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PERCEPTIONS ABOUT INDOOR RESIDUAL SPRAYING FOR MALARIA PREVENTION IN THE SAVELUGU-NANTON DISTRICT, NORTHERN REGION, GHANA

BY

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DECLARATION

I, Prosper Nyaaba Azure, hereby declare that this piece of work is as a result of my own research except for the references to other people's research for which I have duly acknowledged.

I declare that not in part or whole has this work been presented elsewhere for the award of master's degree.

…… ……

(PROSPER NYAABA AZURE) **DATE**

(STUDENT)

…… ……

DR. COLLINS AHORLU **DATE**

(ACADEMIC SUPERVISOR)

DEDICATION

This piece of work is dedicated to my God Almighty for giving me the opportunity and all it took for me to successfully complete this programme. I equally dedicate this work to my mother, Madam Felicia Apeere.

ACKNOWLEDGEMENT

First and foremost I want to acknowledge the Almighty God for giving me the strength to put this piece together. To him is glory forever.

I also want to acknowledge the invaluable contribution of my academic supervisor, Dr. Collins Ahorlu to this work. I am exceedingly grateful to him for his patience, tolerance and mentorship throughout the course of producing this piece. May the good Lord continue to give him the strength to carry on with future endeavours.

I equally express my gratitude to the head of department and his team for their kindness and support which made this work a reality.

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ABSTRACT

Background: Malaria is the number one cause of morbidity in Ghana, accounting for about 38% of all outpatient illnesses, 35% of all admissions and about 34% of all deaths in children. The World Health Organisation (WHO) recommends the spraying of at least 80% (ideally 100%) of houses, structures as well as units in target areas in any round of Indoor Residual Spraying. The Ministry of health intends to achieve at least 90% coverage in one third of the districts in Ghana by 2015. Indoor Residual Spraying (IRS) requires high spraying coverage and acceptance rate by households, to be effective. Local perceptions about IRS influence its acceptability, hence coverage.

Objective: The objective of the study was to assess IRS related perceptions as a vector control strategy and its acceptability in the Savelugu-Nanton District.

Methods: The study was a descriptive cross-sectional study that employed the mixed methods. A structured questionnaire was used in gathering quantitative data from 335 randomly selected household heads in a total of six communities. Qualitative data were collected through Focus Group Discussions. A total of four focus group discussions were held in four different communities.

Analyses of quantitative data were done using excel 2010 and stata/SE 13 soft-ware. Tables and charts were generated and used to describe demographic data. Chi-square test was performed and used to describe the relationship between independent and dependent variables. Qualitative data were translated into English language and manually transcribed and coding of themes was done using Nvivo software. Thematic analysis was finally used to analyse qualitative data.

Results: The majority (94.0%) of respondents indicated that malaria is caused by mosquito bites with only a few mentioning dirt and bites from bedbugs as the cause of malaria. About 99.4% of respondents have had their households sprayed at least once with the majority (86.5%) mentioning the killing of insects as a benefit of IRS. Only 29.0% mentioned reduction in malaria incidence as a benefit of the programme.

Mentioning reduction in the incidence of malaria as a benefit was positively associated with being 50 years old or younger (OR= 2.8, 95% CI= 1.36-5.74and P>0.004). Among respondents and participants whose households have never been sprayed, refusals as well as absence of household heads during spraying were reasons that accounted for non-

participation. Over 99.0% of respondents indicated that they will participate in future spraying exercises while 92.5% of them were considered knowledgeable about practices that can affect the functioning of the intervention. Varied types of malaria control strategies were reported and prominent among them was the use of bed net, 85.3%, (273).

Conclusions: The study revealed that respondents as well as participants demonstrated a better understanding of the causes of malaria and the control strategies available. Indoor residual spraying was generally perceived to be beneficial. However associated benefits of IRS differed among respondents and study participants. Majority of respondents indicated that their households will continue to participate in spraying activities.

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ACT	Artemisinine-based Combination Therapy
AIDS	Acquired Immune Deficiency Syndrom
AIRS	Africa Indoor Residual Spraying
DA	District Assembly
DOT	Directly Observed Therapy
FGD	Focus Group Discussion
FY	For Year
GHS	Ghana Health Service
GNMCSP	Ghana National Malaria Control Strategic Plan
GSS	Ghana Statistical Service
HIV	Human Immune Virus
ITN	Insecticide-Treated Net
IPT	Intermittent Preventive Treatment
IRS	Indoor Residual Spraying
JSS	Junior High School
LLIN	Long Lasting Insecticide-treated Net
MICS	Multiple Indicator Cluster Survey
MSLC	Middle School Leaving Certificate
NMCP	National Malaria Control Programme
PMI	President's Malaria Initiative
RDT	Rapid Diagnostic Test
RBM	Roll Back Malaria
SNDA	Savelugu-Nanton District Assembly
WHO	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1 Background

Globally, an estimated 3.2 billion people are at risk of malaria infection with 1.2 billion people being at high risk. The burden of malaria is heaviest in Africa where 90% of all malaria deaths occur with malaria related mortality in children under five years accounting for 78% of all deaths (World Malaria Report, 2014).

Malaria is endemic and perennial in all parts of Ghana with seasonal variations that are more pronounced in the northern parts of the country. The entire population of Ghana is at risk of malaria infection with pregnant women and children below five years being at higher risk of severe illness (MICS 2011, Ghana Malaria Operational Plan, 2015). It is the number one cause of morbidity in Ghana, accounting for about 38% of all outpatient illnesses, 35% of all admissions and about 34% of all deaths in children under five years. Between 3.1 and 3.5 million cases of clinical malaria are reported annually in public health facilities in Ghana, out of which 900,000 cases are in children under age five. Malaria is also reported to be a significant cause of adult morbidity and a leading cause of work-days loss due to illnesses (NMCP 2010 Annual Report).

In the year 2000, Ghana adopted the Roll Back Malaria Strategy and also signed the Abuja Declaration to halve the burden of malaria through the distribution of insecticide-treated nets, indoor residual spraying, rapid diagnostic test as well as prompt and effective treatment with artemisinin-based combination therapy (Multiple Indicator Cluster Survey Report, 2011). In 2005, the President's Malaria Initiative (PMI) was launched by the President of the United States of America and by 2007, Ghana became a PMI country. This initiative sought to reduce malaria-related mortality in 15 high-burden sub-Saharan African countries by 70% by the year 2015 through the scaling up of all malaria control interventions (Ghana Malaria

Operational Plan FY 2014). Ghana's own national malaria strategy continues to scale-up proven malaria control interventions with a goal of reducing malaria related mortality by 75% by the year 2015 using 2006 as the baseline (Ghana Malaria Operational Plan FY 2014).

Indoor Residual Spraying, (IRS) involves the spraying of the interior walls of dwellings with insecticides that have long-lasting effects on mosquitos. As a vector control strategy, it aims primarily at reducing man vector contact in targeted areas. IRS operations in Ghana were started in Obuasi in 2005 by Anglo Gold Ashanti mining company. This was followed by operations in nine districts in the Northern region by the President's Malaria Initiative which was later scaled up to 45 districts within the northern savannah malaria epidemiologic zone through the support of Global Fund (Multiple Indicator Cluster Survey, 2011). Due to cost constraints, IRS has been targeted in geographic areas where seasonal variations in transmissions are more pronounced making it yield its greatest impact (Ghana National Malaria Control Strategic Plan 2008-2015). The target of Ghana's National Malaria Control Strategic Plan is to ensure 90% coverage of households in targeted districts and a third of the total number of districts in the country by 2015 (GNMCSP, 2008-2015).

According to Ingabire et al. (2015), Long-lasting insecticidal nets (LLIN), IRS and malaria case treatments with ACT have proven to significantly reduce malaria but may not necessarily lead to complete elimination of the malaria disease. The availability of public health interventions is not in itself enough to ensure optimum use. Community acceptance of available interventions for malaria remains one of the key parameters in the elimination of malaria (Greenwood, 2008).

It was therefore the desire of this study to explore IRS related perceptions among the people of Savelugu-Nanton District and to assess the level of acceptability of IRS as a public health intervention in the district.

1.2 Problem statement

The President's Malaria Initiative which is a core component of the Global Health Initiative aims at reducing malaria related mortality in 15 malaria endemic countries by 70 percent by the end of 2015 (Ghana Malaria Operational Plan FY 2014). Ghana, which is one of the 15 countries has developed a National Malaria Control Strategy which aims at contributing to the reduction of malaria burden. Among other interventions such as the distribution of insecticide-treated nets and prompt diagnosis and treatment of malaria among pregnant women with effective medicines, is indoor residual spraying. The aim of this strategy is to reduce man-vector contact during peak seasons of malaria transmission in areas where transmissions have seasonal variations by ensuring 90% coverage of IRS in targeted districts.

However, according to the 2014 semi –annual report of the Africa IRS Project, Ghana was the only country that recorded IRS coverage below the PMI minimum acceptable target of 90% coverage for targeted countries (83.8% against PMI minimum coverage of 90%). The 2015 Ghana End of Spray Report states that 33.2% of unsprayed structures in targeted districts are attributable to refusal of households to allow for their structures to be sprayed (Ghana End of Spray Report, 2015). These refusals among other factors could frustrate the efforts being made towards achieving the desired goal of the President's Malaria Initiative; which is to achieve and sustain 90% coverage in targeted districts.

The Savelugu-Nanton District is one of the targeted districts in northern savannah epidemiologic zone that has benefited from the Africa IRS project. However in 2014, the district recorded the lowest coverage i.e. 68% coverage compared to the national coverage of 83.8%. Refusal of households to have their structures sprayed was one of the major reasons associated with low coverage in the district (AIRS semi-annual report, April-Sept, 2014). Subsequently, in 2015 the Savelugu-Nanton District was excluded from the list of targeted districts to be sprayed (Ghana End of Spray report, 2015). This could pose a major drawback

towards achieving the desired goal of the President's Malaria Initiative which is to ensure and maintain 90% coverage in targeted districts while scaling up IRS activities to cover many more districts.

In order to achieve high levels of acceptability among community members, IRS strategies often include public education components that aim at demystifying ill perceptions as well as sensitizing beneficiary communities on behaviours and attitudes that promote the effectiveness of IRS. This study therefore sought to describe IRS- related perceptions and its acceptability among the people of Savelugu-Nanton District.

1.3 Research questions

1. What is the level of knowledge about how malaria is transmitted?
2. What are the perceived benefits of the IRS strategy by community members?
3. What is the level of awareness about practices that affect the effectiveness of IRS after spraying
4. What is the level of acceptance of the IRS strategy among community members?

1.4 Objectives

1.4.1 General objective

The general objective was to assess IRS related perceptions as a malaria control strategy and its acceptability in the study area.

