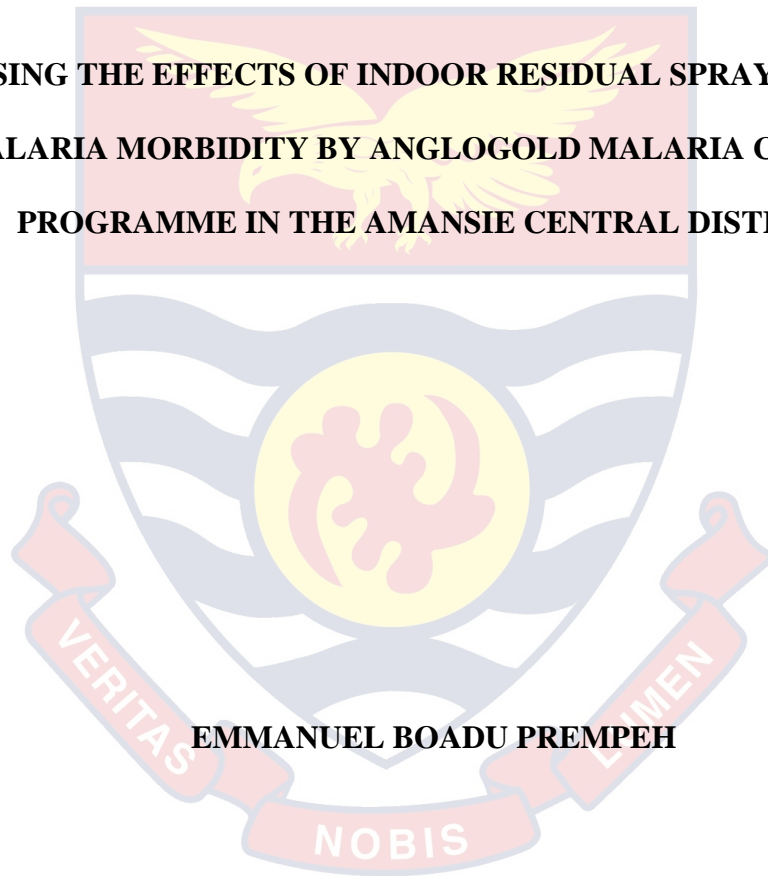


**CHRISTIAN SERVICE UNIVERSITY COLLEGE**

**ASSESSING THE EFFECTS OF INDOOR RESIDUAL SPRAYING (IRS) ON  
MALARIA MORBIDITY BY ANGLOGOLD MALARIA CONTROL  
PROGRAMME IN THE AMANSIE CENTRAL DISTRICT.**

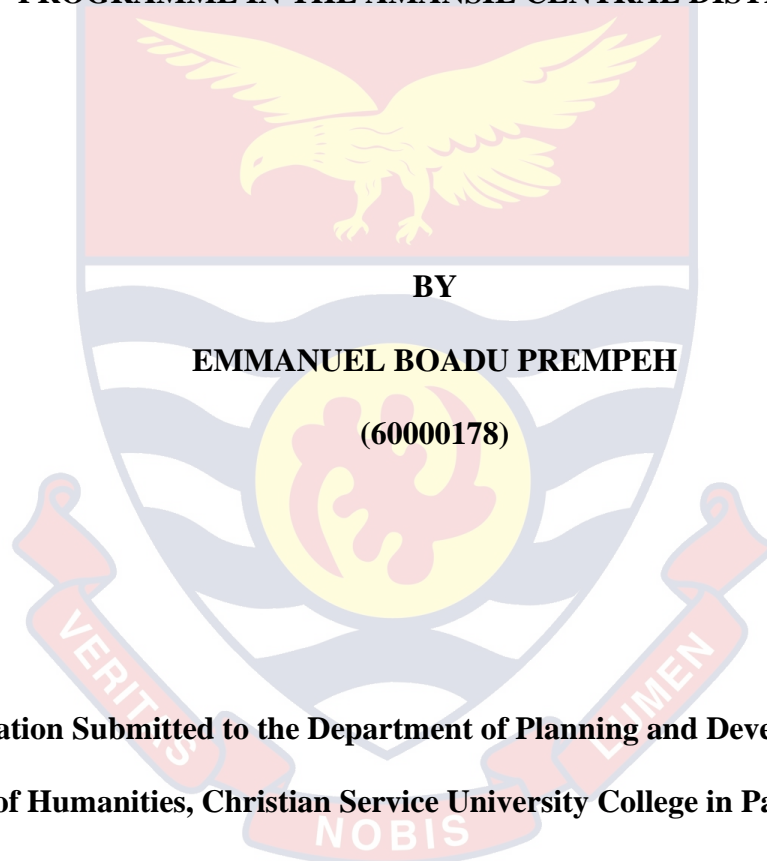


**EMMANUEL BOADU PREMPEH**

**2020**

**CHRISTIAN SERVICE UNIVERSITY COLLEGE0**

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**BY**

**EMMANUEL BOADU PREMPEH**

**(60000178)**

**Dissertation Submitted to the Department of Planning and Development of the  
Faculty of Humanities, Christian Service University College in Partial Fulfilment  
of the Requirements for Award of Master of Science Degree in Monitoring and  
Evaluation**

**SEPTEMBER, 2020**

## DECLARATION

### Candidate's Declaration

I hereby declare that this thesis is the results of my own work towards the Master of Science in Monitoring and Evaluation and that no part of it has been presented for another degree in this university or elsewhere, except where due acknowledgement has been made in the study.

Emmanuel Boadu Prempeh .....

**Candidate**

**Signature**

**Date**

### Supervisor's Declaration

I hereby declare that the preparation and presentation of the research on assessing the effects of indoor residual spraying (IRS) on malaria morbidity by anglogold malaria control programme in the Amansie Central District was supervised in accordance with the guidelines on supervision of dissertation laid down by the Christian Service University College.

Dr. Oduro Ofori .....

**Supervisor**

**Signature**

**Date**

## ACKNOWLEDGEMENTS

My sincere appreciation goes to the Almighty God for His guidance and grace throughout my academic life. It is by His grace that I have come this far. I wish to also express my sincere gratitude to my hardworking supervisor, Dr.Oduro Ofori for his guidance and constructive comments which have helped to shape this work.



## DEDICATION

I dedicate this work to my family.



## ABSTRACT

Though significant strides have been made to control or eradicate malaria, it still remains the number one killer in tropical Africa in general and Ghana in particular.

Various control interventions have therefore been put in place since 1957 to help control the disease.

Among other interventions has been the Indoor Residual Spraying (IRS) which has been implemented in the country by various agencies at various locations to help reduce the malaria burden. Despite the implementation of IRS alongside other interventions, there are still doubts as to the real contribution of IRS to the fight against malaria.

This study therefore seeks to do an assessment of the IRS intervention as against others like use of insecticide treated nets, intermittent preventive treatment etc. in the fight against malaria. The cross-sectional research design was adopted for the study. The cross-sectional design allows data to be collected from a selected population at a specific time based on particular variables of interest. Structured questionnaires were used to collect data from the study population. The multi stage simple random sampling method was used to select its respondents and the quantitative approach was used to analyse the data collected. This made it possible to be able to draw inferences between variables. Also, data collected from the Integrated Health Management Information Systems was used to analyse data from fourteen different health facilities. This was done to assess the impact of IRS on illness caused by malaria before, during and after the indoor residual spraying.

The study focused on the implementation of IRS in the Amansie Central District of the Ashanti Region by Anglogold Malaria Control Limited by analysing malaria data from all health facilities in the district, prior to the implementation of the IRS, during the four's year period of implementation and two years after implementation.

The research revealed that, during the four year period of the implementation of the IRS programme, malaria burden in the Amansie Central district was relatively lower as compared to the period before the IRS intervention and after the IRS intervention. This was evident in the reduction in the number of malaria cases and OPD attendance during the program period (2013 to 2015) and consequently reduced the malaria incidence by 50%. At the end of the research the recommendations made were that the District Health Directorate should make efforts that ensure that beneficiaries of the intervention are involved in the program from the very beginning to the end and also prioritize public education as a way of gaining the people's support. Finally, spraying operators should be encouraged to be polite and respectful to the people and also make it a point to recruit spraying operators from the district.

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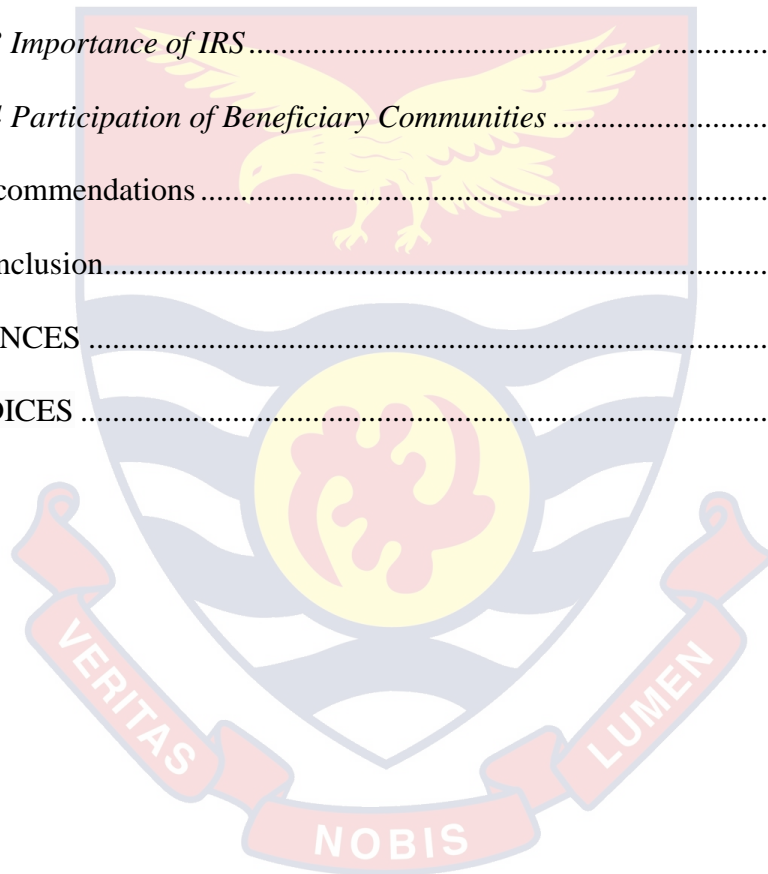
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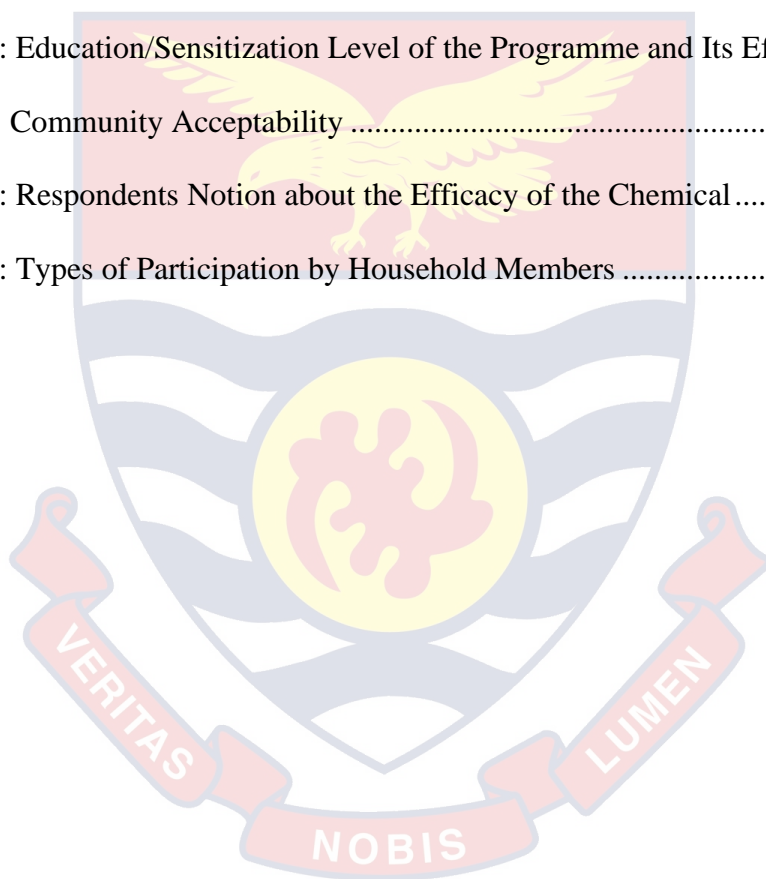
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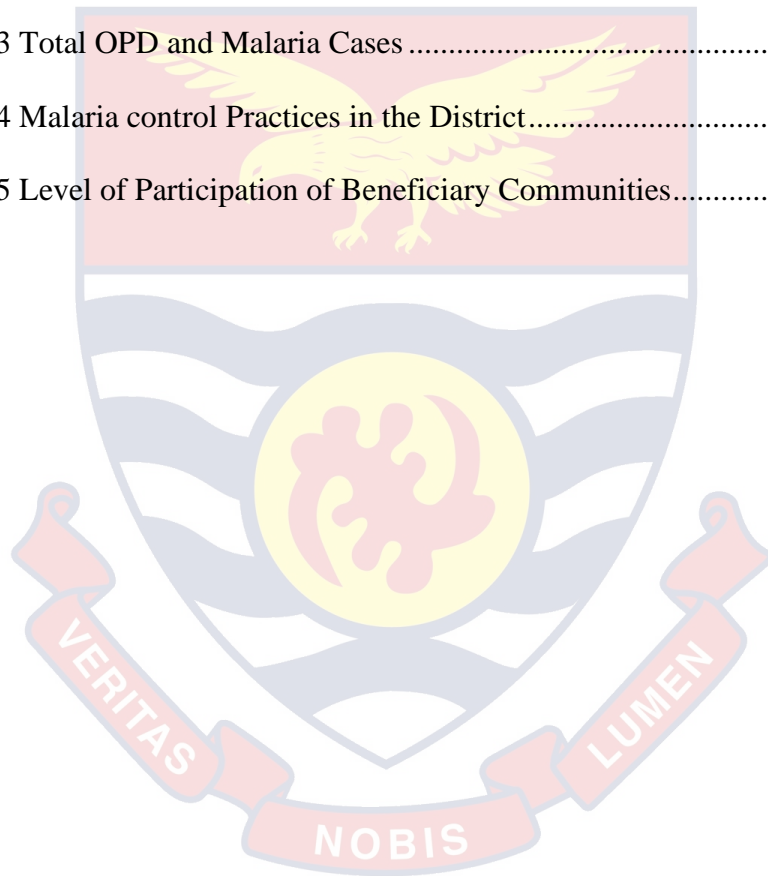
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## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of Study

In spite of all the attempts made through the century to eliminate or curb malaria, it continues to be the most well-known and detrimental sickness in the tropical regions. For ages, malaria has been a deadly illness caused by the female anopheles mosquitoes and also accounts for a significant cause of sickness and death in Ghana, largely among children and pregnant women, consequently malaria accounts for 32.5 % of all outpatient department (OPD) attendance and accounts for 48.8 percent of children below the age of five years put on admission in hospitals in the nation (NMCP annual report, 2009). According to WHO assessments, about 40% of the populace of the universe live in regions where malaria is widespread with both direct and indirect costs of management being high (WHO/UNICEF, 2005).

In Ghana efforts to curb malaria started in the mid-90s and it was targeted at decreasing the burden malaria as a disease was causing in the country to a point where it becomes insignificant to the public. During this period, it was realized that the fight against malaria could not be left to the health sector alone and hence several approaches were to be adopted in correlation with other health related disciplines. In relation to this, several strategies were programmed to help in the control of this deadly disease (Van Eijk *et al.*, 2004). The primary malaria control intervention strategies implemented during this phase in Ghana included applying insecticide against adult mosquitoes, mass chemoprophylaxis with pyrimethamine medicated salt and enhancement of the drainage in the country. One important strategy adopted to reduce the risk of people getting infected by malaria was the use of insecticide treated

mosquito nets. In spite of all these programs, the disease persisted and remained the major cause of sickness in Ghana.

Internal residual spraying is the use of long-acting chemical insecticides on the roofs and walls of homes and on the shelters of domestic animals in a particular region or place so as to kill the female anopheles mosquito that settle on the sprayed areas (WHO, 2006). The long-acting chemicals sprayed on these surfaces worked mainly in two ways; to reduce malaria infections the chemicals reduced the life duration of the female anopheles mosquitoes so that they are unable to spread the parasite from one human to the other and also decreases the population of the female anopheles mosquitoes in an area or region. Internal residual spraying under certain circumstances can cause the complete eradication of locally imported anopheles mosquitoes while other chemicals when applied repel mosquitoes and in effect reduce the total number of mosquitoes entering a sprayed environment or area and therefore reducing the rate at which there is a contact between a person and a female anopheles mosquitoes.

The internal residual spraying has passed the test of time as it has proven to be effective in the fight against malaria transmission, the positive effects of the IRS have been reported in both high and low endemic regions. Also, significantly contributing to the eradication and drastic decrease of disease in several areas of Asia, Europe and Latin America (Pluess *et al.*, 2010).

In Ghana, IRS has been implemented since 2006 in some selected districts in the Ashanti, Central, Upper West and Northern regions by AngloGold Malaria Control Limited and Abt Associates with funding from Global Fund and USAID respectively. IRS was also implemented in the Amansie Central District by AngloGold Ashanti

Malaria Control Limited from May, 2012 to February, 2015 with two rounds of spraying each in 2013 and 2014. Since IRS implementation in the district no direct studies have been carried out to assess its effects. This study therefore seeks to gain an insight into the effects of indoors residual spraying program on malaria morbidity in Amansie Central.

## 1.2 Problem Statement

Indoor Residual Spraying as a malaria prevention intervention program has been implemented in various parts of the country as part of an integrated approach in the fight against malaria. Other interventions like the distribution of Long Lasting Insecticide Nets (LLINs), Intermittent Preventive Treatment (IPT) and others have also been implemented alongside Indoor Residual Spraying in the Amansie Central District from 2012 to 2015. Even though the success of the indoor residual spraying programmes implemented in Africa have been recorded in multiple research (Teklehaimanot *et al.*, 2009), there is no available data to ascertain how the indoor residual spraying as a malaria prevention intervention has contributed to the fight against malaria in Amansie Central District in Ghana. Consequently, the relevance and effectiveness of the IRS project will continue to be in doubt without such data or information, considering the fact that IRS implementation is arguably more expensive compared to the other malaria control interventions.

