months for controls. About 53.3% (40) of the cases and 77.3% (58) of the controls received polio 3. The mean age at which polio 3 was given to the children was 6.9 months for cases and 6.3 months for the controls.

#### **4.4.5 DPT**

Seventy-two percent (54) of the cases and 85.3% (64) of the controls received DPT1. DPT1 was given at mean age of 3.2 and 2.4 months for cases and controls respectively. As much as 66.7% (50) and 80.0% (60) of cases and controls respectively had DPT2. The mean age at which the children received it were 5.7 months for cases and 4.8 months for controls.

DPT3 vaccination was received by 38 (50.7%) of cases and 55 (73.3%) of the controls. The mean age of DPT3 vaccination was 7.0 months for both cases and controls.

#### **4.4.6 Yellow Fever**

Among the study population 89 out of 150 were vaccinated against yellow fever. These consist of 40 (53.3%) cases and 49 (65.3%) controls. For those who were vaccinated against yellow fever, 4 (10.0%) of cases and 3 (6.1%) of controls received it before 9 months.

Those who received the yellow fever vaccination at the age of 9 months were 20.0% (8) of cases and 28.0% (14) of controls. The rest of 70.0% (28) of cases and 65.3% received the vaccination after they were older than 9 months.

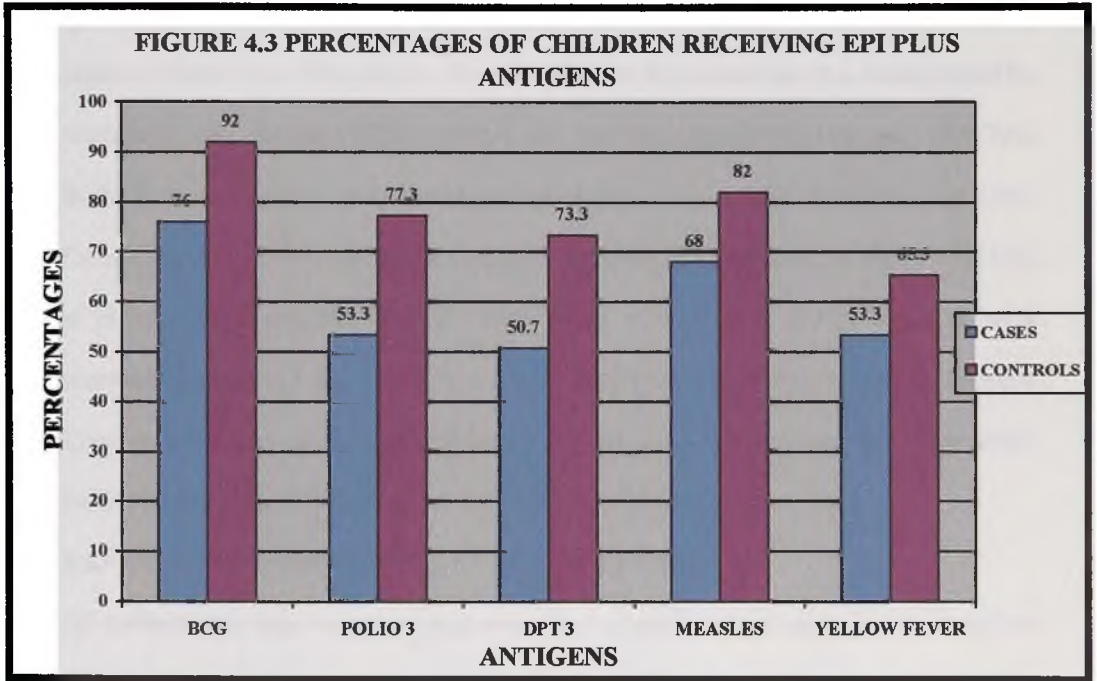
Figure 3.3 below shows the proportions of children of cases and controls receiving the various antigens.

#### 4.4.7 CSM

Twenty-three out of 150 children were vaccinated against cerebrospinal meningitis (CSM). This was made up of 9 cases and 14 controls. Six of the cases and 5 of the controls received the vaccination before two years. The rest were vaccinated after two years.

In all 13 out of the 150 were not vaccinated against the six killer diseases. These were 9 of cases and 4 of controls.

It is concluded therefore that in this study, vaccination against other childhood killer diseases appears not to have any influence on the development of measles.



#### **4.4.8 Vitamin A**

Seventy-two out of the 150 children received vitamin A since the time it was introduced, consisting of 34 (45.3%) of the cases and 38 (50.7%) of controls.

#### **4.5.0 DISTANCE**

The respondent of both cases and controls were asked to state the distance they travel to reach the nearest health facility. This was to determine whether distance was a barrier to the use of health facilities and therefore the immunization status of the children.

Of all the mothers/caregivers, the mean distance covered before assessing a health facility was about 420.3m. The distance to the nearest health facility ranges from 20.0m- 9km for cases and 20m-2.5km for controls. The mean distance travelled to reach a health facility by mothers of controls was 285.9m and this was less than that travelled by cases (554.7m). Both mothers of cases and controls travelled the same median distance of 200.0m. Caregivers, who travelled less than a kilometre to assess a health facility, were 86.7% (65) of cases and controls 96.0% (72). Only 13.3% (10) of cases and 4.0% (3) controls travelled more than 1 km to reach a health facility. In all controls travelled a shorter distance than cases to use a health facility. It does appear that distance from a health facility has a strong influence on the development of measles.