1.4.2 Specifically, the study sought to:

1. Assess the level of knowledge about malaria transmission
2. Explore the perceived benefits of IRS among community members
3. Measure the level of acceptance of IRS
4. Assess community knowledge of practices that affect the effectiveness of IRS after spraying

1.5 Variables

1.5.1 Independent variables

1. Age of respondent
2. Sex of respondent
3. Educational level of respondent
4. Occupation of respondent
5. Marital status of respondent
6. Religion of respondent
7. Experience with IRS

1.5.2 Dependent variables

1. Knowledge of malaria transmission
2. Perceived benefits of IRS
3. Knowledge of potency duration of insecticides used for IRS
4. Participation in future IRS programmes
5. Awareness of community practices that affect the effectiveness of IRS
6. Level of satisfaction with IRS as an intervention
7. Level of comfort with IRS implementation processes and procedures

1.6 Conceptual framework of the study

Below is a conceptual framework of factors and how they influence IRS related perceptions and acceptability.

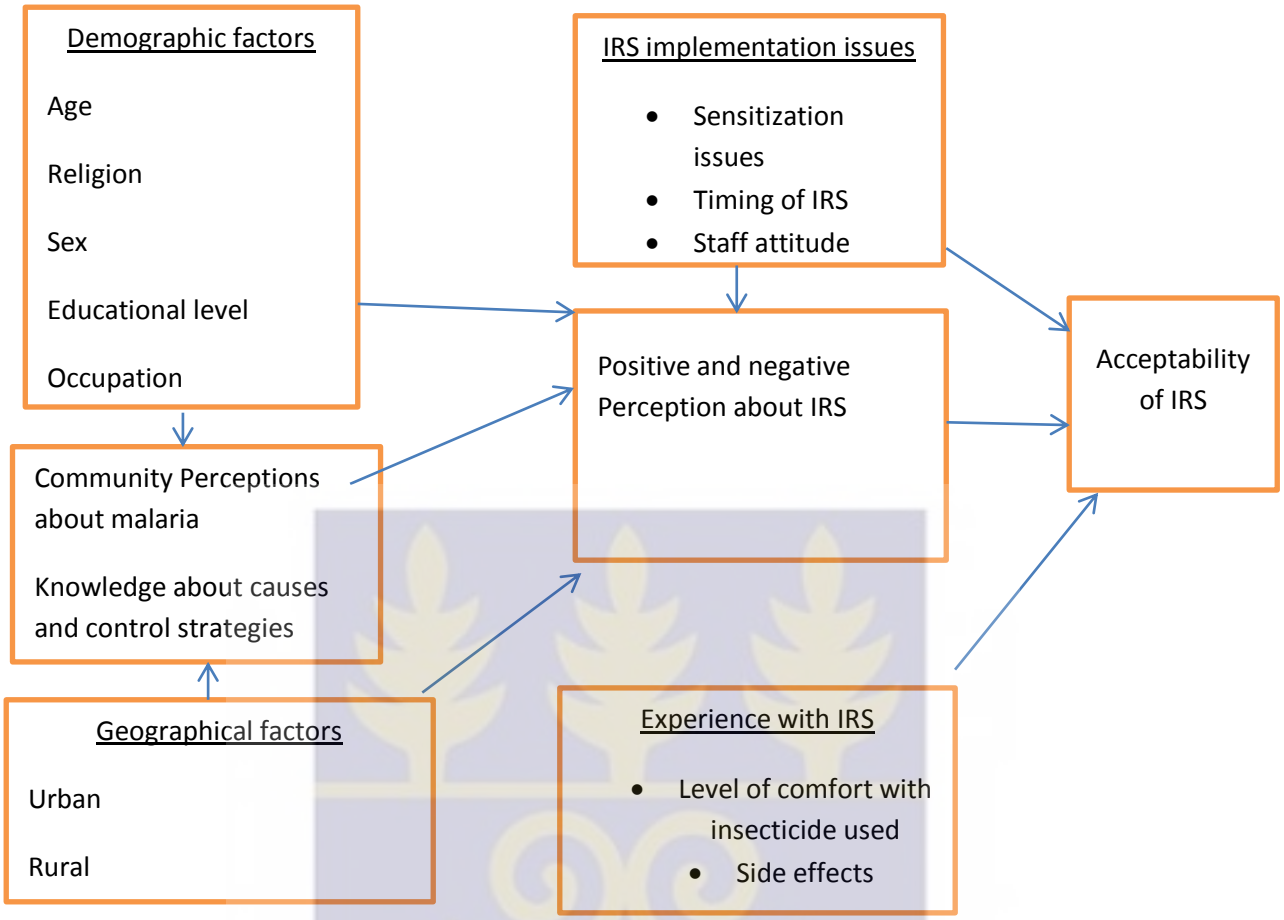

Figure 1: Conceptual framework **Source: (Ediau et al. 2013)**

Perceptions and misperceptions about the benefits and risks associated with IRS, the ability of the insecticide to reduce mosquito densities, residual effect of the chemical, the health consequences of having one's household sprayed as well as the intended purpose of mass spraying exercises are influenced by several factors. These factors include; demographic, geographical and social as well as implementation issues.

Demographic factors such as age, sex, religion, occupation and educational level of household heads influence their perceptions regarding the severity of malaria and their susceptibility to it which can ultimately affect their perceptions about the functions and benefits of IRS as a malaria vector control intervention. A study conducted on community knowledge and perceptions about indoor residual spraying for malaria prevention in the

Soroti District of Uganda (Ediau et al. 2013), showed that older respondents, those with higher education as well as those who were knowledgeable about IRS had a positive perception about the intervention. Religious belief systems can also result in negative or positive perceptions about the IRS intervention. Montgomery et al. (2010) in their study reported partial acceptance of IRS among traditional healers' households where it was believed the insecticide could negatively affect the performance of traditional rituals.

An individual's experience with the insecticide can also affect his or her perceptions and acceptance of the IRS intervention. Positive experience with the chemical used, its potency duration and efficacy as well as the spraying season may result in positive perceptions which may lead to high levels of acceptance. A study by Ingabire et al. (2015) indicated that strong repugnant smell associated with IRS was a deterrent to its usage. Similarly, the level of comfort with spraying procedures such as the movement of household belongings, intrusion of privacy by sprayers etc. could influence their perceptions about the programme which could subsequently affect their adherence to it, Ingabire et al. (2015).

Dwelling status can also influence people's perceptions regarding IRS as a vector control intervention and subsequently influence the level of acceptability of the strategy. IRS related perceptions among urban dwellers may differ from those of rural dwellers and this could affect acceptability.

Similarly, community beliefs about the causes of malaria and the mode of transmission can have an influence on community perceptions about the ability of the IRS programme to impede transmission route.

Lastly IRS implementation issues can influence the acceptability of the strategy. Weak communication systems could lead to scepticism and suspicion around the entire strategy. According to Munguambe et al. (2011), implementation lapses such as short or no

notification of spraying schedules result in unpreparedness of households to allow sprayers into their houses. Sources of information about IRS may affect acceptance. Staff attitude towards community members can also have an influence on acceptability.

CHAPTER TWO

LITERATURE REVIEW

2.1 Global burden of malaria

Globally, an estimated 3.2 billion people are at risk of malaria infection with 1.2 billion people being at high risk. Malaria affects everyone but those most at risk include children under five years of age, pregnant women, people living in emergency situations and those living with HIV/AIDS. The burden of malaria is heaviest in Africa where 90% of all malaria deaths occur with malaria related mortality in children under five years accounting for 78% of all deaths (World Malaria Report, 2014).

Malaria has been linked to poverty. According to Gallup and Sachs (2001), the areas of Africa that are malaria free are also the richest and India which has the greatest number of poor people in the world also has high malaria burden. Estimated mortality rates from malaria are highest in countries with higher proportions of their population living in poverty (World Malaria report, 2012).

Malaria is endemic and perennial in all parts of Ghana with seasonal variations that are more pronounced in the northern parts of the country. The entire population of Ghana is at the risk of malaria infection with pregnant women and children below five years being at higher risk of severe illness (MICS 2011, Ghana Malaria Operational Plan, 2015).

It is the number one cause of morbidity in Ghana, accounting for about 38% of all outpatient illnesses, 35% of all admissions and about 34% of all deaths in children under five years. Between 3.1 and 3.5 million cases of clinical malaria are reported annually in public health facilities in Ghana, out of which 900,000 cases are in children under age five. Malaria is also reported to be a significant cause of adult morbidity and a leading cause of workdays loss due illnesses (NMCP 2010 Annual Report).

2.2 Malaria transmission

Malaria is a life-threatening disease caused by plasmodium parasites that are transmitted to people through the bites of infected female Anopheles mosquitos usually referred to as malaria vectors. With over 400 species of Anopheles mosquitos, about 30 are malaria vectors of importance. Five parasite species cause malaria in humans. Two of these species- P. falciparum and P. vivax pose the greatest threat. P. falciparum is the most prevalent malaria parasite on the African continent and it is responsible for most malaria related mortalities the world over. P. vivax on the other hand, is much more widely distributed than P. falciparum and predominates in regions outside of the African region (WHO Media Centre, 2015).

Anopheles mosquitoes lay their eggs in water, which hatch into larvae, eventually emerging as adult mosquitoes. Different species of Anopheles mosquito have different preferred aquatic habitat ranging from small, shallow fresh water to murky water. Transmission is more intense in places where the mosquito lifespan is longer and where humans are the preferred biting target. The long lifespan and strong human-biting habit of the African vector species is the main reason why nearly 90% of the world's malaria cases are in Africa (WHO Media Centre, 2015)

Transmission also depends on climatic conditions that may affect the number and survival of mosquitoes, such as rainfall patterns, temperature and humidity. In many places, transmission is seasonal, with the peak during and just after the rainy season. Malaria epidemics can occur when climate and other conditions suddenly favour transmission in areas where people have little or no immunity to malaria.

Human immunity is another important factor, especially among adults in areas of moderate or intense transmission conditions. Partial immunity is developed over years of exposure, and while it never provides complete protection, it does reduce the risk that malaria infection will

cause severe disease. For this reason, most malaria deaths in Africa occur in young children, whereas in areas with less transmission and low immunity, all age groups are at risk (WHO Media Centre, 2015).

The major malaria vectors found in Ghana are Anopheles Gambiae species complex and Anopheles A. funestus with P. falciparum parasite being responsible for over 90% of all malaria infections. P. malariae and P. ovale are also prevalent in Ghana and these account for a little below 10% of malaria infections (Noguchi Memorial Institute for Medical Research unpublished report). Malaria vectors found in Ghana are indoor resting and generally bite late in the night. Outdoor biting however is common in the northern part of the country (GNMCSP, 2008-2015). Like many other parts of Africa, malaria transmissions in Ghana have seasonal variations, peaking in the rainy seasons where fresh stagnant waters are common. Intense transmissions last between 6-7 months in the northern savannah zone while lasting between 10-11 months in the forest zone (MICS, 2011).

2.3 Malaria control interventions

Over the years, various malaria control strategies have evolved to take advantage of improved control methods, increasing resource base and revised international technical standards (MICS, 2011).

