# Community perceptions and acceptability of malaria vector control interventions in upper western Ghana

by

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# DEFINITION OF TERMS

**Acceptability** – The act of accepting or using preventive interventions or the opinions held by householders prior to, during, and after accepting the interventions.

**AGA Mal Ltd.** – Company responsible for implementing indoor residual spraying

**Barrier** – The motivation or reason for not accepting interventions

**Community** – A group of people who live at the same place or who have similar characteristics

**Efficacy** – The potency of insecticides in killing mosquitoes or preventing malaria

**Facilitator** – The motivation or reason for accepting interventions

**Factor** – The reasons for accepting or refusing preventive interventions

**Ghana Health Service** – Government agency responsible for health care

**Hang up campaign** – A distribution exercise for insecticide treated nets (ITNs) that involves volunteers hanging ITNs in the rooms of beneficiaries as part of the distribution process

**Householders** – Heads of households who participated in this study or their representatives

**Indoor residual spraying** – The act of spraying insecticide on the indoor walls of rooms

**Insecticide treated nets** – Nets that are treated with insecticide for malaria prevention; including insecticide treated nets that are subject to regular retreatments, and long-lasting insecticide treated nets

**Mop-up spraying** – A second spraying conducted to spray houses that could not be sprayed on the scheduled spray day

**Net coverage** – The number or percentage of households who own insecticide treated nets

**Perception** – The way people or communities think about something.

**Spray pump** – Cylinder-like equipment in which insecticides are mixed with water to

conduct indoor residual spraying

**Spray coverage** – The number or percentage of houses or communities that have been sprayed.

**Spray operators or providers** – Staff who conduct spraying onto walls to prevent malaria

**Volunteers** – Residents of communities who voluntarily support the implementation of health interventions or other community work without remuneration

# ABBREVIATIONS

| | |
|---|---|
| AGA Mal | AGA Mal Ltd. |
| BCC | Behaviour change communication |
| DDT | Dichloro-diphenyl-trichloroethane |
| CHPS | Community-based health planning services |
| DBI | Daffiama-Busie-Issa District |
| GHS | Ghana Health Service |
| HIV | Human Immunodeficiency Virus |
| HBM | Health belief model |
| IRS | Indoor residual spraying |
| ITNs | Insecticide treated nets |
| IEC | Information education and communications |
| LLINs | Long lasting insecticide treated nets |
| NHIS | National Health Insurance Scheme |
| RDHS | Regional Director of Health Services |
| SBREC | Social and Behavioural Research Ethics Committee |
| SSA | sub-Saharan Africa |
| SMC | Seasonal malaria chemoprevention |
| *P* | *Plasmodium* |
| USD | United States Dollars |
| WHO | World Health Organization |

# ABSTRACT

**Introduction**: Malaria is the leading cause of morbidity and mortality in sub-Saharan Africa, including Ghana. The disease persists as a significant public health challenge in the Upper West region of Ghana despite the implementation of vector control interventions such as indoor residual spraying (IRS) and insecticide treated nets (ITNs), which have been proven to be successful interventions elsewhere. In attempts to rationalize the persistence of malaria as a major public health issue and unravel the underlying factors contributing to this endemic disease, researchers have suggested that people's awareness or conceptualisations of malaria plays a critical role in their acceptance of preventive interventions. Although community acceptability is a prerequisite for the successful implementation of vector control interventions, the 69.1% indoor residual spraying coverage in the Upper West region of Ghana is well below the 80% standard minimum coverage required for the effectiveness of IRS interventions. Moreover, despite the relatively high ITN coverage of 77.4% in the region, the level of ITN use (54.5%) is considerably lower. The below standard IRS coverage and low ITN use raise questions about the acceptability of these interventions. There is also a global gap in the academic literature regarding the acceptability of combining IRS and ITN interventions at the household level. This research aims at exploring the facilitators and barriers to malaria control in the Upper West region of Ghana by exploring local community perceptions about malaria and the acceptability of IRS and ITNs.

**Methods**: A qualitative inquiry was conducted between April 2016 and October 2016, employing focus group discussion and semi-structured interviews. Nine focus groups were conducted with householders at four communities in the selected districts of Wa Municipal and Daffiama-Busie-Issa, and two focus groups were conducted with AGA Mal spray operators. Also, twelve semi-structured interviews were conducted with programme officials; eight with AGA Mal officials and four with Ghana Health Service officials. The data were analysed using framework analysis.

**Findings**: A total of 105 respondents participated in this study. Several facilitators were identified in relation to the acceptability and implementation of IRS and ITNs, including community understanding about malaria, and the perceived benefits of IRS and ITNs. The health belief model, which provides explanations for individual health behaviour, postulates that the acceptance of an intervention is subject to several factors, including the perceived benefits of the intervention. Householders who perceived IRS and ITNs to be beneficial were motivated to accept the interventions for malaria prevention. Education activities, training and stakeholders' partnerships

were also found to be important facilitators in the implementation of IRS and ITN interventions. These mechanisms are crucial to the outcome of interventions in conformity with the realist evaluation framework approach. The findings also identified significant barriers to the uptake of IRS and ITNs, including, poverty, poor education and structural factors such as religion and communities' cultural perspectives in the study setting which indicate the role of social determinants of health as barriers to malaria control in Upper Western Ghana and highlight the importance of the social determinants of health framework to this study. Other barriers include operational challenges to Programme implementation such as breakdown of spray equipment and mobility challenges. These findings have implications for the design of malaria control strategies to enhance the acceptability and implementation of IRS and ITNs.

**Conclusion**: Although some householders deliberately refused to accept or use IRS and ITNs, several other factors were identified that contributed to the non-spraying of some houses and the non-use of ITNs by householders. For example, several Programme implementation related challenges affected the implementation of IRS and ITNs that may have accounted for the low levels of acceptance. These findings have policy and practice significance for improving the acceptance and implementation of IRS and ITN interventions.

# DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed: Vitalis Mwinyuri

Date: 29/01/2019

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# 1 CHAPTER ONE: INTRODUCTION

## 1.1 Background

Malaria is a vector borne disease that poses a serious public health challenge, especially to low- and middle-income countries including sub-Saharan Africa (SSA). The disease is caused by the transmission of Plasmodium parasite from an infected person to another, mainly by female Anopheles mosquitoes (Stratton et al., 2008). The adverse health outcomes from malaria date to prehistoric times and the disease has caused monumental human toll globally (Moss, Shah & Morrow, 2008), with estimates of deaths of about half the world population who ever lived (Zabludoff, 1998). The world malaria report indicates that an estimated 216 million people were infected with malaria in 2016, with SSA accounting for 90% of cases (World Health Organization, 2017). Moreover, about 445,000 malaria deaths were recorded worldwide, out of which 91% occurred in SSA (World Health Organization, 2017).

Ghana is one country in SSA where malaria is endemic. The entire Ghanaian population is at risk of malaria infection, although the risk of infection is higher during the rainy season (Ghana Statistical Service, 2011). Malaria is the leading cause of morbidity and mortality, especially among pregnant women and children under the age of five years (Ghana Statistical Service, 2003). In 2013, an estimated 1,639,451 confirmed cases and 2,506 confirmed deaths were reported in Ghana (World Health Organization, 2014a). The Upper West region has a disproportionate share of morbidity and mortality cases attributable to malaria, especially among children aged under five years. As of 2011, the Ghana Statistical Service (2011) reported that the region recorded the highest malaria prevalence (51%) among children 6—59 months old. The high prevalence of malaria in the region may be due to several factors, including the low acceptance of malaria control interventions.

## 1.2 Malaria control interventions

Against the background of high prevalence of malaria and malaria mortality across SSA, many malaria control interventions have been implemented over the past decades. These interventions include targeted indoor residual spraying (IRS), insecticide treated nets (ITNs), seasonal malaria chemoprevention (SMC) for children under five, intermittent preventive treatment of malaria in pregnancy, artemisinin-based combination therapy, monitoring of anti-malaria drug resistance, malaria surveillance, and larval control (World Health Organization, 2017).

Artemisinin-based combination therapy (ACTs) are the most effective anti-malaria

drugs for treating uncomplicated malaria. These drugs combine two active ingredients and operate based on different mechanisms (Sinclair et al., 2009). Seasonal malaria chemoprevention is the administration of full anti-malaria treatment courses during the malaria season with the aim of maintaining therapeutic anti-malaria drug concentrations in the blood to prevent malaria illness (World health organization, 2013a). This has proven to be a safe, feasible, and cost-effective intervention for preventing malaria transmission especially among children under five years of age. Similarly, intermittent preventive treatment of malaria in pregnancy involve the regular administration of chemoprophylaxis to pregnant women in malaria endemic areas to prevent malaria. Evidence suggest that the administration of a two-dose regime of sulfadoxine-pyrimethamine (SP) is cost-effective in preventing malaria in pregnant women (Sicuri et al., 2010).

Beyond these drug-based interventions are malaria vector control interventions. Larval control is one of the important vector control interventions, and involves the large-scale modification of mosquito larval habitat with the aim of killing the larvae. This reduces the vector population, and thus, help reduce malaria transmission. Indoor residual spraying and insecticide treated nets are the most effective vector control interventions recommended by the World Health Organization (WHO) for adoption, either individually or in combination (World Health Organization, 2014b). Individually, IRS has been proven to be a very effective intervention against malaria (Kim, Fedak & Kramer, 2012; Pluess et al., 2010; Sharp et al., 2007) while the effectiveness of ITNs, and the health gains emanating therefrom, have been demonstrated in more than 81 trials and 30 descriptive studies worldwide (Oresanya, Hoshen & Sofola, 2008).

Global partnerships including the Roll Back Malaria Partnerships and health policy recognition in the form of Millennium Development Goals and Sustainable Development Goals all supported efforts aimed at combating malaria. As these efforts gathered momentum, there was a renewed spirit to provide funding for malaria control activities, with the Global Fund leading the way.

## 1.3 IRS and ITN interventions in Ghana

### 1.3.1 Indoor residual spraying (IRS)

Indoor residual spraying was the primary intervention for the global malaria eradication campaign, and thus, played a significant role in enhancing the elimination of malaria in several parts of Europe, Asia, Russia, and Latin America (Tanser, Pluess et al., 2007). This track record of IRS makes it the cornerstone of all vector control

activities (Mabaso, sharp et al., 2004). For this reason, AngloGold Ashanti Ghana Ltd. (a gold mining company) implemented IRS as a social intervention in the Obuasi Municipality in 2006, with the objective of reducing malaria morbidity by 50% within two years. The intervention succeeded in achieving its initial goal of reducing malaria cases by 50% within two years, and by over 75% in six years (Sarpong et al., 2015). This enabled the programme to attract funding from the Global Fund to fight AIDs, Tuberculosis, and Malaria in 2008 to extend the intervention to 40 malaria endemic districts in Ghana, including all districts in the Upper West region. However, it was not until 2012 that the extension of the intervention began, starting from the Upper West and Ashanti regions. The extended programme required the creation of a distinct company (AGA Mal Ltd.) to operate separately from AngloGold Ashanti Ltd. This separation was designed to exempt imports for the Global Fund sponsored malaria programme from being taxed in the same way as mining equipment imported by AngloGold Ashanti Ltd.

The AGA Mal indoor residual spraying programme in the Upper West region of Ghana was made up of four main components, including indoor residual spraying (IRS), information education and communications (IEC), surveillance monitoring and evaluation (M&E), and entomology. IRS involved the spraying of insecticides on the inner walls of people's dwellings (World Health Organization, 2013). Spray operators recruited from within the district of operation in the Upper West region were trained to conduct the spraying from community to community. Spray operators are transported in groups from one community to the next to conduct spraying under the supervision of a field supervisor. Prior to departing for the communities, spray operators are required to collect their equipment, which include insecticides and personal protective equipment. The operators conduct pre-checks on their equipment every day to ensure it is in good condition before their departure to communities for spraying. In most instances, spraying in communities is preceded by the creation of spray awareness by the information, education and communication (IEC) personnel and volunteers a few days earlier.

When spray operators arrive in a community, householders are expected to prepare their rooms for spraying. Because spray is applied to inner walls, householders must often pack some household items outside while moving heavy furniture to the centre of each room to allow space for the spray operators to spray. Pets and animals must be removed from spray areas (World Health Organization, 2013), and food and cooking utensils taken outside to prevent contamination. Householders are required to stay outside during spraying and are advised to keep valuable items such as cash or jewellery with them. Prior to spraying each house, spray operators normally seek

the consent of adult household members to conduct spraying. After consent is obtained, spray operators provide instructions about house preparations for spraying if necessary. Thereafter, spray operators conduct their spraying in accordance with the company's standard operational procedures.

After spraying is finished, spray operators are required to open windows and doors for ventilation and clean any insecticide spillage or other residues found on household belongings to prevent exposing householders to the spray insecticides. Operators also provide householders with information on what they should and should not do after spraying, such as the need to stay outside for one to three hours before entering sprayed rooms. The recommended time is subject to the level of ventilation in the rooms. IRS spraying normally starts in the early morning at about 7am or 8am and runs to early afternoon. When spraying is completed, spray operators are transported back to their operational sites (or central locations) where soak pits are constructed for waste disposal. Here, spray operators wash their spray equipment and personal protective equipment and hand them in to be kept until the next spray day. Soak pits are specifically designed and constructed for disposal of surplus insecticides in an environmentally safe way.

The information, education and communication (IEC) component is implemented alongside the IRS intervention, and this was done under the supervision of the principal researcher who was an employee of AGA Mal from November, 2011 until February, 2015. The IEC oversees stakeholder engagement activities with the aim of enhancing community participation. IEC is critical to the spraying because the main aim of IEC activities is to create community awareness about spraying to enhance community acceptance of it. The education activities undertaken by IEC personnel go beyond IRS education to encompass broad general education on malaria and malaria prevention, including the use of ITNs. IEC activities are conducted using several strategies, including radio talk shows, community forums, community meetings during which chiefs and opinion leaders are briefed about the intervention, public education at Department of Health outpatient facilities, fostering partnerships with Ghana Health Service etc. The most important IEC activity that is critical to community acceptance is the provision of spray notification or awareness creation in communities before spraying. Pre-spray notifications may be undertaken by community volunteers alongside IEC implementers.

The third component of the programme, monitoring and evaluation surveillance, involves monitoring of spray indicators and monthly collection of passive case surveillance data from designated sentinel facilities located in existing sub-district

health centres in IRS operational districts. Spray data is recorded using the Malaria Information System to monitor the targets of spray operations and produce reports on coverage levels.

Entomology is the fourth component of IRS. For quality control, entomologists undertake tests on the quality of spraying on already-sprayed walls to determine the effectiveness of the sprayed insecticides and the quality of spraying. The Entomology personnel are responsible for monitoring vector resistance to insecticides and recommending resistance management strategies. In line with this, four different types of insecticides have been used for spraying in the upper west region, including, vecto-guard in 2012, pro-guard in 2013, actellic 50EC in 2014, and actellic 300CS since 2015. Vecto-guard, pro-guard, and actellic 50EC have 3 months of efficacy so these were sprayed twice a year, whereas actellic 300CS has 9 months of efficacy, hence, spraying is conducted only once a year. Entomologists also conduct human landing catches in the communities to determine the potential number of mosquitoes entering people's rooms at night.

AGA Mal's implementation of IRS in the upper west region was undertaken in collaboration with the Ghana health service, and in partnership with key stakeholders such as the district assemblies, regional coordinating council, regional and district health directorates, community leaders among others. In addition to the IRS intervention implemented by AGA Mal Ltd. in Ghana, the President's Malaria Initiative in collaboration with the Global Health Initiative of the US government implemented a separate IRS intervention in selected districts in the Northern region of Ghana (President's malaria initiative, 2014).

### 1.3.2 Free distribution of long-lasting insecticide treated nets

Insecticide treated nets (ITNs) are the most effective vector control intervention that was developed since the development of IRS and chloroquine in the 1940s (Hill, Lines & Rowland, 2006). Since the 1970s, synthetic pyrethroids have been the ideal insecticide for the treatment of ITNs following the discovery of their remarkable insecticidal mortality and low mammalian toxicity (Lengeler, 2004). Prior to the development of long-lasting insecticide treated nets (LLINs), ITNs were treated by dipping them into suitable insecticides at least once a year, thereby, requiring seasonal retreatments. On the contrary, LLINs are treated at factory level only once, can resist multiple washes, and are therefore, effective for the entire life of the net, that is about 4-5 years (Guillet et al., 2001). ITNs became an important component of national and global malaria control strategy since the mid-1990s (Hill, Lines & Rowland, 2006).

The Ghana Health Service (GHS), with support from the Department for International Development, the Global Fund to fight AIDs, Tuberculosis, and Malaria, United Nations Children's Emergency Fund and other partners embarked on a campaign in the year 2012–13 to distribute free of charge 12.5 million long-lasting insecticide treated nets (LLINs)—to be referred to as insecticide treated nets (ITNs) because most bed nets in use are now LLINs—in all ten regions of Ghana (Paintain et al., 2014). The aim was to achieve universal coverage of ITNs, which is defined as universal access to and use of appropriate interventions by the population at risk of malaria infection (World Health Organization, 2017). The distribution of ITNs was based on a specific criterion; the number of ITNs to be given to each household was calculated by dividing the number of household members by two; and where this was less or more than the number of sleeping places, then the number of ITNs given was adjusted to equal the number of sleeping places (Paintain et al., 2014).

Volunteers were recruited and trained in behaviour change communication to facilitate the registration of householders in their communities and the distribution of ITNs. The volunteers were initially tasked with registering householders to provide a register which was subsequently used to facilitate the free distribution of ITNs to the householders. ITNs were allocated to health centres at the sub-districts level, from which they were transported to communities and given to the volunteers for onwards distribution to householders. In the Upper West region of Ghana, the free ITN distribution was also dubbed the 'hang-up campaign' because it was believed that householders would be more motivated to use the ITNs if these were installed for them. Therefore, where householders allowed it, volunteers entered rooms to hang up the nets for householders. Alternatively, householders were provided with ropes and nails to hang the ITNs themselves.

Evidence from the Ghana Demographic and Health Survey indicated that the percentage of households in Upper West region who owned at least one ITN for every two persons in the household increased from 30.2% in 2003 to 71.7% in 2008 and 77.4% in 2014. This was considerably higher than the national coverage, which stood at 17.6%, 45.4% and 68.3% respectively (Ghana Statistical Service, 2003, 2008, 2014).

## 1.4 **Problem statement**

Despite the implementation of indoor residual spraying and insecticide treated nets in the Upper West region of Ghana in 2012–13, malaria has remained a serious public health threat in the region. For instance, malaria prevalence among children aged 6–

59 months old only fell from 51% in 2011 (Ghana Statistical Service, 2011) to 37.8% in 2014 in the region (Ghana Statistical Service, 2014). Thus, in the almost three years following their implementation, the combined use of IRS and ITNs along with other interventions against malaria in the Upper West region had not had the impact on reducing malaria morbidity seen in other regions in Ghana (Sarpong et al., 2015).

In attempts to rationalize the persistence of malaria as a major public health issue and unravel the underlying factors contributing to this endemic disease, malaria researchers have suggested that people's awareness or conceptualisations of malaria, which in part influences their adoption of preventive behaviours and interventions, plays a critical role in any intervention aimed at controlling malaria (Okafor & Amzat, 2007). It has also been argued that current challenges with malaria prevention interventions are related to the sociocultural context of targeted populations (Launiala & Kulmala, 2006). Available evidence indicates that the failure of malaria-related health interventions may be because the design and implementation of those interventions were based on a limited understanding of lay perceptions about the disease and its transmission (Manderson 1998; McNaughton, Miller & Tsourtos, 2018).

The effectiveness of vector control interventions is largely determined by householder acceptability and sustained use of the intervention (Galvin et al., 2011). This means that community acceptability is a pre-requisite for the successful implementation of malaria vector control interventions (Komalamisra et al., 2009). For IRS, a standard coverage of not less than 80% of available structures is deemed to be a necessary pre-condition for effectiveness (World Health Organization, 2006a). Despite the fact that the IRS programme in the Upper West region of Ghana has a coverage target of 90% (Sarpong et al. 2015), evidence from the Ghana Demographic and Health Survey indicates that in all households in the Upper West region of Ghana, only 69.1% of children aged under five were covered by either IRS or ITNs (Ghana Statistical Service 2014). This suggests that the actual IRS (only) coverage may be lower than 69.1%, and possibly much lower than the standard minimum coverage of 80% required for the effectiveness of IRS interventions (World Health Organization, 2006a). Despite the potentially low IRS coverage in the region, no scholarly research has been conducted in Ghana on the acceptability of IRS.

Similarly, this study is necessitated by the fact that despite the high coverage (77.4%) of insecticide treated nets (ITNs) in the Upper West region, evidence shows that ITN use is considerably lower (at 54.5%) (Ghana Statistical Service, 2014). This raises questions about the acceptability and continued use of ITNs by people in the Upper

West region.

Given the importance of community acceptability to the successful implementation and effectiveness of vector control interventions (Galvin et al., 2011), evidence on the acceptability of combining IRS and ITNs at the household level is likely to be highly valuable. Despite this fact, research on the acceptability of vector control interventions have focused either on the acceptability of IRS alone (Dye et al., 2010; Komalamisra et al. 2009) or the acceptability of ITNs alone (Binka & Adongo 1997; Okrah et al., 2002). However, the fact that both interventions are indoor based implies that householders' use of one of these interventions could influence their use of the other intervention. Despite this possibility, prior research on the combination of IRS and ITNs has only focused on the effectiveness of the combination (Bekele et al., 2012; Corbel et al., 2012; Fullman et al., 2013; Keating et al., 2011; Kleinschmidt et al., 2009; Pinder et al., 2014; West et al., 2014, 2015), resulting in a lack of evidence about householders' practices in terms of how they accept and combine IRS and ITNs for malaria prevention.

The aim of this research is to explore the facilitators and barriers to malaria control in the Upper West region of Ghana. The study is conducted because malaria continues to pose a serious threat to public health in upper western Ghana despite the implementation of indoor residual spraying and insecticide treated nets, which have been proven to be successful interventions elsewhere. The research will be conducted by exploring local community perceptions about malaria and the acceptability of IRS and ITNs. This study also seeks to explore the acceptability of combining IRS and ITNs at the household level. Evidence from this research could inform policy and decision-making regarding the implementation of IRS and ITN interventions and facilitate the adoption of malaria control strategies that will enhance the acceptance of IRS and ITNs by householders.

## 1.5 **Outline of thesis chapters**

Chapter One presents the background including malaria as a global public health problem, especially in SSA and Ghana, and the interventions designed to prevent or control malaria, with an emphasis on the use of indoor residual spraying and insecticide treated nets for malaria vector control. Thereafter, the problem statement or justification for this study is presented.

In Chapter Two, the relevant literature is reviewed and categorized under six main sections: malaria, its impact and control strategies, lay perceptions about malaria, and the acceptability of IRS and ITNs. A summary of the research gaps, research

objectives and research questions are then presented. The other sections include relevant theoretical frameworks (including the health belief model, realist evaluation framework and social determinants of health framework), as well as the health system in Ghana, and finally a conclusion section is presented.

Chapter Three presents the methods and outlines the study setting, research design, study participants, their recruitment processes, and data collection. The chapter also presents the processes of data analysis, measures that were adopted to enhance the rigour and credibility of the findings, and steps taken to ensure compliance with ethical issues relating to research with human participants.

The findings of this research are presented in Chapter Four under three main sections including: (I) household participants' perceptions about malaria, including their perceptions about the causes of malaria, the risk of malaria infection, the impact of malaria, and preventive strategies, (II) householders' acceptability of vector control interventions (IRS and ITNs), including their perceptions about the facilitators and barriers to IRS and ITN acceptability, and (III) Programme officials' perspectives on the barriers and facilitators to the implementation of IRS and ITNs.

The fifth chapter discusses the findings and is presented in two main sections; the facilitators of malaria control and the barriers to malaria control in the Upper West region of Ghana. The barriers to malaria control are further categorized under three levels: the individual, the community, and health system levels (although these three categories are not mutually exclusive). The last chapter is the Conclusion, where a summary of the findings and the implications of the study for malaria control are presented. Recommendations are made to improve policy and practice.

# 2 CHAPTER TWO: LITERATURE REVIEW

## 2.1 Introduction

This review is structured into seven sections. The first section provides a brief introduction to the biomedical aspects of malaria, its socio-economic impact, prevention strategies, and resistance development for an understanding about some of the broader issues relating to malaria. Having reviewed the biomedical aspects of malaria, the second section of this chapter covers a review of literature on lay perceptions about malaria, with a focus on the perceptions about the causes of malaria which are important for understanding how these perceptions influence malaria prevention efforts. Thereafter, section three details a review of literature on the acceptability of indoor residual spraying (IRS) and insecticide treated nets (ITNs) which is necessary for an insight into the facilitators and barriers to the acceptance of IRS and ITN interventions. Section four summarizes the research gaps and identifies specific research objectives and research questions for this study. Section five introduces relevant theories (the health belief model, the realist evaluation framework and social determinants of health) that underpin this research for an understanding about the applicability of these theories to the study. The sixth section presents the health system in Ghana, and finally, in the last section a summary of the content of the entire chapter is presented.

A systematic search of the literature was conducted (see search strategy below) to identify and review relevant literature. A narrative review was undertaken to enable the researcher to familiarize himself with current available evidence (Kiteley & Stogdon, 2014). Cronin, Ryan and Coughlan (2008) state that narrative reviews are designed to critique, synthesize and summarize the available evidence on a topic to highlight the significance of new research. This is because narrative reviews help to identify research gaps, enabling researchers to define or refine the research questions (Cronin, Ryan & Coughlan, 2008). Therefore, this narrative review was conducted to help refine the research questions or identify gaps for this PhD study, unlike systematic reviews which synthesize literature in response to a specific enquiry (Ferrari, 2015).

### 2.1.1 Systematic search for literature

The preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines were used to inform the systematic search for literature (Moher et al., 2009). In doing so, a set of search terms was developed based on three main concepts related to my study namely (a) malaria, (b) interventions, and (c)

perceptions. The search was conducted using specific searches for each concept (malaria, fever, mosquito, febrile illness, insecticide, and insect) AND (indoor residual spraying, insecticide treated nets, ITNs, LLINs, IRS, bed net, mosquito net, DDT) AND (perception, attitude, knowledge, belief, accept, barrier, and practice). A systematic search of literature was then undertaken in several public health related databases, including PubMed, Scopus, Web of Science, ProQuest Central, CINAHL and Google Scholar. These databases were selected because of their coverage of public health, medicine, nursing, health systems, and health promotion. In addition, relevant documents from the WHO, government reports and books were searched by hand. Therefore, the search strategy included searching peer reviewed journal articles from relevant databases that were published in English between 2000 and 2017 as well as from reports and other relevant documents and books. The timeframe enabled the researcher to select highly relevant recent articles and documents. To ensure the selection of highly relevant studies, inclusion criteria were used as shown below.

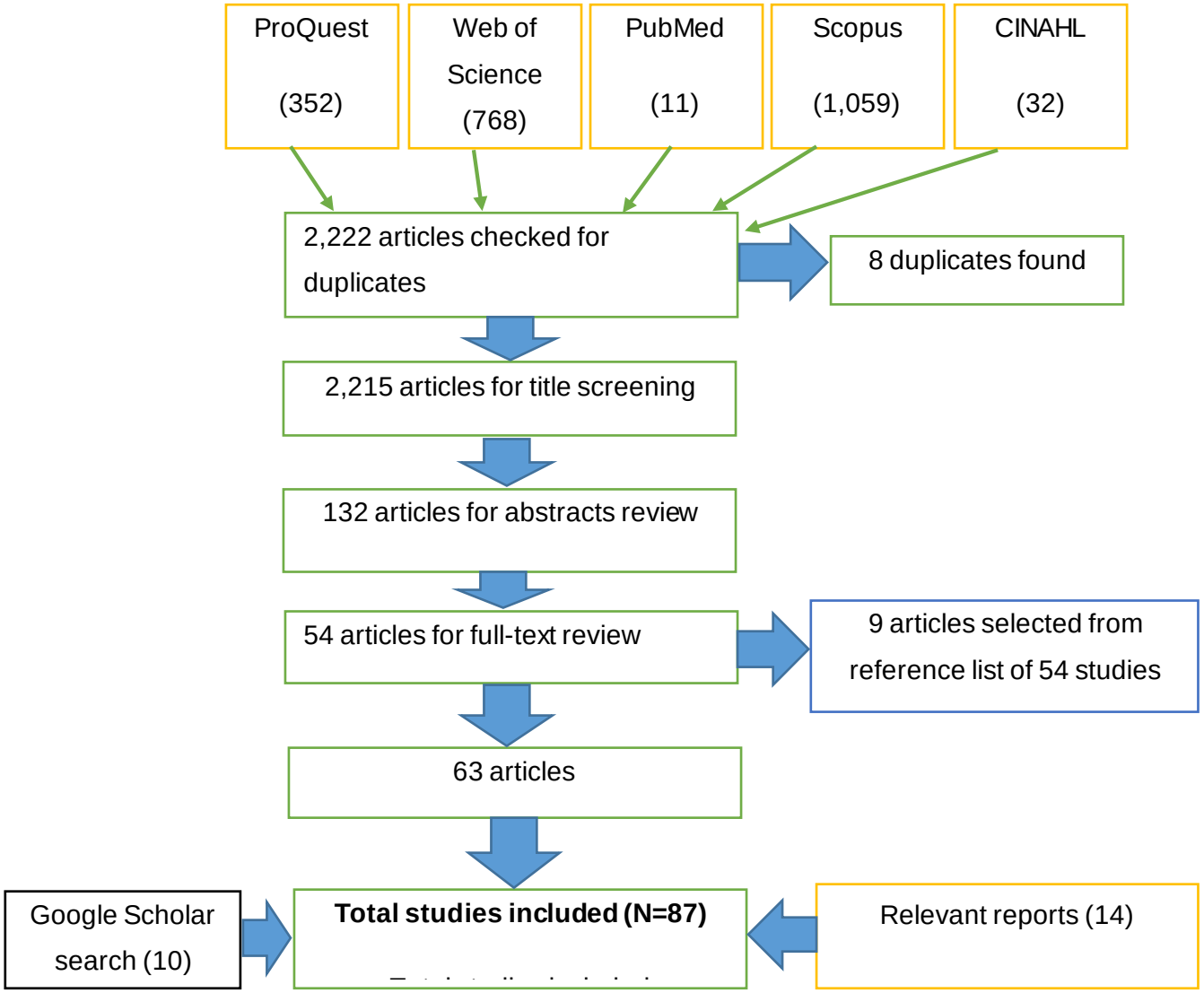
Inclusion criteria:

1. Quantitative and qualitative studies conducted in Sub-Saharan Africa on perceptions about causes and prevention of malaria, and the reasons for the use or non-use of insecticide treated nets.
2. Quantitative and qualitative studies conducted in Sub-Saharan Africa on perceptions about causes and prevention of malaria, and the reasons for the acceptance or refusal of indoor residual spraying.
3. Qualitative studies on the reasons for the use or non-use of insecticide treated nets, conducted in Sub-Saharan Africa.
4. Qualitative studies on the reasons (facilitators) for the acceptance or refusal (barriers) of indoor residual spraying, conducted in Sub-Saharan Africa.
5. Studies and reports on the biomedical aspects of malaria, IRS, ITNs, resistance development, social determinants of health, and the health system in Ghana.