Malaria control interventions impose substantial costs to both individuals and governments (RBM 2005). These interventions must be economically justifiable with the huge cost invested by these organizations of which AngloGold Ashanti Malaria Control Limited is no exception. IRS has been implemented as a malaria control intervention along with other interventions with little or no data specifying its

contribution made in the fight against malaria. Such a study is needed and relevant to justify the huge investment that goes in to the implementation of the IRS project. The study will aid in answering the question of whether it is economically prudent to implement IRS as a malaria control intervention with its huge operational cost, taking into consideration its contribution to the fight against malaria.

### **1.3 Objectives of the Study**

Based on problem stated in section 1.2, the research strives to assess the effects of indoor residual spraying (IRS) on malaria morbidity in the Amansie Central District. The specific objectives are outlined as follows:

1. To assess the effect of the IRS intervention on malaria morbidity by comparing the malaria burden before the implementation of the intervention, during the implementation of the intervention and after implementation of the intervention.
2. To determine the relevance or otherwise of the IRS project as a malaria control intervention.
3. To analyze the challenges in the implementation of the IRS in the selected communities

### **1.4. Research Question**

1. What are the effects of indoor residual spraying intervention on malaria morbidity by comparing the malaria burden before the implementation of the intervention, during the implementation of the intervention and after implementation of the intervention?
2. What is the relevance or otherwise of the IRS project as a malaria control intervention?



3. What are the challenges in the implementation of the IRS in the selected communities?

### **1.5 Methodology**

Secondary data on malaria cases was collected from selected health facilities in the district a year prior to the IRS implementation, during the IRS implementation, and a year after the IRS implementation. Malaria cases here refer to out-patient department (OPD) cases that have been tested to be positive malaria cases through microscopy or rapid diagnostic test. Malaria data was obtained from health facilities under the five sub districts from 2012 to 2016. Also, data was collected from community members in order to identify malaria cases that were not recorded at the various health centers in the district. An analysis compared the figures on yearly basis to establish a trend as to the effect the IRS programme has had on the malaria burden.

### **1.6 Scope and Limitation of the Study**

The research was undertaken in the Amansie Central District which is situated in the Ashanti Region of Ghana. The Amansie Central District shares borders with Amansie East and Amansie West and Obuasi District Assembly to the north east, west, and the south east respectively. To the East it shares boundaries with Adansi North and Adansi South and Upper Denkyira in the central Region to the South. Amansie Central District lies between 6°00 N and 6°30 N with longitude 1°00W and 2°00W. The extents of the district covers nearly 710 sq. km (441.17 square miles) and this land area constitutes about 2.5% of the overall surface area of the Ashanti Region.

The indoor residual spraying program on the illness caused by malaria forms the basis of this study, in other words the context of the study is to research and make findings into how the indoor residual spraying has affected malaria morbidity in the Amansie

Central District. Also, it elaborates on the suspected and confirmed cases of malaria for the periods before, during and after the program. The study brings to the fore the challenges of IRS as well as the strategic measures of mitigating these challenges and improving the effectiveness of IRS in the district.

### **1.6.1 Limitation of the Study**

In the course of this research a few challenges were encountered, the major limitation was time constraint as the entire project was to be submitted within a limited time frame as stipulated by the university. Another challenge encountered was that, all cases of malaria were identified at the health facilities. This is because householders might term another disease as malaria, therefore, the health facilities were best to give credible data on malaria. The exclusion of households could affect the findings of the research as Malaria cases of people who were not from the district but visited the health facilities were not isolated from the list and this can affect the findings.

### **1.7 Organization of the Thesis**

The study is introduced in chapter one with a brief background of the study, this chapter also outlines the objectives of the study, the problem statement, research questions, importance or significance of the study, methodology, geographical and contextual scope and the limitations of the research. This is followed by the literature review captured under chapter two of this study, as the name suggests it is a review of already existing researches done on the subject matter and also other strategies implemented to eradicate the disease. In chapter three the methodology is discussed, it is a detailed explanation of how the entire research was undertaken. Data collected is analyzed and the results interpreted and discussed and finally recommendations and conclusions were made in chapters four and five respectively.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

In the previous chapter the study was introduced and highlighted the problem as well as the objectives that the study seeks to achieve. Following that, this chapter reviews pertinent data from already existing research done on the subject which is the occurrence of the transmission of malaria parasites using data gathered from hospitals. Literature review is very crucial and purposeful as it aids the researcher to uncover and make findings related to the matter of interest to the researcher. When this is achieved, the researcher is able to explore new areas regarding the subject matter as he or she is well informed on what already exists (Leedy, 1989). According to Kumekpor 2002, unavailability of relevant documented source of information has the ability to create grave challenges to researchers and this is the case in West Africa. In the few cases where data is available, it is usually poorly managed and hard to obtain current data on several topics that is of use to the researcher. This chapter will explore previous studies undertaken on malaria and some interventions meted out to control the disease.

#### 2.2 Worldwide Distribution of Malaria

There was a 37% global decrease in documented malaria cases in 2015, with the year 2000 as the reference point (Global Health Observatory, 2018). The World Health Organization's Global Health data (2018), show that worldwide malaria incidence and deaths reduced significantly in 2015 since the year 2000 (22% and 50% respectively), though the recorded statistics are still jaw-dropping. The World Malaria Report (2016) reported that, a whopping 212 million malaria cases were recorded globally in 2015, with mortality amounting to 429,000. This gave a global incidence of 37%

(22% reduction since 2000). WHO (2018) further testified that, an estimated ninety one nations and 3.4 billion people in these nations are at risk of getting malaria, out of these numbers, 1.1 billion people are even more prone to getting infected by malaria within a year.

It is rather unfortunate that persons infected with malaria were very high in World Health Organization Africa Regions, constituting 92% of all mortalities due to malaria were recorded, and children below 5 years of age constituted more than two- thirds of these deaths (WHO, 2018). Papua New Guinea is one of the countries where the incidence of malaria is a main problem as malaria is the cause of a significant number of illness and deaths in the country. This is because malaria does not just over burden persons infected by it but it also causes so much pressure on hospitals and other health facilities and negatively affects economic development. A malaria vaccine is the only way forward and has been picked to be the best solution, cost effective and safe way to relieve the stress that is caused by malaria (Reeder, 2001).

### **2.3 Malaria in Ghana**

In Ghana, malaria is recorded to be the highest cause of illness and death. That is, it accounts for over one third of OPD cases recorded every year in the country (MOH, 2008). Additionally, about twenty to thirty percent of the malaria mortality recorded are children below the age of five and eleven percent being pregnant women. A lot of the known information on the disease and its prevention and control in Ghana and other areas in Africa as a whole emanates from studies undertaken in rural regions. However, a greater part of the Ghanaian communities are urban and thus a higher population of Ghana resides in urban areas. A report from the 2010 national census reveals that out of the 24, 658, 823 Ghanaians, 48% of this number resided in cities (A city or an urban area in Ghana is considered to be a community with a population

of five thousand and above), and twenty four percent lived in one of the six urban areas in the country with a population not less than 150,000. These cities include in no particular order, Sekondi-Takoradi, Accra, Obuasi, Kumasi, Cape Coast and Tamale (Ghana Statistical Service, 2010). Meanwhile, the nation's population has been reported to have increased with subsequent increase in urban population. For instance, World meters (2018), a statistical body whose facts are based on the UN's estimates, recorded an updated national population of 29,431,412 with urban population proportion of 54% of the recorded population (16,018,511) as at June 12, 2018. The number of Ghanaians that reside in cities is anticipated to increase sixty three percent by 2025.

#### **2.4 Causes of Malaria Incidence**

Sharma et al. (2001) are of the view that low standards of living and social and cultural elements have very significant roles in preventing or recording increasing incidences of malaria. They further explain that simple behaviors of a person such as little or no awareness of the disease and how it can be treated or prevented, surroundings or environment where one's hut or house is situated, sleep patterns, the kind of malaria transmission and engaging in activities outdoor after dusk are behaviors that are important when it comes to getting infected by malaria.

#### **2.5 Epidemiology of Malaria**

For persons, malaria infections is transmitted by 4 different kinds of the plasmodium protozoa (single celled parasites) – *plasmodium ovale*, *plasmodium vivax*, *plasmodium malariae* and *plasmodium flaciparum*. Among the above mentioned plasmodium protozoa the plasmodium flaciparum is the most deadly and is responsible for the greater proportion of deaths caused by malaria. How severe a transmission is and the immune system's response of an infected persons are the

major elements that influence the epidemiology of the plasmodium flaciparum and malaria infections caused by other type's malaria plasmodium (Tutu, 2009). Malaria transmission with a region is either persistent or intermittent. A person's immune system is persevered when the person is often exposed to the malaria parasite. In stable transmission regions, the persons that have been infected with the malaria parasite have become asymptomatic (Desai et al., 2007). In regions where the malaria transmissions or infections are not consistent, the elderly especially females, who do not have high levels of immunity mostly become symptomatic when infected with the malaria parasite and are more prone to have severe symptoms and more likely to die from the disease ( World Health Organization Regional Office for Africa, 2004).

All four species of the plasmodium are said to be in all areas of the world but are said to be brought to the new world by Africa and Europe in the sixteenth century with the exception of the plasmodium vivax which is not found in tropical Africa (Chessbrough, 1987). The centers for disease control and prevention in the United States of America in 2004 shows the worlds distribution of malaria of which the most affected continent is Africa. On the continent of Africa where several cases of malaria infections and mortality of malaria are recorded, 74% of the population lives in areas that are widespread and 19% in epidemic prone areas (U.S.A. Centers for Disease Control and Prevention, 2004). Just 7% of Africa's populace live areas that are considered to be less prone or entirely free from malaria infections.

## **2.6 Diagnosis of Malaria**

According to Breman et al. (2004), in other to cure malaria and prevent complications there is the need for early diagnosis and effective treatment of malaria. The strength of malaria diagnosis is in blood examinations and this way of malaria diagnosis was first discovered by Charles Laveran in 1880 (Sutherland et al., 2009). In Africa, other

disease that have the same symptoms as the malaria infections such as feverish infections and sepsis are usually mistaken for severe cases of malaria resulting in failure to properly treat the infected person and possibly leading to death. In areas where malaria is prevalent, parasitemia is not a sure way to a successful malaria diagnosis since parasitemia can be very similar to other coexisting diseases (Beare et al., 2005).

### **2.6.1 Symptomatic Diagnosis**

The history of a particular fever that usually is a symptom of malaria is used as a parameter to diagnose and offer malaria treatment in places where basic laboratory diagnostics is not available or is not affordable. A typical case is in Malawi, where Giemsa-stained blood smears from children disclosed that where proper diagnosis were done using laboratory diagnostics, rather than just relying on a history of fevers recorded, accurate diagnosis increased from twenty one percent to forty one percent and being treated for malaria one should be treated for some other disease reduced considerably (Redd et al., 2006).

### **2.6.2 Microscopic Examinations of Blood Films**

Blood film examinations using microscopes has been the most reliable and economic means of identifying a malaria infected person because all the four different types of parasites have distinctive attributes. Conventionally, there are two types of blood examinations; the thin films which are almost the same as the common blood films and enhances the identification of the parasite this can be attributed to the fact that the plasmodium specie presence and appearance is best kept in this type of setting, and is there is the thick films which gives the laboratory technician the luxury of screening larger quantities of blood and are 11 times more sensitive when compared to the previous film (thin films), therefore, it is easier to identify the lowest form of

infections on the later (thick films) but also the appearance of the plasmodium is a lot more haphazard and as a result making out the different types of plasmodium parasites in the thick films is much more strenuous. In view of the advantages and disadvantages of both the thin and thick films, it is essential to take advantage of both films while making an effort to make an accurate identification of which species of plasmodium a person is infected with (Warhurst et al., 1996).

### **2.6.3 Antigen Tests**

According to Pattanasin et al., 2003, in some places that do not have laboratory staff, that are experienced at malaria diagnosis or where microscopy is not available, there are other means of diagnosis (antigen detection tests) that need just a droplet of blood. The Malaria Rapid Diagnostic Tests (RDT) and the dipsticks tests were established, tested on the field and distributed. The above mentioned diagnostic test make use of fingerstick and takes a total of about fifteen to twenty minutes for the results of the tests to be ready and also the outcome of the test are seen physically with the appearance of or absence of lines on the dipsticks which makes it the best for work on the field. The only significant drawback of this test is that the results are qualitative which means that the test is only able to determine the presence of parasites in blood but is not able to tell the quantity of the parasites in the blood.

### **2.7 Some Malaria Control Initiatives in Africa**

Between the years 1955 and 1969, the attempts made at eradicating malaria under a program themed “Malaria Eradication Program” played an important role in the reduction on the stress malaria has imposed worldwide, especially Latin America, Asia and Southern Africa. This malaria elimination campaign was focused on indoor residual spraying against mosquitoes as authorized by the World Health Organization Kamapala Conference in 1950. These endeavors together with several other strategies



resulted in the complete elimination of malaria from Europe, several countries in Asia and the Caribbean. According to Bruce-Chwatt in 1985; WHO, 2006, about seven hundred million persons which accounts for over 50 percent of people exposed to the parasite were no more prone to getting infected by the disease. However, a majority of African countries were not engaged in these attempts. Subsequently, other endeavors to curb the disease through basic health care delivery were futile. According to WHO (2006), the effects of the disease that continue to linger around presently, most of which can be found in Africa and in secluded areas of Asia and Latin America is unsatisfactorily on the rise. In present times malaria continues to be of the main elements causing low standard of living and slow economic development and it is projected that about 3.2 billion people are prone to getting infected with this disease. It is recorded that more than 2 out of three malaria cases discovered happen in Africa and also about ninety percent of deaths caused by malaria occur in Africa and these deaths usually occur in children below the ages of five. In all, malaria is recorded to have infected more than 350 million people and not less than 1 million of the infected persons die from the disease.

In view of the successes recorded in Europe and other tropical regions, there was a massive engagement in long term control plans and strategies to eliminate the diseases. The already successes attained in some areas against the diseases also raised high hopes of a possible elimination of malaria worldwide (Alilio et al., 2004; WHO, 2006). In areas that the complete eradication of the disease was not realistic with the available facilities and technologies, the focus was to reduce the stress imposed by malaria to a point where it is economically and socially acceptable (WHO, 2006). According to the Ministry of health in 2007, the director general of the WHO organized a worldwide program dubbed the “Roll back Malaria (RBM) Initiative”.

The purpose of this initiative was to alleviate illnesses and deaths caused by malaria by 50% by the year 2010. The initiative aimed to further decrease illness and deaths caused by malaria by fifth percent and seventy five percent respectively by 2015, this initiative was to continue till the point where malaria was no more a sickness for public health concern.

## 2.8 Some Malaria Control Initiatives in Ghana

Following the roll back malaria program, some initiatives were carried out in Ghana. The Ghanaian partnership stressed on consolidating the general health services and creating enhanced control and curing plans more available by the public (World Health Organization, 2005). The effort to provide enhanced accessibility to quick and enhanced treatment made headway, some of these initiatives include the distribution of ITNs (Insecticide Treated Nets), and the use of preventive measures such as administering sulphadoxine-pyrimethamine to pregnant women. The World Health organization in 2005 reports that, based on medicinal effectiveness studies, Ghana moved from the use of chloroquine to artesunate and amodiaquine for dealing with malaria cases that were not complicated and used arthemeter and lumefantine plus artesiminin and piperaquine as alternate medication for persons who were intolerant with the previous medication.

As a country, Ghana was dedicated to the RBM (Roll back Malaria) initiative organized by WHO, the RBM initiative is an upgrade on the Global Malaria Strategy centered principally in African countries and aimed at halving the world malaria load by 2010. As a result, Ghana came up with a “Medium Term Strategic Plan for Malaria Control in Ghana”, this initiative focused on improving the extent of malaria prevention programs by implementing a partnership scheme which involves and promotes inter-sectorial approach between private institutions and public institutions.

In the quest to meet particular objectives on malaria control and treatment, Ghana dedicated itself to the Declaration on Roll Back Malaria in Abuja, Africa (WHO, 2005). The World Health Organization (WHO) organized a meeting in Geneva in the year 2000; the purpose of the meeting was to deliberate on the use of an anti-malaria drug. Based on the available information worldwide, the meeting scrutinized and upgraded recommendations on the usage of anti-malaria drugs for chemoprophylaxis and curing malaria. According to the ministry of health 2007, the amalgamation of different medications was considered to be a useful and workable option in enhancing the effectiveness and delay the development of resistant parasites. This strategy also possessed a potential value of malaria therapy. In view of this, Ghana in the year 2002 introduced a method of administering ACTs after the world health organization had suggested some strategies for the treatment of malaria in all nations that continued to experience resistance to single-therapy in the treatment of malaria caused by the falciparum parasite. Considering several factors such as the effectiveness, cost involved, its effects on the country's economy and its compliance with the demographics of the country such as its effectiveness and if it's safe for use in children below the age of five and also if it's safe for pregnant women, Artesunate-Amodiaquine was chosen as the first medication to be administered to a person who is infected with malaria that is not considered to be severe. The drug was set to be introduced in the country on January 1<sup>st</sup> 2005 but it was set to be in the public domain in the later part of the same year. Several mechanisms were put in place to check the drug's effectiveness, any negative reactions as a result of the drug and also for the monitoring of G6PD in pregnant women in relation to the use of Sulphadoxine-Pyrimethamine for intermittent preventive malaria treatment (NMCP, 2009).

Since 2001, WHO (World Health Organization) has prioritized the promotion of integrated vector management as an innovative means control mosquitoes. The integrated vector management is the use of varying means of curbing vectors only or a blend of the different approaches to decrease the rate of a person's contact to the insect. As part of this approach, the methods used were supposed to be less costly, while still tackling the issue at hand sustainably. In spite of the fact that insecticide treated nets were largely subsidized and made available in addition to the awareness campaigns undertaken on the essence of the use of the nets, there is seems to be a very big difference between the number of people that own use the insecticide treated nets as compared to those who do not use the insecticide treated nets.