#### **4.6.0 OUTREACH AND STATIC CLINIC ATTENDANCE**

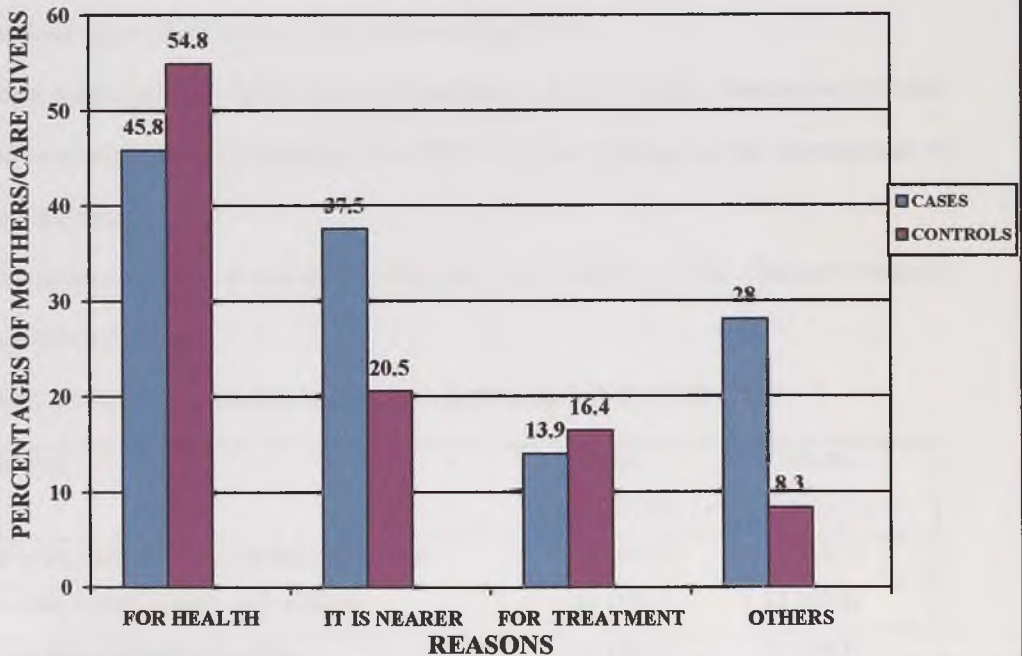
All mothers were interviewed on their attendance of static and outreach clinics, to explore the barriers to the use of these facilities and how these have influenced the immunization status of the children. For these reasons, questions were asked on the use of Child Welfare clinics (CWC) and health facilities near the mothers/caregivers, and reasons for using them.

Most of the mothers interviewed said they use the health facilities near them. This consists of 72 (96.0%) of the mother of cases and 73 (97.3%) of that of controls. The respondents gave various reasons for doing so, these are displayed in Figure 4.4 on page 34.

The main reasons given for using the health facility near them was because of the health of their children.

Three of the mothers of the cases who said they did not use the health facility near them stated distance related reasons and that nurses were not regular at the out reach clinic.

**FIGURE 4.4: MOTHERS REASONS FOR USING HEALTH FACILITY NEAR THEM**



Two of the mothers of controls did not use the health facility near them because the nurses were not regular at the outreach clinic and that, the nurses were better at the facility she currently use.

Two of the 3 mothers of cases immunized their children against measles even though they did not use the health facility near them. All the two mothers of the controls who did not use the health facility near them immunized their children against measles.

There were 69 (92.0%) mothers of cases and 72 (96.0%) that of controls who attended CWC with their children. The mothers/caregivers who attended CWC and said they immunized their children against measles were 56 of cases and 62 of controls. The mothers who did not immunize their children with measles vaccine, but were attending CWC were 13 of cases and 10 of controls. Six of the cases and 3 controls were not vaccinated against measles because their mothers were not attending CWC.

There is no significant difference in the attendance at CWC among the mothers of cases and controls and hence attendance at CWC was not important in the development of measles in this study.

The mothers had various reasons why they sent their children to CWC. These are shown in the Table 4.5 below.

**Table 4.5: Reasons given by mother for sending their children to CWC.**

<b>Reasons</b>	<b>Cases N=69(%)</b>	<b>Controls N=72 (%)</b>
<b>To Immunize and weight their children</b>	<b>44 (63.8)</b>	<b>48 (66.7)</b>
<b>For the child's health and welfare</b>	<b>11 (15.9)</b>	<b>13 (18.0)</b>
<b>To protect against sickness</b>	<b>14 (20.3)</b>	<b>11 (15.3)</b>

The main reason why mothers sent their children to the CWC was to immunize the children and to know their weights.

Six mothers of the cases said they did not send their children to CWC because they travelled and lack of money. Three mothers of the controls did not send their children to CWC. Their reasons were; lost of Road to Health card, travelled and sickness after delivery.

Majority of mothers who attended CWC with their children use a particular outreach or static clinic because it is near them, for the cases (89.9%) and controls (83.3%). The mothers who did not attend CWC stated travelling to their home village and lack of money as reasons for doing so.