The Roll Back Malaria (RBM) Strategy which was launched in 1998 sought to halve the burden of malaria in sub-Saharan Africa through the distribution of insecticide-treated nets (ITNs) to cover populations at risk, indoor residual spraying (IRS) to reduce transmission, prevention of malaria among pregnant women through IPTp as well as prompt diagnosis and treatment with effective medicine (MICS 2011). In the year 2005, the President's Malaria Initiative was launched and by 2007, sought to reduce malaria-related mortality in 15 high-

burden sub-Saharan African countries by 70% by the year 2015 through the scaling up of all malaria control interventions (PMI Ghana Malaria Operational Plan FY 2014).

In line with international malaria prevention strategies, Ghana has adopted two main approaches to preventing malaria. The first is integrated vector control which aims primarily at reducing man-vector contact through the use of Insecticide Treated Nets (ITNs) and Indoor Residual Spraying (IRS). The second preventive measure is Intermittent Preventive Treatment.

There are two types of insecticide-treated nets; a factory-treated net that does not require any further treatment or a net that has been soaked with insecticide within the past 12 months (MICS 2011). ITNs have proven to be one of the most effective malaria prevention measures as it does not only reduce malaria transmission by as much as 90% under clinical trials but also reduces the indoor vector population (Hawley et al, 2003). Sleeping under ITNs is estimated to reduce malaria mortality rates by 55% in children under five years of age in sub-Saharan Africa. However 44% of people in countries with populations at risk of malaria sleep under ITN (WHO World malaria report, 2014)

Ghana's National Malaria Control Strategic Plan 2008-2015 calls for universal coverage with insecticide-treated nets with a target of 100% household ITN ownership by 2015; 85% coverage of children under five years and pregnant women, and 80% of the general population, sleeping under ITNs by 2015. As of 2011, 51% of households owned at least one mosquito net out of which 31% slept under a mosquito net the night before the MICS Survey (MICS, 2011).

Under the Intermittent Preventive Treatment during pregnancy (IPTp) programme, pregnant women are given Sulphadoxine-Pyramethamine (SP) under Directly-Observed Therapy (DOT) by health personal two or more times in scheduled antenatal visits. This programme

has proven to be effective in reducing maternal anaemia, low birth weight as well as perinatal mortality (WHO World malaria report 2014).

In 2010 a total of 576142 (67.1%) pregnant women received IPT1, 469,473 (49.52%) received IPT2, whilst 368,960 (38.92%) received IPT3 (GNMCP 2010 Annual report)

2.4 Home-based management of malaria

Home-based management of malaria is a case management strategy which involves presumptively treating febrile children in high transmission areas with anti-malarial drugs distributed by Community-Based Agents (Hopkins et al, 2007). A study in Democratic Republic of Congo revealed that Home-based Management of Malaria led to a two-fold reduction in the mean malaria prevalence and incidence and a five-fold in parasitological indices, (Ibid)

In Ghana, as a strategy that reduces child mortality and also improves on the general health of children, the concept of home management has been broadened to include management of diarrhea and acute respiratory infections and it is being implemented in phases in selected districts across the country (GNMCP 2010 annual report).

Knowledge and Perceptions about malaria: causes and control strategies

According to Laar et al. (2013) community knowledge, perceptions and practices relating to malaria causation, transmission, prevention and control are important considerations in designing and improving malaria control activities as they provide the epidemiological and behavioural baselines for monitoring interventions. Additionally, risk perceptions regarding malaria is also another key determinant of adherence to malaria prevention practices and control (Atkinsin et al, 2013). A study by Ingabire et al. (2015) which indicated that; although malaria was generally considered a serious health problem there were variations in the degree

of severity which informed varied levels of attention and treatment among community members.

As indicated earlier about the role perceptions relating to malaria causation plays in adherence to interventions, Laar et al (2013) in their study observed that although mosquito bites was wildly reported as the main cause of malaria some respondents associated malaria causation to other factors such as heat from the sun, eating of oily foods, and genetic inheritance as well as eating of sugary foods.

Similarly, a study that was conducted in Northwest Tanzania reported that the majority of respondents indicated that bites from mosquitos were the main cause of malaria. However, a few respondents reported other causes of malaria including germs and dirt (Mazigo et al, 2010).

2.5 Indoor Residual Spraying

As defined by Montgomery et al, (2010), IRS is one of the primary vector control interventions for reducing malaria transmission whereby long-acting chemical insecticides are sprayed on the walls and roofs of all structures in a determined area to kill the mosquitoes that land and rest there. The World Health Organisation (WHO) recommends the spraying of at least 80% (ideally 100%) of houses, structures as well as units in the target area in any round of spraying. The insecticide to be used in areas where IRS is the main form of vector control, should be rotated annually to preserve the effectiveness of current compounds. IRS as a vector control has been adopted as policy for the control of malaria in 90 countries worldwide, including 42 of 45 malaria-endemic countries in the WHO African Region (WHO World Malaria Report, 2014).

There has been a downward trend in the proportion of the populations at risk that is being protected by IRS since 2010. About 124 million people, representing 4% of the global

population at risk, were protected by IRS in 2013, decreasing from more than 5% in 2010. WHO African Region had the highest proportion of the population at risk protected by IRS. That proportion increased substantially from 2006 to 2008 and reached 11% in 2010, but it decreased during 2010–2012 and in 2013, 55 million people were protected, representing 7% of the population at risk (WHO, World Malaria Report, 2014).

2.6 Indoor Residual Spraying in Ghana

IRS was started in Ghana by AngloGold Ashanti in Obuasi District in the Ashanti region. With support from PMI and Global Fund, its operations were scaled-up to include nine districts in the northern savannah epidemiologic zone. Currently IRS is being scaled-up to cover 45 districts by 2015. However, due to cost constraints IRS operations in Ghana have targeted such areas where seasonal variations are more pronounced. These areas mostly fall under the northern most part of the country (MICS, 2011).

The NMCSP, 2008-2015 calls for a one-third coverage of all districts in Ghana by 2015 with 90% coverage of dwellings and structures in target districts. Between April, 2014 and May, 2015, a total of 553,954 persons had been protected out of which 11,676 were pregnant women and 98,525 were children under five years. The coverage for the same period was 91.7% (Ghana End of Spray Report, 2015).

2.7. Indoor residual spraying related perceptions and acceptability

According to Ingabire et al. (2015), Long-lasting insecticidal nets (LLIN), IRS and malaria case treatments with ACT have proven to significantly reduce malaria but may not necessarily lead to complete elimination of the malaria disease. The availability of public health interventions is not in itself enough to ensure optimum use. Community acceptance of available interventions for malaria remains one of the key parameters in the elimination of malaria (Greenwood, 2008).

Studies have indicated that IRS can be most effective to control malaria by applying and expanding the IRS to up to 80% of structures and dwellings in the target area (WHO, 2006, Nejati et al. 2012). The processes of IRS effectiveness requires households acceptance which is deeply associated with willingness of households to accept residual insecticides during spraying (Mazigo et al. 2010; WHO, 2013).

In order to deliver IRS effectively, several critical factors that are necessary include; community awareness and cooperation that influence the effectiveness of IRS programs; IRS acceptability by the local households, which helps in obtaining a desirable level of coverage; informing the households and making them aware about the program and its benefits (WHO, 2013).

According to Americo et al. (2006) vector control interventions like indoor residual spraying strive on community acceptability which is largely influenced by perceived benefits that community folks associate with it. A study by Sakeni et al, (2015) found out that 93% of households whose structures had been sprayed indicated that spraying was beneficial with 83.6% of respondents reporting that the most important benefit of IRS was reduction in malaria transmission whereas 64.8% associated spraying with killing of mosquitos. Another study conducted in the Soroti district in Uganda showed that although two-third of the respondents perceived IRS to be beneficial others associated negative side effects with the intervention (Ediua et al, 2013).

2.7.1 Factors influencing adherence to IRS campaigns

Available literature suggests that multiple factors influence adherence and acceptability of indoor residual spraying as a vector control intervention. According to Munguambe et al. (2011), very few households with thorough understanding of the concept, purpose and benefits of IRS willingly accept the intervention for those reasons and that most households

however accept IRS without being able to explain its purpose and associated health outcomes.

Householders' previous experience with IRS, the ability of the insecticide to kill other insects including mosquitos and the fear of punishment from health authorities as well as a reduction in the nuisance caused by mosquitos are some of the underlying reasons for adherence and acceptability of IRS (Munguambe et al. 2011). Similarly, Atkinson et al (2010) contend that adherence to malaria prevention practices "appears to be a complex interaction between risk perception, intervention acceptability, socio-cultural factors and practical issues."

2.7.2 Factors influencing non-adherence to IRS

Two types of non-adherents have been observed; those who deliberately refused the intervention and those whose structures were not sprayed due to reasons other than unwillingness to accept IRS (Munguambe et al. 2011).

The second type of non-adherents is occasioned by IRS implementation lapses such as inability of spraying officers to show up, short-notice or no-notification of the spraying schedule, resulting in unpreparedness of households to allow the sprayers into their houses on the scheduled day and the unavailability of primary or secondary decision makers who could give consent to or facilitate the spraying procedures (Munguambe et al. 2011).

Perceived ineffectiveness of IRS and misunderstanding of the mechanisms of actions of the intervention as well as perceived poisonous nature of the insecticide among other factors account for deliberate refusals by households to accept IRS. Even among some of the households that accept the intervention, there are reports of partial acceptance. This is particularly so with traditional healers' households where it was believed that the insecticide could desecrate objects employed for traditional rituals (Munguambe et al. 2011).

A study conducted by Montgomery et al. (2010) revealed that there was limited understanding of the principles underlying indoor residual spraying as a malaria control intervention as most respondents indicated that spraying will be most effective when outdoor surfaces are targeted rather than indoor surfaces.

2.7.3 Perceptions about the Efficacy and Potency duration of the Insecticide

Various studies have reported varied opinions regarding the potency of indoor residual spraying from different countries the world over. A study in Mozambique reported that the effect of spraying was limited to only one week after which mosquitos returned to the households, (Montgomery et al., 2010). Chunga et al. (2014) reported in their study that some respondents complained about the short residual effect of the chemical as in their view the chemical lasted for only one to three weeks. Similarly, another study carried out in south east Iran reported that spraying was ineffective and never reduced insect redundancies including mosquitos, (Sakeni et al., 2015).

Contrary to the above perception, other studies have reported IRS as being effective in eliminating mosquitos and insects at large. A study by Rodriguez et al. (2006) indicated that over 80% of respondents reported that indoor residual spraying was effective in eliminating mosquitos.

2.8 Satisfaction with IRS as an intervention

Varied levels of satisfaction with IRS among different communities and about different components of the intervention have been reported. A study conducted by Chunga et al. (2014) on community satisfaction with IRS for malaria control in Karonga, Northern Malawi showed that IRS satisfaction level among the people of Fundi was 66.5% while among the people of Mwahimba it was 68%. However, there were some slight differences in the sets of factors that influenced satisfaction in the two communities. While the factors that underlined

IRS satisfaction in Mwahimba included: Communication, minimal adverse effect, good spraying time, IRS service in general, convenience, spray operator courtesy and confidentiality those that underlined satisfaction in Fundi included factors such as: sprayers' courtesy, confidentiality of issues in the house and access to all households.