The world health organization's worldwide campaign against malaria recommended three key initiatives that must be carried in all the counties around the world where malaria is still prevalent, this initiative was also undertaken as a means to attain the MDG's (Millennium development goals) for malaria control and prevention. The three recommendations are listed below;

- Effective malaria diagnosis and administration of effective drugs for treatment
- Supply of insecticide treated mosquito nets to know the full extent of the populace of the world that are still prone to malaria;
- And finally, the indoor residual spraying as one of the most important approaches to control the malaria vector and decrease and completely eradicate being infected by the diseases and where necessary the use of DDT.

According to the World Health Organization in 2006, the main limitations to achieve the present targets set for the management of control are increasing the scale of accessibility and attaining a larger coverage of enhanced intervention, chiefly to

populations who are the most prone of getting the disease and keeping these interventions when they are implemented.

### 2.8.1 Indoor Residual Spraying

Indoor residual spraying is the administration of chemicals that lasts long on surfaces such as walls and roofs structures and the shelters of animals in a particular region. The main aim of this action is to eliminate the adult anopheles mosquitoes that land on the areas that have been sprayed (WHO, 2006). The impacts of the internal residual spraying in curbing malaria infections are listed below;

- To decrease the life duration of the female anopheles mosquito so that they are unable to transfer the parasites of the disease from one human to the other
- To decrease the total number of the female anopheles mosquitoes in a given area. In several cases the indoor residual spraying has been recorded to completely eradicate locally imported female anopheles mosquitoes. Some of the chemicals sprayed also serve as a repellent to mosquitoes and thus decrease the quantity of the insects that enter a sprayed room and consequently also reduces a person's contact to the female anopheles mosquito.

According to WHO in 2006, in present times the use of the indoor residual spraying has reduced, in spite of its widespread use in its initial stage of introduction and its success the elimination and prevention of malaria transmissions. The phenomenon can partly be attributed to lack of commitment and the absence of funds to keep the implemented initiatives still running over a long period of time. Yet, another important cause was the massive disagreement for the use of DDT, concerns were raised against the use of DDT due to the fact that it may have detrimental impacts on health and the natural environment in the long run, which are baseless if the chemical

was to be used as prescribed for the indoor residual spraying. Long ago, the chemical was a commonly used compound in agriculture and household hygiene resulting on the excess release of DDT into the natural environment.

Science has proved the effectiveness of indoor residual spraying in the fight against malaria transmission in diverse instances and this has been known since the 1940's through to the 1950's (De Mellion, 1936; Russell, 1955; MacDonald, 1957). Several researches have proven that indoor residual spraying has considerably caused a decline in children and infant deaths caused by malaria. This result was what informed the basis of the launch of indoor residual spraying as a main strategy for malaria prevention and elimination. Data over the years has proven that the use of the indoor residual spraying is effective and efficient in the control and eradication of malaria transmission, data also proves that IRS has contributed to a reduction in the levels of malaria transmissions. A typical example that proves its effectiveness is the number of malaria cases recorded declined by over ninety percent and more in typical tropical areas during the malaria elimination scheme undertaken with a blend of indoor residual spraying and other measures (WHO, 2006).

Pilot surveys conducted to test the effectiveness of the indoor residual spraying in the complete elimination of African countries proved the method's efficacy. The project was undertaken in several countries including, Burundi, Kenya, Cameroon, Madagascar, Senegal, Uganda, Benin, Burkina Faso, Liberia, Nigeria, Rwanda among others. The surveys conducted in these countries provided evidence that proved that indoor residual spraying was largely able to control the transmission of the disease and caused a substantial decline in the female anopheles mosquito density in a given area and largely reduced the number of malaria cases recorded (Livides et al., 1958; Garret Jones 1964; De Zuleta et al., 1964; Kouznetov, 1997; Beales et al., 1989).

Though with exception of a few areas, indoor residual spraying was not undertaken on large scale in greater parts of Africa.

However, Hansford, 1972; sharp et al., 1990; SAMC, 2000 states that, the administration of indoor residual spraying often done in African countries such as Zimbabwe, South Africa, Namibia, Botswana and Swaziland over the years bigger regions has greatly changed the distribution of the female anopheles mosquitoes and consequently changed the epidemiological pattern of the malaria parasites. The *Anopheles funestus* has declined drastically to a point where they are no more of public concern. Where the parasites were present, the other main vector *Anopheles gambiae* which usually settles indoors was well under control. Even at high coverage levels, *Anopheles arabiensis* which does not settle in rooms as the *Anopheles gambiae* is not affected by indoor residual spraying and accounts for just minimal cases of malaria infections and seasonal outbreaks.

WHO presently encourages the use of 12 chemicals for indoor residual spraying, these chemicals belong to 4 chemical groups; organochlorine, pyrethroids, organophosphates and carbamates. However, the insecticides ability to influence the vector, the safety of the environment and human beings exposed to the insecticide and how costly the insecticide is are considered before choosing an insecticide (WHO, 2006).

According to WHO (2006), there is a demand for investigations and studies to create new chemicals suitable for use as insecticides to be used as alternative options for pyrethroids and DDT. Owing to the concerns that are coming up due to the resistance the malaria parasites seem to build over the already existing insecticides and the over dependence of initiatives pyrethroid insecticides. They added that, further research

must be undertaken, especially in the tropical regions to measure the possible effects of resistance on the efficiency of the indoor residual spraying for different resistance strategies. More efficient, long-lasting, environmentally friendly compounds of the old insecticides are being demanded for as well as more enhanced technologies for their administration.

### *2.8.1.1 Community Perception and Acceptability of IRS*

For the malaria prevention and control strategies to work it was necessary that the implementation schemes covered large areas and the individuals that lived in the communities in question to show immense interest in the entire process (Duut, 2016). He added that, a major limitation to the success of these intervention programs was the community members' perception of the IRS programs. Munguambe et al. (2011) asserts that a research conducted to check the people's level of compliance to indoor residual spraying to combat malaria in the district of Manica in Mozambique establishes that the use of indoor residual spraying as a mechanism of malaria control was not accepted amongst the people that live in the district of Manica. The study states that, IRS for malaria control is not fully accepted by the proposed beneficiaries. In other words strategies against malaria such as the use of insecticide treated nets were favorites over the use of indoor residual spraying. Duut 2006, mentions that the implementation of the indoor residual spraying was due to the support of political factors. The reasons linked to why the indoor residual spraying is preferred includes the fact that, it promptly or almost reduces the number of insects, the level of confidence in the spraying technicians and the people being persuaded by community authorities. Moreover, another research on the infrastructure and social services when malaria prevention and eradication is a matter of interest in the Atacora Region in Benin reveal that a lot more people had a good perception of the indoor residual



spraying; only a minimal number of the people were not in support of the use of indoor residual spraying (Aikpon et al., 2013). Several respondents were strongly against the use of DDT in particular for indoor residual spraying. The opposition to the use of DDT can be attributed to many reasons including the stench and marks it leaves on the surfaces it is sprayed on. Even though the stain can be used as an easy way to assess whether the room has been sprayed or not, it is the reason why several areas refuse their room to be sprayed (Mabaso et al., 2004). The remaining respondents were against the use of DDT because it is not able to kill bedbugs and cockroaches. Contrary to the people's view the chemical makes these insects excited and hence they create more nuisance. Chunga and Kuwenda (2014) reveal that most villages where researches on IRS have been undertaken indicated that there was a very minimal level of satisfaction with the use of indoor residual spray due to the fact that residents of the villages did not show immense interest in the process and the reasons why the compounds should be diluted were not explained to the people.

Ediau et al., assert that, citizens of Ugandan had little or no awareness of the indoor residual spraying as mechanism to combat malaria, most of the citizens had undesirable views regarding the use of indoor residual spraying and this was mostly common in rural areas and among people who have little or no formal education.

According to Tesfaye et al., (2013), a research undertaken to explore the awareness and knowledge of women on malaria prevention mechanisms in Eastern Ethiopia to be more specific Kessa. This study reviewed that many of the homes visited did not have any knowledge of the IRS and also did not use insecticide treated nets. It was revealed that, the effects of the strategies were not accepted by the people and hence there was the need for massive public education campaigns on malaria transmission

that is particularly targeted to cause a change in behavior regarding the use of IRS and ITNs.

### ***2.8.1.2 Community Participation in IRS Programs***

Community awareness and involvement in IRS program enhance its smooth implementation and effectiveness. Public education on the need and importance of the use of indoor residual spraying is very significant to ensure that a majority of the populace accept indoor residual spraying which consequently contributes to reaching a greater audience. World Health Organization, 2013 are of the view that the beneficiaries of the program are well informed and educated on its usefulness.

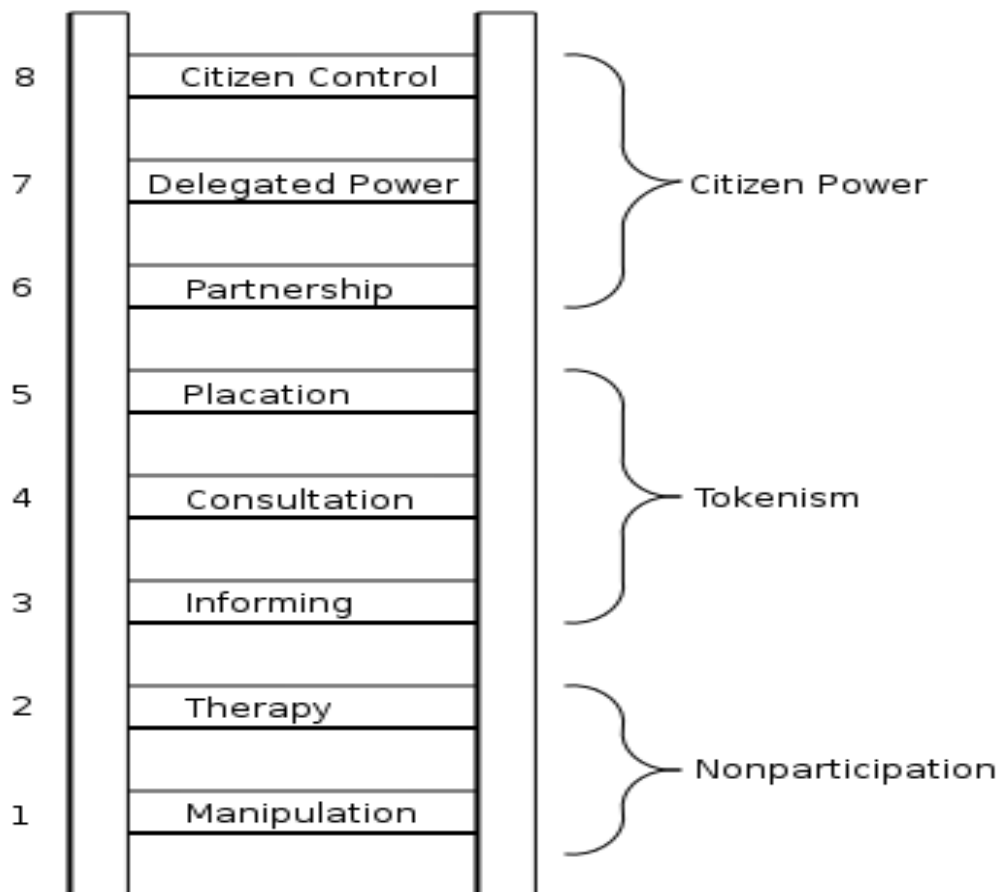
According to Duut (2016), in the execution of most IRS programs, residents of a community are unable to have an up-close conversation with the indoor residual spraying officials; they only meet them at seminars and meetings organized by community leaders and authorities. Members of the community are last in the hierarchy and are usually just beneficiaries of the interventions and have no authority except for the right they have to accept or refuse the aid being given them. They just comply with what their chiefs and leaders and the officials of the IRS program tell them to do. Aikpon *et al.* (2013) suggest that, to ensure the integration and participation of all stakeholders in IRS intervention, an intensive public education on indoor residual spraying is significant to deal with all misconceptions about the indoor residual spraying and also help to realize the full objectives of the program.

According to Prasad 2009, a research conducted in India revealed that a malaria prevention intervention was compromised or was nearly unsuccessful due to an improper implementation of the strategies; inadequate professional behavior was evident in the entire initiative. Mechanisms to combat malaria transmissions must be

in the long run focused in the creation of massive awareness of the malaria transmissions and the varying means of prevention and control to the citizens or beneficiaries of the interventions.

Chunga and Kuwenda (2014), reveals that level of acceptance by the people with regards to indoor residual spraying in Mwachimba, India was estimated to be 68%. He added that, this level of satisfaction was caused factors such as; public education, reduced levels of negative effects, good operation services offered by IRS staff, convenient and good spraying times on the other hand factors that create unsatisfactory perceptions among beneficiaries include, ineffectiveness of spraying, level of beneficiaries' involvement and quality of service. From the perspective of the leaders, there was quite a high level of satisfactory as compared to the general public of the community. A research in Mozambique revealed that the involvement of community authorities in the initiative resulted in a higher level of satisfaction and positive views on indoor residual spraying.

According to Arnstein (1969: 216) redistribution of power that enables the have-not citizens, presently excluded from the political and economic processes, to be deliberately included in the future. Participation” can be a compromise response to the rise of marginalized groups (minority groups, students, the poor, etc) to demand a say in decisions that affect them. He added that, participation empowers marginalized people to have a say in addressing economic, social and political conditions that affect them directly and can lead to shared decisions and enhance policy and plan implementation. Sherry Einstein's level of participation was used to determine the depth of participation of the community members. The levels of participation are shown in figure 2.1.



**Figure 2.1: Arstein Level of Participation.**

### ***2.8.1.3 Ghana's Level of Coverage in Indoor Residual Spraying***

Since the year 2008, Ghana has been undertaking indoor residual spraying in the northern parts of Ghana funded by PMI. NMCP partners with PMI and the Ghana Health Service to undertake an IRS program in Ghana, as part of this initiative 5 districts were selected with the aim of upgrading the scheme to add other districts. Between 2011 and 2012 the initiative was indeed scaled up by adding for more districts resulting in a total of nine districts.

As a whole, the project was initiated to achieve the target of reducing the burden that was caused by malaria especially deaths among pregnant women and children below the age of five years. A report on the initiative revealed that the extent of coverage for round one and round two of the program was ninety three percent and ninety five

percent respectively all done in the 2012. The World Health Organization's report in 2006 indicated that for a successful IRS program, not less than eighty percent of houses in the chosen community must be covered. Indoor residual spraying is considered a very resourceful tool when it comes to the eradication of malaria, it also turns out to be more effective in areas that have moderate to high transmissions level and a moderate use of insecticide treated nets. Monitoring of malaria preventive measures undertaken simultaneously with the indoor residual spraying has proven to yield better results.

### **2.8.2 Intermittent Preventive Treatment of Malaria**

The first preventive strategies to be undertaken in Africa against malaria were initiated in the 1950's (Valerie, 2007). They included a weekly or twice every month administration of monthly chemoprophylaxis with chloroquine (CQ) and dapson-pyrimethamine or sulfadoxine-pyrimethamine (SP) in West African and East African countries respectively. According to Garner et al., 2003, several researches revealed the effectiveness of such a medication in preventing anemia in pregnant women, placenta infections and low weight birth. Sadly, as a consequence of the parasite building resistance to the medicines mentioned above and the women's inability to continue to tolerate the drug, the medication began to record very low levels of effectiveness. It was recommended in the year 1998 the drug should not be used for the treatment of malaria, the recommendation was finally implemented in 2004. The drug was replaced with sporadic preventive treatment of the disease for all pregnant women that resided in areas of consistent malaria infections (World Health Organization, 2004).

According to WHO/UNICEF (2003), sporadic preventive treatment of the disease in pregnant women promises an increased success rate. The use of malaria preventive

drugs during pregnancy in predetermined intervals after having proven to be very useful to the health of pregnant women and infant health. It is the perfect method due to the fact that adhering to the intermittent preventive treatment method is higher than adhering with the weekly administration of chemoprophylaxis. The intermittent preventive method permits a pregnant woman to take a whole treatment of an anti-malaria medicine during antenatal visits with the supervision of a health personnel but chemoprophylaxis demands that a pregnant woman takes the intermittent preventive treatment medications in the house on many days predetermined every week. Anti-malaria treatment during the course of pregnancy is as a result of a hypothesis that all pregnant women residing in areas where transmission of malaria is very high for example in a country like Ghana where there is a high incidence of malaria, a pregnant woman is very likely to have malaria parasites in her blood, whether or not she experiences symptoms of malaria (Ghana Health Service, 2005).

Schultz *et al.*, 1994; Parise *et al.*, 1998; Shulman *et al.*, 1999 report that the initiative on controlling malaria during the course of pregnancy has been well researched and documented and has proven to cause a decline in malaria incidents, maternal parasitaemia, anemia and incidence of LBW.

#### ***2.8.2.1 Intermittent Preventive Treatment with Sulphadoxine–Pyrimethamine***

Sulphadoxine–pyrimethamine (SP) is considered as a very efficient anti-malaria drug for intermittent preventive treatment because of the successes it has achieved in maternal health, its efficiency in reproductive-age females and how realistic the initiative is. It also gives one the opportunity to administer a one-time dose treatment once there is the supervision of a health personnel and is highly recommended by the World Health Organization. Sulphadoxine–pyrimethamine is a better choice of drug as compared to chloroquine, the drug is conventionally used for pregnant women

because resistant to chloroquine has spread widely and is on the rise in many areas where malaria is prevalent. Researches in Malawi and Kenya have indicated that intermittent preventive treatment of malaria with Sulphadoxine–pyrimethamine has positive effects on and infant and maternal health (World Health Organization, 2004). The World Health Organization suggests that first administration of the drug should be done at first antenatal care after 16 weeks of pregnancy- this ensures that the pregnancy has gotten to the 2<sup>nd</sup> trimester and in cases where there was no antenatal visits in the first two trimesters it is still advisable to give the intermittent preventive treatment and also during the last stages of pregnancy.