#### **4.7.0 HOW MOTHERS/CAREGIVERS WERE TREATED BY HEATH STAFF**

To know how the respondents were treated by health staff providing immunization services and how this could adversely affect the vaccination status of the children, the caregivers were made to give their views on how they were treated at the health facilities. This was to explore the barriers inherent in health staffs that may prevent effective utilization of static and outreach clinics.

Most of the mothers stated that the health staff providing the immunization services treated them very well, this was made up of 78.7% of cases and 77.3% of controls, and the rest expressed the view that they were treated well. None of the mothers said that, they were treated badly. Mother of both cases and controls were given the same treatment by the health staff providing immunization services.

There is therefore no relationship between development of measles and how health staff providing preventing health services treated mothers/caregivers in the study.

#### **4.8.0 SIDE EFFECTS OF IMMUNIZATIONS**

Mothers/caregivers were also asked to state any complication that occurred after immunizing their children to determine whether this affected the vaccination status of the children and therefore the incidence of measles.

Only 6 (8.0%) mothers of cases and 10 (13.3%) that of controls stated that, their children got sick after immunizations. For those who were sick, all (6) of the mothers of cases and (8/10) of the controls said that, their children had fever after immunization. Each of the other two of the controls said that, the arm of the children became swollen and there was a little sore on the arm. There was no significant difference between the cases and the controls in the development of side effects of immunizations.

In the study therefore, side effects of immunization was not significant in deterring mothers/caregivers in immunizing their children and hence not related to the development of measles.

#### **4.9.0 SOCIOECONOMIC FACTORS**

Mothers were interviewed with regard to their socio-economic status by asking them of their monthly incomes, the type of houses they live in, the electronic gadgets they own in the house by either the husbands or the mothers of cases and controls. The findings are presented in table 4.6 on page 38.

The mothers/caregivers were also made to estimate the monthly incomes of the fathers their children.

**Table 4.6: Socio-economic characteristics of mothers/caregivers**

<b>Socio-economic Factors</b>	<b>Cases N=75 (%)</b>	<b>Controls N=75 (%)</b>	<b>OR</b>	<b>p-value</b>
<b>Income/¢1000</b>				
<100	64 (85.3)	57 (76.0)		
100-149	6 (8.0)	9 (12.0)		
150+	5 (6.7)	9 (12.0)		
<b>Possessions:</b>				
<b>Own electronic gadget–yes</b>	48 (64.0)	43 (57.3)	1.32	0.405
<b>Radio/cassette player</b>	34 (45.3)	30 (40.0)		
<b>Television</b>	28 (37.3)	23 (30.7)		
<b>Video deck</b>	3 (4.0)	3 (4.0)		
<b>Type of house</b>			1.07	0.850
<b>Mud house</b>	56 (74.7)	55 (73.3)		
<b>Cement house</b>	19(25.3)	20 (26.7)		

**4.9.1 Income of mothers/care givers**

As many as 121 (86.4%) of all the mothers were earning incomes below ¢100,000 per month. Of these 64 (91.4%) were mothers of cases and 57 (81.4%) mothers of controls.

Statistically, the mothers/caregivers were earning similar monthly incomes. Therefore, income levels of the mothers/care givers were not important factor in determining the development of measles in the study.

#### **4.9.2 Income of the fathers of the children**

Most fathers of the children in the group have their income per month below ₦100,000. About 36 (48.0%) of the fathers of cases and 35 (46.7%) of controls earn below ₦100,000 per month. There was no difference in the incomes of the fathers of cases and controls. This implies that, the income levels of the fathers of the children do not influence measles incidence in the Municipality.

#### **4.9.3 House type**

A large number 111(74.0%) of all respondents were living in mud houses with their children and only 37 (24.7%) were living in houses built with cement. Those living in mud houses were 56 (74.7%) of cases and 55 (73.3%) controls. Twenty-five percent (19) of mothers of cases and 26.7% (20) of controls were staying in cement built houses. The cases and controls were dwelling in approximately the same type of houses. The incidence of measles is therefore, not related to the house type the children live in.

#### **4.9.4 Possession of electronic gadget in the house**

In response to the question whether the respondent or the husband owns an electronic gadget such as Television, Radio/Cassette player and Video decks. Of all the mothers, 48 (64.0%) of the cases and 43 (57.3%) of that of controls own some electronic gadgets in their houses. Radio/cassette players were possessed by 34 (45.3%) and 30 (40.0%) of mothers of cases and controls respectively. Twenty-eight (37.3%) of cases and 23 (30.7%) of controls owned Television sets that were either black and white or coloured. Only 3

(4.0%) each of cases and controls were having video decks. With regards to possession of electronic gadgets in the house the cases and the controls were the same.

In the study, it is revealing that socio-economic status of mothers/caregivers has no effect on the development of measles.

**4.10.0 OVERCROWDING**

The mothers/caregivers were asked to give the number of other people sleeping in a room with each of the cases and controls to ascertain whether overcrowding had contributed to the incidence of measles among the cases. The results are as follows:

The mean number of people who sleep in a room with a child is 2.1 and 1.9 for cases and controls respectively. Majority of the children of both cases and controls sleep with one or two other people in a room (cases –70.7% and controls-74.7%). About 29.3% of cases and 25.3% of controls sleep in a room with 3 or more other people. The cases and controls were similar in terms overcrowding.