Similarly dissatisfaction with the programme among community folks was influenced by a myriad of factors including: community involvement, quality of service, poor chemical efficacy, inconvenience, residual effects and communication (Chunga et al, 2014).

In summary, the perceptions of a group of people about any public health intervention are informed several factors ranging from demographic to social factors. These perceptions ultimately influence the level of acceptance of those intervention.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was conducted in the Savelugu-Nanton District of the Northern Region of Ghana. The district has an estimated population of 139,283 (District Analytical Report, 2014). It is made up of six area councils that are relatively sparsely populated with Dagomba as the main ethnic group. The main economic activity in the area is farming, with less than 13% of the economically active class engaging in trade and provision of services. Islam is the dominant religion in the area beside Christianity and other religions. The district capital is Savelugu. Social amenities such as schools, hospital and clinics are available in the area.

3.2 Study Population

The study population was persons 18 years and above resident in the Savelugu-Nanton District. Opinions of heads of households in the district were used for quantitative data while qualitative data were gathered from Focus Group Discussions that were conducted with known voluntary associations. These included youth groups as well as male and female traders associations. The opinions of all persons below the age of 18 years were not included in the study.

3.3 Study Design

A cross-sectional study model that employed the mixed methods was used in the design of the study.

Structured questionnaires were used to gather socio-demographic data, data on knowledge of malaria transmission, IRS-related perceptions, and level of acceptance of IRS as well as community knowledge of practices that negatively affect the efficiency and effectiveness of IRS as an intervention. Focus Group Discussion guide was used for collecting qualitative data

on knowledge of malaria transmission, perceived benefits and side effects as well as acceptability of IRS.

3.4 Sample Size and Sampling Method

3.4.1 Sample size

A total of 335 households were covered using the proportion of households in the Savelugu-Nanton District that received IRS in the previous year i.e. 68% with confidence interval of 95% and a margin of error of 5%. Thus from the formula $s = c^2 * P(1 - P)/e^2$, where S=sample size, c=confidence interval, P=proportion and e=margin of error, 335 households were sampled for the study.

Four Focus Group Discussions were conducted with a total of forty four participants involved. FGD membership ranged from ten participants to twelve participants in a group with an average membership of eleven.

3.4.2 Sampling Method

A multistage sampling technique was employed. Communities that had previously benefitted from indoor residual spraying were used as the sample frame. Two beneficiary sub-districts were selected; one urban sub-district and the other, a rural sub-district. The lottery system was used to randomly select one urban sub-district from a total of two urban sub-districts in the district. A random number table was also used to randomly select one rural sub-district from the group of rural sub-districts in the district. The number of interviews to be conducted in each sub district was dependent on the proportion of households in that particular sub-district expressed as a percentage of the total number of households in the two selected sub-districts.

Three communities were then selected from each of the two selected sub-districts. For each sub-district, number tags were assigned to each beneficiary community in the sub-district.

These number tags were then written on pieces of paper and folded. The folded papers were put into a cup and shaken gently. These were poured onto a table and three people; one at a time, randomly picked one folded paper.

The number of households interviewed in each community was obtained by expressing the number of households in each community as a proportion of the total number of households in all three communities that will be selected in a sub-district.

In the selection of households at the community level, a list of the entire number of households for each community was obtained from the Ghana Statistical Service (GSS). The total number of households was divided by the number of households to be interviewed to get the sample interval. Using the lottery system, a random number tag selected from the interval range was used as the first household to be interviewed. Starting from the first household, the next household to be interviewed was the first household plus the sample interval. Within each selected household, the household head was then selected and interviewed after his/her h consent had voluntarily been given.

A list of available groups and associations in the selected communities were also compiled with the help of local stakeholders such as assembly members, chiefs and opinion leaders. The groups were first categorized into rural and urban, where two groups were selected from each category to obtain a total of four groups. A criterion to ensure that there was a balance in representation in terms of the sex and age compositions of the selected groups was used and this resulted in the selection of two groups for each sex groupings.

3.5. Data collection techniques and tools

3.5.1 Data collection techniques

One-on-one interviews were conducted by three research assistants using a questionnaire as a guide. Questions were read out to respondents who could read and understand the English language. For respondents who could not read and understand the English language, research assistants translated questions from the English language into the local language. Focus Group Discussions were carried out to explore people's perceptions and level of acceptability of IRS as a vector control measure. Discussions were led by a moderator with the assistance of a co-moderator in the local language. Back to back system translation was used where the moderator translated questions from the English language into the local language and retranslated from the local dialect into the English language.

3.5.2 Data collection tools

A structured questionnaire was used to collect quantitative data while FGD guide was used to collect qualitative data. A total of forty-five questions with four sub-sections were used to elicit responses on socio-demographic characteristics, knowledge of malaria transmission, IRS awareness and information, level of satisfaction and comfort with IRS as well as perceptions about IRS and its acceptability. Focus Group Discussion guide containing various thematic areas such as knowledge of malaria transmission, IRS awareness, perceived benefits and acceptability of IRS was used by moderators. An electronic recording device was then used to record discussions. Lists of communities and households were obtained from GSS and Savelugu-Nanton District Assembly (SNDA).

3.6 Quality control

Research assistants were trained for 3 days on data collection. The training covered; understanding and interpretation of data collection instruments, interviewing skills and techniques, moderation as well as note taking and electronic recording during Focus Group

Discussions. Pretesting of questionnaire and FGD guide was also carried out before real data collection commenced. Research assistants were trained on how to translate each of the questions from the English language into the local dialect (Dagbani) by a linguist with specialization in Dagbani, the main language spoken in the study area. Mock interviews and discussions were conducted during training sessions to familiarise research assistants with data collection instruments.

3.7 Data procession and analysis

Quantitative data was manually entered into excel spread sheet and then imported to stata SE 13 soft-ware. Frequency tables and charts were generated and used to descriptively summarize demographic data as well as other dependent variables. Chi-square test was performed and used to describe the relationship between independent and dependent variables and the strength of the associations among variables was measured with odds ratios. A Likert-scale was used to score respondents on their level of comfort, satisfaction level as well as their knowledge on practices that could adversely affect the functioning of the IRS programme. Based on scores obtained from a set of questions, each respondent was classified as comfortable or not comfortable, satisfied or not satisfied, knowledgeable or not knowledgeable. Mean scores on each of the variables mentioned above were also calculated and used to assess general levels of comfort, satisfaction and knowledge among respondents.

Qualitative data was translated into English language and manually transcribed using Microsoft word. The transcripts were then imported to Nvivo and coding of thematic areas was done using the same Nvivo software. Thematic analysis was performed and the findings from qualitative data were compared and contrasted with findings from quantitative data.

3.8. Ethical considerations

3.8.1 Ethical Clearance

Ethical clearance to conduct the study was obtained from the School of Public Health and the Ethical Review Committee of the Ghana Health Service.

Verbal consent was also obtained from the Savelugu- Nanton District Health Directorate as well as the District Assembly.

3.8.2 Benefits

There were no direct benefits to respondents for participating in the study. However, participation in this study may help policy implementers adopt strategies that would make IRS more effective in preventing malaria both within and outside the district. Society as a whole may benefit indirectly from the study since the outcome of the research could inform future policy direction on IRS as an intervention.

3.8.3 Risks

Participation in the study, did not in any way pose any form of risk whatsoever to respondents.

3.8.4 Confidentiality

Respondents' personal identifiable information was never discussed with anyone outside this study. Information about participants and or their households was kept private and confidential. Data from this study was reported in the aggregate.

3.8.5 Voluntary Participation

Participation was entirely voluntary and a respondent's decision to participate or not to participate did not affect him/her or any of his/her household members. Respondents who

accepted to participate in the study were still free to refuse to answer any of the questions that made them feel uncomfortable.

3.8.6 Right to Refuse or Withdraw

The right of respondents to withdraw from participating in the study at any point in time was strongly upheld. There was not any form of penalty whatsoever to participants who decided to discontinue an interview.

Informed consent was obtained from household heads and FGD participants. Informed consent forms were given to participants who could read to read through and make a decision regarding their participation or non-participation. They were also allowed to seek clarifications on clauses in the consent form that were not clear to them. Those who accepted to participate in the study were made to sign or thumbprint beneath the form to indicate their acceptance. For volunteers who could not read and understand the clauses in the consent form, a witness was present while the clauses in the consent form were read to the volunteer. Both the volunteer and the witness were made to sign or thumbprint beneath the form to indicate their acceptance. Copies of the consent form were given to the volunteer for his/her personal records.

3.8.7 Data Storage and Usage

Data from the study was stored in a cabinet and locked. Access to data was limited to only the Principal Investigator and his Supervisor. No one, other than these two persons had access to the data. The data was used solely for purposes of research and not to any other use.

3.8.8 Declaration of Conflict of Interest

The Principal Investigator, his supervisor or Research Assistants did not have any personal or financial interest in this study. Findings from the study were analysed solely on their merits.

CHAPTER FOUR

RESULTS

4.1 Socio-Demographic Characteristics of Respondents

This section presents the socio-demographic characteristics of the data. These include the age and sex distribution of respondents, marital status, level of education, occupation, dwelling status as well as religious affiliations.

A total of three-hundred and thirty five (335) respondents participated in the study, out of which 44.8% (150) lived in rural areas ,55.5% (186) of respondents were aged 40 and below. Majority, 71.6% (240) of the respondents were males while the dominant occupation, 63.6% (213) was farming. Only 4.78% (8) were either civil or public servants. About 72.2% (242) of the respondents had no formal education and an overwhelming majority, 99.1% (332) were Islamic believers.

Table 1: Socio-demographic characteristics of respondents

Variable name	Frequency	Percent
Age		
30yrs and below	81	24.18
31-40yrs	105	31.34
41-50yrs	75	22.39
51yrs and above	74	22.09
Sex		
Male	240	71.6
Female	95	28.4
Level of Education		
No Education	242	72.24
Primary	19	5.69
Junior High Sch.	27	8.06
Senior High Sch. And above	47	14.03
Occupation		
Farmers	213	63.58
Traders	59	17.61
Artisan	21	5.45
Public/Civil Servant	60	15.55
Unemployed	91	23.64
Religion		
Islam	332	99.10
Christianity	3	0.09

4.2 Respondents' knowledge and perceptions of malaria

Table 2 shows respondents' knowledge about the causes and control strategies as well as their perceptions about malaria as a health problem. Almost all (99.1%) of the respondents reported that malaria is a health problem in their households with the majority (81.6%) indicating that it is a serious health problem. These positions were supported by the following representative narrative:

> *Malaria is a very serious health problem to those of living in this community. This year they did not spray our community which has resulted in an increase in the*

number of malaria cases at the hospital. When you visit the hospital now, you will see that the place is crowded with children suffering from malaria [42 years old female trader, FGD].