Intermittent preventive treatment with Sulphadoxine–pyrimethamine when administered as a component of antenatal care has caused a large decline in the occurrence of anemia in pregnant women and the occurrence of low birth weight. The World Health Organization in 2002, reported that when Sulphadoxine–pyrimethamine is administered every week as a prophylaxis; pregnant women begin to show signs extremely intense cutaneous allergies such as toxic epidermal necrolysis and Stevens–Johnson syndrome. Nevertheless, there is no proof that the intense skin allergies is higher when administered to pregnant women or when Sulphadoxine–pyrimethamine was administered for the intermittent preventive treatment. Even though sulphonamides are produced in breast milk viable long lasting neonates are said to be very low. Pyrimethamine is mostly administered together with sulphadoxine. Nonetheless, research has shown that in instances where pyrimethamine was administered without sulphadoxine, there were no negative side effects recorded during the course of pregnancy and it is said to be harmonious with breast feeding. Schultz *et al.*, 1994; Parise *et al.*, 1998; Shulman *et al.*, 1999 states that both medications are said to be safe during the second and third trimester of pregnancy.

Even though concerns have been raised that medications containing sulphur be accompanied kernicterus when administered to a prematurely born child, this phenomenon was not encountered in the research of intermittent preventive treatment where Sulphadoxine–pyrimethamine was given to a pregnant woman. Many research work have proven that to discover whether or not Sulphadoxine–pyrimethamine has negative effects such as skin allergies and conditions that may be considered as unsafe to the unborn child or infant and the mother, initiative efficacy are usually the outcome of such studies. There is no proof of very dangerous skin allergies as adverse effects or a higher rate of the infant getting jaundice when Sulphadoxine–pyrimethamine was administered during the second and third trimesters of pregnancy. Even though the available information on Sulphadoxine–pyrimethamine encouraging it is very important that additional check for the safety of anti-malaria drugs used in treating and preventing malaria in pregnant women and Sulphadoxine–pyrimethamine is not an exception.

Valerie *et al.*, 2007, asserts that research has revealed that, there is a high success rate in intermittent preventive treatment given with Sulphadoxine–pyrimethamine in comparison to placebo or CQ prophylaxis on infections of the placenta, low weight in a new born or very serious anemia in pregnant women. Another drug under scrutiny and review for intermittent preventive treatment is the Artemisinin combination therapies. ACT have been proven to be very effective and useful in pregnant women except when administered in the first trimester of pregnancy. Nevertheless, if the impact of intermittent preventive treatment is largely prophylactic, then drugs that are not long lasting are anticipated to give very minimal outcomes. To add to this, Artemisinin combination therapy is very costly and is not easily administered as they



demand several doses that cannot be administered under direct supervision at the antenatal care hospital (Valerie et al., 2007).

Valerie (2007) suggested that, the attributes of a perfect medication as an alternate medicine include;

- It should be safe to be administered during pregnancy and should be tolerable to make sure that it can be given as treatment to women who turn out to be asymptomatic when they have malaria
- Have a lasting effect, as it has been proven that intermittent preventive treatment has a prophylactic effect instead of a long lasting impact and the life span of a prophylaxis is considered to be the most important element in the effectiveness of an intermittent preventive treatment.
- Easy administration, preferably only one dose
- And should be less costly

### **2.8.3 Insecticide Treated Nets and Bedclothes**

According to Binka et al., 1997, insecticide treated nets aid to repel mosquitoes from a person and hence highly decreases the human to vector contact and consequently causes a decline in malaria infections. The nets do not provide a complete blockade from the mosquitoes and hence they are treated with insecticides which is purposely to kill the mosquitoes before they even get close to the net. The treated nets are said to be nearly two times as efficient as the nets that have not been treated and provides more than seventy percent protection from mosquitoes in comparison with no nets. Even though treated nets have shown to be more efficacious against the transmission of malaria, the number of children protected by insecticide treated nets are less than two percent. D'Alessandro *et al.*, 1996; Terkuile *et al.*, 2003 states that in regions

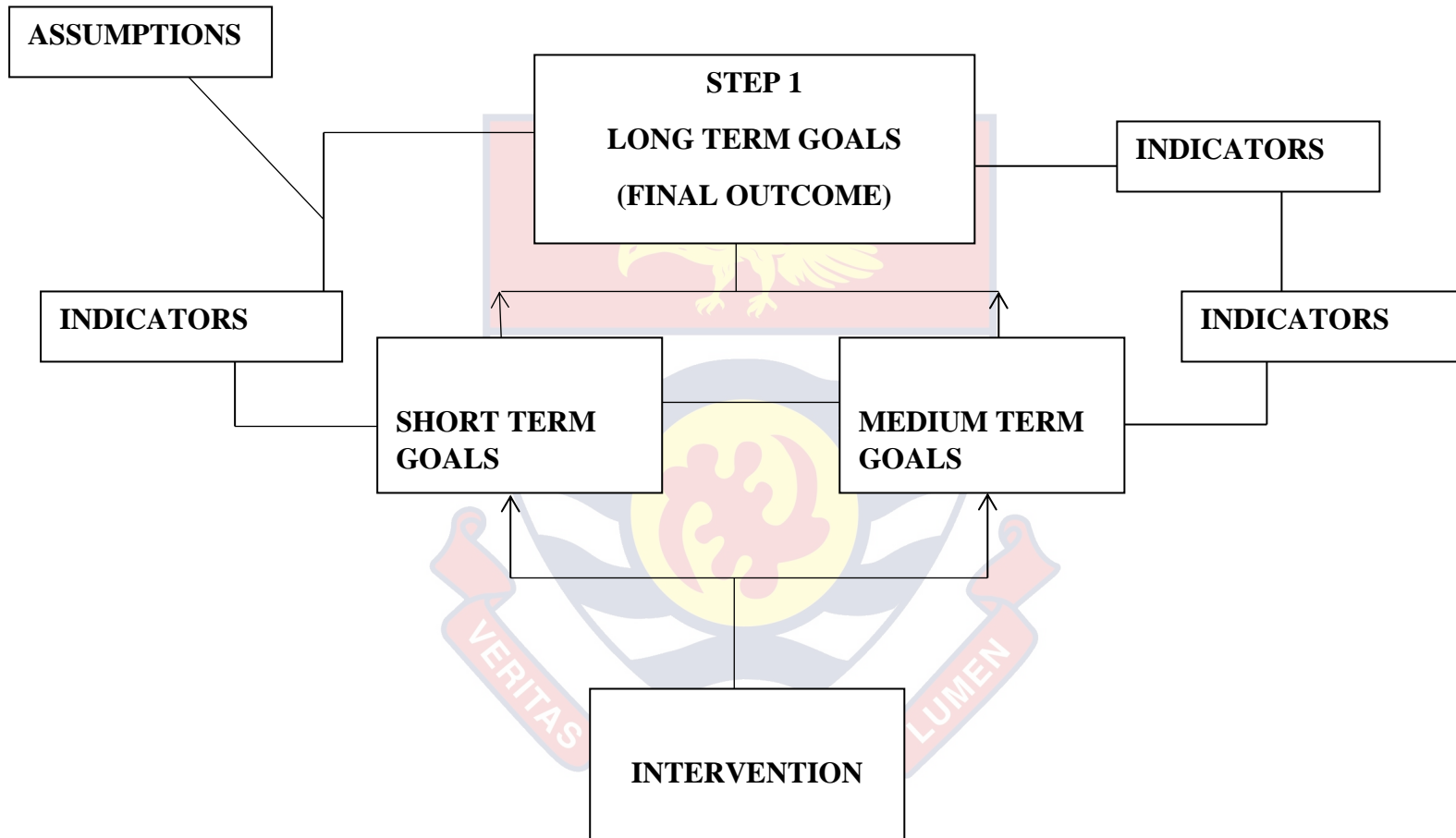
where there are prevalent transmission of the disease, the use of the insecticide treated nets have proven to be very useful against the disease. And this has created positive effects such as the reduction in the number of recorded anemia cases, pre mature births, and low birth weight and a decline in incidences of maternal and new born mortalities. Since the female anopheles mosquito is mostly nocturnal, a preferable strategy is to install a big bed net over the middle of a bed in a way that it hangs down and completely covers the bed. Insecticide treated mosquito nets enhance sound sleep as they prevent the noise caused by mosquitoes. The nets also promotes the development of the fetus and the infant and is also less expensive as compared to treating malaria. The usefulness of the insecticide treated nets in decreasing the large number of children and adults infected with malaria and its consequent impact on a nation's economy as a whole cannot be exaggerated. For instance, during pregnancy, women who are unable to take Sulphadoxine–pyrimethamine, insecticide treated nets a perfect alternative for protection against malaria transmissions. Therefore, it is preferable for women whether in areas where there are high incidences of malaria or not to always endeavor sleep under insecticide treated net in the most preliminary stages of pregnancy and make it a habit throughout the course of pregnancy and when they have delivered. *Binka et al.*, 1997, asserts that, the supply of insecticide treated mosquito nets have proven to be very resourceful in the control and prevention of malaria and is also considered as a very less expensive approach of malaria control.

## 2.9 Theoretical Framework

The theoretical framework can be described as a structure that supports or serves as a blueprint for a research study. The theoretical framework carves a pathway for research work and is firmly founded on a theory that is related to the study and also explains the hypothesis of the study (Adom et. al, 2018). In simple terms, the

theoretical framework is developed based on a selected theory or theories that explain the hypothesis of the entire research work. According to Fulton and Krainovich-Miller (2010), the purpose of a theoretical framework can be likened to a map that a sojourner or traveller uses as a guide or a tool that gives a traveller direction to his or her intended direction. Similarly, the framework serves as a guide that a researcher uses so stay within the confines of the scope of the theory used.

The theory of change was adopted for this research. A theory of change is an approach to research that makes very detailed underlying assumptions and uses the intended outcome of a research as a tool to guide planning, implementation and evaluation of the research. The theory of change also states explicitly which set of interventions need to be made to achieve the intended outcome. In a theory of change, it is necessary that the researcher identifies the context in which the expected change or outcome is to occur. Once the context is determined, the researcher adopts a backwards mapping process by firstly focusing on the intended outcome of the project then work his or her way back to determine how the intended outcomes will be achieved. In other words, when using the theory of change, a researcher is to develop a long term goal. This long term goal is achieved when a set of short or medium term goals are achieved. In other to be able to monitor and evaluate the whole process, it is necessary that set of indicators are set to be able to measure whether or not the intended outcomes of the project will be met. (Daniel Reinholz & Tessa C. Andrews, 2020). The process explained above is presented visually in the diagram below.



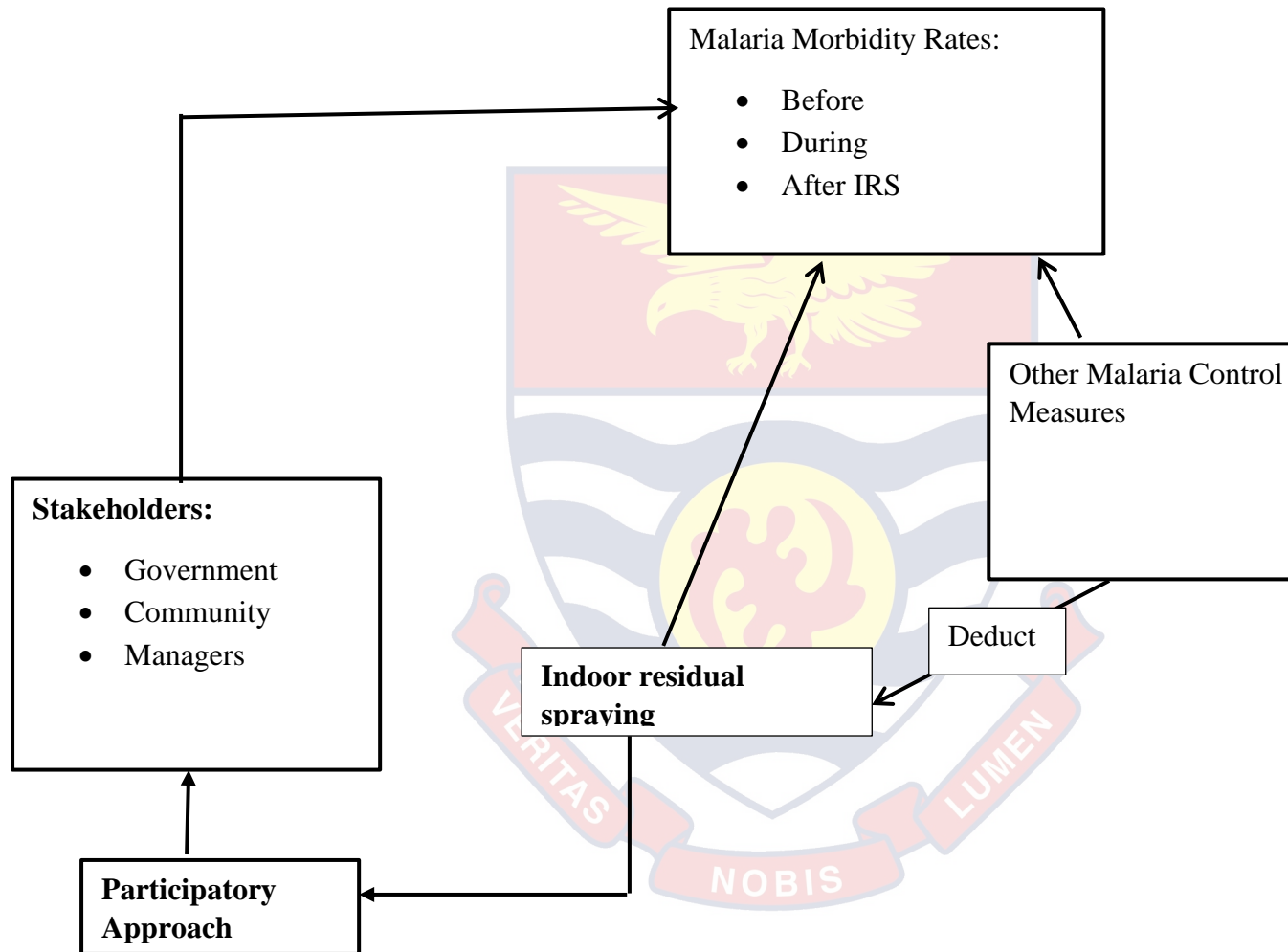
**Figure 2.2: Theoretical framework**

Source: Author's Construct, 2020

In applying the theory of change to this study, the main objective which is to assess the effects of IRS was set as the long term goal. The major underlying assumption was that data from the health facilities will be readily available and that the respondents will be will also be willing to give the needed information. Working backwards, the medium/short term goals to be able to determine the malaria morbidity before, during and after the IRS intervention, analyze the challenges that impede the IRS program and finally determine if the IRS intervention was an effective way of dealing with malaria causing illness in the Amansie Central District. The four year IRS program served as the intervention for the attainment of the short and medium term goals. This included the distribution of treated mosquito nets, spraying chemicals or compounds on the surfaces of walls, and public sensitization on the need to allow the IRS officials to spray their homes and also for the people themselves engage these practices. As mentioned in the explanation of the theory, the indicators need to be set for proper analysis. For this research, the indicators included assessing the difference between malaria reported incidences and morbidity before, during and after the IRS intervention. This will make it possible for the success of the IRS program to be measured.

### **2.9.1 Conceptual Framework**

Indoor Residual Spraying (IRS) against malaria has the potential to affect malaria morbidity rates. For the IRS activity to be effective, it should follow a more participatory approach by giving due consideration to the managers, the community and government agencies. Figure 2.2 gives details of the framework.



**Figure 2.2: Conceptual Framework**

Source: Author's Construct, 2020

From Figure 2.3, the study argues that the effect of IRS malaria morbidity rates could be ascertained by using a before and after approach. This approach helps to ascertain malaria morbidity rates before and after an IRS exercise. To be able to arrive at this, all other malaria control measures being implemented must be considered.

### **2.9.2 Empirical Review**

Indoor Residual Spraying gained prominence in the fight against illness and deaths caused by malaria. Over the years, several researchers have investigated the efficacy of IRS on the incidence of malaria causing illness and morbidity. In this section, the findings from research work done on IRS will be discussed.

In a research conducted by Gogue C. et al., in 2020, on the topic; “An observational analysis of the impact of indoor residual spraying in Northern, Upper East, and Upper West Regions of Ghana: 2014 through 2017”, it was revealed that incidences of malaria reported to public health facilities were reduced by 40% from 2014 to 2017 after the implementation of the IRS program. Findings from the research also indicated that, there was a two years reoccurrence of malaria reported cases in the Upper East Region after the IRS program was terminated for a certain period of time. Due to the resurgence of the malaria cases, the IRS program was reintroduced and this resulted in a 35% reduction in malaria confirmed cases. Comparing the two scenarios, it can be concluded that, IRS contributes significantly to the reduction in malaria causing illnesses and morbidity.

Coleman S. et al., in 2017, conducted a research on the topic; “A reduction in malaria transmission intensity in Northern Ghana after 7 years of indoor residual spraying”. In the research he stated that main aim of Indoor Residual Spraying is to decrease malaria transmission by reducing the survival of malaria vectors after entering and in

effect preventing the transmission of malaria infection. The significant reduction in the parity rates in the Indoor Residual Spraying in Northern Ghana from 2011 to 2014 can be associated with the efficacy of IRS. The incidences of malaria increased in 2013 to 2014 when the IRS program was withdrawn. He further explained that, even though some climatic conditions could such as temperature and humidity can affect vector longevity, these conditions are the same across all the areas IRS program was implemented and thus the reason for the resurgence can largely be attributed to the withdrawal of Indoor Residual Spraying.

In a research conducted by Suuron V., M., et. al., in 2020 on the topic “An exploratory study of the acceptability of indoor residual spraying on malaria control in upper western Ghana” revealed some barriers to Indoor Residual Spraying. Even though the study acknowledges the efficacy of IRS on malaria causing illness and morbidity it also points the several challenges that impede the progress of the program. The study revealed that, inadequate education of the public on the Indoor Residual Spraying prior to the implementation of the program posed a major challenge to its success. Respondents were concerned about the fact that most of the time they are not given any prior information before the actual spraying day and thus people found it difficult allow spraying officials into their homes. Another reason for the low acceptance rate was the fact that, all belongings had to be packed out before the spraying can be done. This posed a great challenge to the program as a lot of households felt reluctant to move their belongings due to the time and workload involved. Other challenges identified by the study included dislike for the chemicals used for the spraying because of the fear that it may have negative side effects, unprofessional attitude of spraying officials and individual religious beliefs and cultural practices.