In the study therefore, overcrowding was not found as a significant factor contributing to the development of measles in the Tamale municipality.

**Table 4.7: The number of other people sleeping in a room with a child.**

<b>Number of people</b>	<b>Cases N=75 (%)</b>	<b>Controls N=75 (%)</b>
<b>1</b>	<b>30 (40.0)</b>	<b>30 (40.0)</b>
<b>2</b>	<b>23 (30.7)</b>	<b>26 (34.7)</b>
<b>3</b>	<b>12 (16.0)</b>	<b>15 (20.0)</b>
<b>4</b>	<b>7 (9.3)</b>	<b>4 (5.3)</b>
<b>5</b>	<b>3 (4.0)</b>	<b>6 (8.0)</b>

#### 4.11.0 MOTHERS'/CARE GIVERS' KNOWLEDGE, ATTITUDE AND PRACTICES

Mothers were asked questions pertaining to their knowledge, attitudes and practices about measles. The results obtained are presented here.

##### 4.11.1 Cause of measles

The mothers' opinions on the cause of measles are shown in the table 4.8 below.

**Table 4. 8: Mothers' opinions on the cause of measles.**

<b>Causes of Measles</b>	<b>Cases N=75 (%)</b>	<b>Controls N=75 (%)</b>
<b>It is a disease that occur seasonally</b>	<b>29 (38.7)</b>	<b>10 (13.3)</b>
<b>Dirt and heat</b>	<b>24 (32.0)</b>	<b>15 (20.0)</b>
<b>Not immunizing the child</b>	<b>14 (18.7)</b>	<b>16 (21.3)</b>
<b>Don't know</b>	<b>6 (8.0)</b>	<b>31 (41.3)</b>
<b>Others</b>	<b>2 (2.7)</b>	<b>3 (4.1)</b>

Almost all the mothers /caregivers did not know the cause of measles. Only 14 of the mothers of cases and 16 controls said that measles is due to inability to take their children for immunization. The other opinions expressed by the caregivers as the cause of measles were that, measles is a seasonal disease and heat or dirt may cause it.

#### **4.11.2 What mothers would do if their child were to have measles**

On the opinion of what should be done when a child had measles 6 mothers of cases and none of the controls said the child should be bathed with cold water before taking him/her to hospital or clinic. The majority of the mothers 82.7% (62) of cases and 90.7% controls said that the child should be send to hospital. And only one mother of cases said that local gin should be applied to the skin of the child. About 8.0% of mothers of cases and 9.3% that of controls said the child should be bathed with or given herbs.

All the mothers said that cases of measles could be treated at hospital.

When the mothers of cases were asked what they did when their children had measles, as many as 70 (93.3%) said they sent their children to the clinic or hospitals without giving any treatment at home. Whilst, the rest of the children were either given or bathed with cold water or herbs by their mothers/care givers before sending them to hospital. The actions of the mothers of cases were not different from the ideas expressed by the mothers of the controls on what should be done when measles occurs.

#### **4.11.3 Prevention of measles**

The mothers were asked weather they knew about immunization and its importance and how measles could be prevented. The different opinions they expressed are presented in table 4.9.

All the mothers interviewed said they knew about immunizations. Generally all the mothers/caregivers had fair ideas about the importance of immunizations. Forty-two (56.0%) of mothers of cases and 35 (46.7%) that of controls stated that, it prevents the child from getting diseases. Some expressed the view that it makes the child to grow strong and healthy, these constitute 31 (41.3%) and 40 (53.3%) of cases and controls respectively.

**Table 4.9: Opinions expressed on the importance of immunizations and prevention of measles.**

<b>Opinions</b>		<b>Cases</b> N=75 (%)	<b>Controls</b> N=75(%)
<b>Importance of immunizations</b>	<b>It prevent diseases</b>	<b>42 (56.0)</b>	<b>35 (46.7)</b>
	<b>Makes children grow Strong and healthy</b>	<b>31 (41.3)</b>	<b>40 (53.3)</b>
	<b>It is good for Children</b>	<b>2 (2.7)</b>	
<b>Prevention of measles</b>	<b>By immunizations</b>	<b>63 (84.0)</b>	<b>69 (92.0)</b>
	<b>Cannot be Prevented</b>	<b>5 (6.7)</b>	<b>2(2.7)</b>
	<b>Others</b>	<b>7(9.3)</b>	<b>4(5.3)</b>

On prevention of measles, many of the caregivers had the knowledge that, it could be prevented by immunizations. These were 84.0% of cases and 92.0% of controls. Few of the mothers thought that measles could not be prevented. Others were of the view that by keeping children neat, good food and avoiding contact with cases could help in preventing measles.

The mothers'/caregivers' knowledge, attitude and practices about measles were the same for both cases and controls. In the study, the level of the mother's knowledge, attitude and practices were not significant in development of measles in the Municipality.