In respect of respondents' knowledge about the causes of malaria, majority (94.0%) indicated that malaria is caused by mosquito bites. Figure 1 below shows reported causes of malaria by respondents.

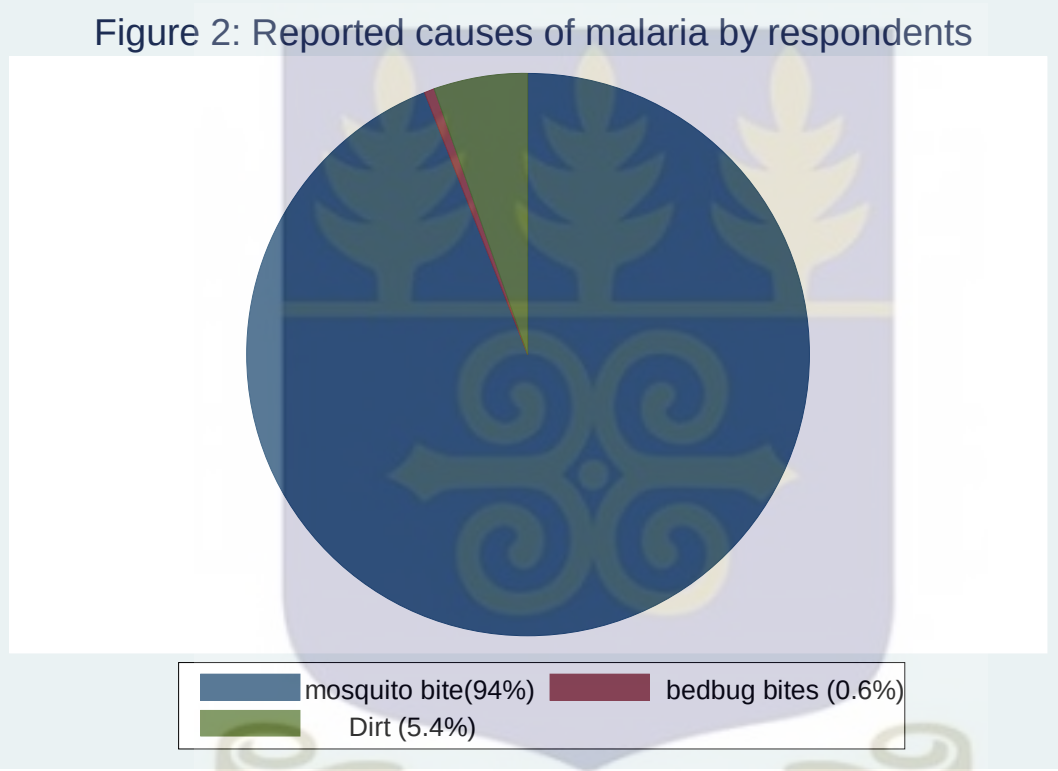

Figure 2: Reported causes of malaria by respondents

This position was also supported by qualitative findings as represented in the narrative below:

Mosquitos and dirty water are the main causes of malaria. Stagnant water breeds mosquitos which then bite us at night while we are asleep infecting us with malaria [50 years old housewife, FGD].

A composite variable on knowledge, derived from reported causes of malaria as indicated by respondents showed that 94.03% (314) were correct about the causes. Respondents who mentioned mosquito bites were therefore considered knowledgeable on causes of malaria. Those who mentioned dirt and bedbug bites were considered as not knowledgeable on the causes of malaria. Reported knowledge of malaria control strategies include: the use of bed nets (77.3%, 259/335), indoor residual spraying (63.6%, 213/335), the use of mosquito sprays or coils (28.4%, 95/335) and proper hygiene (20.3%, 68/335).The qualitative narrative below supported these positions.

> *Malaria can be controlled through the use of ITN$_S$ especially among farmers. The reason is because the farmers sometimes pass some nights in their farms which are very far from residential areas* [32 years old male public servant, FGD].
>
> *If we indeed want to control malaria, then we must continue to have our homes sprayed through the IRS programme* [29 years old male mason, FGD].
>
> *I think Zoom Lion (a waste management company) has an important role to play by ensuring that we have clean environment. Another way of controlling malaria is the use of mosquito coil to repel mosquitos* [48 years old trader, FGD].

Table 2: Respondents' Perceptions and Knowledge about causes and malaria control strategies

Variable Name	Frequency	Percent
Malaria as a health problem		
Yes	332	99.10
No	3	0.90
Severity of malaria		
Very serious	171	51.51
Serious	100	30.12
Somewhat serious	47	14.16
Not serious	14	4.22
Knowledge on causes of malaria		
Mosquito bites	314	94.03
Bedbugs bites	2	0.60
Dirt	18	5.37
Composite knowledge		
Knowledgeable	315	94.03
Not knowledgeable	20	5.97
Knowledge on Malaria control strategies (multiple responses)	N=335	
ITNs	259	77.31
Mosquito sprays/coils	95	28.4
IRS	213	63.9
Proper hygiene	68	79.7

4.3 Indoor Residual Spraying Awareness and Information

All of the respondents were aware of IRS activities in their respective communities with the majority, 99.4%, (333) reporting that their households have been sprayed at least once. Those whose houses were not sprayed cited the absence of the household head during spraying and harmfulness of the insecticide as the reasons for non-participation. During group discussions, various reasons were given for the refusal by some households not to spray their rooms as presented in the following narratives;

> *Yes. I did not allow them to spray my room during the second round of spraying. I refused because the chemical discoloured the walls of my room when they sprayed it the first time. One other reason why I refused was because I had a difficulty in packing my household items outside for them to spray* [36 years old farmer, FGD]

> *I did not allow them to spray because I do not like the scent of the insecticide used for spraying* [39 years old mason, FGD].

Some participants also mentioned that some household heads refused because of other reasons that were not connected to spraying.

> *Others refused because they think that the real intention of the exercise is to search for weapons in their rooms and not just the spraying as is purported* [38 years old farmer, FGD].

> *Other household refuse because they have 'juju` in their rooms and so are not comfortable allowing non householders into the bedrooms* [35 years old tailor, FGD].

Even though, all the respondents reported having received information about IRS prior to actual spraying, there were varied reports of the kind of information they received. More than

half,79.9%,(267/334) reported having received information about spraying dates prior to actual spraying. These positions were supported by the following narratives:

> *Before spraying, public announcements are made using the information vans to inform us of the date of spraying while urging people not to leave their homes on the said date but rather stay at home and pack their belongings in order for the spraying team to carry out the spraying exercise* [56 years old female trader, FGD].

> *Sometimes, the information is given in the afternoon of the day preceding the day of spraying. We often watch video documentaries on the causes of malaria, how it is transmitted, and the dangers associated with it as well as the benefits of spraying* [31 years old male farmer, FGD]

Table 3: Respondents' awareness of IRS and type of information received by respondents before spraying

Variable name	Frequency	Percent
IRS awareness	N=335	
Yes	335	100
No	0	
Has household ever been sprayed	N=335	
Yes	333	99.40
No	2	0.60
Number of times household been sprayed	N=333	
Once	47	14.11
Twice	78	23.42
Thrice	125	37.54
More than thrice	73	21.92
Don't know	10	3.00
Kind of information given to household (multiple responses)	N=333	
Spraying date	267	79.9
Benefits of IRS	92	72.5
Role of householders	167	50.0
Post IRS practices	32	9.5

4.4 Perceptions about Indoor Residual Spraying

4.4.1 Perceived Benefits

Regarding the perceived benefits of IRS, all the respondents reported that it is beneficial to their households. Most of the respondents mentioned the killing of mosquitos, 85.6%,(285).

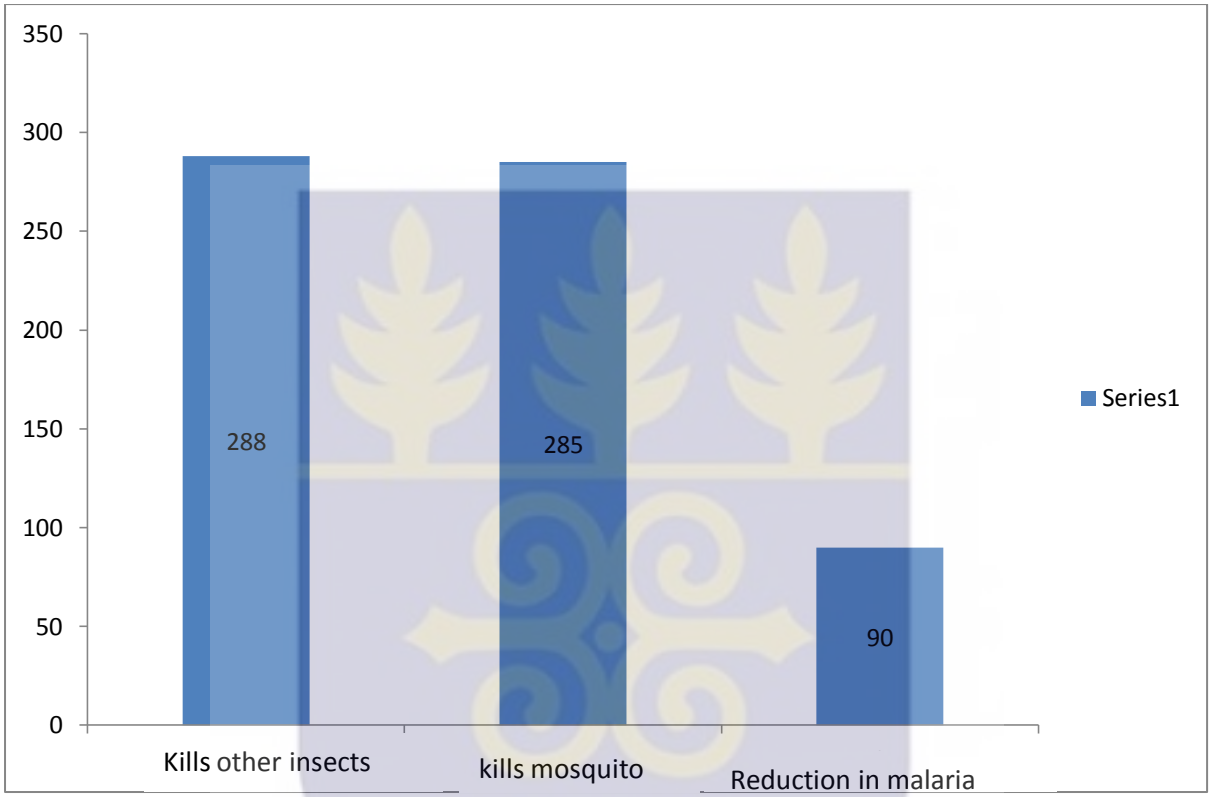

Figure 3: Perceived benefits of Indoor Residual Spraying

Of the 90 respondents who mentioned reduction in malaria as a benefit of IRS, 58.9% of them lived in urban areas, 70% were males and 57.7% were aged 40 years and below. However, a chi- square test of association between residential status and reporting malaria reduction as a benefit of IRS was not significant (P>0.417) and this was the same for sex (P>0.717). Thus neither residential status nor sex of respondents could be associated with malaria reduction as a perceived benefit of IRS. However, mentioning malaria reduction as a benefit was positively associated with being 50 years old or younger (OR= 2.8, 95% CI= 1.36-5.74and P>0.004).