The searches of the five electronic databases was done on 7th December 2017, yielding a total of 2,222 articles. Of these, 352 articles were obtained from ProQuest, 11 from PubMed, 1,059 from Scopus, 768 from Web of Science, and 32 from CINAHL. The articles were downloaded into EndNote version X8 after the search on each database. Screening for duplicates was conducted using EndNote software, and 8 duplicates were found, leaving a total of 2,215 articles. The titles of the 2,215 articles were screened and 132 articles were found to be relevant to this study. The abstracts of these 132 articles were reviewed using the inclusion criteria and 54 of them

selected. Afterwards, 9 articles were selected from the reference list of the 54 studies. Using the same search terms above, a separate search was conducted on Google Scholar in December 2017, and 10 relevant articles were selected for inclusion. Finally, 14 relevant government and WHO reports, as well as books were included. Therefore, the search process resulted in the selection of a total of 87 articles and reports for review. Data from the selected literature was analysed through thematic analysis by identifying recurring themes. A summary of the flow chart of the literature search can be found in Figure 1 below.

**Figure 1: Flow chart of the literature search**



## 2.2 Malaria, its impact and control strategies

Malaria is a life-threatening disease that is caused by the *Plasmodium* (*P*) parasite, with symptoms such as fever, headache, body soreness, backache, joint pain etc. The parasite is transmitted to humans through the bite of *Anopheles* mosquitoes (Neafsey et al., 2015). Four main species of *Plasmodium* are responsible for malaria infections, including *P. vivax, P. malariae, P. falciparum, and P. ovale* (Cox, 2010), with *P. falciparum* accounting for much of the morbidity and mortality from malaria (Snow et al., 2005). In Ghana, the parasite species responsible for malaria causation are *P. falciparum* (about 90%), *P. malariae* (under 10%) and *P. ovale* (under 2%) (Ghana Statistical Service, 2011). The main *Anopheline* mosquito species that transmits malaria parasites in Ghana is *Anopheles gambiae.* This is the most efficient vector, and can be found across much of Africa (Teklehaimanot & Mejia, 2008). Although malaria is a tropical disease commonly found in the tropical regions of Sub-Saharan Africa (SSA), Asia, South and Central America (Tantular, 2010), the dominance of *Anopheles gambiae* in SSA may be the reason why almost 90% of malaria morbidity and mortality occurs in SSA (World Health Organization, 2017).

### 2.2.1 Socio-economic impact of malaria

Some scholars have argued that malaria and poverty are geographically specific. In other words, where malaria thrives, poverty is pervasive (Sachs & Malaney, 2002). Although malaria and poverty are interlinked, the relationship between malaria and poverty is complex and not entirely straightforward (Teklehaimanot & Mejia, 2008). Poverty creates favourable conditions for malaria to thrive and malaria serves as an impediment to economic growth, trapping individuals and communities in perpetual poverty (Sachs & Malaney, 2002). Poor housing facilities expose people to mosquito bites, poor households are unable to afford preventive interventions such as insecticide treated nets if payment is required, poor families may have inadequate access to health care, and the peak time of malaria transmission is during the rainy season which could lead to time lost from farm work leading to food insecurity (Teklehaimanot & Mejia, 2008). Therefore, it is not surprising that countries where malaria is endemic are also among the least developed in the world (Gallup & Sachs, 2001).

To understand the economic burden of malaria, two main approaches are often used. The first of these relates to microeconomic research on the direct costs of malaria prevention and treatment at the individual, household and health facility level, and the indirect costs in terms of lost time due to malaria (Teklehaimanot & Mejia, 2008). For instance, a study in Ghana found that the total cost (direct and indirect) of malaria

treatment was about $6.39 (USD) per case and $9.39 (USD) per household (Akazili, Aikins & Binka, 2007). The second approach, derived from the macroeconomic perspective, measures the long-term impact of malaria on economic growth and development at the national level (Teklehaimanot & Mejia, 2008). The renowned Gallup and Sachs report on the economic burden of malaria indicates that malaria may be affecting the economic growth and development in countries where it is endemic (Gallup & Sachs, 2001), which could subsequently affect the overall health status of people. To stem the tide against malaria, various strategies are currently being implemented to prevent and control the disease. These include, but are not limited to, vector control interventions such as insecticide treated nets and indoor residual spraying, details of which are presented below.

### 2.2.2 Malaria prevention and control strategies

Shiff (2002) argues that the failure to eradicate malaria during the Global Malaria Eradication Programme (1958–1969) makes it highly unlikely that any single approach to control malaria will ever be adopted. This necessitates the adoption of an integrated approach using different strategies for malaria control (Moss, Shah & Morrow, 2008). Integrated malaria control is derived from Ronald Ross's concept of threshold densities and proposes that the success of malaria control does not depend on the elimination of *Anopheles* mosquitoes but the reduction of their numbers below a certain threshold (Moss, Shah & Morrow, 2008). This implies that malaria control could be more successful through integrated programmes rather than using a single intervention. This is because malaria control is so complex that any attempt to address it with a single approach is bound to encounter challenges (Shiff, 2002).

Integrated malaria control is a term for the strategic use of multiple sets of malaria control interventions to combat malaria. The World Health Organization often recommends an integrated set of interventions for adoption by countries depending on the level of endemicity. These interventions may include IRS, ITNs, killing of larvae, environmental management, diagnostics, malaria case management, health education and surveillance, among others (World Health Organization, 2017). Large scale malaria control interventions normally include vector control as an integral part. For the purpose of this research, IRS and ITNs, the two key vector control interventions that are currently used to prevent malaria transmission (Fullman et al., 2013), will be discussed.

#### *2.2.2.1 Indoor residual spraying (IRS)*

Indoor residual spraying involves the spraying of long-acting chemical insecticides onto the inner walls and roofs of houses and domestic animal dwellings (World Health

Organization, 2006a). The intervention operates by repelling mosquitoes from houses and by killing adult mosquitoes that land on the walls, implying that IRS is most effective against indoor resting (or endophilic) mosquitoes (Pluess et al., 2010). Specifically, the objective of IRS intervention is to interrupt and reduce malaria infections by reducing vector density, survival and human–vector contact in a way that is safe for both the environment and human health (World Health Organization, 2013). Much of the impact of IRS takes place after feeding, when the *Anopheline* mosquito is more likely to rest on a sprayed surface and hence, pick up a lethal dose of the insecticide, preventing it from transmitting the parasite to other people in the neighbourhood (World Health Organization, 2013).

When selecting areas for the implementation of IRS, the WHO manual for IRS operations recommends considering malaria vectors, humans and environment, in addition to malaria transmission levels (World Health Organization, 2013). The implementation of IRS in the current study setting (Upper West region) thus was informed by the high prevalence of malaria in the region (Ghana Statistical Service, 2011). The manual also recommends considering the implementation of IRS in targeted locations, and the potential for combining IRS with other vector control interventions such as insecticide treated nets (ITNs) (World Health Organization, 2013). This may have been the basis for the implementation of ITNs alongside IRS intervention in the Upper West region of Ghana in 2012. The effectiveness of malaria vector control interventions is determined by a wide range of factors, including the acceptability and sustained use of preventive measures (Galvin et al., 2011).

#### *2.2.2.2 Insecticide treated nets (ITNs)*

Insecticide treated nets are the most useful malaria control intervention to be developed since the advent of IRS in the mid-20th century (Hill, Lines & Rowland, 2006), and they are known to provide a high degree of protection for individuals (Pluess et al., 2010). Insecticide treated nets act as a physical barrier, preventing vector mosquitoes from having access to individual ITN users, thereby providing personal protection against malaria (World Health Organization, 2007). The Alma-Ata Declaration of 1978 indicated the need for self-reliance and active community participation in all health promotion and disease prevention efforts (Dare & Badru, 2000). With the renewal of emphasis on community- and individual-level preventive measures, some experts argue that use of ITNs is the most important malaria control intervention that could easily be deployed in endemic areas on large scale (Lengeler, 2004). ITNs provide a physical barrier, preventing vector–human contact and hence giving protection to individuals using them. It is for this reason that the WHO recommends full coverage of all people who are at risk of malaria infection in areas

that are targeted for malaria prevention (World Health Organization, 2007).

The 'Roll Back Malaria' partnership endorsed by over 50 heads of state in Africa spearheaded efforts towards scaling up preventive interventions such as ITNs (Yamey, 2000). This partnership initially promoted the scale-up of free ITNs to vulnerable groups such as pregnant women and children (World Health Organization and UNICEF, 2005) and eventually led to mass ITN distribution campaigns that helped increase the coverage of ITNs in several African countries including Ghana (Paintain et al., 2014) where an estimated 68% households owned at least one ITN (Ghana Statistical Service, 2014).

Despite the efforts put in place to control malaria, issues relating to development of resistance has been a key challenge to malaria control. These range from vector resistance to anti-malaria drug resistance. The next section provides a detailed review of resistance development and management issues.

### 2.2.3 Resistance development and management

Resistance development in malaria control usually involves the resistance of malaria parasites to anti-malaria drugs or of malaria vectors to insecticides. As a complex disease, the epidemiological and clinical manifestations of malaria are variable in different parts of the world. This variability is attributable to a number of factors, including the species of malaria parasites available at a particular place; their susceptibility to available treatments; the type, distribution and efficiency of mosquito vectors; the environmental conditions and immunity of the population at risk, among others (Chiyaka, Garira & Dube, 2009).

#### *2.2.3.1 Vector resistance to insecticides*

There is extensive use of insecticides for malaria vector control, particularly with the recent scale-up of ITNs and IRS interventions in several endemic countries (Roberts & Enserink, 2007) in SSA including Ghana. Four classes of insecticide, organochlorines, organophosphates, carbamates and pyrethroids, remain the mainstay of vector control programmes (World Health Organization, 2006b). These four classes of insecticides are all nerve poisons that target either the voltage-gated sodium channel of vector neurones or acetylcholinesterase in the synapses (Ranson et al., 2009). The WHO recommends twelve insecticides (based on the four classes of insecticides) for IRS whereas only six insecticides, all pyrethroids, are available for use in treating ITNs (World Health Organization, 2006b). Despite the availability of options for IRS, most malaria vector control programmes largely depend on pyrethroids (Ranson et al., 2011).

Given that these same classes of insecticides are also primarily used in agricultural pest control, mosquitoes are potentially exposed to them when contaminated groundwater enters their habitats, leading to the development of resistance in the *Anopheles* mosquito (Quinones et al., 2015; Ranson et al., 2009). Insecticides resistance is usually determined by conducting efficacy tests on the susceptibility of malaria vectors to insecticides. In a process referred to as response to exposure test or bioassay test, mosquitoes are exposed to insecticide impregnated papers for a given period after which the fatalities are recorded (World Health Organization, 2016). Vector resistance to pyrethroids is currently widespread among most African vectors (Ranson et al., 2011) although this chemical is largely used for the treatment of ITNs.

The development and spread of insecticide resistance is a major concern in many countries where malaria is endemic because it has the potential to reverse gains achieved in the reduction of mortality and morbidity due to malaria (Quinones et al., 2015). Therefore, critical attention and the adoption of prudent and meticulous measures are required to avert development of resistance because of the limited chemical arsenal available for malaria vector control (Ranson et al., 2009). The adoption of a resistance management regime by malaria control programmes is the sure path to sustaining the effectiveness of the available insecticides (Djènontin et al., 2009). In the current study setting, development of resistance to IRS insecticides is being managed by periodically changing the insecticides used for spraying.

#### *2.2.3.2 Anti-malaria drug resistance*

Anti-malaria drug resistance is determined by an assessment of the number of patients in a trial who do not respond to treatment within a 28-day or longer follow-up period (Wongsrichanalai & Sibley, 2013). Resistance of *P. falciparum*, *P. vivax* and recently, *P. malarae,* has been documented over the last 50 years (Vestergaard & Ringwald, 2007). Chloroquine-resistant *P. falciparum* was first reported in south-east Asia, and by the 1980s it had spread to several countries in East Africa (Wongsrichanalai et al., 2002). Thereafter, chloroquine resistance spread to all areas where *P. falciparum* was endemic, apart from Central America and the Caribbean (Vestergaard & Ringwald, 2007).

*P. falciparum* is the most resistant malaria species, reported to be resistant not only to chloroquine but also to quinine, amodiaquine, and mefloquine, whereas *P. vivax* and *P. malarae* have only been reported to be resistant to chloroquine (Vestergaard & Ringwald, 2007). The WHO responded to the threat posed by parasite resistance by unveiling artemisinin-based combination therapy as the first-line treatment for uncomplicated *P. falciparum* malaria in all endemic areas (Maude et al., 2009). This

therapy involves combining artemisinin with a non-artemisinin drug, such as artesunate with amodiaquine or artemether with lumefantrine (Bosman & Mendis, 2007).

Notwithstanding their high effectiveness, evidence of resistance to artemisinin treatments is gradually increasing (Lubell et al., 2014). This poses a threat to gains made in the fight against malaria because the recent decline in global malaria incidence is largely due to the scale-up of malaria vector control interventions, the highly effective artemisinin-based combination therapy, rapid diagnostic tests and other measures (Wongsrichanalai & Sibley, 2013). A loss of artemisinin efficacy will certainly threaten the gains achieved over the last decade (Maude et al., 2009). This is particularly so given the lack of a suitable alternative for large scale implementation (Lubell et al., 2014; White, 2004).

## 2.3 **Lay perceptions about malaria**

According to Kleinman (2007), illness is part of an idiosyncratic meaning system encompassed by a shared cultural system that is easily understood within the broader society. Cultural beliefs about the aetiology of illness will invariably influence the choice of intervention for treatment (Okafor & Amzat, 2007). This implies that people's cultural beliefs may influence their perceptions about the causes of malaria, thereby influencing the adoption of preventive behaviours and interventions. Therefore, perceptions about the causes of malaria could influence the acceptance and use of IRS and ITNs, hence the relevance of it to this study.

Indeed, the social science literature has for decades highlighted the need to focus on human behaviour and understanding because this will strengthen malaria control and prevention efforts (Spjeldnæs, Kitua & Blomberg, 2014). This is probably because an understanding of local perceptions about the causes and prevention of malaria could help in designing sustainable community-based malaria control programmes that will lead to behaviour change and the adoption of new ideas (Adongo, Kirkwood & Kendall, 2005) or interventions.

### 2.3.1 Perceived causes of malaria

Many studies have shown that most household respondents are increasingly aware about the role of mosquitoes in causing malaria (Adongo, Kirkwood & Kendall, 2005; Astatkie, 2010; Dye et al., 2010; Gobena, Berhane & Worku, 2013; Govere et al., 2000; Ingabire et al., 2015; Mazigo et al., 2010; Ng'ang'a et al., 2009). Quantitative studies in Ethiopia and Kenya found that about over 90% of participants perceived mosquito bites as the cause of malaria (Astatkie, 2010; Ng'ang'a et al., 2009), while

a similar study at a different setting in Kenya found that only 47% of participants believed malaria was caused by the bite of mosquitoes (Mazigo et al., 2010). Studies in Ghana, where my current study was undertaken, and South Africa have shown that a significant majority of participants (over 70%) perceived mosquito bites as the primary cause of malaria (Adongo, Kirkwood & Kendall, 2005; Govere et al., 2000). Although mosquitoes are involved in malaria causation, the quantitative nature of these studies did not allow respondents to express their views on other relevant issues relating to the processes of malaria transmission, such as the vector species responsible for the transmission of malaria parasites.

The limited qualitative evidence that was found showed that although respondents associated mosquitoes with malaria, the mode of transmission was largely not known (Dye et al., 2010; Ingabire et al., 2015). A qualitative study in Rwanda found that while the majority of participants associated malaria with mosquitoes, only a few participants were aware of the type of mosquito responsible for transmitting malaria parasites (Ingabire et al., 2015). Another study in Kenya observed that mosquito bites were perceived to be only one in a sequence of factors leading to malaria causation (Dye et al., 2010). This evidence shows that most participants did not adequately understand that malaria transmission only occurs when an infected female *Anopheles* mosquito bites an individual, thereby transmitting *Plasmodium* parasites (Neafsey et al., 2015). Although the authors of these Kenyan and Rwandan studies have contributed to knowledge by reporting on respondents' misunderstandings about the malaria transmission processes, the authors did not attempt to explain how these misunderstandings could serve as a barrier to the use of preventive interventions. My current study seeks to explain how these misunderstandings could serve as barriers to malaria prevention from the perspective of household respondents.

Some studies found that dirty surroundings such as stagnant water and other poor environmental conditions such as house flies and bushy areas were perceived by respondents to be related to the causes of malaria (Astatkie, 2010; Dye et al., 2010; Ingabire et al., 2015; Mazigo et al., 2010; Ng'ang'a et al., 2009). Studies in Tanzania, Kenya and Ethiopia reported that 4.4%, 16% and 34.4% of participants perceived malaria to be caused by stagnant water (Astatkie, 2010; Dye et al., 2010; Mazigo et al., 2010; Ng'ang'a et al., 2009). Similarly, a study in Rwanda reported that stagnant water was a determinant of malaria transmission (Ingabire et al., 2015). However, the perception that mosquitoes breed in stagnant waters is not entirely correct because although stagnant water breeds mosquitoes, *Anopheles* mosquitoes—the species responsible for the transmission of malaria parasites—tend to prefer clear and non-turbid water for breeding (Herrel et al., 2001).

Apart from what has been discussed so far on the perceived role of stagnant water in causing malaria, other studies have revealed that dirty surroundings or environments around the home were perceived by respondents to be responsible for malaria causation (Adongo, Kirkwood & Kendall, 2005; Ng'ang'a et al., 2009). Adongo, Kirkwood and Kendall (2005) found that 3% of respondents cited house flies as a cause of malaria. Although dirty surroundings such as bushy areas may provide hiding places for mosquitoes, such dirt cannot contribute to mosquito breeding. Therefore, it is incorrect to attribute malaria causation directly to dirty environments. From a theoretical perspective, the fact that such dirty environments do not have a direct effect on malaria infections could limit the cues used by householders to take action against malaria, especially where householders focus only on keeping their surroundings clean to prevent malaria instead of using vector control interventions such as IRS and ITNs (Champion & Skinner, 2008).

Dietary factors have also been perceived as related to the causes of malaria (Adongo, Kirkwood & Kendall, 2005; Astatkie, 2010; Dye et al., 2010; Ng'ang'a et al., 2009). The consumption of sweet foods like mangoes and sugar was perceived to be part of the cause of malaria by the Kasena-Nankana people of Ghana (Adongo, Kirkwood & Kendall, 2005), while in Kenya, Ng'ang'a et al. (2009) found that about 5.2% of respondents perceived malaria to be caused by eating food or raw mangoes. In Ethiopia, Astatkie (2010) found that about 30% and 3.7% of respondents indicated hunger and drinking of dirty water as causes of malaria respectively. Similarly, the consumption of bad food and water were reported to be among the causes of malaria in a rural Kenyan community (Dye et al., 2010). The perceived role of dietary factors in causing malaria is inaccurate because these perceptions do not implicate mosquitoes in malaria causation. It may be worth noting that none of the previous studies offered a theoretical explanation regarding how these perceptions serve as barriers to the use of preventive interventions by householders. This current study seeks to fill this gap in knowledge by providing a theory-based explanation about how perceptions could affect malaria prevention.

Exposure to extreme temperatures has been previously reported as a perceived cause of malaria (Adongo, Kirkwood & Kendall, 2005; Dye et al., 2010; Ng'ang'a et al., 2009). In Central Kenya, Ng'ang'a et al. (2009) found that about 10.6% of participants regarded wet and cold conditions as causes of malaria, while other participants considered working in the sun, in rice paddies or being rained on as causes of malaria. A similar study in Ghana found that 2% of participants perceived heat and sunshine as causes of malaria (Adongo, Kirkwood & Kendall, 2005). However, it must be noted that exposure to cold, heat or rain do not contribute to

malaria causation, hence, the perception that such exposure contributes to malaria causation is incorrect. The evidence from the Kenya and Ghana studies could not indicate why participants held these perceptions although this could have provided an in-depth understanding about the contextual factors relating to them. Mixed methods research conducted in Kenya (Dye et al., 2010) indicated that walking in dirty water after rain, and walking in the evening without warm clothing were perceived to cause malaria. The findings from this Kenyan study could have significance for the current study's setting, given that rain and the cold harmattan winds are local characteristics in the current study setting that could influence householders' perceptions about the causes of malaria.

Another scholar found that overworking was perceived by 4.6% of study participants in Ethiopia as related to the cause of malaria (Astatkie, 2010). Indeed, overwork cannot lead to malaria causation, and therefore this is a misconception about the causes of malaria. However, the quantitative nature of the evidence does not allow for an understanding as to why participants held this view. The fact that only one study reported overwork as a cause of malaria, and only 4.6% of the participants held this view, suggests that this evidence is inconclusive.

Adding to the above, a few previous studies found that spiritual factors were perceived by some respondents to be responsible for malaria causation (Adongo, Kirkwood & Kendall, 2005; Ng'ang'a et al., 2009). In Ghana, for instance, the 'invisible hand' of God via heredity was suspected to be one of the causes of malaria (Adongo, Kirkwood & Kendall, 2005). Similarly, evil spirits, witchcraft and demons were reported to cause malaria by a few participants (0.3%) in a study in central Kenya (Ng'ang'a et al., 2009). The perceived role of spiritual factors in malaria causation as reported in these studies is incorrect, and therefore, constitutes a misconception. These misconceptions highlight the importance of religious and cultural factors in shaping people's perceptions about the causes of malaria, and the fact that differences in contexts could lead to differences in opinion about the causes of malaria. This implies that understanding the contextual factors in the Upper West region of Ghana is relevant to providing appropriate interventions or strategies for malaria control in the region. The realist evaluation framework that is central to this study emphasizes the need to consider contextual issues because it is not interventions that work *per se*, but pre-existing structures of a locality and other elements such as the systems, relationships, and technology are equally important to the successful outcome of interventions (Pawson & Tilley, 1997b).

Despite the various misconceptions about malaria causation explained above, it is

encouraging to note that some respondents (6%) in a study in Tanzania were aware that *Plasmodium* organisms were among the causes of malaria (Mazigo et al., 2010). The awareness level reported in Tanzania was low and while these researchers have contributed to an understanding about household awareness in relation to malaria, they did not explore issues regarding transmission of malaria parasites. The exploratory nature of the current study will ensure that household participants air their views (Merriam, 2002) about malaria causation and transmission.

It can be concluded from the foregoing that previous studies on the perceived causes of malaria have largely found that participants perceived mosquitoes to be involved in malaria causation, although the transmission process was not well understood. Although earlier studies reported several misconceptions about the causes of malaria, no theoretical interpretations were given by authors regarding the implications of these findings for participants' preventive behaviour. Furthermore, these studies did not explain how the implementation of interventions such as IRS and ITNs in specific contexts could be influenced by misconceptions about malaria causation. Moreover, the differences in the contexts of the various studies may have accounted for the differing findings, especially in relation to the role of cultural and religious factors in shaping perceptions about malaria causation. Hence, context specific studies may be required for the design of malaria control strategies suitable to specific settings. Therefore, research on the perceived causes of malaria in the Upper West region of Ghana is necessary to facilitate the acceptability and implementation of IRS and ITNs for malaria control.

The next section presents a critical review on the acceptability of indoor residual spraying and insecticide treated nets to understand the enablers and barriers to the acceptability of these interventions.

## 2.4 Acceptability of indoor residual spraying (IRS) and insecticide treated nets (ITNs)

The concept of acceptability in healthcare can be varied and is to some extent ambiguous. According to Sekhon, Cartwright and Francis (2017), acceptability can be inferred from the perspective of the individual but may also constitute a reflection of the collective opinion about the nature of interventions. Other scholars have argued that acceptability is subject to changes following one's experience with the intervention (Andrykowski & Manne, 2006). Sekhon and colleagues classified acceptability into three main components: prospective acceptability, the opinion held prior to participation in the intervention; concurrent acceptability, the judgement of the intervention during participation; and retrospective acceptability, the opinion after

participating in the intervention (Sekhon, Cartwright & Francis, 2017). Therefore, in the context of this study, acceptability may be defined as the act of accepting or using preventive interventions or the opinions held by householders prior to, during and after using IRS and ITNs. In other words, prospective, concurrent and retrospective acceptability are all relevant to the current study because not only can householders' opinions about IRS and ITNs affect their acceptance of the interventions, but also the opinions held by householders during, and after their use of IRS and ITNs can affect their future acceptance of the interventions.

Community acceptability is critical to the effectiveness of vector control interventions such as IRS and ITNs (Rodríguez et al., 2006). As such, issues regarding the facilitators and barriers to the acceptance of IRS and ITNs need to receive serious consideration if these interventions are to be successful. This is in accordance with the health belief model (HBM) that associates the acceptability of interventions with perceived benefits and barriers (Janz & Becker 1984). Further, the realist evaluation framework emphasizes the importance of contexts and mechanisms to the outcome of interventions (Ogrinc & Batalden, 2009). Relating this to this study, the processes through which interventions are executed and the context of implementation are essential to the outcome of the interventions. This is because the context and mechanisms could facilitate or constrain interventions, subsequently affecting the outcome.

Despite the importance of acceptability to the successful implementation of IRS and ITNs, only a few studies have explored the facilitators and barriers to the acceptance of them. Therefore, a review of relevant literature was conducted to provide an understanding of the factors that facilitate or constrain the acceptance of IRS and ITNs.

### 2.4.1 Facilitators for acceptability of indoor residual spraying (IRS)

Evidence shows that acceptance of IRS is informed by its perceived impact in reducing malaria infections and other diseases (Govere et al., 2000; Ingabire et al., 2015; Kaufman et al., 2012; Munguambe et al., 2011). Govere et al. (2000) observed that 79.9% of participants in South Africa believed that spraying was intended to kill mosquitoes with the aim of reducing malaria. This study sought to identify perceived reasons for the implementation of IRS, but did not explore the facilitators of acceptability such as the perceived benefits of spraying. Similarly, community members in Tanzania reportedly accepted IRS with the aim of providing health protection to their neighbours and visitors. This was based on the belief that mosquitoes were mobile insects that could move from one house to the other to bite

people and infect them with diseases (Kaufman et al., 2012). Similar findings were reported in Mozambique, where the avoidance of general diseases was perceived to influence the acceptance of IRS (Munguambe et al., 2011).

Although the evidence highlighted above conforms with the HBM because spray acceptance was based on the perceived benefits of spraying in reducing or preventing malaria and other diseases, the authors did not recognize the significance of the HBM in relation to this finding. The current study explores the facilitators of IRS and incorporates the HBM because it provides explanations for individual preventive behaviour (Champion & Skinner, 2008).