Mends-Brew Edwin & Fletcher Afenyi Ernest in 2016 conducted a research on Indoor Residual Spraying (IRS) and Its Impact on Malaria Prevalence in West Africa Using the Panel Data Regression Model. The study revealed that IRS reduces malaria incidence by 71%, and ITN coverage is also associated with a 0.32% reduction in malaria prevalence.

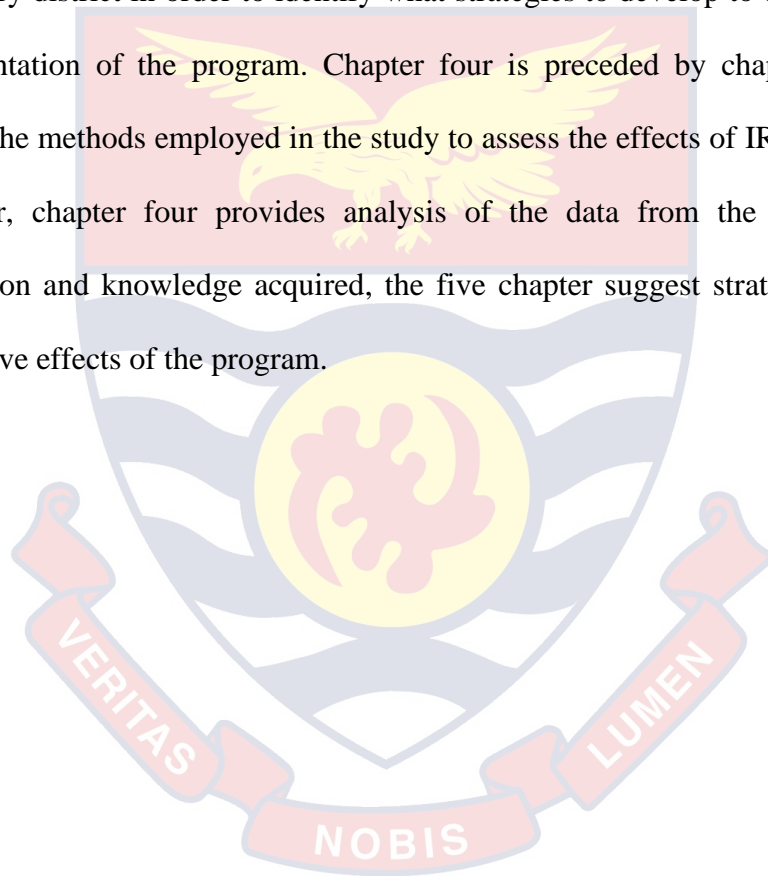
It is evident from the review above that Indoor Residual Spraying is an effective way to reduce malaria causing illness and morbidity. According to the world health Organization, Indoor Residual Spraying is the application of long-acting chemicals on the walls and roofs of all houses and domestic animal shelters in a given area, in order to kill the adult vector mosquitoes. The main aim for Indoor Residual Spraying is to reduce the life span and consequently to decrease the density of the vector mosquitoes. The report further stated that in some areas IRS can lead to the total eradication of locally imported malaria vectors. The report further elaborates that between 1955 to 1969 a malaria eradication program bases on IRS succeeded in reducing the global malaria burden. IRS combined with other efforts led to the complete eradication in Europe and several countries in Asia. Despite the success of IRS in malaria control, IRS is faced with a few challenges that usually manifest in Africa. These include small scale of the project, inadequate public sensitization and in some cases a complete withdrawal of the program leading to resurgence of reported malaria cases.

### **2.10 Linkage of the Literature and the Rest of the Study.**

This chapter discussed available literature related to the research topic under study. It covered details on the distribution, epidemiology, causes, and some prevention initiatives of malaria. The literature review has revealed the need and effects of malaria control interventions. This need is based on the increasing cases of malaria as well as promoting good health and development in the wellbeing of individuals.

However, the effects malaria control interventions (IRS, ITN, etc.) can be yield if there are effective public education and involvement beneficiaries. That is to say that analysis of the various stakeholders as well as how they will affect or affected by the intervention in order to informs the policies and programs to ensure sound implementation.

In his respect, chapter four looks at the analysis of the existing situation of the beneficiary district in order to identify what strategies to develop to ensure successful implementation of the program. Chapter four is preceded by chapter three which outlines the methods employed in the study to assess the effects of IRS on the district. Moreover, chapter four provides analysis of the data from the field. Based on information and knowledge acquired, the five chapter suggest strategies to enhance the positive effects of the program.



## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

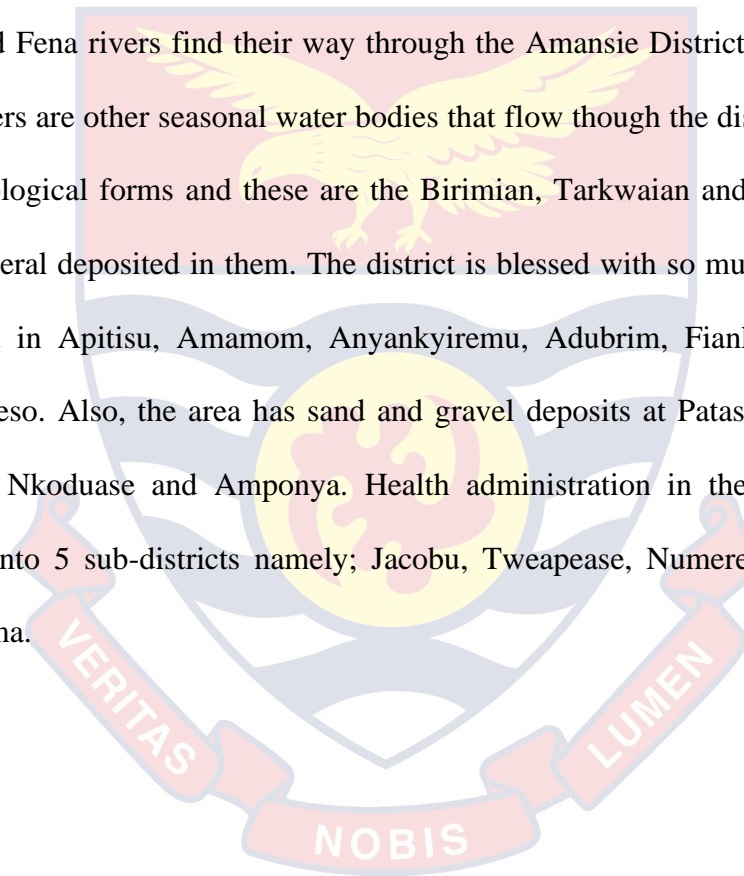
The validity, consistency and accuracy of every research is highly dependent on its methodological approaches. The previous chapter presented an exhaustive exposition of malaria control programs. It actually elaborates on the past studies on malaria and some interventions meted out to control the disease. Lessons from experiences of other countries were also explored.

Having revealed the importance and types of malaria control programs, this chapter elaborates on the methods adopted to collect data in an attempt to respond to the research questions. The methodology capitalizes upon the various variables identified during the review of literature, in order to determine an appropriate research methodology to be adopted. It details the research design and approach, the study population and the methods used in determining the sample size and the techniques used in the research. It also explains the how data gather, the type of data collection instruments used and the data processing and analyses used to attain the aims of this study.

#### 3.2 Profile of the study area

The Amansie Central District is located in the Ashanti Region of Ghana. The Amansie Central District was created from the Bekwai Municipality, this was done by a legislative instrument (LI) 1774, 2004. Amansie Central is bounded to the north east by Amansie East, to the west by Amansie west and to the south east it is bounded by the Obuasi District. The Amansie Central District also shares boundaries with Adansi South and Upper Denkyira in the Central Region to the south.

There are nearly two hundred and six towns in the district Jacobu as its administrative capital. The Amansie South District is situated between 600N and 6030N and 1000W and 2000W latitudes and longitudes respectively. It has a total land area of 441.17 sq. miles and constitutes nearly 2.5% of the entire land area of the Ashanti Region of Ghana. The Amansie south district can be found in the zone of the country, the district is popular for its agriculture which serves as the main source employment for its people and also provides agricultural products for internal and external uses. The Oda, Offin and Fena rivers find their way through the Amansie District and in addition to these rivers are other seasonal water bodies that flow though the district. Amansie has three geological forms and these are the Birimian, Tarkwaian and granite rocks that have mineral deposited in them. The district is blessed with so much Gold and it can be found in Apitisu, Amamom, Anyankyiremu, Adubrim, Fiankoma, Jacobu and Aketechieso. Also, the area has sand and gravel deposits at Patase, Afoako, Esreso, Asikasu, Nkoduase and Amponya. Health administration in the district has been divided into 5 sub-districts namely; Jacobu, Tweapease, Numereso, Fena-Hia, and Fiankonma.



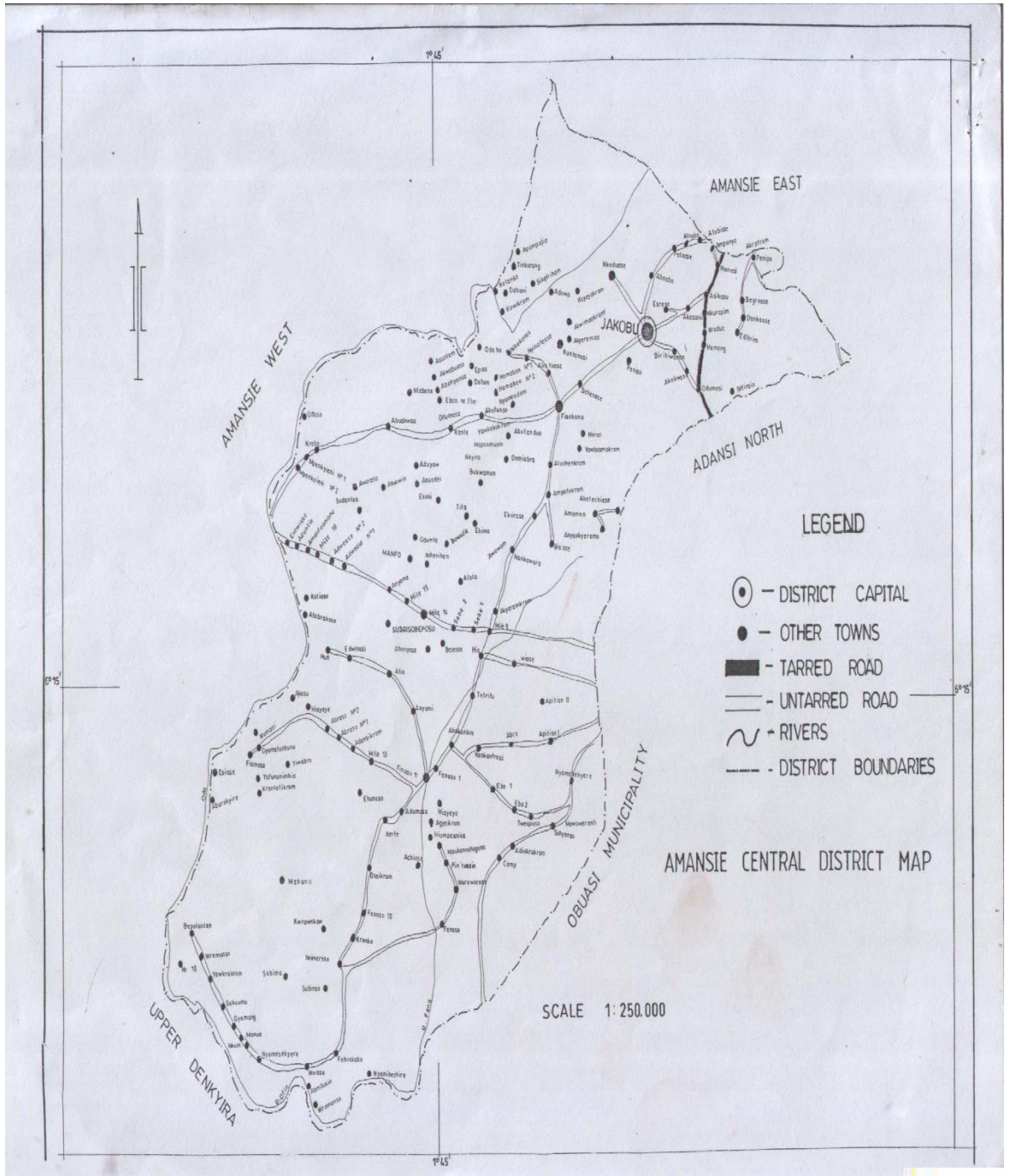


Figure 3.1 Amansie Central District Map

### 3.2.1 General Health Situation in the District

Regarding the health situation in the district, the five main illnesses that occur frequently in the district included malaria, Acute Respiratory Tract Infection (ARTI), Rheumatism, skin diseases and diarrhoea. The reported cases of the commonest illnesses affecting people in the district from 2013 to 2016 are shown in table 3.1:

**Table 3.1: Top 5 Commonest Diseases in Amansie Central District**

DISEASE	2013		2014		2015	
	No	%	No	%	No	%
<b>Malaria</b>	22,374	34.9	15,555	25.5	18,975	30.0
<b>ARTI</b>	7,006	10.9	5,221	8.6	5,995	9.5
<b>Hypertension</b>	3,516	5.5	4,317	7.1	3,576	5.7
<b>Rheumatism</b>	3,274	5.1	2,695	4.4	2,466	3.9
<b>Skin disease</b>	2,356	3.7	1,855	3.0	2,008	3.2

Source: Field Survey, 2019

Amansie Central district records a high number of Buruli ulcer cases every year and the records indicate that the number of cases is on the rise and are not showing any signs of decline. The disease has been a major health challenge in the Amansie Central District. Data from the health sectors of the Amansie Central District also indicate that there are quite a number of HIV/AIDS cases as they account for 5 percent of cases recorded. The most recorded OPD cases recorded in the year 2001, in the district are malaria, URTI, skin diseases, accidents and diarrhea. Sadly, the district lacks adequate health professionals to manage health issues in the district and this is compounded by inadequate social services and infrastructure as this makes the area unattractive to health workers.

AWDP, 2005 reports that, the district has just one doctor that attends to all cases and to make matters even worse the number of nurses in the hospital are very few. There is also no pharmacist in the district. The nurse to patient ratio and doctor to patient ratio is 1:5,452 and 1: 144,197 respectively, the ratios recorded in the district are higher when compared to the ones in the region where the nurse to patient ratio is 1: 3,082 and the doctor to patient ratio is 1: 31,477. As expected the situation above poses critical issues to the quality of health care services provided in the district. However, the district has resorted to relocating the available nurses the most remote places in the area to provide professional health care to the people with the aid of the residents of the community. Nonetheless, inadequate or poor structures to house the nurses sent to these areas have become a major challenge to the adopted initiative.

### **3.2.2 Description of IRS activities**

In Ghana, IRS has been implemented since 2006 in some selected districts in the Ashanti, Central, Upper West and Northern regions by AngloGold Malaria Control Limited and Abt Associates with funding from Global Fund and USAID respectively. IRS was also implemented in the Amansie Central District by AngloGold Ashanti Malaria Control Limited from May, 2012 to February, 2015. Consistent biannual spraying in the district commenced in 2013 targeting over 90,000 people with approximately 200 households and ended in February 2015. The districts received two rounds of spray per year over the 3-year period. The study regarded these spray rounds as rounds one to six. The spray rounds, were undertaken twice a year in 2013 and 2014 and once a year in 2012 and 2015 started with an organophosphate insecticide (Vectoguard) before switching to Proguard and Actellic respectively in 2013 and 2014. The initial spray round was introduced at the beginning of November 2012 and ending in March 2013. The second to sixth spray rounds were done at about

every 4 months beginning from September 2013 to February 2015 using Actellic 50 EC. Averagely, the number of homes covered and the total populace that benefitted from the spraying during the entire duration of the initiative was 92%.

### **3.3 Study Design**

The study adopted a cross-sectional approach for its data collection process, the study made use of structured questionnaires that collected data on demography, the respondent's knowledge and understanding of the available initiatives for the prevention and control of malaria, the views of respondents on the effectiveness of indoor residual spraying and the approach that the IRS officials used in applying the compound. The adopted a quantitative approach to analyze the data gathered to make it relative easier and more effective to analyze the relevant variables of the study and also to be to draw links and connections between variables. The method used in selecting individuals to respond to the questionnaires was the multistage simple random sampling method. To begin with, out of all the sub-districts (sample frame) from the Amansie Central District, 3 sub-districts were chosen at random. In the next phase of the process, 2 settlements were selected from each of the three sub-districts that were selected in the first stage, again this selection was done at random. At the final stage, in a home or house where there was more than just one household head the respondent was again selected at random.

### **3.4 Study setting and Sampling Method**

This research utilized information collected 14 health facilities situated in the district under study (Amansie Central District in the Ashanti Region of Ghana), and it is a secondary administrative data. The study was conducted in five Sub-districts and the health facilities listed were involved in the research: Mile 14 H/C, St. Thomas H/C and Fenaso H/C in the Fena- Hia Sub-District; Abuakwa H/C, Fiankoma H/C and



Kofihwikrom CHPS Compound in the Fiankoma Sub-District; St. Peters Hospital, Aketechieso CHPS Compound, Atobiase H/C and Marben Maternity Home in the Jacobu Sub-District; Numereso Hospital and Sukuumu CHPS Compound in the Numereso Sub-District; Apitisu H/C and Tweapease H/C in the Tweapease Sub-District. The judgmental non- random sampling method was employed in selecting these health facilities used for the study in the district, of which selection was based on availability of data.

### **3.5 Data Collection Approach**

The data collection tool employed in the course of the research was the questionnaire. The questionnaires used contained both close ended and open ended questions that were used to collect the views of respondent on the indoor residual spraying “IRS” initiative. The data gathered from the respondents were mainly collected through interviews using structured questionnaires.