The usefulness of IRS has also been captured in the following qualitative narratives:

> *Spraying has been very useful to us because it kills cockroaches, flies, bedbugs and mosquitos. The only problem I have with the spraying exercise is that our bathrooms and toilets are often excluded from spraying and this makes it possible for mosquitos to still bite us any time we use the washrooms. I think they should include washrooms if they really want to eliminate mosquitos from our homes [28 years old housewife].*

> *There are immense benefits to it because the incidence of malaria especially among infants and children at large has reduced tremendously. Parents are able to save money that would otherwise have gone into the payment of hospital bills of their wards. Productive time that is often spent at hospitals by parents seeking treatment for their wards has also now been reduced. Instead of spending several hours and days at the hospital, parents can now use that time for other productive endeavours [35 years old tailor, FGD].*

4.4.2 Perceptions about the potency duration of Indoor Residual Spraying

Perceptions about the potency duration of IRS varied considerably with the majority of respondents, 52.6%, (175) reporting that the insecticide had an efficacy period of more than six months, 35.4% (118) indicated the efficacy of the insecticide spans between three to six months. The remaining 12% (40) reported that the insecticide had efficacy duration of less than three months. Among respondents who lived in rural communities the majority, (57.0%) reported that the potency of the insecticide exceeded six months while among urban folks, more respondents (51.0%) indicated that the insecticide could only last for six months or less.

Participants in group discussions also had varied perceptions about the time frame within which the insecticide can kill mosquitos. The differences in perceptions regarding the longevity of the insecticide are presented in the statements below

It takes more than a year for the chemical to lose its power. More than one year after they sprayed my room I could still smell the chemical [28 years old male farmer, FGD].

It normally last over two years before the insecticide loses its power. I am saying this because, two years into spraying, you can still smell the chemical in your room [30 years old mechanic,[FGD].

The chemical can last for about two months. Sometimes it even exceeds two months [46 years old female trader].

4.5 Respondents level of comfort with IRS activities.

Respondents' level of comfort with IRS was scored on a scale of 0 to 4 using four key aspects of the IRS program; sprayers entering householders' bedroom, householders moving their belongings before and after spraying, the smell of the insecticide as well as the time spent on spraying. The results revealed that, of the 333 respondents, 73.0% (243) scored 3 and above (from a maximum of 4) while 27.0% (90) scored 2 and below. Respondents who scored 3 and above were considered being comfortable whereas those who scored below 3 were considered not being comfortable. The mean score, 3.1, (SD=0.34) revealed that respondents were generally comfortable with IRS on those four aspects.

Table 4: Reported level of comfort with IRS by respondents

Variable Name	Frequency	Percentage
Composite level of comfort		
Comfortable	243	72.97
Not comfortable	90	27.03
Mean score	2.9	
S.D	0.34	

4.6 Relationship between respondents' demographic characteristics and level of comfort

Out of a total of 149 rural dwellers, 79.2% (118) reported being comfortable while 68% (125/184) of urban dwellers reported being comfortable. The result from the logistic regression analysis revealed that being comfortable with IRS was positively associated with respondents who lived in rural areas (OR= 1.8, 95% CI =1.08-3.00, P<0.022).

Of the 260 respondents aged, 50 years and younger, 70.4% (183) of them were comfortable with IRS while 82.2% (60) of respondents aged 51 years and above were not comfortable. A chi-square test revealed the existence of an association between the level of comfort and the two age groups with a border line p-value of 0.045. Respondents aged, 50 years and younger were less likely to be comfortable with IRS based on the four items compared with those aged, 51 and above (OR= 0.5, 95% CI =1.00-3.74).

Out of a total of 238 male respondents, 29.4% (70) were not comfortable with IRS whereas 22% (20) of female respondents were not comfortable. Sex was not associated with respondents' reported level of comfort (P>0.12).

4.7 Respondents' level of satisfaction with IRS

Respondents' satisfaction on three items namely; satisfaction with the length of time it takes for the insecticide to lose its power, satisfaction with the time of the year that spraying is normally conducted as well as levels of satisfaction regarding the ability of IRS to reduce mosquito density in households were scored on a scale of 0- 3. Respondents who scored at least two out of the three items were considered satisfied while those that scored less than two were considered not satisfied. The results showed that 98.2% (327) of respondents were satisfied whereas 1.8% (6) were never satisfied.

Level of satisfaction of respondents had no relationship with their dwelling status, age, sex or level of comfort (p>0.79, p>0.75, p>0.52, p>0.73 respectively). However, 5 out of a total of 6

respondents who expressed dissatisfaction were males aged 50 years and above. There were no differences in the dwelling status of respondents who expressed dissatisfaction as 50% of them lived in rural communities while the remaining half lived in urban areas.

Table 5: Respondents' level of satisfaction with IRS

Variable Name	Frequency	Percentage
Composite level of satisfaction		
Satisfied	327	98.2
Not satisfied	6	1.8
Mean score	2.9	
S.D	0.3	

The following narratives support the high level of satisfaction reported by respondents in the survey.

> *We are very satisfied with IRS because when you go to the hospital you would realize that there has been a drop in the number of malaria patients unlike previously when the hospital was always inundated with malaria cases. The hospital could not even accommodate the patients due to insufficient space. The situation has improved drastically because of the spraying exercise* [40 years old female trader, FGD].

> *I am very satisfied to the extent that the insecticide is able to kill mosquitos and other insects. However the problem with the programme is that the walls develop cracks after spraying. The cracks become even more visible when you paint your room* [32 years old male farmer, FGD].

4.7.1 Respondents' knowledge about practices that affect the functioning of IRS

Table 6 shows respondents' knowledge about community practices that negatively affect the effectiveness of IRS. Scores ranging from 0 to 3 were assigned to responses based on the

extent to which respondents agreed or disagreed with statements relating to practices such as painting of walls immediately after spraying, decorating walls with posters as well as constant exposure of rooms to sunshine. Respondents who scored at least two out of the three items were deemed knowledgeable.

Of the 333 respondents, 92.5% (308) were knowledgeable about practices that affect the effectiveness of IRS. The mean score for respondents on knowledge was 2.6 out of a possible maximum score of 3.

Table 6: Respondents' level of knowledge about Post-IRs practices

Variable Name	Frequency	Percentage
Composite level of knowledge		
Knowledgeable	308	92.5
Not knowledgeable	25	7.5
Mean score	2.6	
S.D	0.7	

The narrative below showed that community members were aware of certain practices that could affect the potency of the IRS intervention

> *Yes, there are certain practices within the community that can undermine the programme. For instance, some people do not wait for the six months period given by the sprayers to elapse before painting their rooms. Others put posters of football clubs and players on the walls of their rooms* [32 years old male teacher, FGD].

4.7.2 Relationship between respondents' knowledge and socio-demographic factors

Being knowledgeable about practices that can affect the effectiveness of IRS was positively associated with sex and living in rural areas (OR= 2.5, 95% CI= 1.09-5.70, P>0.03 and OR =2.7, 95% CI =1.07-7.006 P>0.04 respectively). Thus, male respondents and those who lived

in rural settings were more likely to be knowledgeable about practices that can negatively impact on the effectiveness of the IRS program.

4.8 Respondents use of other malaria prevention strategies

Respondents were asked if they used other malaria control strategies after their rooms have been sprayed. Majority of them, 95%, (307/323) indicated that they used other methods of controlling malaria even after their rooms have been sprayed.

Of the 310 respondents who indicated that they use other malaria control strategies, 33.5% (107) reported using those other strategies six months or more after their households were sprayed. Varied types of malaria control strategies were reported and prominent among them was the use of bed net, 85.3%, (273).

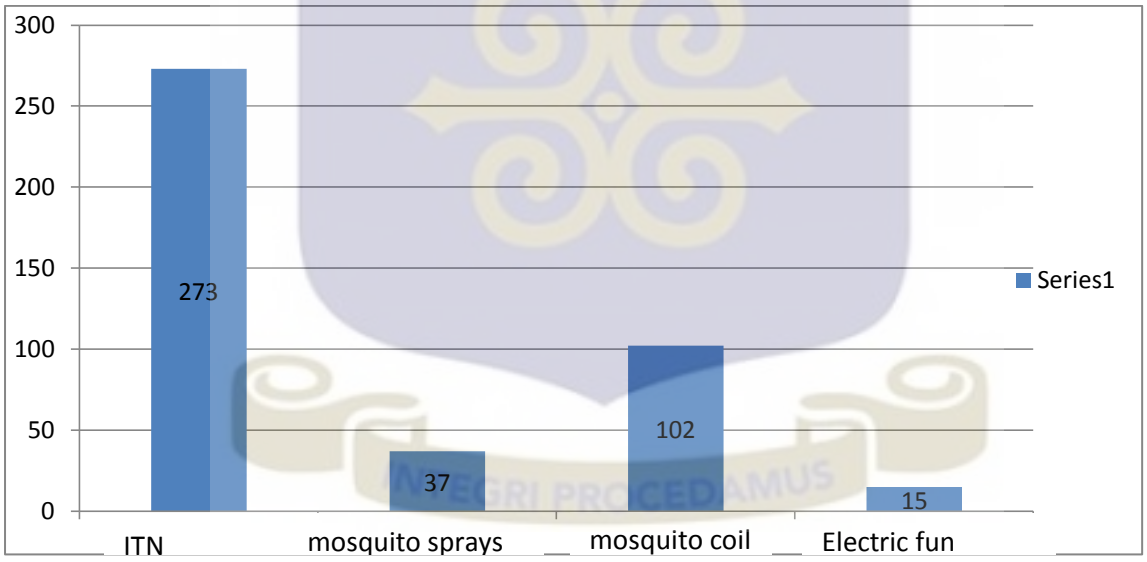

Figure 4: Respondents' use of other malaria control methods

Using other malaria control strategies after spraying was positively associated with living in rural areas (OR= 4.2, 95% CI =1.4-12.6, P>0.01). Results from chi-square test indicated no statistical significance between reported use of other strategies and biological sex as well as ages of respondents.

4.9 Indoor Residual Spraying Acceptability

Almost all the respondents (334, 99.7%) indicated that their households will continue participating in future indoor Residual Spraying programs. Only 1 respondent indicated that he will not participate in future IRS program citing his discomfort with the insecticide as the reason for non-participation.

The acceptability of IRS as a vector control strategy was confirmed during group discussions. Participants expressed their support and commitment to have their rooms sprayed anytime spraying exercises are being undertaken. This was what one of the participants had to say;

> *Some people may decide not to spray their rooms in the future but for me I will never refuse spraying. My husband will not even entertain any refusals. Whenever he hears that the sprayers are around, he normally looks for them to come and spray our house. He does not permit us to open our shops on spraying days just like the National Sanitation Days* [42 years old trader, FGD].