One of the facilitators of IRS acceptance reported by previous studies is the immediate effectiveness of spraying in killing insects (Govere et al., 2000; Kaufman et al., 2012; Munguambe et al., 2011). In Tanzania, Kaufman et al. (2012) found that the death of insects such as bedbugs following spraying was one of the primary reasons for IRS acceptance by respondents. Similarly, the immediate lethal effect of IRS on insects such as fleas, ticks, and cockroaches was reported to be a reason for spray acceptance in Mozambique (Munguambe et al., 2011). In South Africa, the killing of cockroaches, other insects and germs was perceived to be a reason for IRS (Govere et al., 2000). However, these researchers did not adequately explore householders' perceptions about the acceptance of spraying because of the death of insects. Morever, there was insufficient information about which spray insecticides were perceived to be efficacious in killing insects, particularly given that different types of insecticide (with varying characteristics) may be used for IRS. Realists evaluators contend that programme implementers should not only concern themselves with 'what works', but rather with 'what works for whom and in what circumstance' (Pawson & Tilley, 1997b, p. 213). This suggests that the reasons for acceptance of IRS might be individually specific because what works for one person might not work for another, based on individual expectations and preferences. Despite the importance of this to acceptability, this perspective was not taken into consideration by the previous researchers, and hence, this shows the importance of the current study.

Another facilitator of IRS acceptance has been identified as individual respect for law and Authority or the fear of punishment (Montgomery, Munguambe & Pool, 2010; Munguambe et al., 2011). Research has shown that many householders accepted IRS in fulfilment of government obligations or for fear of punishment from auhorities (Munguambe et al., 2011). The term 'group-based citizenship' was used by Montgomery and colleagues in reference to Mozambique's nationalist mobilisation movement of the 1970s and 1980s. This is believed to have instilled a sense of

discipline and communalism into the citizenery, providing the basis for the acceptance of IRS. However, it may be argued that the context of IRS implementation in Mozambique is unique, and this may not be the case in other settings such as the current study area, where a sense of group-based citizenship may be lacking. Besides, the Mozambique context may have inspired the use of coercive measures by community leaders in dealing with householders (Munguambe et al., 2011), a practice that goes against the ethics of public health and health promotion (Childress et al., 2002). In other words, the power relationships exhibited in Mozambique had the potential to override the autonomy of the househoder and reduce the individual to a passive receptor on the basis of compliance. This brings to mind the importance of political structures in programme implementation because these could influence the outcome of interventions. Drawing from the realist perspective, the current study explores contextual factors such as the involvement of various stakeholders in the implementation of IRS in the Upper West region.

The involvement of community leaders and members has been reported as one facilitator of IRS acceptance (Kaufman et al., 2012; Munguambe et al., 2011). In Tanzania and Zanzibar, involving community leaders in the provision of information on IRS enhanced the acceptance of spraying (Kaufman et al., 2012). Similarly, including community members in IRS mobilisation activities enhanced IRS in Mozambique (Munguambe et al., 2011). Nevertheless, the authors of these studies only considered that the involvement of community leaders and members was a facilitator to the acceptance of spraying, without considering how this facilitated the implementation of IRS, narrowing the scope of evidence. This is because the mechanisms or the processes (Pawson & Tilley, 1997b) through which IRS is implemented, such as the extent to which community members and leaders are involved, is very important in determining the outcome of spraying.

It can be concluded from the above that there is insufficient evidence about the facilitators of IRS acceptance. Most previous research failed to explore programme officials' and providers' perspectives on IRS implementation processes which are critical to the outcome of spraying, and therefore, acceptance. Despite the fact that two Mozambican studies (Montgomery, Munguambe & Pool, 2010; Munguambe et al., 2011) were conducted to understand IRS acceptability in the context of the implementation process, the findings of these studies included only limited information from the perspectives of health workers and officials. Moreover, it is unclear whether any previous studies on facilitators were conducted in the context where universal distribution of ITNs was being undertaken alongside IRS. None of the aforementioned studies explored the acceptability of combining IRS and ITNs at the household level.

Therefore, the aim of this research is to investigate the facilitators for both interventions (IRS and ITNs) in relation to householder acceptability, and the barriers to this. The perspectives of related health workers and officials will also be considered.

### 2.4.2 Barriers to acceptability of indoor residual spraying (IRS)

Various studies have shown that perceived physical side effects of IRS affect the acceptance of the intervention (Ingabire et al., 2015; Kaufman et al., 2012; Munguambe et al., 2011). These side effects ranged from itching, swelling of body/face, rashes, death of domestic animals, and fears of child death resulting from prolonged exposure to spray insecticides (Kaufman et al., 2012). In Ethiopia, Gobena, Berhane and Worku (2013) found that a few study respondents who refused spraying cited a fear about the death of their livestock and honey bees. Munguambe et al. (2011) observed that IRS was perceived to be poisonous because of its insect-killing effect. The findings in these studies are in conformity with the HBM which posits that negative side effects of an intervention could serve as a barrier to acceptability (Becker & Janz, 1985). This PhD research uses the HBM as its underpinning framework given its usefulness in enhancing an understanding of individual preventive behaviour.

Another barrier to spray acceptability is the perceived odour of spray insecticides (Ingabire et al., 2015; Kaufman et al., 2012). The odour resulting from spraying was reported by some household participants in a study in Rwanda as a deterrent to spray acceptance (Ingabire et al., 2015). Similar concerns were reported in Tanzania, although the respondents did not regard the odour of the insecticides to be of major concern. However, evidence from the studies above does not indicate the type of insecticide that were perceived to have bad odour even though the odour of spray insecticides may vary depending on the type of insecticide used for spraying. Besides, previous studies have no evidence regarding householders' concerns about the effect of spray odour on people with asthma, even though spray odour could present breathing difficulties to asthmatic patients.

A few studies indicated that perceived ineffectiveness of IRS is a challenge to householders' acceptability of it (Ingabire et al., 2015; Montgomery, Munguambe & Pool, 2010). In Mozambique, a significant majority of household participants reported their doubts about the effectiveness of IRS in killing mosquitoes. These householders regarded IRS to be ineffective because it only killed mosquitoes for a few weeks (Montgomery, Munguambe & Pool, 2010). Likewise, Ingabire et al. (2015) found that IRS was perceived to be infective in killing mosquitoes in Rwanda. However, evidence from these studies does not indicate which specific spray insecticides were perceived

to be ineffective, especially given that different insecticides may have different effects on various species of mosquitoes. The concerns about spray insecticides reported in these two studies did not incorporate the perspectives of spray officials although insecticide resistance management usually involves regular changes to spray insecticides (Hunt et al., 2011) in the process of IRS implementation. The involvement of IRS officials (AGA Mal officials) in the current study could provide relevant data relating to resistance management and changes to spray insecticides.

Other authors have identified the packing of household belongings as a barrier to spraying (Govere et al. 2000; Kaufman et al., 2012). The disruptions caused by packing, especially the removal of furniture, was regarded by householders as a challenge to spray acceptability (Govere et al., 2000). Similarly, Kaufman et al. (2012) found that a few women refused spraying because of their inability to move household belongings outside for spraying to be undertaken. Apart from the difficulties involved in packing, other participants expressed their concerns about exposing their belongings to onlookers. According to these respondents, packing would enable neighbours to see the quality and quantity of their possessions (level of wealth or poverty), possibly exposing them to public ridicule (Kaufman et al., 2012). The findings from these studies indicate the need to incorporate the realist evaluation framework approach in research because spray requirements such as the packing of household belongings could affect the outcome of spraying (Pawson & Tilley, 1997b).

Additionally, the perception that IRS was a covert population control measure served as a constraint to spraying in Tanzania. Kaufman et al. (2012) documented household respondents' fears about the possible evil intentions of their government to reduce the sexual capacity of men through IRS. Other participants in the same study feared that spraying was intended to prevent women from bearing children to reduce the population. Although fertility and childbearing hold great meaning in Africa, this is an isolated finding and no other study reported perceived population control as a barrier to IRS acceptance. Besides, this finding may be specific to contextual factors such as the size of the population, population growth rate, and general concerns about population growth/control which may not be applicable under different settings including the current study area.

Further, inadequate understanding about IRS interventions and their mode of operation have been identified in some studies as contributing to IRS refusal (Montgomery, Munguambe & Pool, 2010; Munguambe et al., 2011). Munguambe et al. (2011) reported a lingering suspicion on the part of householders regarding the ability of spray insecticides to kill malaria mosquitoes selectively, and why the

surviving mosquitoes would not transmit malaria. In a similar study, householders questioned why spraying was undertaken inside the house when mosquitoes are found outside in the bushes (Montgomery, Munguambe & Pool, 2010). These findings demonstrate the respondents' lack of understanding that IRS interventions are based on the indoor dwelling and night-time biting habit of *Anopheles* mosquitoes which was why spraying was conducted on inside walls (Pluess et al., 2010). However, these misconceptions may be due to several contextual factors such as the level of education of participants and the content of malaria education messages, particularly in relation to IRS. Hence, these misconceptions about the mode of operation of IRS interventions may not be applicable in different contexts, hence, the need for the current research.

Inadequate or lack of information about IRS has been reported as a barrier to spraying in Mozambique and Tanzania (Kaufman et al., 2012; Montgomery, Munguambe & Pool, 2010; Munguambe et al., 2011). In Tanzania, ignorance about spraying because of the absence of flyers or other public health information was found to affect householders' initial acceptance of spraying (Kaufman et al., 2012). Montgomery, Munguambe and Pool (2010) found that some householders had not received prior information about IRS schedules and hence were unavailable when spray operators arrived in the communities for spraying. A related study in the same country found that the commonest reason for householders' refusal of IRS was the surprise caused by short notifications (or no notification) about spray schedules (Munguambe et al., 2011). The challenges with short spray notifications may be due to the notification strategies being used to disseminate information about spray schedules. From the realist perspective, the existing mechanisms, in this case notification strategies, and other relevant contextual issues need to be considered if the desired results are to be achieved.

Adding to what has been said so far, failure of the spray team or spray operators to visit some houses during the period of spraying has been found to constitute a barrier to spraying (Gobena, Berhane & Worku, 2013; Munguambe et al., 2011). Data from spray implementers in Mozambique showed that a majority of non-sprayed houses were not due to deliberate refusal by householders but rather because the spray brigade did not show up for spraying (Munguambe et al., 2011). Similar findings were reported in Ethiopia, where 61.4% of householders whose houses were not sprayed blamed it on spray operators not visiting the house to spray (Gobena, Berhane & Worku, 2013). These demonstrate that the willingness to accept spraying may not always be the challenge to IRS acceptance, although it is not clear why some houses are not visited by spray operators. This could stem from inadequate housing data

(Fiadzo, Houston & Godwin, 2001) that may affect the planning of spray schedules, making it difficult to allocate various houses to specific spray operators to ensure the entire community is sprayed.

An additional reason for IRS refusal by householders relates to the fear of domestic intrusion by spray operators (Ingabire et al., 2015; Kaufman et al., 2012). In Tanzania, it was reported that spray operators were perceived to be spying on people's lives (Kaufman et al., 2012) while the participants of a study in Rwanda reported that storage areas and bedrooms were usually not sprayed because of perceived insecurity and adherence to cultural norms (Ingabire et al., 2015). A feasibility study in Uganda found that breach of privacy was the main concern of over 90% of householders who were unwilling to move their property outside for spraying (Ediau et al., 2013). Although concerns about privacy and security may be unavoidable given that IRS involves the entry of spray operators into people's rooms, contextual issues which include cultural norms and beliefs cannot be ignored in community-based interventions. Therefore, there is the need to involve community members in the process of implementing IRS.

Furthermore, evidence from some studies show that certain political and religious factors negatively affected the acceptability of IRS (Kaufman et al., 2012; Munguambe et al., 2011). In Tanzania, householders were reportedly suspicious that spraying was being used as a political bait to solicit their votes because the scale-up of spraying in those communities was undertaken during the time of a general election (Kaufman et al., 2012). A similar study in Mozambique found that objects used for traditional rituals must never be sprayed. This meant that special rooms for traditional ceremonies in traditional healers' homes were not allowed to be sprayed (Munguambe et al., 2011). This evidence may be insufficient given the diverse nature of political and religious factors affecting different communities. In other words, if IRS were to be scaled up elsewhere when elections were not impending, the political factor reported in Tanzania may not affect spraying. There are three main tribal groups in the current study's setting who practise Christianity, Islam and African traditional religions respectively, and this may present more intricate political and cultural issues than previously reported. Therefore, context specific research may be necessary to identify any such issues that could affect the acceptance of spraying.

From what has been said so far, it is obvious that although the evidence on the barriers to IRS is important, it is nevertheless inconclusive. The evidence is largely based on the perspectives of beneficiaries, despite the fact that challenges in the implementation process could significanlty influence spray outcomes. Of more

importance is the fact that none of the aforementioned studies discussed householders' beliefs about barriers to the combination of IRS and ITNs. This may be understandable given that most of these studies may have been conducted at a time when no ITN campaign was in place. Although Gobena, Berhane and Worku (2013) found that 27.8% of surveyed houses had been sprayed compared with 65.5% who owned ITN, the study nevetheless did not explore the perceived barriers to the combination of IRS and ITNs by householders who may have had both interventions. Therefore, by exploring the barriers to the combination of IRS and ITNs in the same setting, the current study will be making a major contribution to the literature on malaria prevention.

This section has reviewed literature on the barriers to the acceptance of IRS. In the next section, relevant literature on the facilitators of insecticide treated nets (ITNs) acceptability will be discussed.

### 2.4.3 Facilitators for acceptability of insecticide treated nets (ITNs)

One of the most important facilitators for ITN use is the perceived effectiveness of ITNs in preventing malaria infection and other diseases (Astatkie, 2010; Beer et al., 2012; Berthe et al., 2014; Chukwuocha et al., 2010; Dye et al., 2010; Ingabire et al., 2015; Koenker et al., 2013; Mazigo et al., 2010; Ng'ang'a et al., 2009). Studies conducted in Ethiopia, Kenya, and Tanzania have shown that about 47%, 54% and 20% of participants respectively perceived malaria prevention as one benefit of ITN use (Astatkie, 2010; Mazigo et al., 2010; Ng'ang'a et al., 2009). However, most of these studies limited participants to a set of options, unlike the exploratory nature of the current study which allows the participants to express their views in their own words. Nevertheless, a few qualitative studies have reported the effectiveness of ITNs in preventing malaria infections (Chukwuocha et al., 2010; Koenker et al., 2013), thereby enhancing the general wellbeing of users (Beer et al., 2012). These findings are in accordance with the HBM (Redding et al., 2000) which associates the acceptance of preventive behaviour with the perceived benefits of the intervention. Thus, evidence from the literature shows that the perceived effectiveness of ITNs in preventing exposure to mosquito bites enhances ITN use.

Other studies have found that use of ITNs has been associated with the avoidance of mosquitoes and insects (Astatkie, 2010; Beer et al., 2012; Dye et al., 2010; Koenker et al., 2013; Mazigo et al., 2010; Ng'ang'a et al., 2009). Evidence shows that the prevention of mosquito bites is one of the most frequently cited reasons for using ITNs (Beer et al., 2012; Dye et al., 2010; Mazigo et al., 2010; Ng'ang'a et al., 2009), together with the avoidance of nuisance biting from insects and pests (Koenker et al., 2013).

These findings are also in conformity with the HBM because the use of ITNs is motivated by their perceived benefits in reducing exposure to mosquito bites. However, the use of ITNs for the avoidance of mosquito bites has less impact on ITN use during the dry season when mosquito densities may be perceived to be low, as available evidence shows (Beer et al., 2012; Berthe et al., 2014; Ingabire et al., 2015).

Use of ITNs has also been perceived to provide incidental benefits such as sound and comfortable sleeping (Alaii et al., 2003; Astatkie, 2010; Koenker et al., 2013). In research on community responses to the introduction of ITNs in Kenya, Alaii et al. (2003) noted that participants largely valued ITNs because of the good sleep they afforded them. Comfortable sleep free from the disturbances of mosquitoes, ticks, fleas, lice, and bedbugs was reported as one reason facilitating the use of ITNs in the United Republic of Tanzania (Koenker et al., 2013). Similarly, Astatkie (2010) observed that over 3% participants mentioned that use of ITNs was advantageous because they helped avoid the buzzing sound of mosquitoes. Realist evaluators emphasize the need for programme implementers to concern themselves not only with what works, but rather what works for whom and in which contexts (Pawson & Tilley, 1997a). Thus, reasons for the use of ITNs could differ from one individual to another because of differences in preferences and expectations. As such, what works for one might not work for another. Hence, this PhD research uses the realist perspective alongside other theoretical perspectives to understand successes and failures associated with ITN acceptance, such as why householders use ITNs.

Another perceived incidental benefit provided by ITN use is warmth (Dye et al., 2010; Ingabire et al., 2015; Ng'ang'a et al., 2009). Studies in rural and central Kenya found that about 17% and 11% of participants respectively perceived ITN use to be beneficial in providing warmth (Dye et al., 2010; Ng'ang'a et al., 2009). A similar study in Rwanda also reported that ITNs are used because of their benefits in terms of providing warmth, especially during the rainy season (Ingabire et al., 2015). As with the above, this evidence is commensurate with the realist evaluation framework, implying that understanding individual perceptions regarding the influence of local weather conditions on ITN use is important. For instance, whereas the current study setting has two cold seasons (rainy season, cold harmattan season) (Ghana Statistical Service, 2012), other settings reported in studies above have only one cold season, the rainy season. Consequently, understanding these weather patterns in different settings could enable ITN implementers to design appropriate intervention strategies to improve ITN acceptance and use.

Finally, the use of ITNs has been partly attributed to some householders' frequent use

of mosquito nets which subsequently developed into a habit (Koenker et al., 2013; Mazigo et al., 2010). This was evident in studies conducted in Tanzanian districts (Bukoba and Geita) where some householders reported that they had been accustomed to using ITNs (Koenker et al., 2013; Mazigo et al., 2010). In these studies, respondents mentioned habitual factors as a reason for the use of ITNs. This shows that constant practice is essential in behaviour change interventions because this can lead to habit formation. Therefore, ITN programme implementers need to emphasize the regular use of mosquito nets to enable householders to cultivate the habit of using them.

In summary, this section has reviewed relevant literature on the facilitators of ITN use ranging from the perceived effectiveness of ITNs in malaria prevention, avoidance of mosquitoes and insects, incidental benefits such as sound sleep and warmth to habit. Much of this evidence seems to be informed by the HBM. However, these scholars did not consider the relevance of the realist evaluation approach to ITN acceptance in their studies, although this is essential to understanding the contextual factors that could influence the acceptance and implementation of ITN. In spite of these, the studies above have partly contributed to understanding the facilitators of ITN acceptance. Having explored the factors that facilitate ITN acceptance, it is essential to understand the barriers in order to design suitable strategies to enhance the implementation and acceptability of ITNs. Therefore, the next section presents the barriers to ITN acceptability.

### 2.4.4 Barriers to use of insecticide treated nets (ITNs)

The dry season has been identified as a barrier to the use of ITN (Beer et al., 2012; Berthe et al., 2014; Ingabire et al., 2015). A study in Senegal found that the perceived low mosquito density during the dry season resulted in householders' refusal to use ITNs (Berthe et al., 2014). A similar study in the Zanzibar region of Tanzania reported that the discomfort associated with sleeping under ITNs was responsible for the non-use of ITNs during the dry season (Beer et al., 2012). A study in Rwanda found that the warmth provided by ITNs made them uncomfortable for use by some participants during the dry season (Ingabire et al., 2015). This evidence is in conformity with the HBM because the perceived barriers such as discomfort and warmth of ITNs during the dry season results in the non-use of ITNs. This evidence is significant for the current study setting because the high temperatures ($40^0$ C) experienced during the long dry season (Ghana Statistical Service, 2012) could serve as a barrier, preventing householders from using their ITNs.

The side effects of the chemicals used for ITN treatments have been documented as

a barrier to the use of ITNs (Alaii et al., 2003; Berthe et al., 2014; Chukwuocha et al., 2010; Koenker et al., 2013; Matovu et al., 2009). Matovu et al. (2009) found that ITNs were not used because of perceived side effects such as skin irritation, breathing difficulties and nose congestion resulting from the insecticides used to treat ITN. Another study in Tanzania reported that ITN use was uncomfortable because of the insecticides used (Koenker et al., 2013). Similar findings were reported in Kenya, where the chemicals were perceived to smell bad and householders preferred to wait until the smell wore off before they started using the nets (Alaii et al., 2003). In the same study, other participants perceived the chemicals used in ITNs to be a covert fertility control device used by the government (Alaii et al., 2003). In addition, Berthe et al. (2014) observed that the insecticides were perceived to cause irritation and discomfort, with some respondents perceiving ITNs to contain too much or too little insecticide. Relating this to the HBM, the perceived negative aspects of a recommended health action may act as an impediment to undertaking the recommended health related action (Champion & Skinner, 2008). Therefore, potential negative effects caused by the insecticides used in ITNs constitute an impediment to the acceptability and use of ITNs. Given that the nets distributed in the current study's setting were treated with insecticides, these perceived side effects may be one factor influencing ITN use.

To add to the above, the perceived ineffectiveness of ITNs has been cited as a barrier to utilization (Baume, Reithinger & Woldehanna, 2009; Mazigo et al., 2010). A study in Tanzania found that 2.4% of respondents did not own ITNs because they believed they were ineffective in preventing malaria transmission (Mazigo et al., 2010). A similar study in Ethiopia found that the non-use of ITNs among ITN-owning householders was due to a perceived loss of effectiveness because householders no longer saw dead insects when using ITNs (Baume, Reithinger & Woldehanna, 2009). This supports the theoretical assumption that the perceived level of effectiveness of an intervention affects its acceptance (Redding et al., 2000), further implying that where householders perceive ITNs to be ineffective, they would be unlikely to use them.

The shape, colour, type and size of ITNs have also been reported as perceived factors affecting ITN use (Berthe et al., 2014; Ingabire et al., 2015; Ng'ang'a et al., 2009). A study in Kenya and Rwanda show that some respondents had preferences for rectangular or conically shaped ITNs (Ingabire et al., 2015; Ng'ang'a et al., 2009). However, these studies did not provide additional information on why the participants had these preferences. Moreover, the respondents in a similar study in Senegal reportedly expressed their frustration at the small size and shape of the standard

rectangular ITNs that were distributed to them, and that the preference for the shape of ITNs was informed by the sleeping arrangements of the householders (Berthe et al., 2014). These researchers went further to explain why some householders had these preferences. They revealed that while some respondents perceived conical ITNs to be more suitable for family use because many family members could sleep under them, others perceived rectangular ITNs to be more suitable for individual use because they were perceived to provide some form of decoration in the room. Thus, household preferences for the shape and size of ITNs may require consideration in the implementation of ITN interventions because they could affect acceptability and usage.

Another critical barrier to ITN use reported by previous studies is unaffordability (Chukwuocha et al., 2010; Matovu et al., 2009; Mazigo et al., 2010). The cost of ITNs was reported as the main barrier to their use by pregnant women in the Imo river basin of Nigeria (Chukwuocha et al., 2010). In Tanzania, Matovu et al. (2009) found that low incomes in both rural and urban communities resulted in householders' inability to obtain ITNs or to re-treat their ITNs after washing, especially householders in rural areas whose income depended on low value crops. Another study in north-western Tanzania observed that over 61% of respondents identified the cost of ITNs as the reason for not possessing one (Mazigo et al., 2010). This evidence demonstrates the impact of the social determinants of health (WHO Commission on Social Determinants of Health, 2008) on accessibility to, and use of ITNs. The social determinants of health framework, which conceives health outcomes as the result of social factors, indicates that income levels are crucial to the distribution of health among populations (WHO Commission on Social Determinants of Health, 2008). Given that the current study's setting (Upper West region) is the poorest region in Ghana (National Development Planning Commission, 2005), this suggests that the social determinants of health could negatively affect access to ITNs, especially if potential challenges in the distribution of free ITNs result in some householders having to purchase their ITNs.

Challenges associated with the distribution of free ITNs to householders have been found to be a barrier to ITN use (Ingabire et al. 2015). In Rwanda, Ingabire et al. (2015) found that some householders were unable to use ITNs because the nets distributed to householders did not always correspond with the number of sleeping places or the number of beds. This reportedly led to a situation where some poorer families who needed basic necessities sold their ITNs at cheap prices to other community members who appreciated the use of ITNs (Ingabire et al., 2015). This shows that the criteria used for distributing the free ITNs may play a significant role in

ITN use. Traditionally, ITN distribution efforts have relied on specific criteria (Baume, Reithinger & Woldehanna, 2009; Paintain et al., 2014) and Ghana is no exception. In Ghana, the distribution policy stipulates that for each household, one ITN should be given for every two household members, and the number of sleeping places should also be considered (Paintain et al., 2014). Under these criteria, some households may not get an adequate number of ITNs. Therefore, policy makers may need to devise appropriate ITN distribution mechanisms to ensure adequate coverage of ITNs.

Furthermore, a perceived difficulty in hanging ITNs has been reported in previous studies as a barrier to ITN use (Alaii et al., 2003; Baume, Reithinger & Woldehanna, 2009; Galvin et al., 2011). In exploring the barriers to ITN use in the Niger delta region of Nigeria, Galvin et al. (2011) found that in poor families, the use of ITNs in shared rooms was not only perceived to restrict space but also disrupted family activities (Galvin et al., 2011). Depending on the economic circumstances in a family, sleeping arrangements in a typical extended family setting could range from individual bedrooms to shared rooms where beds, foam mattresses and mats could be used together on the floor of one room. Therefore, in poor householders' rooms where there is limited space, ITNs may need to be hung up at night for use and removed during the day to allow space for other household activities (Galvin et al., 2011). In Kenya, Alaii et al. (2003) identified similar logistical challenges to ITN use posed by the living arrangements in some households, emphasizing that ITN use by children who slept in kitchens and living rooms was challenging because of the need to install and remove ITNs on daily basis (Alaii et al., 2003). A similar study in Ethiopia by Baume, Reithinger and Woldehanna (2009) noted that in local round houses which have conical roofs and high points at the centre, finding four points for hanging rectangular ITNs was challenging. In the same study, it was found that the limited space and multi-purpose use of the interior parts of these houses also posed a challenge because this required the hanging and removal of ITNs every day to allow the space to be used for other purposes (Baume, Reithinger & Woldehanna, 2009). This evidence highlights the need for ITN distribution campaigns to take into consideration the characteristics of local buildings and living arrangements of householders before undertaking free ITN distribution. As such, the typical extended family living arrangements in the current study setting (Ghana Statistical Service, 2014a) may have an influence on ITN use by householders.

Cultural and social factors have been noted to influence ITN use in previous studies (Alaii et al., 2003; Koenker et al., 2013; Monroe et al., 2014). In Tanzania, Uganda and Kenya funerals were perceived to make it difficult to use ITNs because of factors such as the temporary migrations associated with funerals, the logistical challenge in

terms of hanging an ITN in the open and the impracticality of using ITNs given the sharing of sleeping places at funerals (Alaii et al., 2003; Koenker et al., 2013; Monroe et al., 2014). In addition, Alaii et al. (2003) observed that fertility taboos prohibiting the mixing of the bedding of parents with that of children who had reached puberty resulted in a temporary delay in the use of ITNs by householders who were expecting reassurances that such mixing would not take place during ITN re-treatment. However, given that the ITNs distributed in the current study setting are the long-lasting ones and not subject to re-treatment, such concerns may be unlikely to prevent ITN use. Another study investigating social factors affecting the use of ITNs reported that people were less likely to use ITNs at Wedding grounds, while others were unable to use ITNs on nights spent away from home due to reported sacrificial killings in their community (Monroe et al., 2014). "Another study investigating social factors affecting the use of ITNs reported that people were less likely to use ITNs at Wedding grounds, while others were unable to use ITNs on nights spent away from home due to reported sacrificial killings in their community (Monroe et al., 2014). In other words, religious practices such as human sacrifice were reportedly responsible for the non-use of ITNs since some householders slept away from home during certain periods when such sacrifices are made". This evidence shows the role of contextual factors in determining the outcome of interventions as advocated by the realist evaluation approach (Ogrinc & Batalden, 2009). Thus, cultural and social events, particularly funeral activities which are very frequent in the current study setting (Monroe et al., 2015), may have an influence on the acceptance and use of ITNs by householders, hence, the need for this study.

In two studies, respondents cited their wish to save ITNs for future use as the reason for the non-use of them (Baume, Reithinger & Woldehanna, 2009; Berthe et al., 2014). Baume, Reithinger and Woldehanna (2009) reported that some respondents left their ITN packages unopened to save them for future use, because of uncertainty about future replacements or because ITNs could be exchanged for money in some instances. Another study in Senegal found that some respondents who rarely used ITNs did this because of frugality and a desire to preserve the ITNs for a long time (Berthe et al., 2014). It may be argued that the practice of saving ITNs for future use may be the result of perceived unavailability of ITNs for ready access or because low incomes and poverty meant that householders were unable to purchase or replace old ITNs. Although the findings from these studies were inconclusive, they may be relevant for the current study setting especially in rural communities where as many as 96% to 99% of people live below the official poverty line (National Development Planning Commission, 2005).

The use of ITNs for alternative purposes has been identified as a barrier to acceptance. Baume, Reithinger and Woldehanna (2009) observed that a few communities were using ITNs as bed covers, ceiling covers, room dividers, curtains, and table covers, while others used ITNs to dry grains and tie cattle to trees. Koenker et al. (2013) found that ITNs were being put to alternative uses such as fishing, collection of ants and building structures for gardens and poultry, although most participants admitted that only old ITNs were being used for these purposes. This evidence shows that the use of ITNs for alternative purposes may not be a major barrier to ITN use because the practice was reportedly limited to a few communities or involved the use of old ITNs. However, given the difficulties of replacing ITNs as discussed above, the use of old ITNs for these alternative purposes without any replacement may significantly expose householders to mosquito bites and malaria infection.