### **3.6 Secondary Data Collection Procedures**

According to Khothari (2004), a data is described as secondary when it has been collected and analysed by a third party, other than the person undertaking the research. The secondary data was, hence, collected in order to provide a standard upon which subsequent primary data collection was based by bridging the identified data gaps in the secondary data. Secondary data sources included published and unpublished documents relating to the topic. However, to ensure reliability, suitability and adequacy of the content provided, published data was mainly sought and scrutinized.

Moreover, journals and reports provided information on the conceptual and theoretical issues on rural electrification. The conceptual issues derived from secondary data sources were meaning of the concept of IRS, relationship between IRS and health development as well as the challenges of IRS. Other sources included publications from foreign or international organisations, public records and statistics.

### **3.7 Primary Data collection procedures**

In Ghana a system has been designed to create a cumulated mundane report on varying health result and the health sector as a whole. The system is referred to as the Integrated Health Management Information Systems “HMIS”. Information is gathered by professionals (Health workers) during their daily interactions and treatment of their patients and the data gathered is accumulated by the health facility’s record workers. Data collected is compiled into a report and must be submitted to the district health office within which the health facility is located. Submission of the report is done on a monthly basis. This research analyzed data from the Health Management Information systems from 2012 to 2016 from 14 different health facilities in the Amansie Central District. The data collected from the IHMS was used to assess the impact of indoor residual spraying on illnesses caused by malaria in the 14 selected districts before the intervention during the intervention and after the intervention. The fourteen facilities were chosen using a standard which was created on the accessibility and adequacy of the information required for the project. For data to be termed as accessible and adequate, there must be approval for use by the district health officials and also all the variables needed for the study must be available in the report. The data reviewed covered a period of five years, that is from 2012 to 2016 and a total coverage of 6 rounds of indoor residual spraying was assessed. The major elements assessed by this research are; BS “blood smear tests” and this involved all malaria tests conducted and

those that were positive separated by age and malaria test undertaken segregated by age and sex. In addition to the variables above, the research assessed the total number of malaria cases recorded using outpatient department attendance segregated by age and sex. The age segregation used was ages less than 5 and ages greater than 5. Illnesses caused by malaria transmissions were assessed by the slide positivity rate which was of principal interest to the study. Moreover, one-on-one interviews were conducted with the various stakeholder of malaria control such as the Manager for National Malaria Control Program (NMCP), District Health Directorate, Manager of Amansie Central District Malaria Control Program and beneficiary communities in order to solicit for their ideas and opinions as well as the roles they play in combating malaria. This was done with the aid of a structured questionnaire. Questionnaires were administered to household heads who had good knowledge and understanding of English language.

### 3.7.1 Sample Size and Sampling Technique

Using Cochran formula to approximate the sample size

Where  $n$  = sample size

$z$  = reliability coefficient (95%) = 1.96

$p$  = 0.5

$q$  =  $1-p$

$d$  = width of variation = 0.05

An approximated sample size of three hundred and eighty five was targeted. The study recorded 10% non-response rate, therefore the overall sample size was four hundred and twenty four. 6 settlements were chosen at random; 2 towns from each of the three sub-districts, there was a total of seventy respondents from every selected town who gave their consent to undergo the interview process.

### 3.8 Statistical Analysis

As defined by Jensen et al., 2009, ill-health caused by malaria as measured by the SPR is the total number of positive blood smears as a ratio of quantity of malaria treatment administered among respondents who showed symptoms of fever. This was assessed as a difference in SPR in relation to time, recorded as calendar months after the application of indoor residual spraying, this was evaluated as using a linear fixed effects regression model that included polynomials of time and controlled for malaria seasonality and variations in the sub-districts and health facilities. Assessment carried out the health facilities in the 5 sub-districts within a period of 5 years starting from January 2012 – December 2016. One of the main variables in the study was the SPR which was also which was also analyzed by age groups of greater than five years and less than five years.

The indoor residual spraying exposure variable involved a years' period following each round of IRS with time expressed as years before, during and the aftermath of the indoor residual spraying. The year without spraying was treated as the base year and was recorded as zero while the years after the base year were given numbers 1–4. Assessment was done on sub-district basis using two linear fixed impacts regression models regressed on the SPR as the results variable. According to Allison, 2009, fixed effects regression deals with the lack of independence induced by the repeated-measures nature of the data. The difference in percentage in the SPR in relation to the previous time after IRS expressed as calendar year was analyzed, otherwise using the same process. A t- test was used to compare mean SPR variables of the year groups (<5 years and >5 years), while ANOVA was used to compare variances of SPR values based on the rounds of application, and also on years.

## CHAPTER FOUR

### THE EFFECT OF INDOOR RESIDUAL SPRAYING ON MALARIA

#### MORBIDITY

##### 4.1 Introduction

In the chapter above, the methods used to elicit the required information to answer the study questions were analyzed. It elaborated the research design approach, the study population and the methods used in select the sample size as well as the techniques used in the research. It also explained the instruments used for data collection as well as the data processing and analyses used to achieve the objectives of this research.

This chapter further discusses the effects of indoor residual spraying program. It entails the benefits of the program to households and as well as communities. In addition, the roles of stakeholders as well as the challenges of indoor residual spraying in the District are highlighted.

##### 4.2 Background of Respondents

This part of the research explains the various demographic attributes of the household heads that were interviewed for the research. The main demographic variables assessed were gender, age, marital status, educational level, and occupation as presented below.

**Table 4.1 Socio Demographic Characteristics of the**

<b>Variable</b>	<b>Parameter</b>	<b>Number</b>	<b>Percentage</b>
<b>Sex</b>	Male	324	76.3
	Female	100	23.8
<b>Age Group</b>	20 – 29	77	19.1
	30 – 39	104	26.1
	40 – 49	107	26.6
	50 – 59	51	12.5
	60 – 69	49	12.3
	70 – 79	31	7.6
	80 – 89	5	1.3
<b>Marital Status</b>	Married	347	81.8
	Single	55	13.4
	Divorced	14	3.1
	Widowed	8	2.0
<b>Employment Status</b>	Employed	326	76.91
	Unemployed	98	23.09
<b>Educational Level</b>	Tertiary	16	3.8
	Secondary	34	8.1
	Middle/JHS	220	51.9
	Primary	114	26.9
	Non-formal	16	3.8
	None	24	6.2

Source: Field Survey, 2019

From the table above, the distribution of males and females of those interviewed shows that a larger proportion of the respondents were males constituting 76.3 percent of the total respondents. This informed the proportion of males that accepted for the spraying of their homes as opposed to females. Again, a majority of those interviewed were aged between thirty to forty years making up fifty three percent of the total respondents whiles 9.1 percent of those interviewed were above the age 70.

Moreover, 76.91% of the sample population (those who are able and willing to work) are gainfully employed under the various sectors of employment while the remaining 23.09% unemployed. This shows that most of the people are in a gainful venture which allows them to earn income to cater their needs and needs of their families.

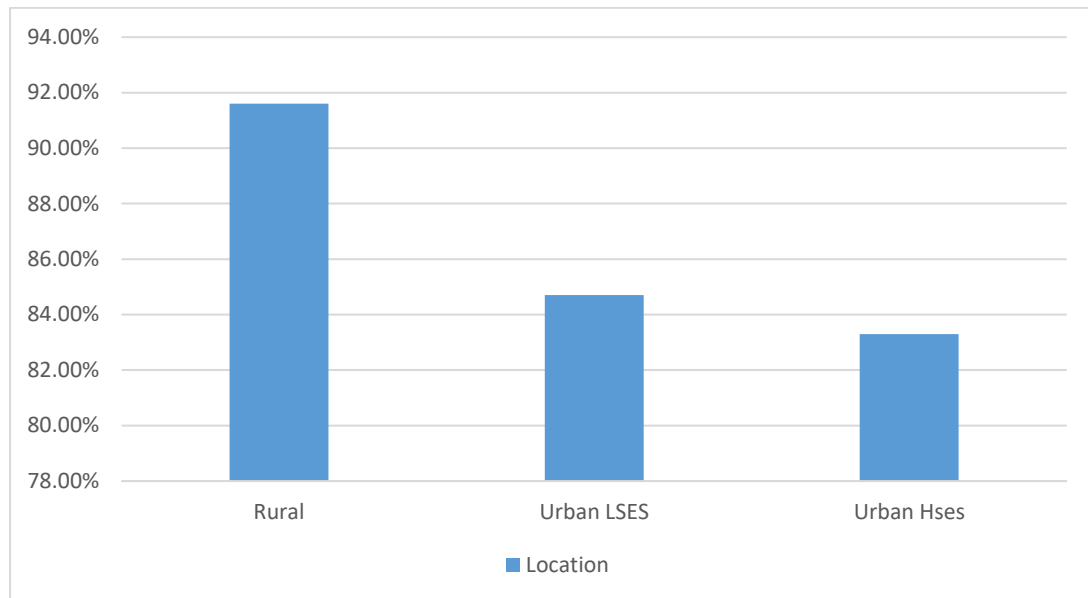
From the survey, it was realized that a greater number of the respondent attained their highest education at the Junior High school or Senior High School. That is 220 inhabitants constituting 51.9% of the sampled household heads has attained this level of education. This was followed by Primary School level which had 114 inhabitants indicating 26.9% of the sample population. 16 contributing to 3.8% people have received non-formal education. 5 inhabitants contributing 3% of the sample population have managed to complete the Senior High School. Only 16 (3.8%) people have attained the tertiary level. However 24 household heads indicating 6.2% have never being to school.

#### **4.3 Indoor Residual Spraying Program in Amansie Central District**

IRS “Indoor Residual Spraying” is characterized the efficient malaria control method most especially applying correct volumes of appropriate insecticide on all surfaces suitable for malaria resting (World Health Organization, 2006). In the Amansie Central District, IRS involved the spraying the interior walls of the houses of beneficiaries with chemicals. It is common with many mosquito specie to settle on a nearby wall so that it is able to digest the meal it just had, therefore the surfaces of the houses were sprayed with a chemical (insecticides), in other to kill the mosquitoes that settle on the sprayed surfaces before the get contact with another person and thus causes a decline in the rate of malaria transmissions. IRS in the district as illustrated in figure 4.1 below indicates 85.7% overall coverage of households structures surveyed within a 6 month period. This is similarly done in other parts of Ghana and

the world as indicated by WHO (2006). The proportion of sprayed structures was highest in the rural communities (91.6%) followed by urban LSES (84.7%) and lastly urban HSES (83.3%).

lastly urban HSES (83.3%).



**Figure 4.1 IRS Coverage in Amansie Central District**

Source: Field Survey, 2019

#### 4.4 Stakeholders in Indoor Residual Spraying Program

Identifying the various stakeholders, their roles and perceptions enhances the effective implementation of program. IRS in the Amansie Central District involved several organizations and individuals. Effective roles played by stakeholders and their perceptions informed the implementation of the program which further help to achieve its objectives. This section discusses the roles played and perception of these stakeholders in the spraying program. The main stakeholders identified during the survey include Manager for NMCP “National Malaria Control Program” District Health Directorate, Manager of Amansie Central District Malaria Control Program, beneficiary communities and many others.



#### 4.4.1 Manager, NMCP

The Manager, NMCP revealed during the survey that, the Amansie Central District Malaria Control Program was a private initiative by AGA which aimed at addressing the high cost of treatment, absenteeism and low productivity associated with malaria infections, the most significant public health threat to its operations in Amansie Central District. He again indicated that, the program enjoyed close collaboration with the NMCP right from its conception to implementation. A presentation of the program was made to NMCP when the idea was first conceived, and we contributed by way of technical guidelines and advice.

In furtherance, the study revealed that NMCP was very much involved and abreast with developments and their outfit assisted in the training and capacity building of staff of the program at the initial stages. The program had done its 5th spraying round. The manager indicated that during the survey that, DDT was not being used due to its damaging effect on the environment and resistance associated with its past use. However, WHO recommenced organophosphate and pyrethroid-based insecticides were used for the spraying program. Resulting from the high standard of operations at the District, the manager was been co-opted into malaria control activities in Ghana and the Centre was responsible for the training of staff of the Presidential Special Initiative program taking place in northern Ghana. The activities of the program were coherent with the national policy of malaria control. The method supported the four key interventions namely. Improved case management, multiple prevention, Focused Research, and improved partnership. Amansie Central Integrated Malaria Control Program was a noble corporate initiative that has benefited the communities and Ghana as a whole. It has relieved the beneficiaries of the cost that would otherwise

have been spent on malaria control in Amansie Central District. Additionally, they have shown the way for other companies to take up initiatives to control malaria.

#### **4.4.2 District Health Director, OMA**

District Health Director indicated that it was a collaborative effort spearheaded by AGA with the Amansie Central District Assembly and the Ghana Health Service and other health institutions to primarily cut down on the high cost lost to productivity and expenditure from malaria treatment suffered by AGA's operations. It also showed the company's commitment to its social responsibility to the whole of the Amansie Central District.

The role of the Health Directorate in addition to its core mandate of health promotion and delivery was to support and facilitate participatory efforts of all development partners. It is important to mention here that, the program did not fully utilize this opportunity with the non-involvement of health professionals in its community advocacy through information, education and communication. The health director revealed that there have been very few dissenting voices from sections of the populace, but it has been widely accepted and knowledge of the program was very high. The new drug policy apart from its initial drawback was doing quite well. The IRS, overall, has been successful, in terms of reported cases of malaria, some figures are actually going up. This was due to the fact that, most clinical cases of malaria are not confirmed, and any febrile illness is hastily diagnosed as malaria infection. It is, however, heart-warming to note that, records from hospitals in the district show gradual declines in impact indicators rates such as low birth weight, still birth and anemia during pregnancy.

#### **4.4.3 Manager, Amansie Central District Malaria Control Program**

The study revealed that, the Amansie Central District Assembly were supporting agency of the program by backing personnel to help and facilitate meetings with community leaders and other principal community leaders such as assembly members and traditional authorities.

The manager of the Amansie Central malaria control program indicated that, the program did not encounter any major problems due to emphasis that were placed on informing, educating the community of the program and what it entailed, and the benefits they would derive from it. The only challenge in the rural areas was the non-availability of water for the pumps which has been overcome by taking water in containers with the spray team. He added that, the Amansie Central model was used as a basis for the Ghana Global Fund proposal to scale IRS to 45 districts in the country. The proposal was injected a whopping amount of \$160 million into malaria control in Ghana. The program is now internationally recognized as a model IRS program and has won the prestigious Global Business Coalition award for malaria and 3 Pan African Health awards. The fact that the Government of Ghana has used the Amansie Central District program as a model for future up scaling of IRS is another indication of its success.

#### **4.4.4 Community Members**

According to the program manager, the communities fully embraced the program, the success was as a result of this acceptance. That is, they totally updated with the program through community committees, volunteer community malaria advocates and regular media coverage, newspapers and regular weekly broadcast on the local FM stations. Malaria according to the assembly members poses a problem to mothers

who were care-givers and pregnant women. The disease was mainly prevented by general environmental cleanliness and avoiding breeding places for the mosquito vector. Moreover, AGA indoor residual spraying contributed immensely to the reduced malaria cases in the communities. However, households are given prior notice and the communities are cooperating very well. There were 5 rounds of spraying which have helped to drastically reduce malaria infections. The exercise had the added benefits of killing other insects such as cockroaches, ants and many more. Community members were appreciative of the gesture from AGA citing low attendance at hospitals as some indicator of success and the need to sustain the program.

#### **4.5 Cases of malaria**

Efforts towards malaria control and elimination have taken many forms and been characterized by eras of ingenuity and discovery; optimism and hope to proliferation of multilateral activities (Alilio et al, 2004). According to National Malaria Control Program (2004) the presence of malaria results in low infant birth weight, the highest cause of death in an infant's earliest weeks of life.

As the fight against malaria continues, it is necessary to assess the changes in the stress caused by malaria and to assess the effects of the initiatives through monitoring malaria cases recorded and that is the total number incidences per person is a core indicator of the burden of malaria (WHO, 2017). In that respect, this section elaborates on the issues in relation of malaria cases in the study districts. It presents the trend of expected and affirmed cases of malaria in the study district for the years before, during and after the ISP.

#### 4.5.1 Suspected and confirmed cases of malaria

Malaria is a main public health threat in the Amansie Central District, largely responsible for lower productivity and high expenditure on treatments (Amansie Central District Assembly, 2018). This section elaborates on the percentage of malaria cases suspected and confirmed 2012 to 2016. It presents the percentage increase or decrease in cases of malaria recorded before, during and after the program as shown in table 4.2.