#### **4.12.0 VACCINE EFFICACY**

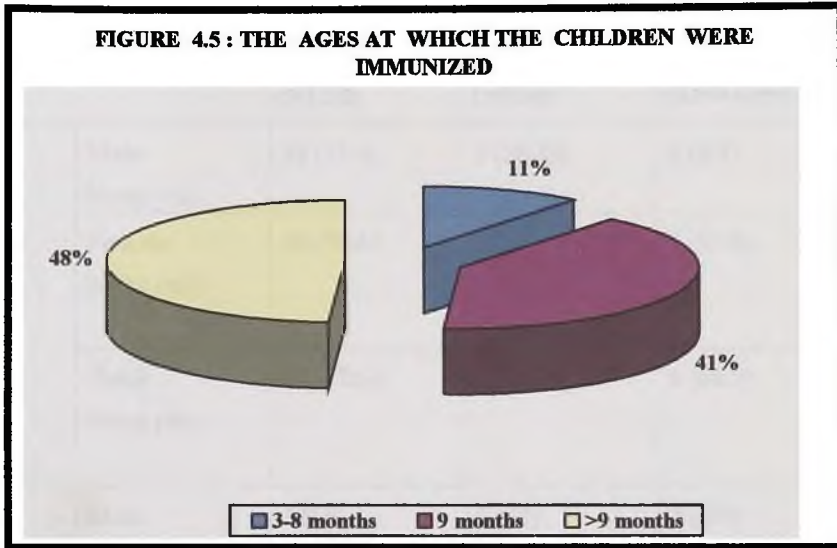
Vaccine efficacy was considered as one of the critical factors for epidemics that occurred in Tamale Municipality. Although, vaccine efficacy is expected to be high for measles, there were no consistent methods of evaluating the efficiency of the cold chain. I describe a subsidiary study to determine the efficacy of the measles vaccine being used to vaccinate children. In this direction, a seroprevalence study was carried out among preschool children between 2-5 years. This was to ascertain the proportion of children with protective levels of measles antibody and seroconversion rate among those who were vaccinated.

Hundred blood samples were therefore taken from day nursery pupils in Tamale municipality for measurement of measles antibodies and these results are presented below.

The pupils were selected by systematic random sampling. There were 56 males and 44 females in the study population. The mean age of the pupils was 53.3 months.

Among the children selected 84 (84%) were immunized against measles. The mean age at immunization was 12.4 months.

About 9/84 (10.7%) of the pupils were vaccinated before 9 months, 40.5% (37/84) were vaccinated at 9 months and the rest of 41/84 (48.8%) was immunized against measles when they were above 9 months. Figure 4.5 shows the ages at which the children were immunized. It appears that majority of the children were not immunized on schedule this is not encouraging and this may have contributed to the incidence of measles in the Municipality.



The blood samples were examined by a competent technician at Noguchi Memorial institute for medical research and the antibody levels were classified into 3 groups: Positive ( $>1.10$ ), Negative ( $<0.90$ ) and Equivocal ( $0.90-1.09$ ). The mean antibody level for all the children was 1.52. The antibody levels and vaccination status of the pupils are shown in table 4.12 below.

Among the selected pupils 67% have a protective circulating measles antibody levels. This is lower than 80% herd immunity that is needed to bring measles under control. For the 84 pupils who were vaccinated 61 were positive for measles antibodies. The seroconversion rate among the vaccinees was 72.6% and that for the unvaccinated was 37.5%.

There was seroconversion rate of 73.6 % among the females and 71.4% in the males who were vaccinated. For those who were unvaccinated, the seroconversion rate was 50% in males and 16.7% in females.

**Table 4.10: Measles vaccination status and antibody levels of the children**

Measles vaccination		Measles antibody levels (OD values)		
		Positive (>1.10)	Negative (<0.90)	Equivocal (0.90-1.09)
Yes	Male N=46 (%)	33 (71.4)	9 (20.0)	4 (8.6)
	Female N=38 (%)	28 (73.6)	5 (13.2)	5 (13.2)
	Total N=84 (%)	61 (72.6)	14 (16.7)	9 (10.7)
No	Male N=10 (%)	5 (50)	5 (50)	0 (0.0)
	Female N=6 (%)	1 (16.7)	5 (83.3)	0 (0.0)
	Total N=16 (%)	6 (37.5)	10 (62.5)	0 (0.0)

In summary the results of the case control study indicated that:

There was 100% recovery from measles among the cases studied. Twelve percent of the cases developed measles before they were 9 months old.

The level of education, age, religion, occupation and socio-economic status of the mothers/care givers were not related to the incidence of measles in Tamale Municipality.

Immunization against measles and on schedule was important in reducing measles incidence in the study population.

Completion of immunization schedules by one year of age was important in reducing measles incidence among the children studied.

Immunization against other childhood diseases does not influence the incidence of measles.

Among the study population, the distance from a health facility has a strong influence in the incidence of measles. However, the attendance at CWC did not show any significant relationship with incidence of measles.

Adverse effects of immunizations did not deter mothers from immunizing their children and was not important in influencing the incidence of measles in the study

The knowledge, attitude and practices of the mothers about measles were the same among the cases and the controls and therefore could not have influenced the incidence of measles in the Municipality. Even though, the majority of both cases and controls knew the importance of immunizations, they did not know what cause measles and how it could be prevented.

In the seroprevalence study the conclusions drawn were:

The majority of the children were not immunized on schedule and this may account for the high incidence of measles in under five children.

The children with protective measles circulating antibodies was 67% which is less than 80% that was expected to prevent outbreak of measles in the municipality. The seroconversion among the vaccinated was 72.6% that is lower than 95% expected.