CHAPTER FIVE

DISCUSSION

5.1 Knowledge about malaria

The study revealed that respondents demonstrated a better understanding of the causes of malaria and the control strategies available; findings which are not different from what was reported by Mazigo et al. (2010) and Ingabire et al. (2015). Knowing that malaria is transmitted through mosquito bites is an indispensable foundation for the acceptance of any strategy that seeks to eliminate mosquitos.

5.2 Indoor Residual Spraying awareness and perceptions

The findings from the study suggest that indoor residual spraying coverage has been high with over 80% of respondents having sprayed their rooms at least twice. This is refreshing and in tandem with the commitment by the National Malaria Control Programme of ensuring that people living in epidemiological zones with seasonal variations in malaria transmission have access to at least one round of spraying in the peak seasons. However, it is worth stating that although almost all respondents reported having been given information about IRS prior to spraying, only 27.5% of them indicated that they were given information about the benefits of spraying. Clearly the findings indicate that the information, education and communication aspect of the programme was deficient in terms of communicating the purpose and benefits of Indoor Residual Spraying as a malaria control strategy. This confirms a study by Montgomery et al. (2010) where the information that was given to respondents prior to spraying related only to operational issues.

Indoor residual spraying was generally perceived to be beneficial, however associated benefits of IRS differed among respondents with over 80% of respondents mentioning its ability to kill insects like cockroaches and bedbugs as well as mosquitos. This affirmed a

study by Ediau et al. (2013) in which majority of respondents associated the benefits of IRS with the killing of mosquitos and other insects.

Again, there were mixed perceptions about the length of time it takes for the insecticide to lose its power with the majority of respondents indicating that it takes over six months. The perception that the insecticide lasts over six months was erroneously influenced by the fact that one could still smell the chemical long after the duration given by the manufacturers. The resultant effect was that respondents who perceived the insecticide to last over six months either did not use any other malaria control methods after their rooms were sprayed or only used such other methods six months after spraying.

Although very few respondents and participants reported that their households had never been sprayed, the findings further suggests that non adherence to spraying was influenced by two main sets of reasons which were deliberate refusals and the absence of some household heads during spraying. This reinforces the findings of Munguambe et al. (2011) and Montgomery et al. (2010) where participants indicated that some of the households were never sprayed because the household members were not around during spraying or for fear of being searched for weapons, as well as the fear of health consequences of the insecticide among others.

The results of this study indicate that majority (73 %) of households from the Savelugu-Nanton district were comfortable with indoor residual spraying although very few households expressed some level of discomfort with IRS intervention. Particularly, rural households were more comfortable with the intervention compared to urban households. The findings of the study confirms the findings of a study conducted in Northern Malawi, Chunga et al., (2014), where the majority of respondents reported that IRS caused them less inconvenience. This finding however, is not in consonance with the findings of Sakeni et al. (2015) in which

respondents expressed discomfort about IRS particularly with the scent of the insecticide used for spraying. Discomfort with the scent of the insecticide, movement of household belongings as well as sprayers entering rooms during spraying, according to Munguambe et al. (2011) are factors associated with non-adherence. Thus, the high level of comfort expressed by respondents holds positive for vector control interventions like IRS in the district.

Respondents' level of satisfaction in terms of the ability of IRS to reduce mosquito densities within households, the spraying season as well as their satisfaction with the time it takes before the insecticide finally loses its power were very high. The results of this study, re-echoes similar reports from a study conducted in Soroti District in Uganda where a significant number of respondents indicated their satisfaction with the ability of IRS to reduce mosquito populations within households (Ediau et al., 2013). The findings also reaffirm the findings of Chunga et al, (2014), in which respondents expressed satisfaction with IRS as an intervention.

These findings however, to some extent do not support the results of a study carried out by Montgomery et al. (2010) where respondents reported low satisfaction level due to the proliferation of mosquitos in households after spraying activities. Respondents' reported satisfaction with the spraying season is refreshing to know because indoor residual spraying targets geographical areas where there are seasonal variations in malaria transmission with particular emphasis and focus on peak seasons of transmissions.

5.3 Acceptability of Indoor Residual Spraying

Majority (99.7%) of respondents indicated that their households will continue to participate in spraying activities. This shows an overwhelming acceptance of the IRS program in the district, a development that should give hope to the dream of achieving and retaining 90%

coverage in any round of spraying in targeted districts. The findings are in consonance with similar findings by Sakeni et al. (2015) that reported an acceptance of IRS (94%) among respondents in South-East Iran.

Most respondents demonstrated that they were knowledgeable about practices and behaviour that could potentially render IRS ineffective, the study concludes that optimum efficiency and effectiveness of IRS as a vector control intervention is guaranteed in the district due largely to the fact that people are relatively knowledgeable about what to do to derive optimal benefits from the programme.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The findings from this study indicate that communities in the Savelugu-Nanton District have a good knowledge on the causes of malaria and its preventive measures. It also indicates that more than half (63%) of the folks in the district are knowledgeable about Indoor Residual Spraying as a malaria control strategy.

Paradoxically however, reduction in malaria was the least mentioned benefit of malaria among householders within the district. Thus, although the findings of the study indicate high acceptance of IRS in the district, such an acceptance is not wholly attributable to the ability of the intervention to reduce malaria in the area. The acceptance of IRS in the district is much in part influenced by its association with such superficial benefits like killing of insects generally. The majority of householders accept the intervention without any thorough understating of the principles, concept, purpose and benefits associated with it.

With less than 30% of householders reporting that they were given information regarding the benefits of IRS prior to spraying activities, it is not a surprise therefore that such a knowledge gap about the benefits of the programme exists. For the most part, information that was given to community members entailed operational issues.

It is however worth noting that since eliminating the malaria vector is an inherent requirement in the malaria control trajectory, some presumptive inferences could be made linking reduction in mosquito populations as reported by household members to a reduction in the malaria situation in the district.

Even though the acceptability of the intervention in the district is not in doubt, an exaggeration of the time frame within which the chemical can effectively act against

mosquitos could potentially jeopardise the integrated approach adopted by the National Malaria Control Programme in fighting malaria. This is because perceived longevity of the chemical was negatively associated with householders' use of other malaria prevention strategies after IRS.

The efficacy of the IRS intervention partly depends on deliberate efforts from households to desist from practices that could negatively affect optimal function of the chemical. Findings from the study indicate that respondents were pretty knowledgeable about these negative practices, the first and important step towards deriving the most benefits from any intervention.

Non-participation is influenced mainly by two groups of factors; factors associated with householders' inability to avail themselves for spraying on scheduled dates and factors associated with deliberate refusals by households.

6.2 Recommendations

From the findings of the study, the researcher would recommend the following;

- Mob up strategies should be considered in any round of spraying to provide an opportunity for households that are not covered in first visits
- The Information, Education and Communication component of the IRS intervention needs to intensify their education of households on the concept, purpose and benefits of the programme so as to ensure that people make decisions concerning their participation based on available information. Also, the suspicion that the real intention of spraying is to search for weapons in the custody of householders must be immediately dismissed.

- Again, people ought to be educated on the length of time the chemicals used for IRS can effectively function as well as on the need to use other interventions even when household has been sprayed.
- Lastly, if possible, the programme should be expanded to include kitchens, bathrooms and toilets in any round of spraying.

6.3 Limitations

Findings of the study were based on the opinions and experiences of a sampled population and not based on those of the entire population in the Savelugu-Nanton District. Hence the findings can only be generalised to the sampled population in the study communities and not the entire district or region. Biases in recall as well as respondent bias were manifested during data collection. Limitations resulting from woefully inadequate funding and time cannot be underestimated.

In spite of the above mentioned limitations, the validity and quality of the study was never in any away affected.

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APPENDICES

Appendix A: Focus Group Discussion Guide

FOCUS GROUP DISCUSSION GUIDE

1. Is malaria one of the health problems in your community?
2. How is malaria transmitted? In your view how do we get malaria?
3. What malaria control strategies are you aware of?
4. Have you heard of IRS? Probe for the sources of information
5. Has your household ever been contacted for IRS by officers?
6. Were you given any sensitization before spraying? Probe for the time interval between sensitization and real spraying

Perceived benefits of IRS, acceptability and insecticide potency

7. What are the benefits associated with IRS
8. Were all the households in your area sprayed? If no why were some households not sprayed? If refusal is mentioned probe for the reasons that accounted for such refusals.
9. How long does it take the insecticide to lose its power? Are you satisfied with the duration of the effectiveness of the insecticide?
10. Are you satisfied with IRS as a mosquito control strategy? why
11. Can our behaviour and attitudes affect the effectiveness of IRS? If yes, what are these behaviours and attitudes? Are these attitudes exhibited by some household members in this community?

Appendix B: Consent Form

HOUSEHOLD CONSENT FORM

Hello, My name is Prosper Nyaaba Azure, a Master of Public Health student of the University of Ghana, Legon. I am writing a dissertation on the topic: "Perceptions about Indoor Residual Spraying for malaria prevention in the Savelugu-Nanton District" to be submitted to the University of Ghana in partial fulfilment of the requirement for the award of Master of Public Health. One of the many processes involved in my dissertation is to collect information from households regarding Indoor residual spraying in the district and your household is among the randomly selected households to be interviewed.

Approximately 335 households and 5 associations from selected communities within the Savelugu-Nanton district are participating in this study. During these interviews, we will collect information on participant's demographic characteristics, knowledge on malaria transmission, perceptions and misperceptions about indoor residual spraying, sources of information about IRS as well as level of acceptability of IRS as a malaria control intervention. All this information will help gain an insight into the prevailing perceptions about IRS among the people of Savelugu-Nanton Disrtict. This could inform policy makers in the design of future IRS interventions for malaria control in the district.

Each interview session will take approximately 20 minutes to complete. The questions that will be asked will be read to you and your response will be recorded on a paper questionnaire.

There is no direct benefit to your household for participating in the study. However every household's participation is valuable to the success of this study. We acknowledge that the interviews will take some of your time and you may get tired in the course of the interview. During the interview, you can take a break in order to rest or attend to urgent personal activities. You are also free to discontinue the interview at any point in time. There is no penalty if you decide to discontinue the interview.

We will not discuss any personal identifiable information about you or your household to anyone outside this study. We will keep everything you tell us private and confidential. Names of individuals and households will not be recorded since responses are to be treated with utmost anonymity. Data from this study would be reported in the aggregate.

Your participation is entirely voluntary and your decision to participate or not to participate will not affect you or any of your household members. If you accept to participate in this study, you are still free to refuse to answer any of the questions that may make you feel uncomfortable. You can also stop the interview at any time to clarify or ask to repeat something if you don't understand.

For additional information about the study you can contact the Principal Investigator, Prosper Azure at 0200746842.