**Table 4.2 Suspected and confirmed cases of malaria**

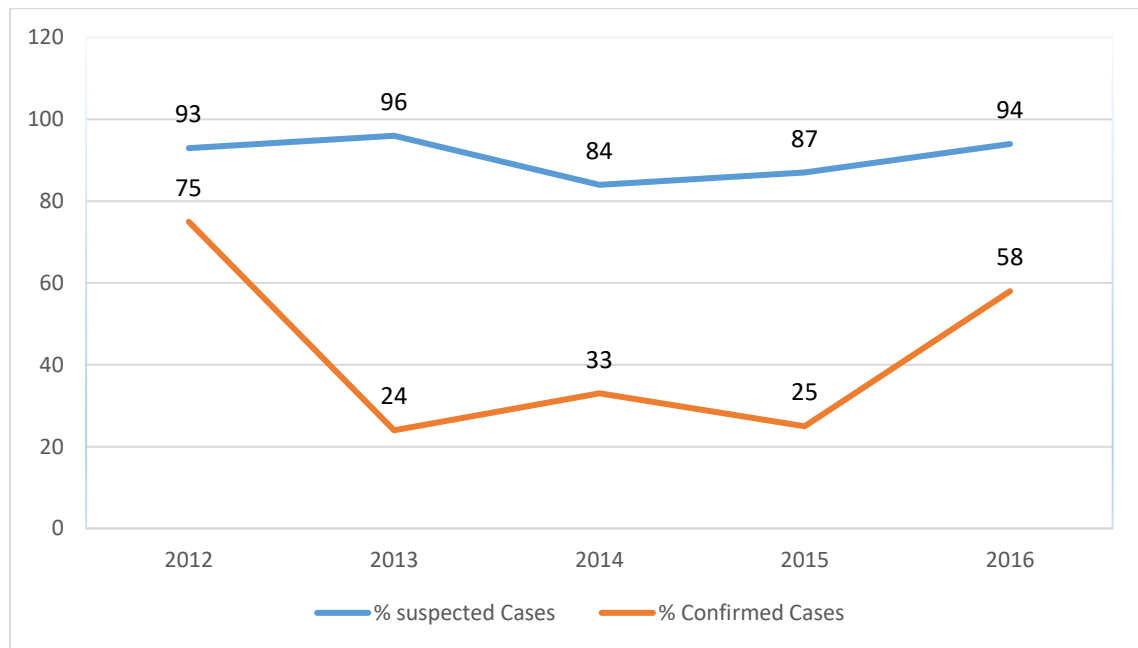
YEAR	Sub District	Suspected malaria cases	Percentage	confirmed malaria cases	Percentage
2012		85,692	93	64678	75
2013	Fena-Hia	6055	99	2373	39
	Fiankoma	5212	97	1889	36
	Jakobu	42783	96	7884	18
	Numereso	2641	96	1142	43
	Tweapease	1974	96	792	40
	Total	58665	96	14080	24
2014	Fena-Hia	6234	93	2215	35
	Fiankoma	5234	96	2075	39
	Jakobu	32785	80	9645	29
	Numereso	3245	96	1536	47
	Tweapease	2125	96	1009	47
	Total	49623	84	16480	33
2015	Fena-Hia	7814	100	2534	32
	Fiankoma	6726	87	3137	46
	Jakobu	42358	84	7525	17
	Numereso	3270	94	1331	40
	Tweapease	5127	95	1892	36
	Total	65295	87	16419	25
2016	Fena-Hia	8956	94	6954	77
	Fiankoma	8672	98	7056	81
	Jakobu	39275	92	16745	42
	Numereso	6051	100	4951	81
	Tweapease	10280	97	6977	67
	Total	73234	94	42683	58

Table 4.2 indicates that, the expected cases of malaria in the year 2012 was 85,692, however, the 64,678 cases were confirmed which formed 75.48% of the total OPD attendance in the district. The year 2013 recoded a decrease in the in the malaria cases to 14,080 which represents 24% of the total malaria cases in the district. In relation to sub district level, Tweapease realized the highest percentage of affirmed malaria cases (40%). On the contrary, Jacobu sub district recorded the least percentage of malaria cases. The total percentage of malaria cases in the district decreased from 24% to 33%, from the year 2013 to 2014 though the total of malaria cases increased the years in question. This can be the result of increased member of population in the area. In the year 2015, Jacobu sub district which recorded the least cases in 2014 still had the least percentage of the malaria cases (17%). Similarly, the study revealed that, the prevalence of malaria in the district decreased from 2014 to 2015, thus 16,480 cases to 16,419 cases respectively. It was realized that the malaria cases for all the sub districts and the whole area increase in 2016. Jacobu sub district, which always records the least percentage had 42% in 2016 indicating more than 100% increase from 2015 to 2016. The malaria prevalence for the district also showed more than 100% increase from 2015 to 2016, thus 16419 to 42683 respectively.

#### **4.5.2 Trend of malaria prevalence before, during and after ISP**

Ascertaining whether indoor residual spraying program was associated with the increased or decreased malaria prevalence in the district, the study established a relationship between the cases of malaria before, during and after the program. In other words, the section highlights the numbers and percentages of malaria cases recorded from 2012 to 2016. As stated earlier, the indoor residual program started in 2012 and ended in 2015. Therefore, comparisons on both suspected and confirmed cases of malaria will be made for the year before (2011), years during (2012, 2013,

2014 and 2015) and the year after (2016) in order to establish a relationship between the program and the cases of malaria as shown in figure 4.2.



**Figure 4.2 Trend of Suspected and Confirmed Cases of Malaria**

Source: Field Survey, 2019

Figure 4.2 indicates the trend (level of increase or decrease) of suspected and confirmed cases of malaria before, during and after the IRS. The study revealed that, the suspected cases of malaria have not been varying much, though the chart shows that it increased for stated periods, thus, from 2012 to 2013 by 3%. On the contrary, the confirmed cases of malaria in the district for the year 2013 to 2015 showed a decrease from 75% to 24%. This can be attributed to the fact that, IRS started in 2013. This is to say that, all other factors held constant, the spraying program can be said to have help reduced confirmed cases of malaria in the area. This can also be buttressed by some of the responses given by the District Health Director. 78% of the households revealed that the introduction of IRS has help reduced the incidence of malaria in their houses. According Manu from a resident of Twapease “before the spraying program, my wife and children always visited the hospital for malaria

*treatment at least every three weeks, but when the program (IRS) was started none of them complained of malaria sickness.”* On the contrary, the confirmed cases of malaria in 2014 recorded a rise of 9% whereas the suspected cases decreased by 8%. This according to the health directorate could be attributed to the sharp increase in the population of the area. Thus, more people migrated to the district to undertake small scale mining. Also, the stagnant waters created by the small-scale miners breed more mosquitoes which contributed to the increased incidences of malaria in the area. The trend of confirmed cases of malaria recorded a sharp increase from the year 2015 to 2016. Thus, it increased from 25% to 58%. That is, since the program ended in 2015, there was no spraying in 2016 and that together with other factors such as increased activities of small scale miners caused the high cases of malaria in the district.

Furthermore, the study identified that the suspected and confirmed incidences of malaria in the area before the program were very high. As indicated in figure 4.1 the percentages of suspected malaria cases revolve around 90 to 100, however, the confirmed cases of malaria recorded a sharp decrease during program period (2013 to 2015). The research proved that, the confirmed cases of malaria for the years after the program (2016) showed an increase, thus, it increased from 25% to 58%.

#### **4.5.3 Cases of Malaria in Children under 5 years**

This section elaborates the suspected and confirmed incidences of malaria in children below the age of 5. It established relation between malaria cases in children under five for the periods before, during and after IRS in the study area. Table 4.3 presents the cases of malaria for the sub-districts before, during and after the IRS.



**Table 4.3 Cases of Malaria in Children under 5 years**

<b>YEAR</b>	<b>Sub District</b>	<b>OPD Attendance</b>	<b>Percentage</b>	<b>confirmed malaria cases</b>	<b>Percentage</b>
2012		39562	42.9	16972	26.24
2013	Fena-Hia	1796	29.3	1031	43.45
	Fiankoma	1667	31.0	980	51.88
	Jakobu	8694	19.5	2928	37.14
	Numereso	925	33.5	548	47.99
	Tweapease	716	34.8	372	46.97
	Total	13798	34.8	5859	41.61
2014	Fena-Hia	1619	24.1	906	40.90
	Fiankoma	1464	26.8	894	43.08
	Jakobu	10965	26.6	3740	38.78
	Numereso	1036	30.6	695	45.25
	Tweapease	700	31.6	383	37.96
	Total	15784	34.8	6618	40.16
2015	Fena-Hia	2152	27.5	1043	41.16
	Fiankoma	2206	28.5	1131	36.05
	Jakobu	10869	21.6	2843	37.78
	Numereso	948	27.3	536	40.27
	Tweapease	1696	31.3	794	41.97
	Total	17871	34.8	6347	38.66
2016	Fena-Hia	2744	28.7	1854	26.66
	Fiankoma	2527	28.6	1838	26.05
	Jakobu	9976	23.5	2974	17.76
	Numereso	1698	28.1	1211	17.76
	Tweapease	3040	28.8	2004	24.46
	Total	19985	34.8	9881	28.72

Source: Field Survey, 2019

From table 4.3, it can be realized that there is a relationship between the introduction of the indoor residual spraying program and both OPD attendance and malaria cases for children under five years. That is, before the commencement of the program (2012), OPD attendance for children under five years recorded 42.9%. However, it decreased to 34.8% in 2013 which was the starting year for the program. From the program period (2013 to 2015), OPD attendance and malaria cases for children under five years showed an indirect relationship, thus, OPD attendance over the stated period remained the same at 34.8%. The malaria cases on the other hand reduced from 41.61% to 38.66%. This indicates that it is likely that IRS has helped reduced the incidences of malaria in children in the in the district. However, MOH (2008), indicated that in Ghana about twenty to thirty percent of the malaria mortality recorded are children below the age of five. This implies that the District has to do more to reduce the malaria incidence in children.

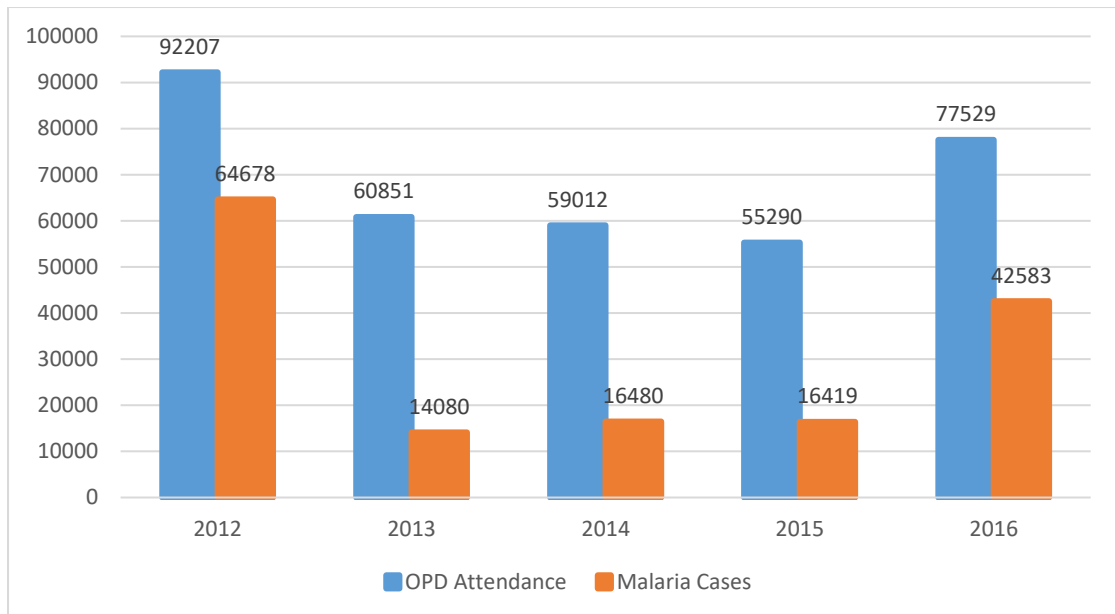
#### 4.5.4 Effects of IRS on OPD Attendance

Implementation of IRS turned to have effects on OPD attendance. This section presents analysis on whether IRS has either reduced or increased OPD attendance in the district.

**Table 4.4 Total OPD and Malaria Cases**

Year	OPD Attendance	Malaria Cases	Percentage
2012	92207	64678	70
2013	60851	14080	23
2014	59012	16480	30
2015	55290	16419	29
2016	77529	42583	55

Source: Field Survey, 2019



**Figure 4.3 Total OPD and Malaria Cases**

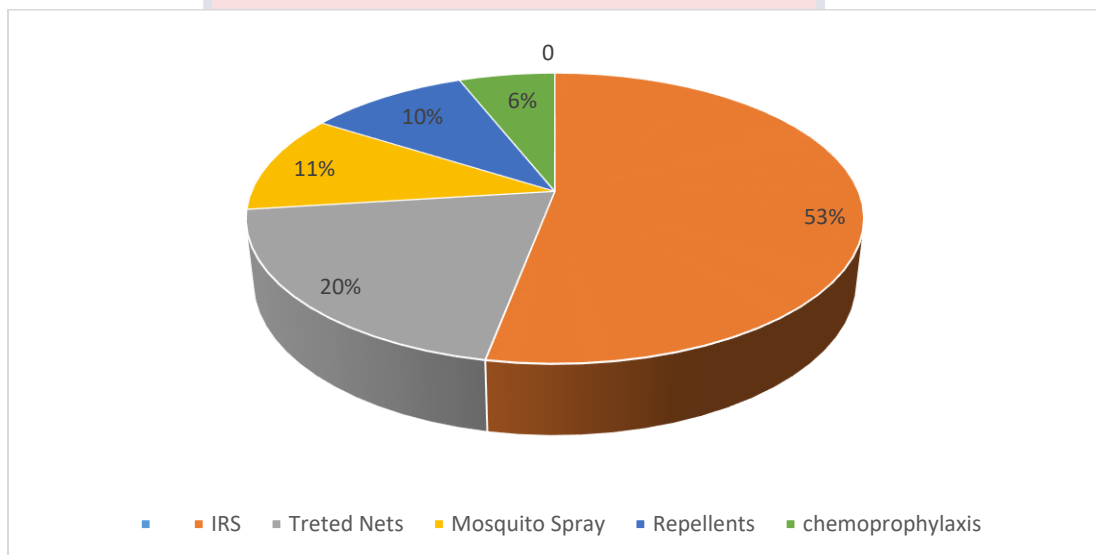
Source: Field Survey, 2019

Figure 4.3 establishes a relationship between OPD attendance and malaria cases that occurred in the district before, during and after IRS. The figure shows that there is a proportional relationship between the two variables, thus, when OPD attendance increases, malaria cases also increase and vice versa. For instance, data from health facilities records showed that in the year 2012, when the OPD attendance was highest at 92207, malaria cases recorded at that same year were the highest at 64678 cases. Moreover, during the program period (2013 to 2015), malaria cases declined to 14080 in 2013, similarly, OPD attendance also decreased to 60851. In 2016, malaria cases increased to 42583 and OPD also increased to 77529.

It was deduced from the figure that the IRS affected OPD attendance. This is in the sense that, the study revealed that the introduction of IRS helped to reduce the cases of malaria recorded, thereby reducing the number of people attending health care facilities in the district.

#### 4.6 Other Malaria control Practices in the District

The malaria prevention initiatives of the residents in the district was evaluated and it revealed that 53% of the sampled population resort to IRS. 20% of the respondents uses treated mosquito nets. 11% also resorts to the use of mosquito sprays as a malaria preventive initiative. The other malaria preventive measures of those interviewed were mosquito repellents, local herb repellents (10%) and only 6% of the sampled population engaged in the use of malaria direct correlation between the use of other malaria control practices of the people and the satisfactory level of indoor residual spraying in the district. Figure 4.4 shows the malaria control practices of the residents of Amansie Central District.



**Figure 4.4 Malaria control Practices in the District**

Source: Field Survey, 2019

#### 4.7 Test Positivity Rate (TPR) for the Amansie Central District

The total number of malaria cases confirmed medically per every 100 cases that were suspected to be malaria, was a main variable used to approximate trends in malaria incidences in the study district. The malaria test positivity rate (TPR) was used as an indicator of deaths caused by malaria because it is based on laboratory-confirmed

incidences and is easy to incorporate into existing monitoring systems. This section elaborates the trends in observed TPR using microscopy for all the sub-districts within the study area before, during and after the program period.

64,678 persons encountered for malaria diagnostic testing were recorded during duration of the research in 2012. About 42.9% of patients presented for testing were children below the age of five. The total number of people that took the test constituted 75.48%. However, in the year 2013, TPR for the all the sub-districts reduced to 24.0% with Jacobu recording the lowest at 18.43%, while Numereso recorded the highest at 43.24%. Further probe revealed that, the total TPR for the district recorded increase to 33.21% in the year 2014. Similarly, that of the sub-districts also showed an increase with the exception of Fena-Hia which showed a decrease of 3%. Contrarily, in 2015, the total TPR for the area reduced to 25.15%. For the year after the program (2016), TPR for the Amansie Central District area and all the sub-districts showed a large increase, thus the total TPR increased from 25.15% in 2015 to 58.28% in 2016. This implies that the introduction of ISP helped in the malaria control in the district.

The study revealed that, there was a strong correlation between where one resides and TPR, thus the distribution of the place one resides among people that undertook malaria tests would have to be largely varied over a period, for the possibility of confounding to be present, and this was the situation all the sub-districts. For instance, the number of people who took malaria test in Fena-Hia reduced from 39.19% in 2013 to 32.53% in 2015 which was the program period. This indicated that, more people have a high chance to suffer from decreased specificity of TDRs partly because of often infections and persistence of parasite antigens after resolution of infection. On the other hand, patients who were from the Fiakoma increased from 36.24% in

2013 to 46.64% in 2015. In addition, results compiled by towns, are presented in table 4.4. Malaria monitoring initiatives make use of the TPR to approximate and survey malaria cases should also explain temporal changes in TPR bearing in mind these results. While the TPR continues to be a preferred means of measuring given that it depends on laboratory-confirmed results and ease of ascertainment, it might be an old reflection of changes in malaria cases.

**Table 4.5 TPR for the Sub-Districts**

YEAR	Sub District	TPR (%)
2012		75.48
2013	Fena-Hia	39.19
	Fiankoma	36.24
	Jakobu	18.43
	Numereso	43.24
	Tweapease	40.12
	Total	24.00
2014	Fena-Hia	35.53
	Fiankoma	39.64
	Jakobu	29.42
	Numereso	47.33
	Tweapease	47.48
	Total	33.21
2015	Fena-Hia	32.43
	Fiankoma	46.64
	Jakobu	17.77
	Numereso	40.70
	Tweapease	36.90
	Total	25.15
2016	Fena-Hia	77.65
	Fiankoma	81.37
	Jakobu	42.64
	Numereso	81.82
	Tweapease	67.87
	Total	58.28

Source: Field Survey, 2019

#### 4.8 The Impact of Operators Education on IRS Acceptability

Ascertaining whether the education on IRS acceptability have had impact on various sub districts, the study established the relationship between the percentages of people who know about IRS and its effects and those who do not. As shown in table 4.6, the study identified that 71.5% of the respondents were educated on the impacts of the compound. Additionally, 290 people representing 68% of the respondent who were educated of the effects of the chemicals accepted the IRS. The research however revealed that 15 (4%) of the respondent rejected the IRS.