## **CHAPTER FIVE**

### **5.0 DISCUSSIONS**

The factors influencing measles in the Tamale Municipality were determined by carrying out a case control and seroprevalence study.

There was evidence of 100% recovery from measles in the cases. Consistent with this was epidemic that occurred in Accra in 2000, where all the cases completely recovered with no complication (26). This is as a result of reduced severity of measles, in children of under fives in the study population. Since the introduction of measles immunization mortality and morbidity due to measles has reduced dramatically (10).

Some of the cases had measles before 9 months. This is consistent with findings in epidemics that occurred in Ibadan and southern Ghana (27,28). However, the 12.0% found was far lower than 20.0% obtained in Ibadan. Most of the cases had measles when they were older than 25 months. This is a departure from the norm in the 1980's when most of the children coming on admission with measles were in the age range of 7-12 months and coupled with the fact that increasing immunization coverage has secondary effect of raising the age of developing the disease (1,29,30). The mean age at which cases developed measles was therefore high.

Socio-economic factors influence the incidence of measles through their positive or negative impact on immunization. It is known that higher female literacy or perhaps effective education at antenatal and CWC and improved economic status contribute to better use of primary healthcare service (25). However in this study most of the mothers were illiterates. The study did not find high level female literacy among the cases and the controls contributing to better use of health services.

The mothers of both cases and controls were similar in terms of their socio-economic status and these were not important in determining the vaccination status and the incidence of measles in the population studied.

Most of the women of both cases and the controls were poor with their main occupation being trading, earning less than ₦100,000 per month and were living mostly in mud houses. Even though, the mothers/caregivers of cases and controls were poor, most of them were sending their children to CWC.

Since a lot of mothers were attending CWC it was expected that the mothers of both cases and controls would know how measles could be prevented, but this was not so. Only 18.7% of the mothers of cases and 21.3% that of controls knew that their children could acquire measles if they are not immunized. This may question the effectiveness of health education at CWC they were attending. Although, the mothers did not know how measles could be prevented, significant number of cases and controls were vaccinated against measles. This drive towards immunization of their children may be due to the fact that, they knew the importance of vaccinating their children as indicated by the results observed in the previous chapter.

It is revealing to know that, all the mothers knew about immunizations even those who never attended CWC. This may be as a results of the general awareness that have been created during National Immunization Days (NID) and couple with the recent door to door immunization campaign against poliomyelitis.

Health facilities providing preventive health services are points for immunization against measles and other childhood diseases. However, their utilization is important in achieving high immunization coverage. This depends on their accessibility, acceptability and how clients are treated by the health staffs.

Distance has been enumerated as a major barrier towards utilization of health services. This is generally, in terms of distance from the residence to the facility (30). In the study area majority of both mothers of cases and controls travelled less than a kilometre to reach health facilities. Distance was not found to be a determinant factor in the use of health facilities. However there is significant evidence that the mothers of controls travel a shorter distance to health facilities than cases

Overcrowding increases the intensity of exposure to infection and measles infection is facilitated by collection of susceptible in a confined room. There is no significant difference between cases and controls in terms of the number of other people sleeping in a room with the child. However, both cases and controls have significant proportions of three or more people sleeping with the child. This would likely increase the incidence among susceptibles.

Measles vaccine successfully controls measles in children of immunizable age (i.e. from 9 months) if the coverage is high enough. It is generally accepted that, efficient immunization on community basis will reduce the transmission of measles among older

children and exposure to infants less than 9 months (1,10). Even though the immunization coverage has been consistently high in Tamale Municipality, measles epidemic still occurs. Among the cases, 68.0% were immunized against measles. This is in sharp contrast to the past when majority of measles cases was in children who were not immunized (29). This brings into focus the efficiency of the cold chain system especially in the field, at the point where the child receives the vaccine.

There was a significant association between getting measles and immunization against measles. Therefore vaccination against measles is still an important way of preventing and controlling measles.

In Tamale Municipality, farmers leave to their farms immediately the rains begin to remote villages, which are cut off from Tamale by rivers and streams. These areas are difficult to reach by health workers during the raining seasons and are mostly outside the domain of the Municipality. This explains why most of the mothers who did not immunize their children said they travelled.

Vaccination is the most cost effective Public Health measure in controlling measles. However, the efficacy of vaccines used in developing countries has not been well documented. To be able to achieve high level of protection of susceptibles through vaccination against measles, the vaccination must be efficacious. Measles vaccine is 95% efficacious when administered appropriately.

The immunization coverage in Tamale Municipality has increased from 63% in 1997 to above 80% in 1999 and 2000. Theoretically, when measles vaccination is given at 9 months and a coverage of 80% is achieved and maintained over 12 years, the incidence of measles

would reduce to zero (1). Despite the relatively high immunization coverage in the Municipality measles incidence is still high.

The results of the seroprevalence studies carried out, was a subsidiary to the case control study to evaluate the efficacy of the measles vaccine in use. This was planned to depart from the norm where vaccination coverage is used. The results shows that, the herd immunity was 67% in the study population, with 84% vaccination coverage. This is lower than the expected 80% needed to bring measles under control and it is also not enough, to prevent out breaks of measles in the Municipality. This might explain why measles still occurs in the municipality.