Another barrier to ITN use is perceived bedbug infestation. A study conducted by Ingabire et al. (2015) found that bedbugs were perceived to hide inside the crevices and cracks in beds and on the top edges of ITNs, from which they come down at night to bite ITN users, resulting in body rashes. This is commensurate with the HBM because a perceived barrier to ITN use such as the role of ITNs in exposing users to bites from bedbugs can lead to their non-use. However, given that ITNs played no role in the initial infestation that reportedly originated from crowded places like prisons (Ingabire et al., 2015), this evidence may not constitute a major barrier to ITN use, especially in countries where bedbugs are scarce.

The poor condition of ITNs was reported to be a barrier to ITN use in a rice farming community in Ethiopia. Baume, Reithinger and Woldehanna (2009) found that torn and dirty ITNs were sometimes not used by householders because of their relatively poor condition, and this was more common in rural communities. In that study, it was reported that dirty ITNs were pulled down for washing but delays in washing or rehanging them led to the non-use of ITNs in the short term (Baume, Reithinger & Woldehanna, 2009). It is not surprising that this evidence was more common in rural communities, because of the likelihood of poor housing conditions in rural communities. Under poor housing conditions, ITNs may soon become dirty because of unsealed floors in rooms, for example, or living arrangements that sometimes involve sleeping on the floor with mats (Galvin et al., 2011). This evidence could have significance for the current study setting because of the endemic poverty in the region, particularly in rural communities (National Development Planning Commission, 2005).

Finally, none of the previous studies explored the perspectives of programme officials

on how the processes and contexts of ITN implementation affect its outcome (Pawson & Tilley, 1997a) in terms of householders' access to and use of ITNs. In other words, most studies on the acceptability of ITNs have primarily focused on householders' perspectives on the benefits and barriers to ITN use. Evidence from this study could help address this gap in literature and provide insight into understanding the outcome of ITN use from a different perspective. This could enhance the design of ITNs and implementation of ITN interventions.

In conclusion, much of the evidence on the perceived barriers to ITN use may have relevance for the current study considering the contextual factors in the study's setting. Issues such as the non-use of ITNs because of the perceived low density of mosquitoes or excessive heat, for instance, could influence ITN use patterns in the Upper West region given the relative high temperatures in the region during the dry season. Given that the distribution of ITNs in the Upper West region involved long-lasting treated nets (LLIN), the insecticides used in treating these insecticides may influence householders' use of ITNs. Cultural factors such as funerals may be crucial barriers to the use of ITNs in the current study setting given the increased frequency of funerals. Although these are important contextual factors that could influence the design and implementation of ITNs, most previous studies have not considered the perspectives of programme officials on the implementation process. The current study's use of the realist evaluation approach will help introduce new perspectives into understanding the barriers to ITN the acceptance and implementation of ITN intervention.

In this section, the barriers to ITN use were discussed to understand the various factors that influence the use of ITNs by householders. The following section summarizes the evidence reviewed above and identifies specific research questions and objectives for this study.

## 2.5 **Summary of research gaps**

This review found that misconceptions about the causes of malaria have been reported by several previous studies, but none of these sought to explain how the misconceptions could influence the implementation of IRS and ITNs. Although the review demonstrated the importance of contextual factors to the acceptance and implementation of interventions, no previous study has explored lay perceptions about the causes of malaria in the Upper West region of Ghana.

Previous studies exploring the facilitators for and barriers to acceptance of IRS and ITN did not explore aspects of the implementation processes which are essential to

the outcome of these interventions. The evidence was largely based on the perspectives of beneficiaries (excluding officials), despite the fact that challenges in the implementation process could significanlty influence outcome. Additionally, no study has been conducted in Ghana exploring the facilitators for and barriers to IRS acceptance, in spite of the fact that IRS has become a key vector control intervention that is being implemented in selected endemic areas. It is important to note that no previous studies explored the faciliators for and barriers to the combination of IRS and ITN interventions by householders.

There is, therefore, a desperate need to investigate malaria in Ghana because there is sparse literature that considers why the prevalence is higher than it should be. This is important because there are unique and complex cultural and religious influences to consider in relation to the acceptability and implementation of IRS and ITN interventions for malaria control purposes.

### 2.5.1 Aim of the research

The aim of this research is to explore the facilitators and barriers to malaria control in the Upper West region of Ghana. The study is informed by the fact that malaria persists as a public health challenge in upper western Ghana despite the implementation of indoor residual spraying (IRS) and insecticide treated nets (ITNs), which have been proven to be successful interventions elsewhere. The research will be conducted by exploring local community perceptions about malaria and the acceptability of IRS and ITNs, and the perspectives of programme officials and providers.

### 2.5.2 Research questions

1. What are the community perceptions about the causes and prevention of malaria?
2. What are the facilitators and barriers to householders' acceptance of indoor residual spraying and insecticide treated nets?
3. What are the facilitators and barriers to householders' acceptance of combining indoor residual spraying and insecticide treated nets?
4. What are the facilitators and barriers to the implementation of indoor residual spraying and insecticide treated nets interventions?

### 2.5.3 Specific research objectives

1. To explore community perceptions about the causes and prevention of malaria
2. To explore householders' acceptability of indoor residual spraying and insecticide treated nets.

3. To explore householders' acceptability of combining indoor residual spraying and insecticide treated nets.
4. To explore the facilitators and barriers to the implementation of indoor residual spraying and insecticide treated nets interventions.

## 2.6 Theoretical frameworks

Given that this study is intended to explore the facilitators and barriers to malaria vector control interventions in relation to the perspectives of householders and programme staff as well as the underlying context, the health belief model (HBM), realist frameworks and social determinants of health framework play a central role in understanding householders' acceptance of these interventions and therefore constitute the theoretical underpinnings of this research. The HBM conceptualizes why people accept or reject preventive interventions (Janz & Becker, 1984) whereas the realist framework is aimed at understanding how programmes work (Marchal, Dedzo & Kegels, 2010) with an emphasis on how the mechanisms of interventions and the context of implementation influence the outcome of interventions. The social determinants of health framework help provide an understanding of how social determinants affect health and influence the acceptance of preventive interventions (Blas et al., 2008).

### 2.6.1 Health belief model (HBM)

The HBM was originally formulated to provide explanations for health (preventive) behaviour (Mikhail, 1981; Rosenstock, 1974a). The focus of the model, thus, is on preventive behaviour although the model was later extended to explain treatment behaviour (Becker & Janz, 1985). The HBM was developed by a group of social psychologists in the United States (US) in their attempt to understand the widespread refusal of people to accept disease preventives and/or screening tests in the early 1950s (Rosenstock, 1974b). The model posits that the possibility of an individual adopting or undertaking a health oriented action is subject to his/her beliefs relating to four key components, conceptualized as perceived susceptibility, perceived severity, perceived benefits and perceived barriers or cost (Redding et al., 2000).

In addition to these four main concepts of the HBM, there have been alterations to the model with the addition of other variables including cues to action and self-efficacy (Mikhail, 1981). Mediating factors such as age, level of education, gender, ethnicity, knowledge have been considered in terms of how these factors impact on perceptions, and thus indirectly influence health behaviour (Champion & Skinner, 2008). A detailed description of these concepts and their relevance for the adoption

of IRS and ITNs for malaria prevention is presented below.

#### *2.6.1.1 Perceived susceptibility*

Perceived susceptibility refers to an individual's estimation of the extent to which they are vulnerable to a health condition (Redding et al., 2000). In other words, perceived susceptibility is the subjective perception of individuals regarding their risk of contracting a disease (Janz & Becker, 1984). This variable of the HBM is supported by more empirical research than all other concepts (Mikhail, 1981). Redding et al. (2000) believe that individuals usually underestimate their susceptibility to infections. In relation to the research questions, perceived susceptibility to malaria could influence the acceptance of IRS and ITNs because where individuals perceive themselves to be susceptible to malaria, they will be more likely to accept IRS and ITNs to prevent malaria infection. For instance, if malaria is perceived to be a common disease in the community, householders may be more likely to accept these interventions to reduce their risk of infection.

#### *2.6.1.2 Perceived severity*

This refers to an individual's evaluation of the consequences of an illness; the higher the perceived severity the more likely that an individual will accept a preventive behaviour, and the lower the perceived severity the less likely that a preventive behaviour will be adopted by the individual (Redding et al., 2000). The consequences of the illness could be clinical, such as disability, pain or death, or social, including the effects of the illness on one's work, relations, family life etc. (Champion & Skinner, 2008; Janz & Becker, 1984). The combination of perceived susceptibility and perceived severity constitutes the perceived threat of a condition.

In the context of the current study, perceived severity is important to the adoption of IRS and ITNs because the acceptance of these interventions may be dependent on individuals' evaluation of the severity of malaria (Champion & Skinner, 2008). If individuals and householders perceive the consequences of malaria to be severe, they will be more willing to accept IRS and ITNs to prevent malaria. On the contrary, if malaria is not perceived as a disease with severe consequences, individuals may not accept IRS and ITN interventions to prevent it. For instance, if the clinical consequences of malaria such as hospitalization, physical pain and death are perceived by householders, this could influence them to accept IRS and ITNs to avert these adverse experiences. Socially, if malaria is perceived to affect householders' social lives, their ability to work etc., this could be critical in determining householders' acceptance of IRS and ITNs.

#### *2.6.1.3 Perceived benefits*

Although individuals perceived susceptibility to and perceived severity of a health condition influence the acceptance of a preventive behaviour, this can only occur when the preventive behaviour is perceived to be effective in reducing the threat of the health condition (Becker & Janz, 1985; Redding et al., 2000). In other words, an individual who is at greater risk of infection will only adopt a preventive intervention if he/she believes that the intervention is efficacious or beneficial (Becker & Janz, 1985). The perceived benefits of an intervention may include other non-health related benefits such as financial savings, pleasing family members that may all be deemed as benefits emanating from the adoption of a preventive behaviour (Champion & Skinner, 2008).

The perceived benefits of IRS and ITN interventions in preventing malaria (Astatkie, 2010; Kaufman et al., 2012) facilitate individuals' acceptance of the interventions. This implies that if IRS and ITNs are perceived to be beneficial in preventing malaria, individuals will be more likely to accept them to prevent malaria, whereas if IRS and ITNs are perceived to be ineffective, individuals may not accept them even if their perceived susceptibility to and severity of malaria are high. In addition, if IRS and ITNs are perceived to provide non-health related benefits, this could enhance householders' acceptability (Govere et al., 2000; Koenker et al., 2013). For instance, if IRS is perceived to be effective in killing domestic insects, this could facilitate the acceptance of IRS. In the same vein, where ITNs are perceived to be effective in providing warmth in cold weather, this perception could facilitate ITN use by individuals.

#### *2.6.1.4 Perceived barriers*

This refers to an individual's cognitive assessment of the personal costs associated with the adoption of a preventive behaviour or intervention (Redding et al., 2000). The perceived barriers also include the perceived negative side effects involved in the adoption of a preventive behaviour such as the cost, inconvenience, unpleasantness, difficulty, time (Becker & Janz, 1985; Janz & Becker, 1984).

The acceptance of IRS and ITNs could be impeded by the perceived barriers associated with these interventions. The acceptance of IRS could present some inconvenience to householders because of the packing usually required for spraying to be conducted (Kaufman et al., 2012). Packing may also be perceived to be a difficult task, especially where householders have many belongings. In relation to ITNs, the hanging of ITNs may be perceived as difficult, especially in instances where householders need to hang and remove their ITNs daily because of the limited space

for other household activities (Galvin et al., 2011). Similarly, if acceptance of IRS and ITNs is perceived to have some side effects (Ingabire et al., 2015; Matovu et al., 2009), this could prevent householders from using the interventions.

#### *2.6.1.5 Cue to action*

Cue to action refers to the stimulus that must occur to propel the adoption of a preventive health behaviour or intervention (Mikhail, 1981). The cue to action might relate to internal factors such as symptoms or external factors such as the impact of information, education or communication activities (Janz & Becker, 1984). Where individuals have personal experience with malaria, this could enhance their acceptance of preventive interventions including IRS and ITNs. Given the level of endemicity of malaria, it is most likely that most householders in the study setting may have been infected before or witnessed the symptoms of malaria from close relations, providing them with the cues to action. If there are malaria education activities, this could facilitate the acceptance of IRS and ITNs for preventive purposes.

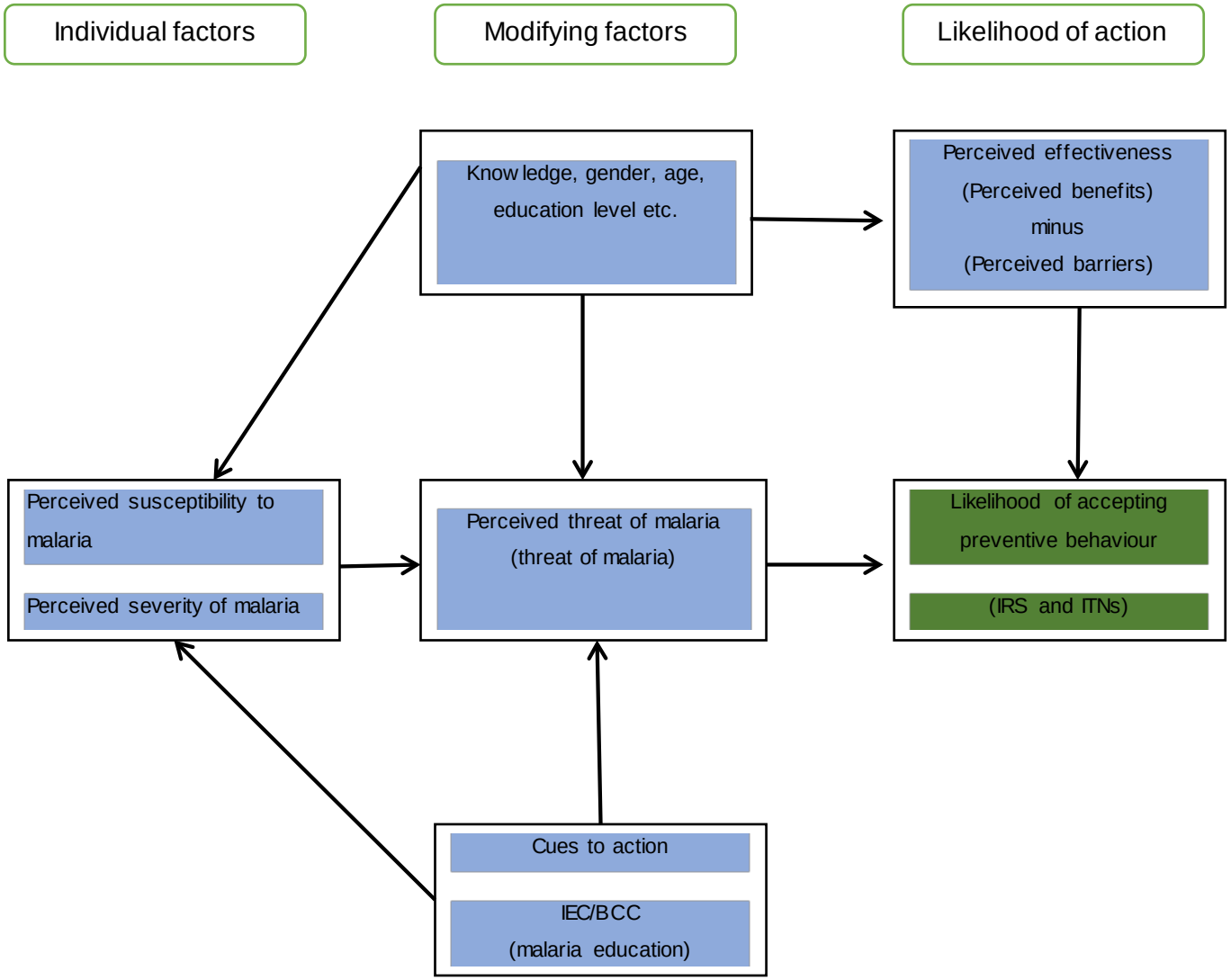
#### *2.6.1.6 Self-efficacy*

Another addition to the HBM is the concept of self-efficacy, which is the confidence of an individual in their ability to initiate action or adopt a preventive behaviour (Champion & Skinner, 2008). Self-efficacy was not incorporated in the original model. However, the addition of this construct to the HBM enhances its application to the adoption of complex health behaviours. This construct may have limited applicability to the acceptability of IRS and ITN interventions.

#### *2.6.1.7 Modifying factors*

The HBM concepts discussed above are all subject to the influence of modifying factors such as knowledge, age, education level (Redding et al., 2000). Thus, individuals perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy may be influenced by their knowledge, education level, age, sex etc. This presupposes that if individuals are aware of the causes of malaria, this could enhance their acceptance of preventive interventions. If individuals are aware that malaria is caused by the bite of mosquitoes, this could influence their acceptance of IRS and ITNs to prevent mosquito bites and hence, malaria. On the other hand, if individuals are not aware about how malaria is transmitted, they may not accept preventive interventions because they may not perceive themselves as susceptible to malaria. Figure 2 below depicts the HBM in relation to malaria and malaria prevention interventions (Becker & Janz, 1985).

**FIGURE 2: HEALTH BELIEF MODEL AND MALARIA CONTROL**



### 2.6.2 Realist evaluation framework

Another theoretical framework with applicability to this study is the realist evaluation framework of Pawson and Tilley (Pawson & Tilley, 1997a). Realist evaluators argue that for a programme to work, both a favourable context and mechanisms are required to achieve a desirable outcome (Hunt & Sridharan, 2010). In other words, "programs work (have successful 'outcomes') only in so far as they introduce the appropriate ideas and opportunities ('mechanisms') to groups in the appropriate social and cultural conditions ('context')" (Pawson & Tilley, 1997b, p. 57). In realist evaluation, there is the need to test and refine interventions to understand how they work (Marchal, Dedzo & Kegels, 2010), hence, the emphasis on "What works for whom in what circumstances?" (Pawson & Tilley, 1997b, p. 213). Thus, realist evaluators are not just preoccupied with the outcome of interventions, but also the context and underlying mechanisms (Marchal, Dedzo & Kegels, 2010).

To understand how programmes work, realist evaluators use what has been termed the Context–Mechanisms–Outcome configuration. This framework presupposes that the outcome of an intervention is subject to how the underlying mechanisms operate in a specific context (Pedersen & Rieper, 2008). The outcome can thus be influenced by modifying the mechanisms, the context or both (Ogrinc et al., 2014). The task of realist evaluators is to identify what types of mechanisms (M) and contexts (C) produce which outcomes (O) (Pawson & Tilley, 1997b). By so doing, realism can provide explanations for the success or otherwise of interventions (Ogrinc & Batalden, 2009), thereby enabling programme planners to know whether a programme can be applied in a particular setting, and furthermore, providing explanations as to why or why not (Marchal et al., 2012). The realist framework is particularly important to this research given its emphasis on the role of mechanisms and context in producing the outcome of interventions. This is because the mechanisms involved in implementing IRS and ITNs and the contextual factors in the study setting could affect the outcome of these interventions. Therefore, the concepts of mechanism, context, and outcome are discussed below in terms of their meaning and their relevance to the current study.

#### *2.6.2.1 Contexts*

In realist evaluation, context refers to the pre-existing characteristics into which interventions are implemented. Contextual factors play a crucial role in determining how intervention mechanisms operate (Ogrinc & Batalden, 2009) because they are the spatial and institutional locations of social situations together with the values and norms of societies and how they interrelate (Pawson & Tilley, 1997b). Contextual factors operate at different levels, including political, social, organizational, local or individual dimensions. At the local level, for instance, the enthusiasm with which local

managers and stakeholders receive an intervention could vary depending on their previous experience, and same could be said of the target beneficiaries (Blamey & Mackenzie, 2007). Therefore, context is also key to understanding the circumstances and the reasons why interventions work or fail. Realist evaluation acknowledges the fact that contextual factors could enhance programme outcomes or serve as a barrier to the outcome of interventions, and that these factors may be within the control of programme implementers or not (Blamey & Mackenzie, 2007). Hence, realist evaluators "need to understand the contexts within which problem mechanisms are activated and in which programme mechanisms can be successfully fired" (Pawson & Tilley, 1997b, p. 216).

These imply that the implementation of IRS and ITNs in the current study setting could be enhanced or diminished by local contextual factors in accordance with the realist evaluation framework (Pawson & Tilley, 1997b). Social factors such as geographic location could influence the outcome of IRS because this could determine the distance IRS spray operators must travel to reach communities. In this instance, location will influence the mechanisms of IRS, hence distant and remote communities could have different outcomes compared with communities that are closer to IRS operational sites. The level of literacy of the population, their cultural values or weather conditions could all influence the outcome of IRS and ITNs. For instance, the hot dry season in the Upper West region of Ghana may serve as a barrier to the use of ITNs because of possible discomfort. The contextual factors that could affect the outcome of IRS and ITN will be diverse and multifaceted in nature.

#### *2.6.2.2 Mechanisms*

Mechanisms are the processes through which interventions are implemented. They are those aspects or components of the intervention that bring out the desired (or unintended) outcome (Ogrinc & Batalden, 2009). According to Pawson and Tilley (1997b, p. 216), "Mechanisms refer to the choices and capacities which lead to regular patterns of social behaviour". Therefore, realist evaluation seeks to understand why programmes work by understanding the mechanisms of interventions (Pawson & Tilley, 1997b). Thus, it could be argued that different programmes may have different mechanisms or processes in their implementation.

There are several mechanisms or processes in the implementation of IRS (Meñaca et al., 2014). The mechanism involved in IRS implementation, such as how other stakeholders are involved and the extent to which they embrace IRS, could influence the outcome of IRS. Other mechanisms relate to the capacity of AGA Mal Ltd. officials in implementing IRS. For instance, the skills of AGA Mal spray operators in conducting

spraying and relating to community members could be critical to outcomes such as acceptability. The capacity of AGA Mal officials and their ability to consider contextual factors such as the culture of the Upper West region in the process of implementing IRS could also be critical to the outcome of spraying. Hence, the outcome of IRS mechanisms is subject to the influence of the contexts of the study setting.

Similarly, mechanisms involved in ITN use, such as the hanging of ITNs above different bedding by individuals, could determine how effectively ITNs are used. The capacity of GHS officials to implement the hang-up campaign and free ITN distribution could influence the outcome of ITN use. Incomplete planning that does not take into consideration the various contextual factors that could influence the use of ITNs could result in different outcomes. For instance, the non-use of ITNs in the dry season that has been associated with heat and discomfort (Koenker et al., 2013) may require careful planning by health officials considering the impact of contextual factors such as weather prior to the implementation of ITN interventions. Therefore, the mechanisms of ITN will produce outcomes relative to the context of the intervention.

#### *2.6.2.3 Outcomes*

Outcomes are the result of a combination of programme mechanisms and the contexts within which the mechanisms are introduced. They are both the unintended and intended products of the activation of specific mechanisms in various contexts (Ogrinc & Batalden, 2009). Outcomes "are not inspected simply to see if programmes work, but are analysed to discover if the conjectured mechanisms/context theories are confirmed" (Pawson & Tilley, 1997b, p. 217). The outcome of IRS and ITN interventions will be subject to the mechanisms of the interventions and the contexts of implementation. Therefore, if these interventions are successfully implemented, this will imply that the appropriate mechanisms were introduced into conducive contexts, resulting in a positive outcome. In the same vein, where outcomes such as implementation or acceptability are unfavourable, this may be because the intervention mechanisms were not designed to suit the context in which the interventions were implemented. Therefore, the outcomes of IRS and ITNs may give an indication of how favourable or unfavourable the mechanisms and contexts of these interventions are.

#### *2.6.2.4 Context–mechanisms–outcome pattern configuration*

A programme which is known for producing a certain outcome may work in a different way by producing different outcomes under different circumstances. Thus, a context–mechanisms–outcome configuration is an expression of how a programme produces certain outcomes under given circumstances (Pawson & Tilley, 1997b). The use of

the realist evaluation framework as one of the underpinning theories of this research will facilitate an understand of how IRS and ITN interventions produce different outcomes under different contexts. For instance, the challenges with implementing IRS in rural communities may be different to those in urban communities, thus providing explanations for any differences in the outcomes of spraying. The next section presents a review of the social determinants of health framework because of its relevance to this study.

### 2.6.3 The social determinants of health framework

The social determinants of health framework examine health from a broader perspective and is related to this study because social determinants of health are likely to affect occurrence of malaria and influence acceptance of preventive interventions such as IRS and ITNs. This suggests that the social determinants of health model extend beyond the scope of the biomedical model by taking into consideration broader pathways to disease causation (Blas et al., 2008). From the viewpoint of this framework, the burden of diseases and their distribution across populations occur because of the daily living conditions of people (Marmot, 2004). In other words, the distribution of health is subject to one's social position (education, occupation, income, gender, ethnicity) and the socio-economic and political context in which one lives, such as governance systems and cultural norms (WHO Commission on Social Determinants of Health, 2008). According the WHO Commission on Social Determinants of Health, the unequal distribution of resources and poverty are the result of social or structural drivers that determine how societies are organized, including bad politics, unfair economic systems and weak social policies among others (WHO Commission on Social Determinants of Health, 2008).

The inequalities in how societies are organized imply that there is unequal distribution of the freedom required to live a good life and enjoy good health (WHO Commission on Social Determinants of Health, 2008). These inequalities can be seen in people's early childhood experiences; education, employment and working conditions, gender, cultural and religious norms, and general environmental conditions which could lead to different groups being at risk of poor health (WHO Commission on Social Determinants of Health, 2008). The impact of these factors on the health of individuals and societies are discussed below.

#### *2.6.3.1 Impact of culture, religion and societal norms on health*

Culture can be defined as "those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation" (Guiso, Sapienza & Zingales, 2006, p23). It is generally agreed among social scientists that

culture is learned, transferred from generation to generation and reflects a group's value system, their beliefs, norms, practices, social roles and communication patterns (Betancourt & López, 1993). Thus, the characteristics of cultural groups tend to have some form of direct or indirect relationship with health-related decisions, behaviours, and priority setting that could influence their acceptance of health behaviour (Pasick, D'onofrio & Otero-Sabogal, 1996), response to treatment and exposure to infections.

One important cultural practice in the current study setting that may expose householders to infection and influence their acceptance of IRS and ITNs is frequent funerals. Funeral attendance is considered so important to the people of the Upper West region and Ghana in general that friends and family from far and wide must attend to pay their last respects, and this may affect householders' acceptance of IRS and ITNs as discussed earlier.

Moreover, traditional religious practices such as the ownership of '*smaller gods*'[1] existing in the current study setting could affect householders' use of vector control interventions for malaria prevention. Because these practices are normally secretive in nature, spray operators may be prevented from entering householders' rooms to preserve the secrecy of their traditional practices, thus serving as a barrier to IRS spray acceptance.

Therefore, it has been argued that health educators should seek to adopt culturally appropriate ways when providing programmes to communities (Kreuter & McClure, 2004). In other words, health education strategies need to consider diversity and culture when developing education messages for populations that are culturally diverse (Institute of Medicine, 2002). Some authors recommend the use of five strategies for health promotion programmes to achieve cultural appropriateness, including peripheral, linguistic, constituent-involving, evidential and sociocultural strategies (Kreuter & McClure, 2004). The use of peripheral strategies involves packaging health promotion programmes in ways that will be appealing to the group, through use of colours, images or declaration titles etc. Evidential strategies enhance the importance of a health issue to a specific group by using evidence about the impact of the health issue (such as epidemiological data) on that group. For instance, malaria education in the Upper Western region of Ghana could involve the use of data on malaria morbidity and mortality in the region. Sociocultural strategies use the cultural values, beliefs, behaviours and other social characteristics of a group in

[1] Sacred objects that are believed to protect the interest of the people, and have supernatural powers.

discussions of health issues (Kreuter & McClure, 2004). The fourth strategy is constituent-involving strategies which involves the recruitment or engagement of members from the target population (Kreuter & McClure, 2004). This strategy could be very important for the implementation of IRS programmes because it will ensure that spray operators are recruited from their communities and districts and enhance community participation. Finally, linguistic strategies make health promotion programmes more accessible by using the local/native language as the medium of communication (Kreuter & McClure, 2004). This could be very important to malaria control because undertaking malaria education in local languages could facilitate people's understanding about malaria especially in settings where the official language is not understood by most people.

From what has been discussed so far, it is evident that one strategy cannot meet the cultural needs of entire populations. As such, there is the need for health educators and policy makers to combine different strategies to achieve the desired results on cultural appropriateness. This could have informed the adoption of the fourth and fifth strategies for the implementation of IRS in the study area. The use of these strategies helped to enhance community participation and promote community ownership of the IRS intervention in accordance with the Ottawa Charter for health promotion (World Health Organization, 1986). The strategies also helped improve communication with household members because the local language (Dagaare) was used in educating them instead of English language. This is because most community members could neither speak nor understand English because of low literacy rates in the study area (Ghana Statistical Service, 2014a).