Those who were interviewed were also assessed on the knowledge they have concerning what roles they were also to perform before, during, and after IRS and it was identified that, seventy two percent of household heads were given some information on the spraying by the spraying officials and 28% of the household heads had no knowledge of it. Further analysis indicated that out of the two hundred and eighty nine people who were educated on IRS, sixty nine percent were satisfied and were in favor of the IRS, whereas three percent did not engage in the exercise. More than half of the household heads who were not educated on the indoor residual spraying did not agree for their structures to be coated with the insecticide. The outcome of this survey proves that there is a direct relationship between educating the people on the exercise and their acceptance of IRS.

**Table 4.6 Education/Sensitization Level of the Programme and Its Effects on the Community Acceptability**

Was IRS accepted by the people				
Variables	Response	No (%)	Yes	Total
<b>Effects known</b>	Yes	67.8	3.7	17.7
	No	14.5	71.5	28.5
	Total	82.3	14.0	100
<b>Sensitize about dos and don'ts</b>	Yes	69.0	3.3	72.3
	No	13.3	14.5	27.8
	Total	82.3	17.7	10

Source: Field Survey, 2019

Table 4.6 indicates the level of education of IRS and the effects on the community acceptability. It can be realized that, 67.8% of the respondents were educated on the effects of the program. 69% was also made known of the dos and don'ts of the program. There reveals that, majority of the beneficiaries were sensitized on the program, which increased their acceptability of the program. This section elaborates the processes employed by the operators in the implementation of the program. Ensuring that IRS is accepted by the beneficiary communities, and also to contribute to attaining an increased coverage, public sensitization and community involvement were undertaken particularly in informing the residents of the settlements about the exercise. This was done to ensure the success of the entire process. The research proved that 48.3 percent of household heads got their information from radio whiles 17.3 percent came to know about indoor residual spraying by the public announcement. The role of the traditional means of information (gong-gong beaters) cannot be downplayed because a greater percentage of the people got to know about IRS through the gong-gong beaters.



Again, the research found that the acceptance of IRS by the community largely depends on the extent of public education carried out. This finding agrees with the world health organization's report in 2013 that stated the beneficiary's knowledge and acceptance of the initiative are very crucial to the effectiveness or success of the indoor residual spraying program and that the community should be pre informed of the exercise and educated on its benefits.

The study again revealed that 71.5% of the respondents sensitized on the impacts of the compound. It was realized that out of the total number of people that were pre informed of the program and educated on its benefits sixty eight percent were in favor of the exercise while fifteen percent rejected the indoor residual spraying. These reveals that the two elements which is the sensitization on the effects of insecticide spraying and public acceptance cannot be independent.

#### **4.9 Community Members Perceived Efficacy of the IRS Program**

According to USAID (2016), the perception of beneficiaries about a program helps ensure smooth implementation of the program. The perception of the beneficiaries about the ability of the program to achieve the intended objectives was assessed and presented in table 4.7. It was revealed that, 80% of the household heads agreed that the compounds used for the spraying did not only kill mosquitoes but other insects as well. However, nineteen percent of those interviewed had doubts about the effectiveness of the chemical and thus 13.8% of those interviewed in this bracket did not accept the spraying. Also, a probe indicated that 81.5% of the respondents agreed that the indoor residual spraying has been able to cause a decline in the number of mosquitoes and other insects.

The views of the respondents concerning the impacts of the compound used in the exercise and the possibility that it could cause a decline in the number of malaria cases was assessed. It was realized that, 82% of the respondents are of the view that the indoor residual spraying intervention has succeeded in causing a decline in the number of malaria incidences in their family and community as a whole. The statistic below are a proof to support the respondent's views on the effectiveness of the sprayed compound and plays a major role on the extent to which the general public accepts the indoor residual spraying. Result from the study conforms to that of Munguambe *et al.* (2011) in Manica district, which indicates that, the indoor residual spraying for the control of the disease and the elimination of mosquitoes are not fully accepted by the beneficiary and that the efficacy of the measures against malaria such as insecticide treated nets are preferred over indoor residual spraying.

**Table 4.7 Respondents Notion about the Efficacy of the Chemical**

<b>CHEMICAL Indoor Residual Spraying acceptance by household heads</b>						
<b>Variable</b>	<b>Response</b>	<b>No N (%)</b>	<b>Yes N (%)</b>	<b>Total N (%)</b>	<b>Chi-square (X<sup>2</sup>)</b>	<b>P-value</b>
<b>Does chemical kill insects</b>	<b>No</b>	55 (13.8)	22 (5.5)	77 (19.3)	188.198	0.0001
	<b>Yes</b>	16 (4.0)	307 (76.8)	323 (80.8)		
<b>Does Spraying cause a decline in the number of mosquito bites</b>	<b>No</b>	61 (15.3)	13 (3.3)	74 (18.5)	260.303	0.0012
	<b>Yes</b>	10 (2.5)	316 (79)	326 (81.5)		
<b>Spraying decrease malaria incidences in the family</b>	<b>No</b>	64 (16.0)	9 (2.3)	73 (18.3)	299.033	0.0000
	<b>Yes</b>	7 (1.8)	320 (80.0)	327 (81.8)		

Source: Field Survey, 2019

#### 4.10 Participation of Community members in the IRS Program

Support and sensitization of beneficiaries of the program are important elements that have effects of the level of success of the intervention. To make sure that indoor residual spraying is accepted by the people and result in a scaling up of the project, public education campaigns and sensitization should be undertaken (World Health Organization, 2013).

The study revealed that the beneficiary communities do not have up close communications with the indoor residual spraying staff. They only meet the IRS officials at meetings directly organized by the community leaders and authorities. Community members are usually considered as the beneficiaries of the intervention and do not exercise any authority or rights with the exception of their rights to accept or decline the spraying of their houses. Residents just adhere to what their opinion leaders, chiefs and assembly men tell them to do as well as complying with the officials of the IRS.

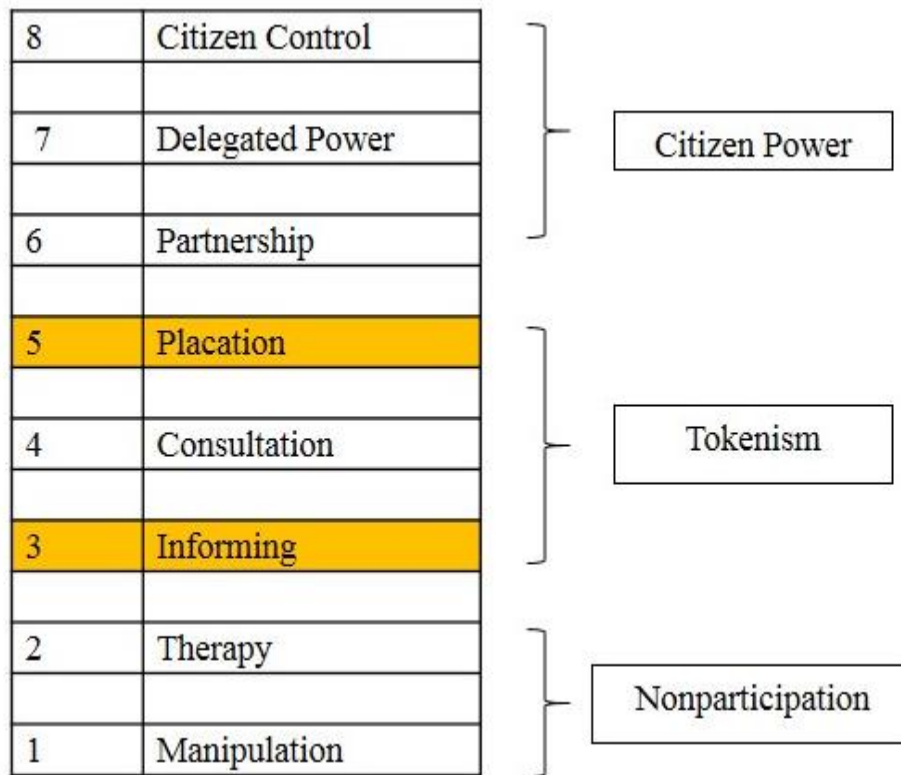
In furtherance, a probe revealed that 93% of the respondent participated through self-mobilization (provided labor and funds), 1% also participated by providing essential information to the operators of the program. However, 6% participated by both information giving and self-mobilization. Under self-mobilization, the respondent contributed by weeding along the road for the main lines and digging holes for the erection of the poles. Others also contributed cash and electric poles as shown in presented in Table 4.8.

**Table 4.8 Types of Participation by Household Members**

Form of Participation	Percentage
Self-Mobilization	93.0
Information Giving	1.0
Both	6.0

Source: Field Survey, 2019

Sherry Arnstein’s level of participation was used to determine the depth of participation of the community members. The study revealed that, the extent of participation of the beneficiary communities was informing and placation as indicated in Figure 5.1 by the color “yellow”. Thus before the spraying began in every community, the operators met with the community members and inform them their roles. However, flow of information was done in one direction, from the contractors to the community members. The flow of information as done through the community members. The community leaders were involved through placation. Table 5.2 indicates that 1.0% of the people (community) contributed through information giving during meetings with the operators. They were made to form committees in order to provide relevant information to the contractors. However the analysis indicates that the beneficiary communities do not have much power in terms of participation.



**Figure 4.5 Level of Participation of Beneficiary Communities**

Source: Field Survey, 2019

As illustrated in figure 4.5, participation of communities in the program is low. Contrarily, a research conducted in Swaziland, revealed that many of the respondents expressed so much knowledge of malaria infections and its impacts. To make sure that the general public is involved in the indoor residual spraying intervention, public sensitizations are important before the initiation of the program to address the misconceptions concerning indoor residual spraying.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

#### 5.1 Introduction

This section succeeds the latter, which presented the discussions and analysis of the data. Thus, it provided an elaboration on the effects of ISP program on the incidence of malaria (Trend of malaria prevalence before, during and after ISP), Test Positivity Rate for the district and cases of malaria in children below the age of 5. To add to this, the chapter presented analysis of issues such as IRS implementation process adopted in the Amansie Central District as well as participation of community members in the IRS Program.

Following the discussions and analysis of the survey data, this chapter summarizes the major findings from the study. It subsequently provides pragmatic recommendations based on the issues identified (challenges). Finally, the chapter presents conclusion focusing on how the objectives of the study have been successfully achieved.

#### 5.2 Findings of the Study

Here, a summarization of the major findings from the study is presented. It discusses the extent to which the IRS program achieve the aim of decreasing the malaria burden taken into consideration the cases of malaria and OPD attendance and TPS/SPR recorded before, during and after the program as well as the acceptability of the program by the beneficiary communities.

### ***5.2.1 Indoor residual spraying coverage***

The study revealed that, IRS in the district was 85.7% overall coverage of household's structures surveyed within a 6-month period. The proportion of sprayed structures was highest in the rural communities (91.6%) followed by urban LSES (84.7%) and lastly urban HSES (83.3%).

The study found out that not all the communities (14.3%) selected for the program benefited. Thus the program was not implemented in those communities. Also, with those communities and household that benefitted, 80% of the households testified that the compound does not only kill mosquitoes but other insects as well. However, nineteen percent of those interviewed had doubts concerning the effectiveness of the chemical and thus 13.8% those interviewed in this bracket refused to allow their homes to be sprayed.

Also, a probe indicated that 81.5% of the respondents agreed to the fact that the indoor residual spraying was able to cause a decline in the number of mosquito bites and consequently reduced malaria transmissions.

### ***5.2.2 Effects of IRS Intervention on Malaria and OPD attendance***

With regards to the effects of the IRS on cases of malaria before, during and after the program, the study identified that, the IRS Program which sets itself to reduce malaria incidence by 50% within a three year period in the Amansie Central District has made some significant achievements. This is evident by the reductions in the cases of malaria and OPD attendance during the program period (2013 to 2015). For instance the confirmed cases of malaria in the district for the year 2013 to 2015 showed a decrease from 75% to 24%. The high community acceptability and unanimous calls

by all segments of the community for long term sustainability of the program is an indication of this achievement.

Also, IRS have had effect on TPR. Thus, TPR reduced during the program period. For instance, in the year 2012, TPR of the district was high at a rate of 75.48% however, in 2013 it reduced 24.0%. Further probe revealed that, the total TPR for the district recorded increase to 33.21% in the year 2014. Contrarily, in 2015, the total TPR for the area reduced to 25.15%. Another inference was that, the year after the program (2016), TPR for the district and all the sub-districts showed a high increase, thus the total TPR increased to 58.28%.

It was again identified that the introduction of IRS helped to reduce OPD attendance. OPD attendance was low during the program period. In 2012, the OPD attendance recorded was 92207, during the program period (2013 to 2015), OPD attendance decreased to 55290. However in 2016 which is a year after the program, OPD attendance increased from 55290 to 77529.

### ***5.2.3 Importance of IRS***

It was realized that, all stakeholders of the IRS program saw it as relevant and the most effective means of fighting malaria. Also IRS is comprehensively been implemented according to WHO standards and guidelines. The overall high IRS coverage of 85.7% as recorded in the survey of household respondents over the 80% threshold (WHO, 2006) scientifically evident for effective transmission control to reduce the related issues such ill-health and deaths is commendable.

Another inference was that, the communities fully embraced the program, which helped to attain some level of success. Thus, community members were appreciative of the gesture from AGA citing low attendance at hospitals as some indicator of



success and the need to sustain the program. Community education and communication campaigns were undertaken, particularly with regards to sharing to the general public. This was done to enhance acceptance of the program by the various communities as well as attaining a high level of coverage.

The study again revealed that, the relevance of the program motivated several stakeholders to support it. That is stakeholders such as the Amansie Central District Assembly provided backing personnel to help and facilitate meetings with community leaders and other principal community leaders such as assembly members and traditional authorities. Similarly, the Amansie Central District Health Directorate was also supportive of the program by providing personnel to support the Passive Case monitoring at the sentinel sites. These ensured smooth implementation of the program.

#### ***5.2.4 Participation of Beneficiary Communities***

Participation of community members was low. Residents of the community were last in the hierarchy structure. They were just beneficiaries of the intervention and usually had no power to make decisions except to either accept or decline the intervention. The study revealed that that 93% of the respondent participated through self-mobilization (provided labour and funds), 1% also participated by providing essential information to the operators of the program. However, 6% participated by both information giving and self-mobilization. This indicates that the beneficiary communities do not have much power in terms of participation.

### 5.3 Recommendations

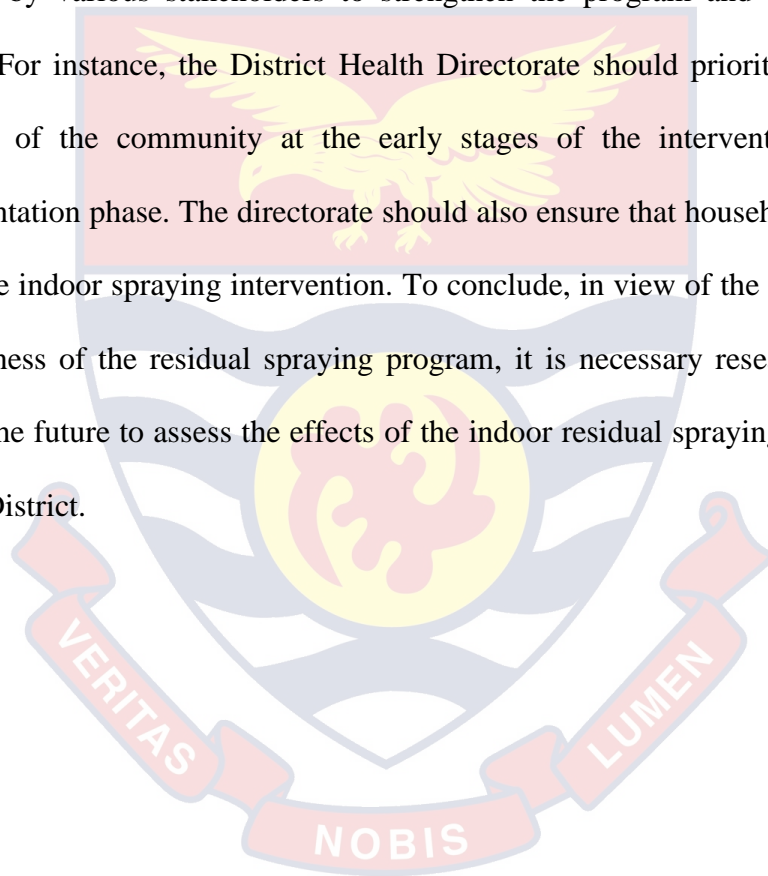
Recommendations to solve the challenges and ensure smooth implementation of IRS program in the study district is based on the findings of the study. It suggest specific strategies to IRS by the stakeholders in the process. IRS encompasses several activities and therefore should be a comprehensive and holistic approach. This section suggests strategies that will help to ensure effective implementation of the project in question. The recommendations as outlined below are a combination of both structural and non-structural measures.

- It is recommended that, the District Health Directorate should make efforts that ensure that beneficiaries of the intervention are involved in the exercise from the preliminary stages through to the end of the program and also ensure respondents cooperation and support of the indoor residual spraying intervention.
- There should be intensification of advocacy through information, education and communication with the involvement of health professionals to ensure continual community support and acceptability of the Indoor Residual Spraying. The District Health Directorate need to prioritize massive public education on health in the Amansie Central District to deal with all misconceptions concerning the indoor residual spraying, during health education of mothers and fathers in during their outreach program.
- The NMCP staff that take part in recruiting spraying technicians should sensitize the spraying operators to be polite and respectful to the people and also make it a point to recruit spraying operators from the district and those recruited should be people that have cordial relations with the rest of the community.

#### 5.4 Conclusion

Malaria is a prevalent sickness in several regions in Africa and hinders the development and wellbeing of community members. Even good health is considered as an important factor in development by international community such as UN. The introduction of IRS program in the District have helped in the control of malaria.

Despite the successes achieved by the program, there is the need for more actions to be taken by various stakeholders to strengthen the program and the fight against malaria. For instance, the District Health Directorate should prioritize involving all members of the community at the early stages of the intervention through the implementation phase. The directorate should also ensure that households support and accept the indoor spraying intervention. To conclude, in view of the perception of the effectiveness of the residual spraying program, it is necessary research that will be done in the future to assess the effects of the indoor residual spraying in the Amansie Central District.



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## APPENDICES