Out of the vaccinated population, 72.6% sero-converted and this is lower than 95% that was expected. This does not also compare with 90% and 92% obtained in studies carried out in southern Ghana (32,33).

This raises again the question of the efficiency of how the cold chain is maintained in the field, at the point where the children are given the vaccine. A quick observation made on the field shows that, maintenance of the cold chain was all right at the Regional store and the District Health Administration where the vaccines are stored. However, the maintenance of the cold chain at the sub-district level and in the field, the point at vaccination, might be a problem. An observation made at one of the static clinics in Tamale Central sub-district where a vaccine carrier was found not well closed, because the wrong sizes of ice packs were used. This would affect the maintenance of the cold chain and therefore vaccine potency. In addition the staffs in-charge of the cold chain management at the sub-district level had not receive in-service training on management of the cold chain for a long time now.

The key factors that were found to influence the development of measles in the Tamale Municipality were the immunization status of the children, distance to the health facility, immunization of the children on schedule (at 9 months) and the sero-conversion rate among the vaccinees. Other factors such as the mothers' or care givers' level of education, knowledge, attitude and practices about measles, marital status, religion, socio-economic status and immunization against other childhood diseases were not found to significantly influence the development of measles in the Municipality.

# **CHAPTER SIX**

## **5.0 CONCLUSION AND RECOMMENDATIONS**

### **5.1 CONCLUSION**

In the case control study carried out it is evident that, measles is occurring in vaccinated children. The question of the efficiency of the cold chain system needs to be addressed urgently. The mortality and morbidity associated with measles have reduced since the introduction of immunization against measles. This has led to 100% recovery in the cases in the study population.

The study also confirmed that, giving measles immunization on schedule and completion of all immunization schedules by one year of age was significant in determining the incidence of measles.

The mothers/care givers of both cases and controls did not know the cause of measles and how it could be prevented.

In the study the mothers/care givers age, education level, socio-economic status, level of knowledge about measles and adverse effects of immunizations did not appear to significantly influence the incidence of measles in Tamale Municipality.

The proportion of the children with protective levels of measles antibodies among the 100 preschool children in the seroprevalence study was 67%. This is not adequate to protect against outbreaks of measles in the Tamale Municipality. The sero-conversion rate in the preschool children who were vaccinated against measles was 72.6%, which is lower than expected 95%.

There is therefore the need to determine the efficiency of the cold chain to make sure that potent vaccines are reaching the children.

From this study therefore, the factors that influence the development of measles include the vaccination status of the children against measles, the distance from health facility and the level of circulating measles antibodies in the population.

## **5.2 RECOMMENDATIONS**

The following recommendations are made based on the findings of the research.

1. To be sure of the potency of the vaccines received by children, at the point of vaccination, the efficiency of the cold chain at the district and the sub-district level should be studied by Municipal Health Management Team (MHMT).
2. MHMT should ensure that health education on the cause and prevention of measles be undertaken at CWC and other health facilities by Community Health Nurses and other health staffs in the Municipality. This will discourage the treatment of measles cases with herbs at home.
3. The MHMT should conduct in-service training for all health staffs involve in keeping and maintaining the cold chain in the Municipal Health Administration and at the sub-district levels.
4. Community Health Nurses working in the Municipality should make sure all children in their catchment areas due for measles immunization are immunized on schedule (at 9 months).

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## APPENDIX I

### WORK PLAN

NO.	ACTIVITY	DATE
1	Research proposal writing.	February 5 <sup>th</sup>
2	Presentation of draft proposal.	February 28 <sup>th</sup>
3	Submission of proposal.	April 2 <sup>nd</sup>
4	Meeting with MHMT* (Tamale)	May 22 <sup>nd</sup>
5	Meeting with other Staff	May 23 <sup>rd</sup>
6	Pre-testing of Questionnaire	28 <sup>th</sup> and 29 <sup>th</sup> May
7	Data Collection.	May 30 <sup>th</sup> to June 22 <sup>nd</sup>
8	Data Editing/Entry	6 <sup>th</sup> to 26 <sup>th</sup> June
9	Data Analysis	25 <sup>th</sup> to 29 <sup>th</sup>
10	Report Writing/Typing	2 <sup>nd</sup> to 24 <sup>th</sup> July
11	Presentation to MHMT	9 <sup>th</sup> August
12	Finalizing Report	1 <sup>st</sup> August to 9 <sup>th</sup>
13	Submission to SPH	10 <sup>th</sup> September

- MHMT: Municipal Health Management Team.

## BUDGET

NO.	ACTIVITY/ITEM	QTY	UNIT COST/¢	TOTAL/¢
1.	Preliminary Data from Regional Hospital and MHO* Fuel 3 gallons x 3 centres.	21	10,000	210,000
2.	Presentation of Questionnaire and Photocopying.	200	400	80,000
3.	Training and Pretesting (2 days)			
	• Lunch allowance	12	15,000	180,000
	• T&T	12	7,000	84,000
	• Questionnaires	20	600	12,000
4.	Data Collection			
	• Allowance	200	3,000	600,000
	• T & T.	12	20,000	240,000
5.	Data Input			
	• Allowance			
6.	Report Writing			
	• Photocopying	2	20,000	40,000
	• Pen	3	1,000	3,000
	• Typing	1	50,000	50,000
	• Binding	5	10,000	50,000
7	GRAND TOTAL			<u>1,549,000</u>

## APPENDIX II

**QUESTIONNAIRE**

CASE [ ] CONTROL [ ]

SERIAL NUMBER.....