#### *2.6.3.2 Impact of education on health*

It is well known that there is a clear and persistent relationship between health and education, and this has been observed in several countries using various health indicators (Adler et al., 1994). Educational attainment influences health through several pathways; the attainment of higher education can lead to improved health for individuals and their families because of the ability of highly educated people to make well-informed decisions relating to health (DeWalt & Hink, 2009). This is important because highly educated carers of children under five years infected with malaria are more likely to seek early treatment, and this could be crucial to survival. Moreover, highly educated individuals tend to have high levels of perceived personal control that enhance a healthy lifestyle (Mirowsky & Ross, 1998) and are associated with health behaviour (Leganger & Kraft, 2003). Highly educated people also tend to have comparatively higher social standing and more social support (Mickelson & Kubzansky, 2003), all of which are important for mental and physical health.

Additionally, education influences health because of its role in providing employment opportunities. Highly educated people are less likely to be unemployed, a condition that has been linked with poorer health outcomes and increased mortality rates (Bartley & Plewis, 2002). By having job opportunities, educated people may be more likely to earn adequate incomes, enabling them to access healthcare and preventive interventions where cost is involved. The low level of education of the people of the Upper West region probably explains why over 70% of those employed are engaged in peasant farming (Ghana Statistical Service, 2014a). This may lead to low incomes, preventing householders from spending their incomes on preventive interventions such as ITNs when required.

Educational level is one of the modifying factors or mediating variables in the HBM which could influence the acceptability of preventive behaviour or interventions (Redding et al., 2000). This is because householders' level of education could influence their perceived susceptibility to, and severity of, malaria. Similarly, householders' perceived benefits and barriers to IRS and ITNs could be influenced by their level of education. These could affect the acceptability of IRS and ITNs by householders for malaria prevention.

Despite much research linking education with health, some authors argue that inequalities in health because of education remain a disputed issue, attributing this to limitations in the data used by researchers (Cutler & Lleras-Muney, 2006). However, this may be understood because the effects of any social factor (including socio-economic factors) on health is still dependent on several other factors (Braveman & Gottlieb, 2014), hence the role of education in causing health inequalities may be mediated by other intervening factors. Thus, less educated individuals may be more prone to unemployment and have lower incomes which will invariably affect their ability to access malaria preventive interventions such as IRS and ITNs.

#### *2.6.3.3 Impact of the built environment on health*

The built environment, such as communities and the nature of houses, may have an influence on the health of inhabitants. The effects of housing condition on the health of individuals and communities have been recognized by researchers for several decades (Elton & Packer, 1986). A systematic review of available evidence suggested that improved housing conditions were associated with improved health while poor housing conditions were linked with poorer health outcomes, with a particular emphasis on the importance of the availability of heating systems in homes to improve general health, mental health and respiratory health (Thomson et al., 2013). Other scholars argue that housing condition is an important aspect of an individual's

standard of living, and poor housing often makes it challenging to achieve social inclusion (Angel & Bittschi, 2014). Although much of this evidence is derived from economically advanced countries, it may have relevance for less developed countries (Ormandy, 2014), especially when one considers the pathways through which housing conditions influence the health of the occupants.

There are two main pathways through which housing affects health. Firstly, the physical characteristics of the house, otherwise termed the hard factors, affect physical health (Shaw, 2004). For instance, physical characteristics of houses such as inadequate heating, hazardous features, pest and insect infestation can affect the physical health of residents, while lighting, the quality of indoor air, and crowding can affect the mental health of residents (Shaw, 2004). The poor physical features of housing in many rural communities in the study setting could expose householders to malaria infection. For instance, the use of thatch for roofing of some buildings usually result in instances where there is no proper ceiling and could allow space between roofs and walls, providing entry points for mosquitoes and thereby exposing householders to malaria infection. However, poor buildings may also facilitate the use of ITNs because these may be perceived to provide protection against debris that might fall from the rooftop.

The second pathway through which housing affects health is through psychosocial features (or soft factors) of a house. These include intangibles such as perceived social status, a sense of security and identity based on one's place of domicile which affect mental health because of their effect on stress (Shaw, 2004; Vaid & Evans, 2017).

Beside the health effects of housing, rural and remote communities tend to encounter challenges with access to and utilization of healthcare facilities. Thaddeus and Maine developed a framework which categorizes the challenges of access to healthcare into three main delay categories (Thaddeus & Maine, 1994). In their view, phase one delay relates to delays in making decisions to seek care on the part of the individuals and their families; phase two refers to delays in reaching healthcare facilities, such as physical accessibility challenges; and the third phase is delays in receiving care at healthcare facilities. These three phases of delay affect the utilization of healthcare facilities.

In the context of the current study, phase two of this delay framework may have relevance for the implementation of IRS in rural and remote communities. Because most rural communities in the Upper West region have bad roads, this may present

difficulties with transporting AGA Mal spray operators from operational sites to the communities to conduct spraying every day. This may lead to late arrival in the communities and hence, affect spray operations.

#### *2.6.3.4 Impact of employment and working conditions on health*

Work affects people's health in many ways. For instance, evidence shows that people who are unemployed are at greater risk of experiencing adverse health outcomes and poverty because of loss of income (Gallie, Paugam & Jacobs, 2003). The WHO Commission on Social Determinants of Health identified two main pathways through which work affects health, and these are employment conditions and working conditions (WHO Commission on Social Determinants of Health, 2008).

Several employment conditions, including unemployment and precarious work such as bonded labour, temporary work, contract work, informal work, slavery and child labour are linked with poor health (WHO Commission on Social Determinants of Health, 2008). The literature is awash with evidence on the negative effects of unemployment on income, life satisfaction, marriage and mental health (Bünnings, Kleibrink & Weßling, 2017; Eliason & Storrie, 2006; Green, 2011; Kassenboehmer & Haisken-DeNew, 2009). Perceived job insecurity, largely because of employment in precarious work, is associated with poor mental and physical health (Bünnings, Kleibrink & Weßling, 2017).

The second pathway, conditions of work, usually refers to the quality of work environments and this also affects health and causes health inequities (WHO Commission on Social Determinants of Health, 2008). For instance, low-status jobs are more likely to expose individuals to negative health outcomes. Stress at work has been found to be associated with lower job satisfaction, depression and increased risk of cardiovascular disease (Lewchuk et al., 2003).

Given that about 80% of employment in the Upper West region is precarious work in the private informal sector, mostly peasant farming or agriculture (Ghana Statistical Service, 2014b), householders in the current study setting may be exposed to job insecurity, low job satisfaction and stress. The Ghana Poverty Reduction Strategy found that about 98% of householders in rural communities live in poverty (National Development Planning Commission, 2005), suggesting that householders in rural communities may be adversely affected by the cost of malaria treatment (if not covered by insurance), and may need to pay for additional costs in terms of transportation during patient referrals to district hospitals or the regional hospital.

Employment could also have negative consequences on the acceptability of IRS by

householders in the study setting. In rural communities where there is dependence on rain-fed peasant farming or agriculture (Ghana Statistical Service, 2014b), most householders may be unavailable to admit spray operators to their homes during the rainy season because of their farm commitments. Because of the long distances to many rural communities, householders may be unable to wait for spray operators to travel from their operational sites to the communities. This may lead to a situation where adult household members may be unavailable to provide their consent for spraying, affecting the acceptability of IRS.

#### *2.6.3.5 Impact of gender on health*

Gender refers to how men and women are perceived and expected to act and think because of the nature of societal organization rather than biological differences (World Health Organization, 1998). Undoubtedly, like the other social determinants, gender affects health. Women's lack of control and their powerlessness accounts for their exposure to Human Immunodeficiency Virus (HIV) in much of Africa. Inadequate access to resources such as education, food and medical care disadvantages women in less developed countries (Phillips, 2005). Women also encounter challenges with access to healthcare because of the lack of female health workers, while health services focus mainly on reproductive services and thus neglect the needs of women in other age groups (Paolisso & Leslie, 1995). The Commission on Social Determinants of Health identified gender inequities in working conditions as one of the factors that could be detrimental to the health of women (WHO Commission on Social Determinants of Health, 2008).

There are complex pathways through which gender influences health. Sen and Östlin (2008) classify the intermediary gender-related factors that influence health into four categories: discrimination in norms, values, and practices; biases in health research; biased health systems; and differences in exposure to diseases and ill-health. In their view, these intermediary factors contribute to health inequities with serious social and economic consequences for men and women, boys and girls. Evidence also suggests that the autonomy of women in making certain health-related decisions may be limited.

Ganle et al. (2015) found that access to healthcare facilities by women in the current study's setting is mediated by intra-familial decision-making process. This could have implications for the acceptance of malaria preventive interventions such as IRS, because women or wives may not have the autonomy to make decisions regarding the acceptance of IRS. Women with partners or those who live with other household members may be unable to accept spraying where their spouses decide otherwise,

although the women may be willing to have their rooms sprayed.

The impact of social determinants on people's health and how these cause health inequalities have been discussed in this section. The review also shows that the social determinants of health framework has significance for this research work.

## 2.7 The health system in Ghana

An overview of the healthcare system in Ghana is described below to provide an understanding about the nature of healthcare delivery in Ghana and how this enhances or restricts malaria control and prevention. This review includes three sub-sections: the structure of healthcare delivery, health facilities in Ghana, and the National Health Insurance Scheme.

### 2.7.1 The structure of healthcare delivery

Ghana has a decentralized and well-developed health system that is integrated at three levels and incorporates the community level. The organization, management and governance of the health system reflects this structure (Schieber et al., 2012). The Ministry of Health is responsible for all health sector activities in Ghana. This role is played by providing overall policy direction and coordinating the activities of agencies, partners and stakeholders in health while striving to improve upon performance and accountability within the health sector (Ministry of Health, 2007). This means that decision-making relating to malaria control policy, such as the interventions to be implemented, are made by the Ministry of Health, which is headed by the Minister of Health. Beyond this, the Ministry of Health monitors progress towards the achievement of targets by the Ghana Health Service (GHS) (Adjei, 2003).

The organizational structure of healthcare delivery in Ghana closely follows the administrative structure of the country. There are ten (10) regions, 216 districts and several sub-districts in Ghana (Ministry of Health, 2007). The GHS is responsible for healthcare delivery in Ghana, and this is mainly undertaken through a well-coordinated and decentralized system to ensure access to healthcare services at the sub-district, district and regional levels (Ministry of Health, 2007). It is headed by the Director-General.

#### *2.7.1.1 Regional level*

The Ghana Health Service is administered by a Regional Director of Health Services (RDHS) in each of the ten administrative regions. They are responsible for the organization, planning and implementation of health services in their respective regions, providing support and supervision for health programmes at the district and

regional levels. They report directly to the Director-General of the GHS (Adjei, 2003). Curative care services at the regional level are delivered by regional hospitals while public health services are administered by the public health division of regional hospitals. For this reason, AGA Mal Ltd. collaborates with the regional officials of the GHS to facilitate the implementation of indoor residual spraying.

The management of health services at the regional level is overseen by the RDHS and supported by a group of professionals known as the Regional Health Management Team (Ghana Health Service, 2014). This team includes the regional malaria focal person and the regional disease control officer. The malaria focal person is responsible for coordinating the implementation of malaria control initiatives, such as the hang-up campaign and free ITN distribution to householders. The malaria focal person and disease control officers work together to promote malaria treatment and prevention.

#### *2.7.1.2 District level*

Health services at the district level are managed by a District Director of Health Services supported by a District Health Management Team (Adjei, 2003). Curative services at the district level are provided by district hospitals and some mission-based health facilities. The district health management team and the public health unit of the district hospitals provide public health services. These services may include public education about malaria and how to prevent malaria using vector control interventions. The district malaria focal person and district disease control officer are especially responsible for promoting activities relating to malaria control. AGA Mal Ltd. collaborates with the GHS at the district level to enhance the implementation of malaria control interventions, especially indoor residual spraying. GHS officials are involved in AGA Mal district stakeholders' review meetings during which information regarding the implementation of IRS is shared with stakeholders. This allows district officials of GHS to have input regarding the implementation of IRS and to provide their support if required. The District Director of Health Services provides management and supervision support for the sub-districts within each district (Ghana Health Service 2014).

#### *2.7.1.3 Sub-district level*

Curative and preventive services at the sub-district level are provided by health centres and outreach services to communities within each sub-district (Adjei, 2003). Preventive services offered at the sub-district level include the distribution of free ITNs to pregnant women and educating people about malaria and malaria prevention. At the community level, the community-based health planning services (CHPS) have

gained recognition for their role in providing basic curative and preventive services for minor ailments. Traditional birth attendants and traditional healers play a significant role in providing various health care services to people at the community level (Ministry of Health, 2007).

In the Upper West region, the GHS has a well-organized community volunteer system whereby each community has two health volunteers who work to promote the implementation of health interventions. These volunteers played a central role in the distribution of ITNs to householders during the free ITN distribution and hang-up campaign of 2012–13. Some of these community volunteers were selected by AGA Mal Ltd. to facilitate the implementation of indoor residual spraying in their communities.

To make healthcare accessible to all, various healthcare facilities have been established in the different administrative levels within each region in Ghana. The next section therefore provides detailed information on the different categories of health facilities in Ghana. This is important to give the reader an overview of the kind of healthcare delivered at each facility, starting from the first point of contact at the community through to the district and regional which are the referral centres.

### 2.7.2 Health facilities in Ghana

#### *2.7.2.1 Community-based health planning services (CHPS)*

Community-based health planning services involve a system of mobile community-based care provided by a resident nurse. The CHPS system is implemented with the support of the traditional leaders of communities, and therefore relies on community participation and mobilization for the delivery of healthcare services (Nyonator et al., 2007). The resident nurse is supported by the District Health Management Team to provide curative and preventive care while residing in the community. Health education relating to malaria and malaria prevention may be provided by the resident nurse, such as how to hang ITNs, which could facilitate the use of ITNs by householders. The resident nurse may be available to provide prompt treatment for malaria, and this could be especially useful given that early treatment of malaria helps ensure a quick recovery.

#### *2.7.2.2 Health centres, maternity homes and Christian health association of Ghana (CHAG) facilities.*

Health centres are usually headed by medical assistants supported by heads in areas such as midwifery, environment, laboratory services, nutrition and public health. The main functions of health centres are to provide basic preventive, curative and

reproductive health services, together with minor surgical services (Ghana Health Service, 2014). Health centres may play a major role in malaria control by treating infected persons and educating outpatients about malaria prevention. Personnel at health centres provide education on malaria prevention during antenatal and prenatal care and distribute free ITNs to pregnant women. This may facilitate the use of ITNs by householders

Private maternity homes form a key part of private sector health facilities. They operate within the guidelines of the Ghana Registered Midwives Association (Ghana Health Service, 2014). The Christian Health Association of Ghana (CHAG) contributes to healthcare delivery through its institutions that are mostly located in hard to reach areas, and thus, they provide health care to the poor and marginalized in society in fulfilment of Christ's healing ministry (Ministry of Health, 2007). Information, education, and communication personnel from AGA Mal Ltd. may conduct education on malaria and its prevention at these facilities to enhance the acceptance of indoor residual spraying.

#### *2.7.2.3 District hospitals*

District hospitals provide clinical, preventive and curative care to people at the district level. Each is headed by a medical director. Preventive care such as education about malaria and the use of IRS and ITNs are delivered by the staff of district hospitals to outpatients. District hospitals also provide a platform for AGA Mal Ltd. personnel to meet and educate outpatients about malaria and malaria prevention. These education activities could facilitate the use of IRS and ITNs for malaria prevention. In general, district hospitals provide quality and more advanced care than what is provided at health centres, and their staff are more highly qualified (Ghana Health Service, 2014). Thus, complicated malaria cases may be referred at the health centres to district hospitals for treatment.

Although medical doctors or physicians are usually part of the staff at district hospitals, the difficulty of attracting and retaining medical doctors sometimes means that many district hospitals in the Upper West region operate without a medical doctor (Kuusanoo, 2015). This could affect the delivery of healthcare services such as malaria treatment to patients in districts within the Upper West region.

#### *2.7.2.4 Regional hospitals*

Regional hospitals provide specialized healthcare to people (Ghana Health Service, 2014). but the inability of the Upper West region to attract and retain medical doctors (Kuusanoo, 2015) may limit the extent to which specialized healthcare services can

be provided by the Upper West regional hospital. The overall effect of the inadequate staffing may have implications for the treatment of complicated malaria cases. Given the relatively large number of people seeking healthcare at regional hospitals, it may be prudent for AGA Mal Ltd. to collaborate with officials at regional hospitals to enable it to undertake education activities with outpatients. This could help enhance the acceptance and implementation of IRS.

#### *2.7.2.5 Teaching hospitals*

Teaching hospitals are not part of the structure of the GHS, and their governance involves many players including the Ministry of Health, the Ministry of Education, universities and other political and traditional influences (Ghana Health Service, 2014). The three teaching hospitals, Korle Bu teaching hospital, Komfo Anokye teaching hospital and Tamale teaching hospital were established to provide specialist clinical care, educate and train health professionals, and conduct research into emerging health issues in the country (Ministry of Health, 2007).

### 2.7.3 National Health Insurance Scheme (NHIS)

The National Health Insurance Scheme (established in 2004) introduced a reform that sought to empower the most vulnerable in the population, based on the principles of risk sharing, equity, cross-subsidization, re-insurance, solidarity, community ownership, good governance, transparency and value for money in the delivery of healthcare. The aim of the scheme was to replace the 'cash and carry' system and it has become the main source of health financing in Ghana. The scheme sought to provide coverage for every person who is resident in Ghana within five years of implementation (Durairaj, D'Almeida & Kirigia, 2010). Enrolment into the NHIS requires the payment of premiums based on the socio-economic status of the persons involved. The scheme has exemptions for children under 18 years whose parents are enrolled, those aged over 70 years, pregnant women, the extremely poor, and pensioners receiving social security payments (Durairaj, D'Almeida & Kirigia, 2010). The NHIS benefits include outpatient consultations, inpatient care, shared accommodation, and essential drugs, and it covers about 95% of the common diseases in Ghana (Adinkrah, 2016) including malaria.

## 2.8 **Conclusion**

In this chapter, a narrative review of relevant literature relating to the current study was undertaken. The review was categorized under seven main headings. This review resulted in the identification of gaps in the literature, providing the basis for conducting this study.

# 3 CHAPTER THREE: METHODOLOGY

## 3.1 Introduction

This chapter describes the methodological approaches of this study and is divided into six sections. The first section provides an overview of the study setting, that is the Upper West region of Ghana and the districts where this study was conducted, and the background to the implementation of IRS and ITN implementation in the study setting. The second and third sections relate to the research design, the study participants, their recruitment, data collection, and the sociodemographic characteristics of the study participants, while the fourth section describes the analysis of the data. Section five addresses relevant issues relating to the quality and rigour of this research. In section six, issues relating to the ethics of research are presented.

## 3.2 Study setting

The study was conducted in the Upper West region of Ghana where IRS has been implemented since 2012 and ITNs were freely distributed in 2012–13 during a nationwide ITN distribution and hang-up campaign. Given that malaria is endemic in all eleven districts of the Upper West region, two districts were purposively selected. In one of these, Daffiama-Busie-Issa District (DBI), the prevalence of malaria in 2014 was 56.7%, one of the highest levels recorded in the region. The villages or communities that were selected included Daffiama, Busie, and Kaleo which are predominantly rural (Ghana Statistical Service, 2014). The other district was Wa Municipal, where the study was conducted in Sombo and Konta which are suburban communities. This sampling thus providing an opportunity to contrast and compare rural and urban areas in relation to the research questions, to see whether the implementation of IRS and ITNs in rural and urban communities had different outcomes.

### 3.2.1 Upper West region of Ghana

The Upper West region has a geographical area of about 18,478km$^2$, and this constitutes approximately 12.7% of the total land area in Ghana. The northern part of the region is bordered by the Republic of Burkina Faso, while the south is bordered by the Northern region of Ghana. The eastern part is bordered by Upper East region of Ghana while the western border is with Cote d'Ivoire. Climatically, the Upper West region has a single rainy season which usually runs from April to September, with average annual rainfall of about 115cm (Ghana Statistical Service, 2014a). The highest prevalence of malaria usually occurs in the rainy season, peaking between

June and August. The rainy season is followed by a prolonged dry season often referred to as the harmattan. Harmattan is characterized by cold and hazy weather from early November, followed by a period of very hot weather in March until the start of the rains. The mean monthly temperature ranges between $21^0$ C and $32^0$ C. Temperatures rise to their maximum ($40^0$ C) in March just before the onset of the rainy season, and fall to an average minimum of ($22.6^0$ C) in December during the harmattan season, which is brought about by the north-east trade winds (Ghana Health Service, 2014). The high temperatures in the region facilitate mosquito breeding, and hence the high prevalence of malaria. Much of the region, and especially the western part of the capital (Wa), has a near-flat topography. Generally, the land is between 275m and 300m above sea level, with the exception of the eastern part where the land rises above 300m (Ghana Statistical Service, 2014a).

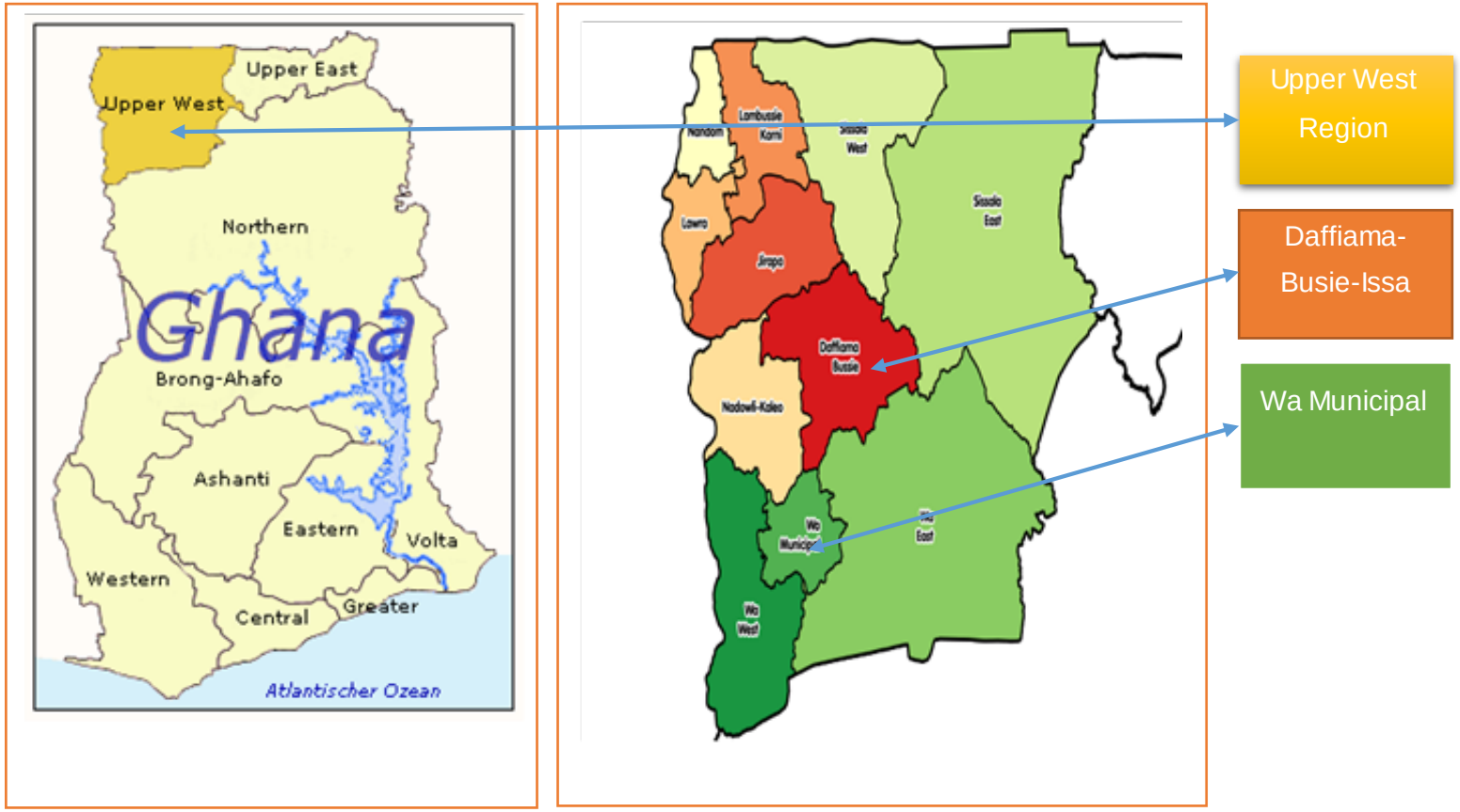
Evidence from the 2010 population and housing Census indicate that the Upper West region has a population of 702,110, making it the least populated region in Ghana. Among the districts in the Upper West Region, Wa Municipal has the largest population of 107,214, or 15.3% of the total population of the region. On the other hand, Sissala West has the smallest population of 7.1% (Ghana Statistical Service, 2012). A total of 84,931 households are engaged in agricultural activities in the region, with 91.4% of these households located in rural areas (Ghana Statistical Service, 2014a).

### 3.2.2 Overview of Wa Municipal and Daffiama-Busie-Issa District (DBI)

Wa Municipal Assembly was created by a legislative instrument in 2004 and shares boundaries with Nadowli-Kaleo District to the North, Wa East District to the East and South and Wa West District to the West and South. On the other hand, the Daffiama-Busie-Issa District (DBI) was carved out of the Nadowli District in June 2012 and is bordered to the west by Nadowli-Kaleo District, to the south by Wa Municipal, to the north by Sisala West District, and to the east by Wa East District. The population and housing Census of 2010 shows that Wa Municipal has a population of 107,214, with 49.4% male and 50.4% female, whereas DBI district has a population of 32,827, with 48.7% male and 51.3% female (Ghana Statistical Service, 2014b).

In DBI District, transportation is a major challenge to development because much of the district is dominated by feeder roads which are often left in very bad state following the rainy season (Ghana Statistical Service, 2014c). Similarly, there are poor road networks linking the rural communities which may affect the implementation of IRS because spray operators often need to be transported from operational sites to the communities to conduct spraying. Figure three below is the map of the study setting.

FIGURE 3: MAP OF STUDY SETTING




Wikipedia, 2019

## 3.3 **Study design**

The exploratory nature of the research questions necessitated the adoption of a qualitative research design for this study. Qualitative research is a type of research in which emphasis is placed on textual rather than numerical data, and data analysis proceeds in a textual form without converting them into numerical data (Schwandt, 2001). An interpretivist approach was used to understand the participants' views regarding the study topic. In other words, the study used the interpretivist approach to understand phenomena from the perspective and worldview of the participants in their social world (Merriam, 2002). The use of the qualitative approach in conducting this research proved to be very useful because of its unique ability to address complex phenomena in given situations (Black, 2006).

The use of an interpretivist qualitative approach in this research was informed by many reasons. Firstly, given that the goal of this study was to explore the perceptions of people, the adoption of an interpretivist qualitative research design was most suitable because this approach is premised on the grounds that there can be no understanding of the social world without interpretation (Angen, 2000). This approach helps provide explanations for outcomes in their individual occurrences (Mahoney & Goertz, 2006), and thus is the most logical approach in research aimed at exploring perceptions about malaria and the acceptability of interventions. Implicit in this research design is the assumption that meaning is socially constructed by individuals in their social world (Merriam, 2002). Moreover, the social world is intrinsically linked with individual perceptions, and is created through individual interactions with the social world (Hesse-Biber, 2010). Thus, a qualitative methodology describes phenomena from the point of view of the participants (Flick, von Kardorff & Steinke, 2004), in tandem with the interpretivist philosophy.

Secondly, given the central interest of this research and the nature of the research questions raised, a qualitative interpretivist approach was best suited to addressing the research questions by collecting information on the processes of implementing a malaria prevention programme. Experiences of householders and programme implementers were explored in relation to the implementation context. Specifically, this was conducted through interviews and focus group discussions in the natural setting of the participants. Consequently, data were collected through focus group discussions and semi-structured interviews (Gill et al., 2008; McLafferty, 2004) because these methods are suitable for exploring perceptions about the causes of diseases (Trilling, 1999).

Focus group discussions were conducted to explore and gain an understanding of local people's (householders') perceptions about the causes and prevention of malaria, as well as the facilitators and barriers to the acceptability of IRS and ITNs, and the combination of these interventions. Semi-structured interviews were conducted to explore the participants' perspectives on the implementation of IRS and ITN interventions.