This study has been reviewed and approved by the Ethical Review Committee of the Ghana Health Service. The committee has ensured that during this study, you are protected from any harm that can be attributed to this study. **If you have any questions about your rights as a participant in this study, you may contact the administrator of the ERC, Hannah Frimpong at: 0507041223.**

PARTICIPANT AGREEMENT

I have read or have had someone read all of the above, asked questions, received answers regarding participation in the study and I am willing to give consent for myself, my child or any other person who may require my consent for participation in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records.

…….. …….. ……..

Name of Participant signature/thumbprint Date

(If volunteers cannot read the form themselves, a witness must sign here)

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer agreed to take part in the research.

…….. …….. ……..

Name of witness signature/thumbprint Date

I certify that the nature and purpose, the potential benefits and possible risks associated with participating in this study have been explained to the above individual.

…… …… ……..

Name of person who obtained consent signature Date

FGD CONSENT FORM

Hello, My name is Prosper Nyaaba Azure, a Master of Public Health student of the University of Ghana, Legon. I am writing a dissertation on the topic: "Perceptions about Indoor Residual Spraying for malaria prevention in the Savelugu-Nanton District" to be submitted to the University of Ghana in partial fulfilment of the requirement for the award of Master of Public Health. One of the many processes involved in my dissertation is to hold Focus Group Discussions with existing associations regarding Indoor residual spraying in the district. Your association is among the selected associations.

A total of 5 associations from selected communities within the Savelugu-Nanton district are participating in this study and each discussion will be made up of between 8 to 12 people with similar experiences regarding IRS activities. During these discussions, we will collect information on participant's demographic characteristics, knowledge on malaria transmission, perceptions and misperceptions about indoor residual spraying, sources of information about IRS as well as level of acceptability of IRS as a malaria control intervention. All this information will help gain an insight into the prevailing perceptions about IRS among the people of Savelugu-Nanton Disrtict. This could inform policy makers in the design of future IRS interventions for malaria control in the district.

Each discussion will take approximately 45 minutes to complete. There will be a moderator whose role will be to introduce various topics for discussion and a co-moderator whose responsibility will be taking of notes. An electronic audio recording device will be used to record your voices so as to enable us play back those voices for transcription. The recorded voices will not be used anywhere for purposes other than this study.

There is no direct benefit to you or your household for participating in the study. However every individual's participation is valuable to the success of this study. We acknowledge that the discussions will take some of your time and you may get tired in the course of the discussion. During the discussion, you can take a break in order to rest or attend to urgent personal activities. You are also free to discontinue the discussion at any point in time. There is no penalty if you decide to discontinue.

We will not discuss any personal identifiable information about you to anyone outside this study. We will keep everything you tell us private and confidential. Names of individuals will be kept private and separate from the main information. You may use pseudonyms if you don't want to your real name to appear on the recruitment form. Data from this study will be reported in the aggregate.

Your participation is entirely voluntary and your decision to participate or not to participate will not affect you or any of your household members. If you accept to participate in this study, you are still free to refuse to speak about any issues that may make you feel Uncomfortable. You can also stop the discussion at any time to clarify or ask to repeat something if you don't understand.

For additional information about the study you can contact the Principal Investigator, Prosper Azure at 0200746842.

This study has been reviewed and approved by the Ethical Review Committee of the Ghana Health Service. The committee has ensured that during this study, you are protected from any harm that can be attributed to this study. **If you have any questions about your rights as a participant in this study, you may contact the administrator of the ERC, Hannah Frimpong at: 0507041223**

PARTICIPANT AGREEMENT

I have read or have had someone read all of the above, asked questions, received satisfactory answers regarding participation in the study and I am willing to give consent for myself, my child or any other person who may require my consent for participation in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records.

…….. …….. ……..

Name of Participant signature/thumbprint Date

(If volunteers cannot read the form themselves, a witness must sign here)

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered satisfactorily and the volunteer agreed to take part in the research.

…….. …….. ……..

Name of witness signature/thumbprint Date

I certify that the nature and purpose, the potential benefits and possible risks associated with participating in this study have been explained to the above individual.

…… …… ……..

Name of person who obtained consent signature Date

Appendix C: Questionnaire

HOUSEHOLD QUESTIONNAIRE

Name of community…… Res. Status……..0-rural, 1-urban

Household ID……

SECTION A

Socio-Demographic Data

1. Age
   - under 21 [ ]
   - 21 - 30 [ ]
   - 31 - 40 [ ]
   - 41 – 50 [ ]
   - 51 – 60 [ ]
   - 61 and above [ ]
2. Sex — Male [0] Female [1]
3. Marital Status
   - Single 1
   - Married 2
   - Divorced 3
   - Widowed 4
4. Religion
   - Islam 1
   - Christianity 2
   - Traditional 3
   - Other (specify) 4……
5. Occupation
   - Farming 1
   - Trading 2
   - Artisan 3
   - Teaching 4
   - Health worker 5
   - Civil servant 6
   - Other (specify) 7……
6. Education
   - None……..1
   - Primary……..2
   - JHS/MSLC……..3
   - SHS/SSS……..4
   - Post Sec……..5
   - Tertiary……..6

SECTION B

Malaria Transmission

No.	Statement	NS
7.	Is malaria a health problem to your household	Yes……..1 No……2
8.	If yes in Q7, how much of a problem is malaria to your household?	Very serious……1 Serious……2 A little serious……..3 Not serious……....4
9.	What, in your view is the cause of malaria	Mosquito bites……..1 Bedbugs bites……...2 Flies……..3 Dirt……...4 Other (specify)…….5
10.	Where do you think the malaria transmitting mosquito mostly rests on?	Indoor surfaces……1 Outdoor surfaces……..2 In the air……...3 Water bodies……4 Don't know……..5
11.	What are the malaria prevention ways that you are aware of?	Use of ITNs……1 Use of repellent……2 IRS……...3 Clearing of bushes……4 Other (specify)…….5 Don't know……..6
	SECTION C **IRS Awareness and Information**	
12	Are you aware of IRS activities in this community?	Yes……1 No……..2
13	Has your household ever been approached by officers for spraying purposes?	Yes……..1 No……...2
14	If Household has ever been approached, were you given prior information about IRS before being approached for spraying	Yes……..1 No……2
15	If yes in (Q 14) What kind of information was your household given	Spraying dates……1 Benefits of spraying……2 Role of householders…..3 IRS friendly/unfriendly practices……..4
16	How many days after receiving information was your household contacted for spraying	7 days or more……..1 5-6 days……...…….2 3-4 days……3 1-2 days……4 contact day……5 Don't know……..99
17	Has your household ever been sprayed?	Yes……1 No……..2
18	If yes in (Q 17) How many times has your household been	Once……...1

	sprayed?	Twice……2 Thrice……3 More than thrice……4 Don't know……5
	SECTION D **Perceived Benefits/Acceptability**	
19	Do you think spraying is beneficial to your household?	Yes……1 No……2
20	If yes, what are the benefits of spraying to your household?	Reduction in malaria transmission……1 Killed mosquitos……2 Killed other insects……3 Other (specify)
21	If no in Q17, why is spraying not beneficial to your household?	Spraying did not kill mosquitos……1 Killed my birds and livestock……2 Increase in mosquitos and other insects……3 Household member(s) became allergic to scent of insecticide……4 Other, (specify……5
22	How long does it take the insecticide to lose its power?	Less than one month……1 One to two months……2 Between three to five months……3 Six months and beyond…4
	How comfortable are you with the following?	
23	Sprayers entering your bedroom to spray	Very comfortable……1 Comfortable……2 Uncomfortable……3 Very uncomfortable……4
24	Packing household belongings during spraying	Very comfortable……1 Comfortable……2 Uncomfortable……3 Very uncomfortable……4
25	Smell of insecticide during and after spraying	Very comfortable……1 Comfortable……2 Uncomfortable……3 Very uncomfortable……4
26	Time spent on spraying activities in a household	Very comfortable……1 Comfortable……2 Uncomfortable……3 Very uncomfortable……4
	How much impact do you think the following can have on your household's decisions regarding your continuous participation in future IRS activities	
27	Sprayers entering your bedroom	Great impact……1 Some impact……2 Little impact……3 No impact……4

28	Packing of household belongings by householders	Great impact……1 Some impact……2 Little impact……3 No impact……4
29	Smell of insecticide	Great impact……1 Some impact……2 Little impact……3 No impact……4
30	Time spent on spraying	Great impact……1 Some impact……2 Little impact……3 No impact……4
	How satisfied are you about the following	
31	How satisfied are you about the **length of time** it takes before the insecticide loses its power	Very satisfied Somewhat satisfied Dissatisfied Very dissatisfied
32	How satisfied are you about the **ability of IRS as a programme to reduce mosquitos** within your household?	Very satisfied Somewhat satisfied Dissatisfied Very dissatisfied
33	How satisfied are you about the **time of the year** when spraying is carried out	Very satisfied Somewhat satisfied Dissatisfied Very dissatisfied
34	Amina says hanging of clothes and others like posters on the inner walls of buildings does not reduce the ability of the insecticide to kill mosquitos.	Strongly agree……1 Agree……2 Disagree……3 Strongly disagree……4
35	Abubakar says that exposing inner walls to direct sunshine after IRS has no impact on the effectiveness of the insecticide	Strongly agree……1 Agree……2 Disagree……3 Strongly disagree……4
36	Iddrisu says painting the inner walls of his bedroom after spraying exercise can negatively affect IRS	Strongly agree……1 Agree……2 Disagree……3 strongly disagree……4
37	Taking all things into consideration, how satisfied are you about IRS as a malaria control strategy	Very satisfied……1 Somewhat satisfied……2 Dissatisfied……3 Very dissatisfied……4
38	Does your household usually use any other methods of malaria prevention after rooms have been sprayed with IRS	Yes……1 No……2
39	If yes in (Q 38) what other method does your household mostly use	ITNs……1 Mosquito sprays……2 Mosquito coils……3 Other……4

40	How long does it usually take your household, after spraying, to use this other method	Less than one month……..1 One month…….2 Two months……...3 Three months……4 Four months……...5 Five months……....6 Six months…….7 More than six months…....8
41	Did any of your household members sleep outside within the first three months of the last spraying exercise?	Yes……1 No……...2
42	I sometimes sleep outside because of excessive heat. When I observe that the temperature in the room is high, I really do not bother about the fact that my room has been sprayed. In such instances, I prefer sleeping outside to sleeping in a sprayed room that has excessive heat. How similar or different are you from this person.	Very similar……..1 Somewhat similar…….2 Somewhat different…….3 Very different……..4
43	If household has never been sprayed in (Q 16), why has household never been sprayed?	Refused to be sprayed……1 Household head was not available when sprayers approached household……2 Asked sprayers to come later……3 Other specify……4
44	If refused, in (Q 43) why did you refuse to allow your household to be sprayed	IRS not useful……1 Discolouring of inner walls by insecticide……....2 Difficulty in moving items in rooms……3 Insecticide could be harmful to human and animal life...4 Bad behavior of officers.....5 Other (specify)……..6
45	Will you allow your household to be sprayed by the IRS team in the future?	Yes……1 No……2