NAME OF INTERVIEWER: .....

NAME OF RESPONDENT: .....

NAME OF CHILD.....

NAME OF COMMUNITY:.....

TYPE OF COMMUNITY: (A) URBAN (B) PERI-URBAN (C) RURAL

SUB-DISTRICT: (A) TAMALE CENTRAL (B) BILPELLA (C) CHOGGU  
(D) SAGNERIGU (E) VITTIN (F) KAMINA/TAHA

**1.0 Characteristics of Mother**

1.1. How old are you? .....

1.2 Can you please tell me the month and year in which you are born?  
.....

1.3 Have you ever attended school? Yes [ ] No [ ]

1.4 If yes, what was the highest level you have attained?  
(A) Primary (B) Middle School/J.S.S (C) Secondary/SS (D) Tertiary (E) Others  
specify.....

1.5 What is your marital status?  
(A) Married (B) Divorced (C) Widowed (D) Never Married (E) Separated  
(F) Co-habiting (G) others specify  
.....

1.6 What work do you do for a living?

.....  
1.7 What is your estimated income per month? (A) <₺100,000 (B) ₺100,000-149,000

(C) ₺150,000-199,000 (D) ₺200,000-249,000 (E) ₺250,000-299,000 (F) >₺300,000.

1.8 What religion do you belong to?

(A) Traditional (B) Islam (C) Christian (D) Others,

specify.....

1.9 What work does your husband do for a living?

.....  
.....  
1.10 What is the estimated income of your husband? (A) <100,000 (B) 100,000-149,000

(C) 150,000-199,000 (D) 200,000-249 (E) 250,000-299,000 (F) >300,000

1.11 Housing type (observe): (A) Mud (B) Sticks (C) Bricks (D) Cement blocks

(E) Others specify.....

1.12 Do you (or your husband) own any of the following? (A) Television set

(B) Radio/Cassette player (C) Video deck (D) none of these

**2.0 CHARACTERISTIC OF THE CHILD**

2.1 Sex: Male [ ] Female [ ]

2.2 What is your child's name?

.....  
2.3 How old is your child? ..... Date of Birth

2.4 How old was your child when she/he had measles in 2000?

.....

2.5 What was the disease outcome? (A) Recovered (B) Not yet recovered  
(C) Disabled (D) Died

2.5 If disabled state type of disability?

.....  
.....

**3.0 INFLUENCING FACTORS**

3.1 How far is the nearest health facility from your community?

3.2 Do you use the health facility near you? Yes [ ] No [ ]

3.3 If yes, why? .....

.....

3.4 If no, why? .....

.....

.....

3.5 Do you attend Child Welfare Clinics (CWC) with your child? Yes [ ] No [ ]

3.6 If yes, why?.....

3.7 If no, why? .....

.....

3.8 How far is the CWC you usually attend?.....

3.9 Why do you use this particular CWC?.....

.....

.....

.....  
 3.10 If no, why.....  
 .....  
 .....

3.11 Has the child been immunized against measles? Yes [ ] No [ ]

3.12 If yes, at what age?.....

3.13 If no, why was the child not immunized?.....  
 .....  
 .....

3.14 Has the child been immunized against other childhood diseases? Yes [ ] No [ ]

3.15 If yes, which ones and at what age? (Using the road to health card fill in the table below)

ANTIGENS	AGE AT WHICH IMMUNIZATION WAS GIVEN
BCG	
POLIO 0	
POLIO 1	
POLIO 2	
POLIO 3	
DPT 1	
DPT 2	
DPT 3	
MEASLES	
YELLOW FEVER	
CSM	
VITAMIN A	

3.16 If no why? .....

.....

.....

3.17 Did any other member of your family ever have measles in 2000? Yes [ ] No [ ]

3.18 If Yes what is/are their names?

NAME	SEX	AGE AT WHICH MEASLES WAS DEVELOPED	MMUNIZATION AGAINST MEASLES (YES/NO)

3.19 What did you do when your child had measles?.....

.....

.....

.....

3.20 How many other children sleep in the same room with your child?

.....

3.21 Does your child attend a Day Nursery school? Yes [ ] NO [ ]

3.22 If yes, what is the name of the school?.....

**4.0 CULTURAL BELIEFS AND PRACTICES**

**4.1 What do you think is the cause of measles?**

.....  
.....

**4.2 If a child gets measles what should be done to treat him/her? .....**

.....  
.....

**4.3 Can measles be treated at hospital? Yes [ ] No [ ]**

**4.4 If no why? .....**

.....  
.....

**4.5 What can you do to prevent your child from getting measles?.....**

.....  
.....  
.....

**4.6 Do you know about immunization? Yes [ ] No [ ]**

**4.7 If yes, what do you think is the importance of immunization?.....**

.....  
.....

**4.8 How are you treated by Nurses /Doctors who provide the immunization service?**

**(A) Badly (B) Well (C) Very Well (D) Others Specify**

.....

**4.9 Did the child become sick after immunization? Yes [ ] No [ ]**

4.10 If yes, what happened? .....

.....

.....