The use of interviews and focus group discussions helped enhance the collection of suitable data for the study. In interviews, the researcher explored the experiences and perspectives of participants by asking open-ended questions (Tong, Sainsbury & Craig, 2007), providing them with the opportunity to express their opinions on the topic without restriction or limitation. The focus group discussions helped bring together the participants for a discussion on the relevant topics that were of mutual interest to the researcher and the participants (Morgan & Spanish, 1984). These discussions enriched the data by their interactive nature, thereby adding breadth to the data (Morgan, 1996). The focus groups and interviews were very useful for exploring participants' beliefs or perceptions about malaria and for providing explanations about their adoption of preventive interventions (Gill et al., 2008; Rabiee, 2004) such as IRS and ITNs. The flexible nature of these qualitative methods facilitated a greater depth of understanding (Qu & Dumay, 2011) on the topics of discussion with the participants. Semi-structured interviews and focus groups discussions were combined for data collection due to three main reasons:

1. The combination of semi-structured interviews and focus group discussions for data collection was for pragmatic reasons (Lambert & Loiselle, 2008). For example, exploration of the important perspectives of the GHS officials (who are responsible for implementation of ITNs) and AGA Mal officials (implementers of IRS intervention) could only be undertaken using interviews because of their self-reported busy schedules. Therefore, it was deemed convenient to organize focus groups for some groups of participants while interviews were conducted with other targeted groups.
2. The combination of the focus groups and interviews also helped reveal different aspects of the phenomena under study such as individual and group perspectives, and hence the combination of methods helped achieve data completeness (Lambert & Loiselle, 2008), thereby contributing to a better understanding of the phenomena (Adami & Kiger, 2005).
3. Finally, although focus groups were conducted with householders to facilitate the collection of rich data (Morgan, 1996) due to the interactive nature of the discussion, the richness of the data was mainly due to the homogeneous

nature of the groups (Krueger, 1994). However, the existence of hierarchies among AGA Mal and GHS officials implies that lower-hierarchy officials may be unable to contribute freely to the discussions, especially in relation to financial, administrative, and logistical challenges that affect the implementation process, and this could affect the quality of data collected. Therefore, combining focus groups and interviews provided a suitable combination of methods for data collection.

## 3.4 Study participants, recruitment and data collection

The study participants were drawn from four groups: (I) householders, (II) AGA Mal Ltd. spray operators, (III) AGA Mal Ltd. officials, and (IV) Ghana Health Service officials.

### 3.4.1 Householders

The householders were community members who were beneficiaries of the two interventions (IRS and ITNs) in the study. Their views, perceptions and acceptability of these interventions were explored because they could be critical for informing strategy and policy development for malaria control purposes.

#### *3.4.1.1 Recruitment of householders*

A convenience sampling technique was used to select householders to participate in the study. Convenience sampling is a technique for the selection of informants or participants who meet certain criteria such as their willingness to participate, geographical proximity, availability at given times etc. (Dornyei, 2007). Because householders were neither required to have used IRS or own ITNs, heads of household or their representatives who were 18 years and above and willing to participate in the study were selected. The use of this sampling technique facilitated the recruitment of participants as potential participants were readily available (Dornyei, 2007). By recruiting householders based on their willingness to participate, this helped avoid the possibility of excluding certain groups of householders from participation. The selected heads of households or their representatives were deemed to be equipped with adequate information about the households' acceptance of vector control interventions, and their personal perceptions about malaria.

Prior to the recruitment of participants, the researcher organized a practice focus group discussion with selected heads of households that enabled him to reflect on his performance as a facilitator for group discussions. The practice group discussion was particularly useful given the fact that this was the first time the researcher had used this method, and the experience and exposure enabled him to refine his strategies.

Following the practice discussion, the primary researcher and two health volunteers in each community involved undertook the recruitment of householders. Recruitment was designed to ensure that the group was homogenous enough to have similar characteristics and thereby facilitate a comfortable discussion among the group members and with the interviewer (Richardson & Rabiee, 2001). The involvement of community health volunteers was to enable the researcher to overcome the numerous recruitment challenges encountered when conducting focus groups (MacDougall & Fudge, 2001). The community health volunteers were householders or opinion leaders who served as health advocates for their respective communities and assisted the GHS in the implementation of health programmes. The researcher and the selected volunteers in each community went house to house to identify people who met the eligibility criteria. However, to ensure that all important aspects of the study were conveyed to potential participants in a simplified form during the first contact, the community health volunteers were provided with a verbal script (appendix I) as a guide to ensure that the message could be easily understood by all possible participants.

Householders who met eligibility criteria were also provided with an information pack by the researcher or community health volunteers. The information packs were also translated into Dagaare, which is the local language of the people in the selected districts, and the dominant language in the Upper West region. Householders were encouraged to contact the researcher if they decided to participate in the study and their consent was obtained thereafter. Some of the community health volunteers also participated in the study.

#### *3.4.1.2 Data collection from householders*

Data was collected through focus group discussions and facilitated by the principal researcher using a semi-structured topic guide. The semi-structured topic guide (appendix II) was developed based on the relevant literature, research objectives and research questions (Ingabire et al., 2015; Munguambe et al., 2011; Rodríguez et al., 2003). A preliminary list of questions for the topic guide containing key issues for exploration was produced, examined and refined for use (McLafferty, 2004). The purpose of the topic guide was to increase the comprehensiveness and efficiency of data collection (Wong, 2008) by directing group discussions in such a way as to stimulate conversation about the research topic (Dilorio et al., 1994).

The domains in the topic guide were derived mainly from the HBM, including knowledge about the causes and prevention of malaria, perceived susceptibility to and severity of malaria, information, education and communications about malaria.

Other topics included the facilitators and barriers to IRS acceptability, facilitators and barriers to ITN acceptability, and facilitators and barriers to the acceptability of combining IRS and ITNs. To elicit information from householders, open-ended questions were asked during the focus groups, such as “Do you sleep under an ITN?” or “What do you think the causes of malaria might be?”, “Did you spray your house during the recent spraying? …if not, why didn’t you spray your house?”. To reduce householders’ hesitance in responding with contentious and sensitive answers (Rodríguez et al., 2006), they were also asked “Why wouldn’t some householders spray their houses?” The open-ended questions were expected to suit the group dynamics which could be critical to the generation of rich data resulting from group interactions by illuminating individual perspectives between groups of individuals (Freeman, 2006; Rabiee, 2004). An iterative process was adopted whereby the insights from initial data collection informed a review of the questions contained in the topic guide. This enabled the researcher to address the research questions adequately.

Between seven and ten householders were selected to participate in each focus group (Rabiee, 2004). A flexible and a pragmatic approach was adopted to enable to selection of sample size that was adequate to answer the research questions (Morgan, 1996). Each focus group was organized in such a way that there were heads of household whose houses had been sprayed during the recent spray season and heads of households whose houses could not be sprayed. Similarly, there were heads of households who owned ITNs and those who did not. This was to ensure collection of data relating to the facilitators and barriers to the acceptance of both interventions. In total, nine focus groups were conducted with householders across the two districts. Data were collected until data saturation was achieved (Onwuegbuzie & Collins, 2007). Thus, data collection continued until such a point that there were no new issues being generated (Green & Thorogood, 2013; O'Reilly & Parker, 2012).

The focus group discussions were conducted in Dagaare. Data were simultaneously collected through an audio recorder and handwritten notes by a research assistant who was trained beforehand. The participants were assured that the use of an audio recorder was to ensure a verbatim transcription of recorded data for the purpose of analysis because analysis from notes and memory alone cannot be trustworthy and reliable (Beyea & Nicoll, 2000).

The data were translated into English during data transcription by the primary researcher who speaks both languages fluently. However, two focus groups were first translated and transcribed by both the principal researcher and a research assistant

(PhD student) who is also competent in Dagaare, and the two outcomes were compared for the purposes of minimizing potential loss of meaning.

### 3.4.2 AGA Mal Ltd. spray operators

The AGA Mal spray operators (mostly high school leavers) constituted a group of participants responsible for conducting IRS in the communities. This participant group was included because of their constant interactions with householders when conducting spraying in the communities.

#### *3.4.2.1 Recruitment of AGA Mal Ltd. spray operators*

Convenience sampling was used to select spray operators and team leaders to participate in the study in Wa Municipal and Daffiama-Busie-Issa (DBI) districts. Their selection was not based on any specific criteria because their participation in the study was needed because of their close interactions with householders during spraying in the communities and the fact that they were responsible for conducting spray activities. Before undertaking recruitment of spray operators, the Director of AGA Mal Ltd. was provided with a letter of introduction (appendix III) and a request for permission letter (appendix IV) for his express approval. The primary researcher also met the Zonal Operations Manager for the Upper West region for a discussion on the research and the role expected of AGA Mal officials and spray operators participating in the study. Following this meeting, flyers (appendix V) containing information about the research were given to the Wa Municipal and DBI managers for onward distribution to their spray operators. Spray operators and team leaders who wanted to participate in the study contacted the researcher later, and their consent was obtained.

#### *3.4.2.2 Data collection from AGA Mal spray operators*

Data were collected through focus group discussions facilitated by the researcher using a semi-structured topic guide (appendix VI) (Wong, 2008) which was developed based on the literature, researcher questions and objectives. This topic guide differed from that administered to householders because it only sought to address issues relating to the acceptability and implementation of IRS. Open-ended questions were asked with the intention of providing spray operators and team leaders the opportunity to express their thoughts. Questions such as “What are the common reasons why some houses are not sprayed after you’ve sprayed a community?” were asked. Further probing was done where necessary for clarification and/or addition. Between eight and nine spray operators and team leaders were selected to participate in each focus group (Rabiee, 2004). One focus group was held in each district and these were sufficient to achieve data saturation (O'Reilly & Parker, 2012).

During the focus group discussions, data were collected through audio recording and notes taken by the research assistant, after permission was obtained from the participants. There was significant rapport between the primary researcher and the spray operators and this could be attributed to the fact that the researcher had worked with AGA Mal three years before undertaking this study, thereby resulting in a positive insider effect (Mwanri & Gatwiri, 2017). An iterative process involving a back-and-forth movement between data collection and analysis was strategically adopted with the aim of improving the quality of data collected (Lewis & Ritchie, 2003). To do this, subsequent data collection was informed by preliminary insights gained from initial analysis. Thus, the process of iteration facilitated a review of the topic guide to suit the research questions, thus ensuring the collection of highly relevant data.

### 3.4.3 AGA Mal Ltd. officials

AGA Mal Ltd. is the private organization responsible for the implementation of IRS in the Upper West region. Therefore, the researcher sought the views of officials of AGA Mal Ltd. about the acceptability and implementation of the IRS intervention, and the acceptability of combining IRS and ITNs by householders.

#### *3.4.3.1 Recruitment of AGA Mal Ltd. officials*

The officials of AGA Mal Ltd. were also purposively selected to participate in the study (Tongco, 2007). To be included in the study, the staff member had to work at the district or zonal office. As with AGA Mal Ltd. spray operators, the recruitment of potential participants was undertaken following the approval of the Director and a subsequent meeting with the zonal manager for Upper West region. To recruit participants, the researcher met the officials of both districts and those at the zonal office individually in their offices for a discussion about their potential participation in the research, during which their consent was obtained.

#### *3.4.3.2 Data collection from officials of AGA Mal Ltd.*

Semi-structured interviews were conducted using semi-structured interview guides that helped define the area to be explored (Britten, 1995). The semi-structured interview guides (appendix VII) consisted of a set of predetermined open-ended questions, thus allowing other questions to emerge from the interactions between the researcher and the respondents (DiCicco-Bloom & Crabtree, 2006). The key questions, including “What are some of the barriers to the implementation of IRS?” or “What do you think limits the prospects of householders accepting IRS more?” concentrated on the acceptability and implementation of IRS, and the acceptability of combining IRS and ITNs. These questions were aimed at exploring the facilitators and barriers to IRS implementation, and how IRS acceptance may be enhanced. That is,

the interview guide was developed in relation to the research questions and the relevant literature.

The semi-structured interviews were conducted in June 2016, just before the end of the AGA Mal spray season. Given the importance of interview sites or location (Elwood & Martin, 2000), the interviews were conducted in the offices of the participating staff members which constituted a natural setting (Noble & Smith, 2014). The choice of offices as the location for interviews was informed by the fact that the offices were free from distractions, and most probably suitable for the participants (Gill et al., 2008) because interviews were conducted during working hours. Because AGA Mal Ltd. only employed a few staff members in the district and zonal offices, data were collected from all staff members who consented to participate in the study in Wa Municipal, DBI district, and the zonal office at Wa. During interviews, data were collected by audio recorder, and this was done after verbally asking for permission to do so. The participants were assured that the need for a verbatim transcription of the interview necessitated the use of the recorder to enhance data analysis (Beyea & Nicoll, 2000). Hence, the participants were assured that audio recordings would be destroyed after data transcription.

The semi-structured interviews were transcribed by the researcher. By being directly involved in the verbatim transcription, the principal researcher gained in-depth insight into the data which subsequently facilitated the process of data analysis.

### 3.4.4 Ghana Health Service officials

Officials of GHS constituted an important group of participants because they were responsible for decision-making and implementation of ITNs and were important partners in the implementation of IRS by AGA Mal Ltd. Thus, their involvement in the study was purposive (Tongco, 2007).

#### *3.4.4.1 Recruitment of Ghana Health Service officials*

To recruit GHS officials to participate in the study, the researcher sought approval (appendixes VIII and IX) from the Upper West regional health directorate. The District Directors of Health, the district malaria focal persons and the disease control officers were purposively selected to participate in the study. Therefore, following the approval from the regional directorate, the researcher met and discussed details of the research with the District Directors of Health—who were themselves eligible for participation—for Wa Municipal and DBI districts and provided them with an introductory letter (appendix X). During the discussions with the directors, it was made clear to them that it was their sole discretion and the discretion of their staff members

to decide whether to participate in the research. Subsequently, the researcher met the staff members who met the inclusion criteria, including the disease control officers and the malaria focal persons for a discussion about their participation. The officials who expressed their willingness to participate in the study signed consent forms.

#### *3.4.4.2 Data collection from Ghana Health Service officials*

Semi-structured interviews were conducted with the officials of GHS by the researcher using a semi-structured interview guide (appendix XI). The interview guide differed slightly from the one administered to the staff of AGA Mal, and focused more on the acceptability and implementation of ITNs and the acceptability of combining IRS and ITNs. Key questions in the interview guide, such as "What do you think limits the prospects of householders accepting ITNs?" or "What do you think might help householders to use ITNs more?" sought to explore their perspectives on the barriers to the acceptance and implementation of ITNs.

Data were collected from all eligible staff members who consented to participate. There was a very good rapport during the interviews, and this could be attributed to the fact that the primary researcher worked with AGA Mal Ltd. and collaborated closely with GHS staff in the Upper West region prior to undertaking this research. Audio recording of the interviews was done after seeking permission from the participants. A summary of study participant groups and data collection can be found in appendix XII.

## 3.5 **Data analysis**

Data were analysed after verbatim transcription of the audio recordings and checking of the veracity of the transcripts by comparing samples of text with the original audio recordings. Using framework analysis (Gale et al., 2013), data were analysed by using the recommended steps: familiarisation, identifying a thematic framework, indexing and charting data into the framework, and interpreting the data. The choice of the framework analysis was informed by the fact that the method is relatively straightforward, provides clear results, and facilitates the drawing of conclusions and recommendations (Johnston et al., 2012). These processes are explained below.

### 3.5.1 Familiarization

The researcher familiarized himself with the data by reviewing the transcripts of the focus group discussions and semi-structured interviews, reading field notes and listening to the audio recordings. The field notes ensured that context was taken into consideration in the process of familiarization (Ward et al., 2013). According to Srivastava and Thomson (2009), the process of familiarization involves the

researcher reading the transcripts and field notes with the aim of immersing her or himself in the data. Although not all transcripts need to be reviewed in the process of familiarisation (Srivastava & Thomson, 2009), the researcher chose to review all of them. In addition to reviewing the transcripts and field notes, the researcher also listened to audio recordings of the focus groups and interviews, particularly the parts where additional comments about context were written as part of the note-taking by the research assistant. The process of familiarisation helped equip the researcher with key ideas and recurring themes across the data (Srivastava & Thomson, 2009).

### 3.5.2 Identifying a thematic framework

The next step in the analysis process involved the identification of a thematic framework. Descriptive coding was undertaken to identify a thematic framework. This involved an initial descriptive coding followed by a transitioning process of iteration of the initial codes as part of the analysis. The researcher selected six transcripts, made up of two householders' focus group discussion transcripts, one spray operators' focus group discussion transcript, two AGA Mal officials' semi-structured interview transcripts, and one GHS official's interview transcript for coding. The selected transcripts were read line-by-line to identifying recurring codes. Coding for each of the participant groups was done separately, resulting in the generation of first cycle codes for householders (appendix XIII), AGA Mal spray operators (appendix XVI), AGA Mal officials (appendix XVII), and GHS officials (appendix XVIII). The choice of descriptive coding method facilitated the generation of an inventory of categories (Saldaña, 2015), essentially providing the basis for further data analysis and interpretation (Wolcott, 1994).

Following the initial coding of data for each participant group, the tentative codes were shared with two other researchers who had supervisory roles in this PhD study and their opinions considered in refining the codes. While refining the codes, the researcher undertook a series of iterations of the descriptive codes for each participant group. This involved an examination of the full set of codes for each participant group and reorganizing or merging them into topic areas and under similar themes. This process involved the identification of links between codes; links that could be an indication of association or causality (Turner, 1994).

To organize the full set of codes for each participant group into categories, sub-themes and under similar themes, two rounds of iterations were undertaken on the codes for householders (appendices XIX & XX), AGA Mal officials (appendices XXI & XXII), and AGA Mal spray operators (appendices XXIII & XXIV) whereas only one iteration was undertaken on codes for GHS officials (appendix XXV) because of the

relatively limited number of participants. Therefore, the second iteration of codes for each of householders (appendix XX), AGA Mal officials (appendix XXII), and AGA Mal spray operators (appendix XXIV) became the final codebook or thematic framework for those participant groups. The only iteration for GHS officials (appendix XXV) became the final codebook or thematic framework. The iteration process enabled the researcher to continuously categorize and merge the coded data until a comprehensive structure or thematic framework was derived (Lewis & Ritchie, 2003).

During the iteration process, the categorization of codes and themes was informed by an integrated approach. In doing so, categories of codes and themes were derived both inductively by reviewing the data and assigning codes/categories based on apparent concepts from the data (Bradley, Curry & Devers, 2007), and deductively from the literature and relevant theories. This implies that an integration of both inductive and deductive approaches to data analysis was employed (Bradley, Curry & Devers, 2007; Ryan & Bernard, 2003). This approach helped to forestall the error often associated with trying to fit all the data into preconceived themes (Srivastava & Thomson, 2009).

Glaser and Strauss's constant comparison method was used to ensure that as emergent codes and concepts were being categorized, they were also compared across other categories in the process of developing the codebooks (Dye et al., 2000). The use of constant comparison facilitated the development of the thematic framework by enhancing data categorization, the delineation of sub-categories, and the connection or merging of categories (Boeije, 2002).

### 3.5.3 Indexing/coding and charting the data

Following the identification of the thematic framework or development of codebooks for each of the four participant groups, all the transcripts were uploaded onto NVivo version 11 (Burnard et al., 2008). A set of codes and sub-codes (referred to as nodes in NVivo software) were created on the NVivo software corresponding with the codebooks or thematic frameworks for each participant group. The investigator then read through all the focus group and interviews transcripts on NVivo one after the other, to identify and highlight portions of each transcript that corresponded to any code or sub-code contained in the thematic framework, a process referred to as indexing. Having highlighted the codes, they were then lifted and placed in the appropriate node as created on the NVivo software.

The indexed data were charted onto a matrix. To simplify the process, a separate sheet was used to create a matrix for each theme, ensuring that the number of sheets

for each participant group corresponded with the number of themes identified in their respective final codebook. Each matrix consisted of one row for each category and a column for the theme. Data were then abstracted from the NVivo software, summarized and inserted into the corresponding cell in the matrix (Gale et al., 2013). The use of NVivo facilitated the research process (Gibbs, 2002; Leech & Onwuegbuzie, 2011) by enhancing data storage, retrieval, location of phrases, and the extraction of quotations (Burnard et al., 2008). The use of NVivo was particularly useful during the process of charting because data could be traced to each transcript without difficulty, making it an ideal tool for the task (Srivastava & Thomson, 2009).

### 3.5.4 Data interpretation

Interpretation of the findings was undertaken by looking at the data from a range of theoretical and conceptual positions to gain a more abstract understanding of the findings (Grbich, 2012). Interpretation was mainly directed by the theoretical underpinnings of this research, that is the HBM, realist evaluation framework, and the social determinants of health framework. This is because of the relevance of these theories to the current study, and the fact that data were collected to suit the application of these theories to the study (Grbich, 2012). However, several other conceptual and theoretical models from the public health literature (and across other disciplines) were also drawn on to enhance the interpretation of the findings (Grbich, 2012). This helped provide a more holistic understanding of the findings (Spiggle, 1994).

Glaser and Strauss's constant comparison method was used to identify potential similarities and/or differences in data from within and between the participant groups, communities and districts with the view to identifying patterns (Dye et al., 2000). Indeed, this method helped reveal some rural/urban differences in the process of data interpretation.

## 3.6 Credibility and dependability of data

Several practical measures were adopted to improve the credibility and dependability of the study, and to enhance the transferability of the findings. These measures sought to achieve internal validity through the rigorous pursuit of several verification strategies throughout the process of the research (Rolfe, 2006). The measures include the following.

Firstly, the adoption of data source triangulation where data were collected from householders, AGA Mal spray operators, officials of AGA Mal and officials of GHS contributed to a holistic understanding of the findings (Lambert & Loiselle, 2008). This

is because data from the operators and officials served to corroborate the views of the householders in most instances, or introduced different perspectives, thereby, provided an illuminating insight to enhance an understanding of the subject under study.

In addition, investigator triangulation was adopted at different stages of the research process. To minimize the loss of meaning, and retain as much information as possible, a second investigator (PhD student) was involved in data transcription and translation of a few focus group transcripts for comparison purposes. This was primarily done because the focus groups were conducted in Dagaare language and required translation alongside data transcription. The principal investigator and his two supervisors triangulated their perspectives during the coding and iteration processes. Following a discussion and consensus with the supervisors, some codes were merged or eliminated, resulting in the development of the final codebooks for each participant group. Therefore, the involvement of other investigators in the research process helped improve the validity of the findings, thereby increasing the rigour of the research process and enhancing the credibility of the findings (Krefting, 1991).

Moreover, a combination of data collection methods was used in the collection of data from the study participants, in what is usually referred to as triangulation of methods (Krefting, 1991). It can thus be argued that the triangulation of methods, data sources and investigators in this study greatly enhanced the credibility, and by extension, the quality of this study. Golafshani (2003) believes that triangulation remains an essential strategy for enhancing the validity of research or the evaluation of the findings therefrom. Arguably, adherence to the ethics of research involving human participants in this study also enhanced the credibility of the findings.

## 3.7 **Ethical considerations**

This study was conducted in accordance with the Nuremberg code of 1948 by upholding the principles of respect, beneficence and justice to ensure that the overall benefits of the research outweighed the risks associated with it (Orb, Eisenhauer & Wynaden, 2001). To do this, ethics approvals were sought from the Social and Behavioural Research Ethics Committee of Flinders University (appendix XXVI) and from the Navrongo Health Research Institute Ethics Review Committee in Ghana (appendix XXVII).

Informed consent (Steinke, 2004) was sought by providing an information pack to participants that included an information sheet, letter of introduction and consent form. The information pack was given to householders (appendices XXVIII, XXIX and XXX;

and their Dagaare translation versions XXXI, XXXII and XXXIII), AGA Mal Ltd. spray operators (appendices XXXIV, XXXV and XXXVI), officials of AGA Mal Ltd. And Ghana health service (appendices XXXVII, XXXVIII, XXXIX). The information sheets reassured the participants about the anonymity and confidentiality of the research process, and their right to withdraw from the study at any point if they so wished. Participants were thus empowered to make an informed decision about whether to participate in the research. The information sheets were accompanied by consent forms that were completed by each participant before their participation.

In addition, because the researcher had worked with and knew some of the study participants before undertaking this research, he adopted prudent measures to forestall the possibility of coercion in the process of recruiting AGA Mal officials and spray operators. This was done by personally meeting all AGA Mal officials individually for a discussion regarding their potential participation and asking them to contact the researcher directly upon deciding to participate in the study. For AGA Mal spray operators, flyers containing the contact details of the researcher were distributed to them by their district managers. Interested spray operators directly contacted the researcher for further details before their participation in the study. Thus, by avoiding a situation where managers played intervening roles in the recruitment process, any real or perceived acts of coercion were prevented. The next chapter presents the results that were obtained following the analysis of the data.

# 4 CHAPTER FOUR: FINDINGS

## 4.1 Introduction

The findings of the study are presented under three main themes preceded by the sociodemographic characteristics of participants. The first theme covers householders' perceptions about malaria, including their perceptions about its causes, the risk of malaria infection, and the impact of malaria. The second theme encompasses householders' acceptability of vector control interventions with emphasis on the facilitators and barriers to the acceptability of IRS and ITNs. The second theme also provides recommendations from householders on how to improve acceptance of IRS and ITNs. Finally, the third theme presents programme officials' perspectives on the implementation of IRS and ITN interventions, the facilitators and barriers to implementation, and their recommendations to improve the acceptance and implementation of IRS and ITNs.

### 4.1.1 Sociodemographic characteristics of respondents

Of the 180 people who were provided with information packs, a total of 105 people (76 householders, 17 AGA Mal spray operators, 8 AGA Mal officials and 4 GHS officials) participated in the study. Details of the sociodemographic characteristics of the study participants, with that of householders also indicating their indoor residual spraying (IRS) status for the recent spray season (prior to the study) and insecticide treated net (ITN) ownership status are presented in appendices XIV and XV.

Most household participants were aged between 31 and 60 years (62.7%) with only a few participants exceeding 60 years of age (5%) (See Table 1). The low representation of participants aged over 60 years may not constitute an under-representation given that much of the Ghanaian population is young. Almost half of the householders had no formal education and were employed in the informal sectors, especially farming. The term informal sector is used to refer to employment in private, non-salaried and non-government sector employment (see Table 1).

Most spray operators who participated in the study were aged 18 to 30 years, constituting about 59% (see Table 1). The relative youthfulness of the spray operators reflects the physical demands of the work. All spray operators had formal education, and over 50% of them had higher education. This is in accordance with the criteria for recruitment because of the range of skills required to discharge their duties and responsibilities, including conducting spraying on the inner walls of houses while collecting data on spray coverage and housing units. All spray operators were male,

with females excluded from this employment position because of the adverse health impact of spray insecticides. Women may be employed as spray operators in IRS interventions elsewhere, but they are frequently made to undertake pregnancy testing as a precautionary measure against exposing the foetus to insecticides. Therefore, to avoid this, AGA Mal decided to exclude women entirely from spray operation activities.

Officials of GHS and AGA Mal who participated in the study were all highly educated, employed in the formal sector, and predominantly male, with most aged between 31 and 60 years. Demographic characteristics of the study participants are summarized in Table 1.

**Table 1: Summary of demographic characteristics of study participants.**

| Participant groups/variables | | **Householders** | **AGA Mal Spray Operators** | **AGA Mal officials** | **GHS officials** |
|---|---|---|---|---|---|
| **Age range (years)** | 18–30 | 21 (28%) | 10 (59%) | 2 (25%) | 1 (25%) |
| | 31–60 | 51 (67%) | 7 (41%) | 6 (75%) | 2 (50%) |
| | 61–80 | 4 (5%) | 0 (0%) | 0 (0%) | 1 (25%) |
| **Sex** | Male | 45 (59%) | 17 (100%) | 7 (87.5%) | 3 (75%) |
| | Female | 31 (41%) | 0 (0%) | 1(12.5%) | 1 (25%) |
| **Level of education** | No formal education | 36 (48%) | 0 (0%) | 0 (0%) | 0 (0%) |
| | Primary level | 10 (13%) | 0 (0%) | 0 (0%) | 0 (0%) |
| | JHS | 10 (13%) | 3 (18%) | 0 (0%) | 0 (0%) |
| | SHS | 10 (13%) | 5 (29%) | 0 (0%) | 0 (0%) |
| | Tertiary | 10 (13%) | 9 (53%) | 8 (100%) | 4 (100%) |

| | | | | | |
|---|---|---|---|---|---|
| **Employment status** | Employed (formal) | 5 (7%) | 17 (100%) | 8 (100%) | 4 (100%) |
| | Employed (informal) | 62 (82%) | 0 (0%) | 0 (0%) | 0 (0%) |
| | Unemployed | 8 (10%) | 0 (0%) | 0 (0%) | 0 (0%) |
| | Student | 1 (1%) | 0 (0%) | 0 (0%) | 0 (0%) |

JHS=Junior High School; SHS=Senior High School; GHS=Ghana Health Service

## 4.2 **Householders' perceptions about malaria**

This theme is about the perceptions of householders about malaria. Four sub-themes are addressed here, including householders' perceptions about the causes of malaria, perceived susceptibility to and severity of malaria, adverse social impact of malaria and perceived malaria preventive strategies.

### 4.2.1 Householders' perceptions of causes of malaria

Household participants identified several factors as causes of malaria, a disease that was referred to as '*maron*' in the local Dagaare language. These perceived causes included mosquito bites, exposure to extreme temperatures, dietary factors, and dirty surroundings. The results for these categories are presented below.

#### *4.2.1.1 Mosquito bites*

Most householders associated malaria infection with mosquito bites as shown in the quotation below.

> "For me I think it is mosquitoes that give us malaria. If we do not have a mosquito net and we sleep anyhow and mosquitoes bite us, then we can get malaria" [Household participant 4; Busie FGD2; recent status: IRS & ITN].

Beyond the belief that malaria was caused by mosquito bites, a few householders showed a good understanding about the transmission. One participant demonstrated an awareness about the role of parasites in transmitting malaria whereas a few other participants reported that mosquito bites may only be infective if the mosquito bites an infected person prior to biting an uninfected person.

> "I think the reason why we get malaria is mosquito. If the mosquito bites you it can give you some 'disease bullets' which gives you malaria" [Household participant 4; Busie FGD1; recent status: IRS & ITN].

> "If you don't sleep under an ITN and mosquitoes bite you; and bite an infected person before biting an uninfected person, the mosquito will transmit malaria from the infected person to the uninfected person" [Household participant 4; Daffiama FGD3; recent status: IRS & ITN].

However, some householders only demonstrated a partial understanding of the transmission process. These householders viewed mosquito bites as not constituting the sole incident required for malaria transmission, but a part of a sequence of processes. For some of these household participants, the incidence of malaria was contingent on someone working in the sun following a mosquito bite the night before. Other participants with this opinion also perceived the transmission process to involve the vomiting of blood into a person during a bite, while some householders assumed that transmission can only occur if a mosquito bite is preceded by a bite involving someone of the same blood group.

> "Mosquitoes transmit malaria bullets, and when you are 'beaten by the sun' [exposed to the sun] then you can get malaria. If you are bitten by mosquitoes, and the next day you work in the sun, then you get malaria" [Household participant 2; Sombo FGD1; recent status: ITN only]

> "When you are with someone and a mosquito bites one of you and then bites the next person and both of you have the same blood group this can result in the transfer of malaria" [Household participant 3, Daffiama FGD2; recent status: ITN only].

In addition, householders, particularly from Busie community, expressed their concerns about factors which expose them to mosquito bites. Key among these factors included attendance at funerals as a communal and reciprocal event. Some householders at Busie reported that it would be disrespectful to leave a dead person lying in state while one goes to sleep in his room. By attending funerals, people are indirectly exposed to mosquito bites, and are therefore susceptible to malaria infection.

> "For me I'm an adult but I have not exceeded a month without being infected with malaria because I like attending funerals. If a person dies and I do not go for the funeral, I'm not happy. I want to go to funeral so that if I'm bereaved then other people will also come and help me mourn. So, when I go to funeral grounds a lot of mosquitoes keep biting me but when I'm in my room the mosquitoes don't get me to bite. So, the funeral ground is where mosquitoes disturb us; I see that my malaria is because of funeral attendance because whenever they are spraying I always spray my room, and if I even buy mosquito spray but still I get malaria which should not have been so" [Household participant 5; Busie FGD1; recent status: IRS & ITN].

Householders also reported that the use of torn mosquito nets exposed them to mosquito bites.

> "My room has so many mosquitoes and my mosquito net is torn. I tie the torn parts but when you sleep the parts you are unable to tie or sew, when you sleep in the net and its dark by the time you wake up the number of mosquito bites you get can be regrettable; as if you should not even have slept in the net" [Household participant 2; Busie FGD1; recent status: ITN only].

Moreover, most household participants associated malaria with seasonality, indicating that malaria is more endemic in the rainy season due to the abundance of mosquitoes than in the dry season, as illustrated below.

> "When you consider malaria, it is during the rainy season that malaria is very common among us. We don't get infected as much during the dry season as in the rainy season. During the rainy season, our backyards can be bushy but we wouldn't weed the bush. Instead, when we come we will just create a narrow path through the bush. When it rains a bit, water will be collected in the bush and breed mosquitoes which will eventually enter our rooms and bite us" [Household participant 1; Sombo FGD2; recent status: IRS & ITN].

Despite agreeing with the fact that malaria prevalence is highest in the rainy season, one householder objected to attempts to associate mosquitoes with the rainy season and insisted that mosquitoes are ever present regardless of season, as quoted below.

> "There are mosquitoes during all these times; even during the dry season there are mosquitoes because they breed in the water we store for use so we should not think that it is only during the rainy season that there are mosquitoes" [Household participant 6; Daffiama FGD3; recent status: ITN only].

#### *4.2.1.2 Exposure to extreme temperatures*

Exposure to cold and heat, especially in the extremes, were reported by householders to contribute to malaria causation. Both householders with formal education and those without formal education held this view. With respect to cold conditions, sleeping on the bare floor, sleeping under a fan overnight, bathing in cold water and being beaten by rain were said to be factors contributing to malaria infection. In this regard, children were deemed to be much more susceptible to malaria through exposure to cold because of their tendency to engage in the practices mentioned above:

> "Some of our rooms may be dirty with water all over the floor and yet we will use mats to sleep on the floor. Some other people can even spread clothes on the floor and sleep on it and when that happen, the cold from the ground

> can cause '*maron'*[2] on those people. We sometimes don't also protect our children; it could be raining and we will allow our children to play in the rain and in gutters, and all these can cause *'maron'* in the children" [Household participant 5; Daffiama FGD1; recent status: ITN only].

Furthermore, a few householders argued that a person could be infected with malaria if they are exposed to cold following a prior exposure to intense sunny conditions. In such circumstances, in one householder's view, not even the use of vector control interventions such as IRS or ITNs would suffice to prevent malaria prevention.

> "The sun can also lead to malaria. When you get beaten by the sun too much and it rains on you as well, then you can get malaria. No matter how they spray your house and you sleep under ITN, you can still get malaria due to the sun and rain" [Household participant 5 Busie FGD2; recent status: IRS & ITN].

Other householders maintained that although malaria is caused by the bites of mosquitoes, exposure to cold and heat could also cause malaria. These householders only partially subscribed to the biomedical model of malaria causation.

> "Another reason why we get infected is that, during this rainy season when you ask the children to wear sandals they refuse, and instead prefer to walk with bare foots. And when we go to the farm there are mosquitoes everywhere but the children don't wear cloths which will cover all their body parts to prevent mosquitoes from biting and transmitting malaria to them so all these cause malaria" [Household participant 5; Busie FGD3; recent status: IRS & ITN].

For some householders, engagement in peasant farming was an indirect cause of malaria because this occupation exposed poor people to the sun, making them vulnerable to malaria infection. They sought to relate malaria to poverty. The following quote illustrates the opinion of one householder on how hard work or poverty indirectly causes malaria.

> "In this community it's because we are poor that is why we do some hard work and thus we get malaria. On the farm, you can be there and it will rain on you, and after you will be in the sun too. All these can give you malaria but if we could also get some other kind of jobs, it could be helpful yet we don't have any other job" [Household participant 10; Daffiama FGD1; recent status: IRS & ITN].

#### *4.2.1.3 Dietary factors*

The study found that eating habits were considered by some household respondents to be a cause of malaria. Householders with this opinion were mostly from the rural communities of Daffiama and Busie. The eating of cold food, particularly, was

[2] Daga are language term for a group of diseases including malaria, fever and cold

identified by some householders as a habit that could result in someone getting malaria without being bitten by mosquitoes.

> "Also, our eating habits can also give us malaria. If it rains and you still eat cold food, you can get malaria. For instance, we the Dagaabas can prepare TZ[3] and keep it in our '*koro*' [form of storage][4]; so, if it rains and I'm in a hurry to go and work on my farm, I will just take the TZ like that and eat it, and I'll have to go and work in the cold again. This can result in me getting malaria. We may say that we have not been bitten by mosquitoes and yet we have malaria" [Household participant 7; Daffiama FGD1; recent status: IRS only].

A few householders considered the unhygienic handling of food as one cause of malaria. To them, such unhygienic practices could expose the food to contamination by flies and other insects, increasing the risk of malaria infection. The quotation below denotes one participant's view.

> "It is not only mosquitoes that give us malaria but the food we eat can also give us malaria. When they cook the food and they do not cover the food and flies are allowed to hover over the food and you eat it you can get malaria. For instance, if you finish eating and you don't wash your dishes and let the dishes remain any how until you are ready to use the cooking utensils again. Or you finish eating and there is some left over and when the children come from school and they also eat their part and the children leave the remaining food uncovered. The children will then go about playing only to later return and eat the food that have been left uncovered" [Household participant 8; Busie FGD2; recent status: ITN only].

However, one householder without formal education was rather concerned that hunger could also contribute to malaria infection:

> "Sometimes when you fetch soup to eat a fly can fall into it, and you have to pour it away may be that is all the soup you have. When will you cook soup again, maybe you are going somewhere when will you cook before going so you get going without the food, and all that can be part of malaria; too much hunger can constitute malaria" [Household participant 2; Busie FGD1; recent status: ITN only].

#### *4.2.1.4 Dirty surroundings*

Dirty surroundings were one of the most reported causal factors of malaria by householders. Dirt, in and outside the house, and unhygienic practices such as defecating outside were said to be direct causes of malaria.

[3] Food prepared with corn dough

[4] A form of storage that involves storing food, mostly TZ, in fermented water

> "For me I think the places we live are very dirty, these places also infect us with malaria. For instance, our sleeping places and rooms or surroundings, some of these places can be very dirty which all help transmit malaria to us" [Household participant 1; Busie FGD3; recent status: IRS & ITN].

Other householders were more concerned about the role of dirty surroundings in providing hiding places for mosquitoes.

> "Sometimes some places are dirty, like in our houses that require sweeping but we don't always do that so if you do not sweep the house and mosquitoes enter the house, they go straight to the dirty parts of the house. Also, our backyard may be full of weeds and if you don't weed them the mosquitoes can be there and move from there into our houses and start biting us" [Household participant 5; Konta FGD1; recent status: ITN only].

Furthermore, householders reported that dirty surroundings contributed to mosquito breeding. Bushy backyards, discarded empty tins, stagnant water in gutters and open manholes were particularly identified by household participants as major contributory factors in mosquito breeding.

> "I think one of the ways by which the mosquitoes get to us is the construction of gutters [stagnant water] in our communities. When there is water in the gutters during the rainy season, the water can be there until it starts to breed mosquitoes. During the night when we open our windows the mosquitoes will enter our rooms through the windows. And if we hang our cloths the mosquitoes will rest on the hanged cloths until we are asleep then they start biting us" [Household participant 7; Daffiama FGD2; recent status: IRS only].

In this section, the findings relating to householders' perceptions about the causes of malaria were presented. The next section presents the findings relating to householders' perceptions about their susceptibility to malaria, and the severity of malaria.

### 4.2.2 Susceptibility to and severity of malaria

This sub-theme presents householders' perceptions about their susceptibility to and severity of malaria. Study participants generally reported that everybody was susceptible to malaria and that malaria is a common disease. Malaria was reported to be severe and some participants noted that malaria was more severe among children, and could result in hospitalisation, mental health challenges, or death. These are presented in the categories below.

#### *4.2.2.1 Fear of malaria*

Many householders expressed their fear of malaria because of the sheer number of people who get infected by it and the sight of malaria patients in hospitals.

> "I think malaria affects us a lot when we are infected with it. Why because if

you are infected or your child is infected you cannot do anything. If for instance the child is infected and is admitted at the hospital, you are forced to frequent the hospital to take care of the child so you cannot do any work to support yourself. You cannot have peace of mind; when your child is not asleep you can't sleep, and when your wife is not sleeping you can't sleep. If you yourself can't sleep then we can't talk about that because both your wife and your children cannot sleep. So, it's disturbing" [Household participant 1; Daffiama FGD3; recent status: ITN only].

#### *4.2.2.2 Malaria is a common disease in the community*

Householders reported that malaria is the commonest disease and that there was no one who had never been infected with malaria.

> "There is nobody here who can say that he has never had malaria. Me sitting here I even have headache, you see. It can be so sunny and you will go and fetch the hot water and bath; the next day it will rain and it is so cold and you feel so much headache. That is malaria you have there is nothing you can do although you've protected yourself from all the mosquitoes yet you end up getting malaria" [Household participant 10; Daffiama FGD1; recent status: IRS & ITN].

Most householders reported that the malaria burden was highest during the rainy season, and that malaria infections were higher during the rainy season than during the dry season.

> "When it is rainy season, people start getting malaria, and mosquitoes also transmit malaria. Everybody who goes to the hospital is told that he or she has malaria" [Household participant 6; Daffiama FGD3; recent status: ITN only].

Some household participants indicated that the disease is so common that it is the first to be suspected at a hospital, before any other disease.

> "For me malaria is the most serious disease in this community. Now when someone gets sick and goes to the hospital, malaria is the disease that is first suspected and tested before anything else" [Household participant 4; Konta FGD1; recent status: neither IRS nor ITN].

Malaria incidence among the people has assumed such levels that one householder was confounded by the disease. For this householder, every hospital visit almost always turned out to be because of malaria infection, regardless of previous treatments.

> "Malaria is the commonest disease because a lot of people get malaria. If you go to the hospital you always get told that you have malaria. We don't know why we cannot get rid of malaria from our body; whether it is due to ineffective medication or what, because we get treated for malaria and the next time you are sick you get told that you have malaria again. It is body that we have so if

you don't feel well you go to the hospital but anytime you go it turns out to be malaria. You cannot know why malaria is so prevalent and what disease it is" [Household participant 4; Busie FGD2; recent status: IRS & ITN].

#### *4.2.2.3 Children more vulnerable with greater severity*

In some householders' view, children were more vulnerable to malaria, and suffered more severity than adults. The need to seek early treatment for children was also reported by householders to be very crucial to survival.

> "When children are infected it is a bit different from an adult; it can kill the child within a short time. When you are still preparing to go to the hospital, and if you don't go early you can lose the child on your way to the hospital. Sometimes you may have the means to go to the hospital but due to the short time required or if the child is seriously infected, you may try as much as you can but still lose the child" [Household participant 1; Sombo FGD2; recent status: IRS & ITN].

#### *4.2.2.4 Hospitalization*

Household respondents reported that malaria could result in hospitalization, with dire implications for the family's finances. Householders in Daffiama and Busie were particularly worried about referrals to the main district hospital located at Nadowli when the severity of the malaria was beyond what could be treated at their health centres.

> "You may go to our health centre here and you are told that the malaria is severe so you get referred to Nadowli, because you can't walk and you are also sick you need to go and borrow money and someone needs to come over to the hospital and take care of you there and there may not be food at home. So, if you get sick, particularly malaria for a long time, you spend a lot of money before you get well, you waste your time, even though you don't have food at home but you have to get food for yourselves and the sick person at the hospital" [Household participant 4; Busie FGD1; recent status: IRS & ITN].

#### *4.2.2.5 Malaria associated with mental health problems*

Some householders associated malaria with mental health problems. They reported that the mental health problems emanating from malaria could occur because of its high severity whereas others assumed that malaria-related mental health challenges were associated with some types of malaria.

> "Sometimes when you have malaria too much, you can have mental health problems, someone can behave in an abnormal way" [Household participant 1; Konta FGD1; recent status: IRS & ITN].

> "Some types of malaria can make someone mad, if they don't restrain the infected person the person may run into the bush. If a person is infected and

there are no strong people around that person may run into the bush" [Household participant 2; Busie FGD1; recent status: ITN only].

#### *4.2.2.6 Malaria kills*

Several householders acknowledged that malaria was the cause of most deaths, especially if treatment was delayed or not sought. The relatively higher risks for pregnant women, children and the aged in this regard were expressed by some household participants.

> "I want to say that malaria is responsible for most deaths. Lots of our people who die do so because of malaria. When you are there and you don't have anything, but you can't just sit there so you do some work but you don't get anything from the work. When you get malaria and you go to the health centre and they give you a prescription to go and buy the drugs from the drug store. You will take the prescription and you will not even go to the drug store, what will you go there and say, there is nothing in your pocket. Instead, you return and go home, especially, the old men and women will return to the house and say they went to hospital and they were given prescription but they don't have money. If they don't have a Son or any family member, they will just sit there until the disease weakens them for them to die… When you are infected with malaria, even if you are an adult, you may have high body temperature like a child, while you will also have headache and pains in your joints to the extent you will find it difficult to walk. Your body will also be weak, especially, if it is a child and you don't go to the hospital quickly the child can die" [Household participant 4; Daffiama FGD1; recent status: IRS & ITN].

> "Malaria could let a pregnant woman lose her baby during labour or delivery" [Household participant 5; Daffiama FGD3; recent status: IRS & ITN].

Having presented the findings on householders' perceptions about the susceptibility and severity of malaria, the next subsection presents findings associated with householders' perceptions about the impact of malaria.

### 4.2.3 Adverse social impact of malaria

The social impact of malaria was well articulated by householders in this sub-theme. They demonstrated their awareness about the impact of malaria on work, income levels and poverty. These are categorized as below.

#### *4.2.3.1 Malaria reduces income level and causes poverty*

Almost all householders were concerned about having to buy malaria drugs from private pharmacists or drug stores. The National Health Insurance Scheme covered the treatment of malaria so hospital admissions may be free of charge, but quite often prescriptions were given for malaria drugs to be purchased and this placed considerable burdens on the finances of householders.

> "When I sent my child to the hospital they gave me a prescription to go and buy drugs and when I went they said they did not have the drugs, but they also requested for Ghc10 [AUD$3]. Well I also needed that money to go and buy corn to cook food for the children, so the money is not even there. I will need to go and look for shea nuts, prepare shea butter and go and sell to raise the money for the drugs but by the time I can do all these if it's death the child would have died already, so that is why I said I will go for herbs and cook and use it for the treatment, if the child does not recover then that is it" [Household participant 2; Busie FGD1; recent status: ITN only].

Householders in remote rural communities like Daffiama and Busie were concerned about the cost of treatment because of the occasional referrals to the main district hospital at Nadowli and the need to travel to urban communities to purchase prescribed drugs.

> "When your child is infected with malaria and you go to the hospital, they will admit the child but write you a prescription for you to go and buy drugs. But in Daffiama here we don't have enough drug stores so it becomes necessary to go far away to other communities and this is affecting us" [Household participant 7; Daffiama FGD2; recent status: IRS only].

Finally, some householders perceived malaria as a major cause of poverty, as illustrated below.

> "Malaria is responsible for causing poverty. If you have malaria, you can't even *kick down shit*[5]" [Household participant 7; Daffiama FGD1; recent status: IRS only].

#### *4.2.3.2 Malaria reduces ability to work*

Householders in all the communities perceived malaria to have serious implications for their work. To them, malaria reduced the progress of work in many ways.

> "That is what we are saying. For those of us here maybe most of us are farmers. Maybe I had money to let the tractor plough my farm for me but one of my household members is sick that means I need to rather take care of the sick person first. By the time the sick person is healed I may not have money again to go and plough my farm; as I am just one person, if I go to weed my farm it won't be that large. This retards the progress of our work" [Household participant 1; Busie FGD2; recent status: IRS & ITN].

Some household participants expressed their worry about how the physical weakness resulting from malaria infection seriously affected their ability to work on their farms. These concerns were particularly rife in Daffiama and Busie.

[5] To be so poor to the extent that one cannot do the least thing required of him or her.

> "When you have malaria, you become so weak and you don't have the desire to do any work. If you are a Pito[6] [local beer] brewer, you can't get near the fire. When you wake up and you want to go and fetch water and all your arms will be paining you" [Household participant 7; Daffiama FGD1; recent status: IRS only].

One householder was apt with his contribution about how malaria affects students and their studies.

> "If you consider how malaria affects us, when a child is infected, may be the child has to go to School but due to the malaria the child cannot go to school to study. The child will be in the room while other students will go and study in school" [Household participant 2; Sombo FGD2; recent status: IRS & ITN].

In addition, some householders lamented the length of time required for malaria treatment. This was said to take a considerable toll on their work and businesses, as illustrated below.

> "If a person is infected with malaria, the person may be the head of the household and breadwinner. If I go to the hospital for about a month and I don't go to farm or do any work that will bring money to take care of the family. If I get treated and I'm told not work for some number of days and try to take the medication as prescribed, all the days that I could not go to work" [Household participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

Most householders also reported that malaria has a negative ripple effect beyond the person infected. The impact trickled down to family and relations who would need to abandon their work to tend to the needs of the sick.

> "When you get malaria and you are at the hospital a lot of things go wrong for you and other people because the one to take care of you will not get time to go to work. Some people will need to leave their work and come to visit you which amount to a waste of time" [Household participant 2; Konta FGD1; recent status: ITN only].

#### *4.2.3.3 Social exclusion of the sick*

A few householders associated malaria with social exclusion, especially where malaria infection remained untreated for a long period. For these householders, when malaria was untreated for some time, the infected person retreated from the rest of society, giving the false impression that the person was infected with HIV/AIDs.

> "Malaria gives us a lot of problems because when someone has malaria and he goes to the hospital and they say the sickness is so serious so they do not have some of the medications for treatment. A prescription may be given for

[6] Local beer prepared with millet

> the person to go and buy from drug store but the person cannot afford so he will return to the house. The person will become weak and retreat from others. When this happen, those people who used to associate with the person will begin to dissociate themselves from the sick person. People will say that these are also symptoms of AIDS so if the person was a food seller or is in other business, the business won't thrive" [Household participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

The findings on householders' perceptions about strategies for malaria prevention are presented below.

### 4.2.4 Perceived malaria preventive strategies

This sub-theme relates to householders' perceptions about malaria prevention strategies. Most householders acknowledged the fact that malaria could be prevented, although others tended to fatalism and assumed that malaria could not be prevented regardless of the use of interventions such as ITNs. This sub-theme will be analysed using the following categories: avoiding exposure to extreme temperatures, avoiding mosquito bites, keeping food clean, avoiding overwork, keeping clean surroundings, controlling mosquito breeding, and testing for malaria.

#### *4.2.4.1 Avoiding exposure to extreme temperatures*

Avoiding exposure to extreme temperatures was regarded by a few householders as one way to prevent malaria.

> "If you go to the farm and you realize that the weather is cloudy and you figure it could rain and you realize that there is no hiding place for you, you have to try as much as possible to get back to your house and don't worry about what you stand to lose by leaving the farm early" [Household participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

#### *4.2.4.2 Avoiding mosquito bites*

The need to avoid mosquito bites was regarded by almost all householders as very important for malaria prevention. The quotation below illustrates one householder's view regarding the need to stay inside one's room during the night to avoid mosquito bites.

> "I try to cook early to get into my room before it's dark. When it's dark the mosquitoes are everywhere outside so if you use the ITN (during sleep) and yet you like staying outside at night, you will get bitten by mosquitoes. Some people too do not like the ITN because of heat but for me the ITN is what I've been using for a long time but if you sleep under it and you delay outside you will be bitten and you will get malaria so we need to get into our rooms early when it's dark" [Household participant 7; Konta FGD1; recent status: IRS & ITN].

Other householders reported the need to prevent mosquitoes from entering their rooms as a way of avoiding mosquito bites.

> "We also need to close our doors and not open them, when you go out you need to close the door so that the mosquitoes cannot enter" [Household participant 3; Sombo FGD1; recent status: IRS only].

Some householders reported using ITNs for malaria prevention. Most of them emphasized the need to let children sleep under ITNs.

> "For me, I sleep under the ITN; my household and I all sleep under the ITN. I sleep with my son under an ITN and my wife sleeps under an ITN with my daughter. This has helped reduce malaria in my household but we still sleep under the nets" [Household participant 9; Busie FGD2; recent status: ITN only].

For a few household participants, mosquito bites could also be avoided by accepting IRS. The quotation below illustrates one participant's opinion.

> "I know that when you spray your room all the mosquitoes will die. There are some people around; I can't remember the name of the organization. Oh, yes AngloGold people spray the rooms, when they get to you and spray your room like mine, even I can sleep naked. I think that can help reduce malaria" [Household participant 1; Sombo FGD2; recent status: IRS & ITN].

Interestingly, a few householders mentioned the need to combine IRS and ITNs to help avoid mosquito bites and thus prevent malaria, as illustrated below.

> "The spraying, and the need to keep sleeping under the ITNs is the way forward. If they spray your room you don't just say that they've sprayed your room. You'll need to sleep under the ITN again because you may decide to spray my room but some parts of another person's house may not be sprayed so mosquitoes can move from that house to your house to bite you" [Household participant 7; Daffiama FGD1; recent status: IRS only].

Finally, a few household respondents reported that the use of insecticide sprays was also helpful in killing mosquitoes. These householders emphasized the need for regular use of these insecticide sprays if they are to be effective in killing mosquitoes.

> "Sometimes there is spray [insecticide spray] which helps so when you spray your house it can help kill mosquitoes in your room and reduce malaria. If you spray it on weekly basis, sometimes when you enter the room, it may take a long while without you seeing mosquitoes but if you don't spray for about a month you can be sitting and you see mosquitoes on the wall and flying and trying to land or rest on your cheek" [Household participant 2; Sombo FGD1; recent status: ITN only].

#### *4.2.4.3 Keeping food clean*

For some householders in rural communities, keeping food clean could also prevent malaria. The fact that this was stated by many household participants in different focus group at Daffiama and Busie implies that this perception is widespread in these communities, both of which are rural. This opinion was expressed by householders with low levels of formal education (or no formal education).

> "We need to take care of our food, and our sleeping places to prevent malaria" [Household participant 4; Daffiama FGD3; recent status: IRS & ITN].

#### *4.2.4.4 Avoiding overworking or hard work*

A few householders reported the need to avoid overwork as a way of preventing malaria.

> "For me, as an adult you need to protect yourself by not overworking" [Household participant 2; Sombo FGD1; recent status: ITN only].

#### *4.2.4.5 Keeping clean surroundings*

Keeping surroundings clean was the preventive strategy against malaria most reported by householders. One aspect of keeping clean surroundings, in the householders' view, was to weed bushy surroundings and refrain from keeping dirty water.

> "This malaria we will drive it from our community because the way malaria is it requires measures to stop it. Dirty water should not be kept; we need to weed surroundings." [Household participant 3; Daffiama FGD3; recent status: IRS & ITN].

Another aspect of keeping clean surroundings that was mentioned by householders was the need to keep the house, sleeping places, kitchen and other surrounding areas clean.

> "We need to make sure that our sleeping places are clean by cleaning our sleeping places, and do not make our places dirty; you know mosquitoes like dirty places. Sometimes refuse containers can take up to two weeks without being emptied but all subsequent people coming to deposit their refuse will end up dumping them on the ground like that" [Household participant 2; Konta FGD1; recent status: ITN only].

Other householders reported that stagnant water in gutters needed to be removed to prevent malaria. They said this could be done by participation in clean-up campaigns, especially during the rainy season, as quoted below.

> "I think if we help each other, especially, in the clean-up campaign during this rainy season when mosquitoes are abundant, we can help each other in the

clean-up campaign to make sure that the gutters do not have water in them" [Household participant 4; Konta FGD1; recent status: neither IRS nor ITN].

#### *4.2.4.6 Control mosquito breeding*

The need to control mosquito breeding was perceived as a strategy for malaria prevention by householders. This was the second most reported malaria prevention strategy. Covering or getting rid of dirty water or any other water that facilitated mosquito breeding was said to be one of the ways of controlling mosquito breeding.

> "In our rooms, we normally keep some water for long times which begins to breed mosquitoes. When a mosquito enters such waters, it will breed in the water. When you also have a gutter behind your house and it rains, such gutters may contain stagnant water which will begin to breed mosquitoes. In this case, if we want to prevent breeding, we need to use water that is used in the preparation of shea nut oil to pour into the stagnant water. This way, the oil will be suspended at the top of the stagnant water and prevent mosquitoes from laying their eggs into the water. So, this is what we can also do to prevent malaria" [Household participant 1; Daffima FGD3; recent status: ITN only]

Furthermore, developing a manhole for bathrooms was generally regarded by household respondents as one key way of controlling mosquito breeding. Householders disagreed as to the best way to handle open pits associated with bathrooms to reduce mosquito breeding.

> "If we can, like where we bath, if we can dig a hole so that the water can run into the hole and we cover it, that will help prevent us from getting malaria" [Household participant 5; Konta FGD1; recent status: ITN only].

> "For me I think that we don't need manholes for our bathrooms. I think if we even dig manholes and fill them with rocks there will still be some space for mosquitoes to be able to pass through to lay their eggs in the water beneath. What we need to encourage is that if we can't dig a manhole and cover the top for the water to sink away, then we need to dig and cement the bottom of the hole so that after bathing we will go and clear the stored water" [participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

Finally, some householders reported that mosquito breeding could be reduced if measures were taken to get rid of bushy surroundings and empty water from discarded tins.

> "We are currently in the rainy season; our surroundings are all bushy. When it rains all the tins around are filled with water everywhere if we could pick them all and set them on fire it can be helpful in controlling mosquito breeding" [Household participant 9; Busie FGD2; recent status: ITN only].

#### *4.2.4.7 Testing for malaria*

One householder reported undergoing malaria testing as a preventive strategy. In

many ways, this could be an effective preventive measure because it targets parasites, and for that matter, aims to reduce parasite prevalence in the population. This householder had tertiary level of education which could possibly explain his better understanding how testing could be helpful in preventing malaria.

> "I think what can be done to prevent malaria is for us to also go to health facilities to test for malaria if you have malaria or not, sometimes you can have malaria parasites without the symptoms and you won't know and it will not go but if you have malaria and you go for test, with the health insurance you don't pay so you have to go and test yourself all the time to know yourself that is one thing you can do to know whether you have malaria or not" [participant 1; Sombo FGD1; recent status: IRS only].

This section presented findings about householders' perceptions about malaria, including their perceptions about the causes, risk, severity, and impact of malaria, and malaria preventive strategies. The second theme of this chapter which relates to householders' acceptance of vector control interventions is presented below.

## 4.3 Householders' acceptability of vector control interventions

This is the second theme which presents findings on the acceptability of IRS and ITNs, mainly from the perspective of householders who are the beneficiaries of these interventions. Where applicable, however, the views of householders are triangulated with the perspective of GHS officials (Government agency in charge of healthcare delivery), AGA Mal officials (private implementers of IRS) and AGA Mal spray operators (IRS spraymen). This theme encompasses three main sub-themes, including the facilitators of using ITNs and IRS, the barriers to IRS acceptance and ITN usage, and recommendations to improve IRS and ITN acceptability.

### 4.3.1 Facilitators for acceptance of IRS and ITN

The use of ITNs and IRS was reported by householders to confer several benefits for those householders who accepted them. Reasons for the acceptance of IRS and ITNs are presented below.

#### *4.3.1.1 IRS and ITNs help prevent malaria*

ITNs were generally regarded by householders to be helpful in preventing malaria and reducing deaths because of malaria.

> "It [malaria] used to infect me regularly but I did not know that it was because I did not use mosquito net. I used to have headache and sometimes I feared going to the hospital because I could be injected. I just go and buy some drugs and take them until I recover from the malaria…when I realized it was malaria

> and I started using ITN, I have not had malaria for about three to four years now" [Household participant 2; Sombo FGD2; recent status: IRS & ITN].

> "The reason why we sleep under the ITN is that malaria was killing us but now it has reduced. We can see how we are healthier now than some years in the past when our children and even some adults used to die due to malaria. But since the ITNs came it has helped it a lot" [Household participant 5; Daffiama FGD3; recent status: IRS & ITN].

Similarly, householders also believed that IRS was effective in preventing malaria and reducing hospital admissions because of malaria. Below is a quotation from a householder who had accepted spraying previously but could not spray her house during the most recent spray season.

> "I think the spraying is very good. Taking myself for instance, I used to get admitted at the hospital about three times in a month due to malaria and whenever I go I get drips. But the year they started spraying the whole year ended without me being admitted at the hospital, and after spraying last year the same thing happened. This year, since Christmas I think it is just this month [June 2016] that I've started getting sick and went to hospital. All these years I've not been admitted at the hospital as I used to be admitted" [Household participant 8; Daffiama FGD2; recent status: ITN only].

For a few householders, malaria prevention was the main reason for using the combination of IRS and ITNs. To these householders, the fact that their houses were sprayed was not enough; they needed to continue their use of ITNs as well.

> "Earlier we used to go to the hospital a lot but now my grand-children are all safe and we don't spend our monies on treating malaria. They sleep under the net and spray their rooms. I tell my children that they are lucky because your ancestors faced great sickness but you are lucky to escape it" [Household participant 3; Daffiama FGD3; recent status: IRS & ITN].

For a few householders, the acceptance of IRS was premised on the fact IRS could help reduce malaria infections, thereby, empowering them to engage in their economic activities, especially farming.

> "The reason we spray our room is to drive away malaria from this part of our country. If malaria is eliminated we will all become strong, if you go to farm you can do more work" [Household participant 3; Busie FGD1; recent status: IRS & ITN].

Some householders sought to associate the use of IRS and ITNs with good health.

> "It is because of our health that we spray our houses otherwise we wouldn't have sprayed; mosquitoes don't get us to bite again. The other insects in the room that could all bite us and give us disease are all dead and the mosquitoes

are all dead too so that is why we are healthy" [Household participant 5; Busie FGD2; recent status: IRS & ITN].

#### *4.3.1.2 IRS and ITNs prevent exposure to mosquito bites*

In the householders' view, IRS was very helpful in killing mosquitoes, and hence, preventing exposure to mosquito bites. Although some participants could not spray their rooms during the recent spraying, they nevertheless expressed their opinion about the effectiveness of IRS, as illustrated below.

> "Since the last time I sprayed my house there were no mosquitoes unless in recent times. When they came to spray the last time, I asked them about the floor and they said if the mosquito wants to rest it rests on the wall so if they spray and the mosquito comes to rest on the wall it will die and after that I realized what they said was true because after they sprayed I started seeing dead mosquitoes" [Household participant 7; Sombo FGD1; recent status: neither IRS nor ITN].

The householders considered IRS to be helpful in preventing mosquitoes from entering their rooms.

> "…no mosquito will dare enter the room after they've sprayed" [Household participant 2; Sombo FGD2; recent status: IRS & ITN].

In the same vein, householders also perceived that ITNs significantly reduced their exposure to mosquito bite by providing a barrier between them and the mosquito. Householders in Daffiama and Busie were more enthusiastic about the benefits of ITN use.

> "We sleep under the mosquito nets so that mosquitoes will not be able to bite us because the mosquito nets are treated with some insecticides that look like the insecticides used for spraying, so if a mosquito gets into contact with the net it will die. Even if you tie the net initially and the power is so strong the next day you can see some dead mosquitoes on the floor" [Household participant 5; Daffiama FGD2; recent status: IRS & ITN].

Furthermore, the avoidance of mosquito bites was one motivation for the combination of IRS and ITNs by a few householders, who continued their use of ITNs after spraying their rooms with IRS to prevent exposure to mosquito bites.

> "When they spray the room you still see some mosquitoes so that imagination is what makes us use the mosquito nets [after spraying]. We are told that when a mosquito enters the room it goes straight to the wall where it will die but we imagine that it is not all the times that the mosquito will go and rest on the wall so that is why we still sleep under the mosquito nets" [Household participant 8; Sombo FGD2; recent status: IRS & ITN].

#### *4.3.1.3 Incidental benefits of IRS and ITN use*

Householders were motivated to accept IRS because of its lethal effect on insects such as cockroaches, spiders, flies and other insects.

> "The spraying is very helpful to us. If they continue to spray, we will be happy because insects such as termites, cockroaches and flies all die along with the mosquitoes. If they spray the room and you sweep you realize that you sweep out a lot of dead insects and there are no insects in the room. The spraying is very good for us. Even mice are killed and they begin to smell in the room until you sweep them out" [Household participant 2; Daffiama FGD1; recent status: IRS only].

These incidental benefits of IRS were large enough to become the primary reason for the acceptance of IRS by some householders:

> "The first time they sprayed, they only sprayed my wife's room but I refused to spray my room because of the odour. The next year I refused to spray, but this year I decided to spray my room not because of malaria but because upon observing the insecticides for some time I realized that the insecticides kill a lot of insects in addition to mosquitoes. If a house is sprayed, it can take up to a month yet if other insects enter the house they will all die instantly, which means the spraying is very helpful than just killing mosquitoes. Since they sprayed my room all the insects in the corners are dead" [Household participant 3; Sombo FGD1; recent status: IRS only].

The insect killing effect of IRS was corroborated by AGA Mal spray operators.

> "Because it is not only mosquitoes that this insecticide kills. Some of them [householders] when you even go they'll tell you it has helped them, it killed a lot of insects in their room and so they even welcome you and they are ready to work with you" [AGA Mal spray operator 1; DBI FGD].

Beyond the insects, a few householders at Daffiama reported that IRS insecticides also killed scorpions and snakes.

> "The reason why we spray is that, when the spraying had not started yet, a lot of things used to happen to us in our rooms. You can be sleeping and by the time you realize a scorpion will come from nowhere and sting you. But since the spraying started I don't think that has happened again. One day someone who had a local mud building was reluctant to spray his house. When the spray man sprayed the upper part of the building, a snake fell from the roof. The householder opened all his doors and packed out his belongings to let the spray man spray all the rooms in the house. This alone shows that the spraying has helped us a lot. Before the spraying we used to encounter all these challenges but since the spraying we've not been experiencing them" [Household participant 4; Daffiama FGD1; recent status: IRS & ITN].

IRS was also reported by householders to facilitate a good sleep without mosquito

disturbances.

> "The spraying is good, if they spray your house and you consider when it is sprayed to when your room is not sprayed, you realize that when you sleep in the sprayed room you feel better and good" [Household participant 7; Sombo FGD1; recent status: neither IRS nor ITN].

Householders associated the use of ITNs in the cold season with warmth, protecting users from cold. This could well be true, especially during the cold harmattan season from December to February.

> "Also, the cold is uncomfortable, if we use the ITNs it is less cold and it becomes a bit warm for us, enabling us to sleep well" [Household participant 5; Busie FGD3; recent status: IRS & ITN].

A few GHS officials reported that ITNs were used by householders during the rainy season for protection from the cold.

> "During rainy season people even use bed nets as cover cloth. Let me put it that way, when they hang it and they sleep inside it the cold that they will experience will not be as much as it would have been had they not slept under a net, so during rainy season most people like using ITNs because when they sleep inside it cold doesn't enter them" [GHS official 4].

#### *4.3.1.4 IRS acceptance because of individual respect for authority*

One householder reported that IRS could be accepted because of one's respect for authority. To him, the spraying exercise had the permission of government, and as such, as a loyal citizen, one must respect the authority or agency responsible for spraying.

> "But I see that it's not only because of the disease; when they say, you should do something, maybe the government gave them the permission, the people doing the spraying have the permission of the government so they were given the right to spray. It is a show of commitment to malaria prevention to spray one's house but it also demonstrates how obedient householders are to the government and its agencies" [Household participant 1; Sombo FGD1; recent status: IRS only].

#### *4.3.1.5 Sensitization on malaria and malaria prevention*

In householders' opinion, the dissemination of information about IRS and ITNs on various platforms facilitated acceptance of the interventions. The education about IRS was reportedly done just before the spray day.

> "We do hear public health information, particularly the nurses at the labour ward, keep informing the women about what to do the prevent malaria. These include sleeping under mosquito nets" [Household participant 4; Busie FGD1;

recent status: IRS & ITN].

> "Just the day before the spray people came to our area, an information van came around to announce about spraying in the evening" [Household participant 7; Konta FGD1; recent status: IRS & ITN].

A few householders reported that there were ongoing education activities on the need to combine IRS and ITNs.

> "At the hospital, we get told that when our rooms are sprayed that does not imply that we should not sleep under the mosquito net. This is because some mosquitoes can come into your room and will not go and rest on the wall but come straight to where you are lying and start biting you. Hence, we are told that we should continue using mosquito nets" [Household participant 8; Daffiama FGD2; recent status: ITN only].

AGA Mal spray operators also reported that education about the benefits of spraying was undertaken during their spray operations in the communities to convince people to accept IRS.

> "To convince a householder to allow you to spray the room there are a lot of factors [strategies] that a spray man use to convince a householder when they are refusing. The other factor is to educate the occupants or beneficiaries the importance of the spraying by telling them the effect of malaria to the beneficiary. You explain to them or you let them flash back, during the previous years the amount of money he or she spent on treating malaria. You again educate them on how to maintain your system when you don't have malaria" [AGA Mal spray operator 7; Wa Municipal].

AGA Mal officials confirmed the fact that intensive sensitization (education) activities were undertaken at the community level, including the involvement of community volunteer advocates.

> "We have these advocates around who normally carry the information to the householders" [AGA Mal official 4].

GHS officials also confirmed the fact that several strategies were used in sensitizing householders to use ITNs, including meetings and community education through outreach activities by community health officers.

> "There are a lot of strategies that we are using. During our *durbars*[7], you know now GHS's strategy is that we move to the communities and we are using the Community Health Officers, that is CHO concept, whereby a nurse is trained to take care of several communities within an area. So, that nurse will be having an itinerary for the month as to how to go by his/her health education.

[7] Community forum or gathering with stakeholders.

So, as part of the health educational package, they move out to talk to community members on prevention of malaria like the use of ITNs" [GHS official 3].

The following section presents the findings on householders' perspectives about the barriers to acceptability of IRS and ITNs.

### 4.3.2 Barriers to acceptance of IRS and ITNs

The perceived barriers to the acceptability of IRS and ITNs from householders' perspective are presented in this sub-theme. However, where applicable, the views of householders are triangulated with the perspectives of GHS officials (Government agency in charge of healthcare delivery), AGA Mal officials (private implementers of IRS), and AGA Mal spray operators or providers (IRS spray men) as presented below.

#### *4.3.2.1 Difficulty of packing householders' belongings for IRS spray*

Packing household belongings outside for IRS was one barrier to IRS acceptance most reported by householders because of the time involved and effort required. The application of IRS requires the packing, or at least the rearrangement, of householders' belongings to allow space for the walls to be sprayed.

> "For me I think having to spend a lot of time preparing my house for spraying is very difficult. Other people too say they cannot pack their house items to allow the sprayers to spray. Others cannot pack their house items because of the nature of their belongings because the spraying is done on the wall. So, we find it difficult to accept spray due to the packing required for spraying to be undertaken" [Household participant 2; Busie FGD2; recent status: ITN only].

Unsurprisingly, packing was also identified by some AGA Mal spray operators as one of the barriers to spraying. Reports from spray operators indicated that the weekday spraying schedule made packing even more difficult because of the time required for house preparation before and after spraying.

> "Any time you go there on a weekday and the person is preparing to leave for work surely he will not let you spray because he needs to arrange the room, let you [spray operator] spray, and after he has to rearrange the room again before he leaves. That is another challenge we face" [AGA Mal spray operator 2; Wa Municipal FGD].

#### *4.3.2.2 Fears and dislikes of insecticides used for ITNs and IRS*

Householders expressed worry about how spray insecticides caused body itching. However, itching as a side effect of IRS has probably lost its relevance given the many changes to spray insecticides, and most householders associated this side effect with the first round of spraying in 2012.

> "After the first spraying in 2012 we experienced body itching, and this prevented me from spraying again" [Household participant 6; Daffiama FGD1; Recent status: ITN only].

> "Truly, when you sleep under the net overnight you realize that your eyes look like some pepper have entered your eyes. Even your body will be itchy… The ITN is like pepper, even if you sleep in the net and you move about and get into contact with the net it feels itchy, and you don't feel like using it again" [Household participant 1; Sombo FGD2; recent status: IRS and ITN].

In some householders' view, the side effects of ITN may have been the result of people's non-adherence to the proper use of new ITNs. One householder reported that new ITNs should not be used on the first day, but only removed from the package to allow air to blow through them to avoid unwanted side effects.

> "Some people say that the mosquito net will let you feel itchy when you come into contact with the net. But it is because we don't hear information about how to use the ITN; they need to remove it from the pack, keep it for some time for air to blow in it for some time to take away the itchy effect" [Household participant 5; Daffiama FGD3: recent status: IRS and ITN].

Some household participants attributed their refusal of IRS and the non-use of ITNs to health reasons, either for fear of becoming sick or being unable to breathe because of the odour of the insecticide used for IRS or treating ITNs. Most householders who accepted recent spraying also reported that the odour of the current insecticide used for IRS was not as bad as the insecticide used for the very first spraying back in 2012. Some householders cited asthma as a condition that may interfere with householders' use of ITNs because they experience breathing difficulties.

> "One of the reasons for refusal is the odour of the insecticides. Some people say that the insecticides smell badly. I think when we sprayed our house most of the people in our house were complaining about the odour of the insecticides. That is why some people refuse to spray their room because when they spray they fear they could become sick" [Household participant 8; Busie FGD1: recent status: ITN only].

> "For me it is because of the insecticides used in treating the mosquito nets that is why we don't want to use it. Some people don't like the odour of the insecticide because they may have asthma and so when they sleep under the mosquito net it becomes difficult for them to breath, especially, when the mosquito net is still new" [Household participant 6; Daffiama FGD2: recent status: IRS and ITN].

> "But to me I think the odour of this year's insecticides is better than the insecticide that was used for the very first round of spraying, that first insecticide was very smelly... But some people say that the insecticide is

> smelly so they wouldn't spray their rooms" [Household participant 1; Busie FGD2: recent status: IRS & ITN].

Other reasons behind householders' fear of the spray insecticides include a perceived inability to sleep or eat after spraying.

> "One of the reasons we don't spray is that the insecticide is smelly. If you spray your room it will smell too badly to the extent that you cannot sleep in the room" [Household participant 1; Daffiama FGD3: recent status: ITN only].

A few householders reported their concerns about the debris or stains left on the inner walls after IRS as a barrier to acceptance.

> "…So yes, you may decorate your room, but the spraying will stain walls and it's not appealing to see your room in that way" [Household participant 7; Busie FGD3: recent status: ITN only].

It emerged during the semi-structured interviews with AGA Mal officials that the odour of the insecticides was not only a barrier to IRS acceptance but was also associated with the type of insecticides used for spraying.

> "When we were using Vector-Guard initially, the scent was also putting people off, but I think after surveys and discussions after the first and second round and it was changed to Actellic I think we've almost done away with that [odour] but some people still have that perception that existed years ago that the insecticide smells. So, once we are doing it and they get to know that it is not like as it was, I think with time people will wholly accept the spraying" [AGA Mal official 1].

#### *4.3.2.3 Individual religious beliefs (religiosity)*

Religious beliefs, manifested in the form of ownership of gods, emerged as a principal cause of IRS refusal among householders in the rural communities of Daffiama and Busie. Some concerns related to householders' unwillingness to allow their traditional religious secrets to be revealed, and for fear that the gods may inflict punishment on them. Most householders did not like to refer to themselves when they were contributing to the discussion on this topic.

> "Some of our community people are not good, gods! They keep them in their rooms. They don't want the spray men to go in and see the gods, and some of the gods if their shrines are sprayed then there will be serious consequences for the owner. So, they will say that no, you can't enter that room, that room is never to be entered" [Household participant 1; Daffiama FGD1; recent status: ITN only].

Other householders reported that some people feared the IRS spray would offend and drive away the spirit of their gods, resulting in the loss of their spiritual protection.

> "Some of our people don't allow their rooms to be sprayed because of their gods. If they allow their rooms to be sprayed and the spray men see the gods they will inform people about what they've seen; if they don't even tell people, the spirit of the gods will escape or run away and the gods will not be able to provide them with spiritual protection as before" [Household participant 3; Busie FGD3: recent status: ITN only].

> "It is because of the gods; the gods are responsible for the continuous spread and breeding of mosquitoes. Some people will not allow them to even spray their bedrooms, we will try to convince them but they will never allow it because they think that if the spraying is done, the god in his room will die. That is their god and protector so they won't allow it" [Household participant 1; Daffiama FGD1: recent status: ITN only].

The ownership of gods was also perceived as a barrier to spraying by several AGA Mal spray operators.

> "Another factor is that some of the houses, they have secret things like King Kong, juju or the smaller gods. Or some of the women will have a snake or python or "Zugu"; it's a spiritual thing so because of that they will not allow you to enter the house and spray" [AGA Mal spray operator 3; Wa Municipal].

#### *4.3.2.4 Secrecy about possessions*

Secrecy about possessions was one factor that emerged in almost all communities. Householders reported that refusal of IRS may have been because of some householders' unwillingness for spray operators to discover their secrets. This concern was reportedly heightened if householders considered their rooms were not nice enough or that their belongings were disorganized in their rooms and houses.

> "Some of us do not want the spray men to enter into our houses to discover our secrets, so we do not allow the spray men in to spray our houses. This may be because someone's house is not nice enough, or because they could not arrange their belongings well, someone can leave their items in a disorderly manner" [Household participant 5; Konta FGD1: recent status: ITN only].

There was a concern among some householders about having one's possessions revealed to the public because some householders thought that spray operators may talk about the state of their rooms to other community members.

> "Sometimes we don't want people to go in and see our possessions because if we allow the spray men in, the next day people will get to know how our rooms look like" [Household participant 3; Busie FGD3: recent status: ITN only].

AGA Mal spray operators also identified secrecy about possessions as a barrier to spraying.

> "They do not want to spray; because some of them they do not always want you to go inside and see their possessions, and maybe go out to talk about them" [AGA Mal spray operator 8; DBI FGD].

#### *4.3.2.5 Lack of adequate information about IRS*

A lack of information or prior notice before a community was due for spraying was one of the major hindrances to spraying. Householders across all communities said that although they may be willing to spray their rooms, they sometimes missed out because of lack of prior notice. Other householders reported that the lack of spray notice resulted in the unexpected arrival of spray operators to their houses for spraying.

> "When they are coming to spray, they don't send us prior information about the spraying. By the time they come some of us would have gone to the farm or elsewhere so we wouldn't be around to open our rooms for them to spray. We don't hear the information that in this month they will be coming to spray or so and that we should try to be around for the spraying. You will just be sitting there and they will come and say come and move out your belongings for them to spray" [Household participant 5; Daffiama FGD1: recent status: ITN only].

Some household participants attributed the lack (or inadequacy) of spray information to the fact that house-to-house notification about spraying was no longer done by AGA Mal workers.

> "At first they came to your house and notified you that your house will be sprayed the next day but now you just sit there and they will appear and say that they have come to spray your house; but you may also just be leaving for work and you cannot go and prepare for spraying. So now the supervisors, the mosquito supervisors are not doing their work" [Household participant 4; Konta FGD1: recent status: neither IRS nor ITN].

For some household participants, the selection of community-based volunteers should have been based on each suburb to facilitate information dissemination and notification, but this was not done. For them, selecting only one volunteer from each suburb to notify the wider community made it difficult for every householder to be notified.

> "They were supposed to select people from each suburb to send information about the spraying. Where you live, you will know all the people there but if you need to come from a different suburb at a late time, by the time you come some people would have gone to farm because someone may like going to farm early. Some people are here whom you will never see going to farm because they go very early so they were supposed to select people from each suburb but they will just select one person from one suburb to send information throughout Daffiama here. I think it should not be so; each suburb should be

separate. That is what I think" [Household participant 1; Daffiama FGD1: recent status: ITN only].

Some AGA Mal spray operators did not disagree with the householders' assertions about how inadequate information was affecting the spraying exercise. In fact, for them the problem was that in poorly planned communities the IEC personnel may only do pre-spray notifications along the main roads and not visit the interior areas.

> "Sometimes you go and they say they are not informed and so therefore they will not spray. Places like Zongo and other big big communities the IEC [ education personnel] will inform some householders along the road but those in the interior will not get the information. If you go, they say they are not informed" [AGA Mal spray operator 8; Wa Municipal FGD].

A few AGA Mal officials admitted the challenges of giving prior notification to householders. They attributed much of this to the difficulties of planning that arose out of their inability to make accurate projections about the number of houses in each community during the planning of spray schedules.

> "The information out there should always be given earlier than we give it out. That also comes in when we have a well scheduled plan but sometimes it's not the fault of the IEC department. Because you might project that we have 34 stands (houses) in this community, you go in there and maybe the stands are either more or less, so it means you either finish earlier than scheduled or it takes more time. So, if you plan it always affects your plan, so given the information there, the exact time that you are coming becomes a problem" [AGA Mal official 1].

#### *4.3.2.6 Spray operators' unprofessional conduct*

Perceived unprofessionalism on the part of spray operators was a barrier to IRS acceptability reported by householders. Although this was not frequently mentioned, a few householders said confrontations between spray men and householders occasionally happened.

> "In any work if you are working and you do not have patience, the work will not be beneficial to be people or the community. Some of them just go and they don't have patience to help the people to arrange their things before they spray. Sometimes they just want to fight the householder but the workers must have values; when you go to spray someone's house, you must give the person some time and say, please arrange your things and let me spray your house. If the person does not want to spray, then you can go if you have somewhere to go but they don't have to have a confrontation with householders. You are trying to help someone so if they don't want the help you just have to go but to have a confrontation because of spray is not good" [Household participant 2; Konta FGD1: recent status: ITN only].

Householders in Daffiama and Busie (both of which are in DBI district) reported that

some spray operators deliberately refused to spray some houses (when spraying a community) despite promising some householders who asked for spraying after waiting so long for spraying.

> "As for me, when they were spraying I came to Banya (a suburb of Busie) to the spray men and asked them to come and spray my house but they told me to wait until the next day. On the next day, I came down and met the one taking care of the spray men and I called him and requested him to spray my room and he said they need to spray all the other houses before they come to me. They did not come! They lied to me and I waited for so long but they did not come; by the time I realize they all entered their car and went away and I returned home. I lost two working days and yet could not get my house sprayed" [Household participant 2; Busie FGD1: recent status: ITN only].

Several householders were also concerned about how perceived targets for spray operators could be responsible for their unwillingness to spray all the houses in a community. The allocation of targets implied that spray operators were not only pre-occupied with meeting their targets, but also became reluctant to continue spraying after meeting their targets for the day. In other householders' views, the pre-occupation with targets made spray operators selective in the choice of houses to spray, with most of them looking for bigger and larger houses that could facilitate the achievement of their targets for the day with minimum effort.

> "The spray men may also have targets for the day, so the spray man may think that if he has to wait for you then he cannot get his target for the day so the spray man may continue with the intention of returning to spray the room later. However, if the spray man gets his target, he may not return to spray that house" [Household participant 6; Busie FGD1: recent status: ITN only].

> "One reason why some rooms are not sprayed is that, the targets that the spray men are given makes them selective, particularly, they are looking for big block houses where they can easily get their targets. If your house has just two rooms, you realize that the spray men will be looking for big houses and they end up not spraying the smaller houses all together" [Household participant 3; Busie FGD1: recent status: IRS & ITN].

Some AGA Mal spray operators acknowledged the stress involved in their attempts to meet their daily targets, and eventually the seasonal targets for the district. The stress reportedly led to shoddy work, compromising the quality of spraying.

> "This time we spray only once, that is for three months, and because of that we are always in a hurry. Due to the short time, they've given us, we are always in a hurry just to meet the district target. Every spray man is always targeted; we have been given targets and you need to meet your target. A district is given a target; within a short possible period, you can see the shoddy work that is likely to go on" [AGA Mal spray operator 1; Wa Municipal FGD].

#### *4.3.2.7 Perceived low efficacy of current IRS*

Most householders in all the communities roundly perceived the recent IRS insecticides as being ineffective in killing mosquitoes and other insects. In doing so, many of them compared the recent insecticide with previous insecticides, especially the very first one.

> "The very first spraying that was undertaken, all the flies were dead, you couldn't find even one fly, but in subsequent years the spraying did not seem to kill mosquitoes and insects for long" [Household participant 2; Busie FGD2; recent status: ITN only].

For a few household participants who sprayed their rooms, current IRS was only effective for a ridiculous one or two days, after which they started seeing mosquitoes again.

> "This year I sprayed and we slept well on the first day but the second day we could not sleep because of mosquitoes" [Household participant 9; Daffiama FGD1; recent status: IRS & ITN: recent status: IRS & ITN].

Some householders called for a change of insecticides whereas others requested the return of the previous insecticide which was very effective.

> "I also want to say something to those responsible for supplying insecticides for spraying that they should send the insecticide they sent some years back. That the previous insecticide is the one that can help us because as for the recent insecticide, it is only called insecticide but it doesn't do the work of insecticides" [Household participant 10; Daffiama FGD1: recent status: IRS & ITN].

#### *4.3.2.8 Unavailability of householders during IRS*

The unavailability of householders to accept spraying was one of the commonly mentioned reasons for the non-spraying of people's houses. In householders' view, early departure to work or farm, travelling away or funeral attendance were the main reasons for their unavailability.

> "Sometimes the sprayers can come and you are not there, you may have travelled so they can't spray your room" [Household participant 8; Busie FGD2; recent status: ITN only].

> "Because of funerals, I can go to a funeral and by the time I'm back they might have finished spraying my community. Or you may go to the farm early or go to fetch some firewood and by the time you return they have finished spraying" [Household participant 1; Busie FGD1; recent status: ITN only].

One householder lamented that no arrangements were made for a follow-up spraying to get non-sprayed houses sprayed.

> "Sometimes when they come to spray, you may have gone to work by then, and you are not there to spray so the spray men were supposed to mark the houses that are not sprayed so that they can go around the next day to spray. But when they go and spray one section and spray a few houses they just say that they have sprayed the community meanwhile it's not all the houses that are sprayed" [Household participant 2; Konta FGD1: recent status: ITN only].

AGA Mal officials reported that the travelling distances to communities [most of which are rural] scheduled for spraying could be a determining factor in whether householders may be available. Where the community is far away, householders may be unwilling to wait for spraying if they have other responsibilities to tend to.

> "Assuming the community is distant and we don't get there in time, especially, during the farming season. Some people may want to spray as early as they could so that they could still go and meet their daily targets at the farms. So, if you are not able to meet such people it becomes an acceptance problem because we are not able to meet them at home simply because they don't have the time to wait for us" [AGA Mal official 2].

A few AGA Mal officials reported that householders in rural communities may be readily available for spraying during the dry season when there are no farming activities but unavailable during the rainy season. This may be because farming is the predominant occupation in most rural communities.

> "I can say, it varies from season to season, especially, when it is farming season they might go to farm to work and will not allow their doors to be opened in their absence for someone to come and spray" [AGA Mal official 4].

A couple of AGA Mal spray operators agreed that the unavailability of householders constituted a major challenge to IRS, particularly in the urban areas where many people may be working during the weekdays.

> "Sometimes you get to the household and they are already prepared to leave for work so they wouldn't have the time to wait for you to spray before they leave. They always want to go, especially, the week days; that is when we are within town [urban area]. For the villages, we don't normally encounter this but within town, especially, an area like SSNIT bungalow, if you don't go there on weekends, on any weekday you go there you cannot get any single house to spray" [AGA Mal spray operator 2; Wa Municipal FGD].

#### *4.3.2.9 Unaffordability of ITNs*

The study found that many householders wanted to use ITNs but some householders were unable to afford them. Some householders expressed their dissatisfaction with

their inability to afford ITNs because of poverty.

> "The reason why I do not use the mosquito net is because I do not even have the net; in our part of the country due to poverty a lot of people cannot buy mosquito net let alone talk about sleeping under the net, when you don't have it how can you sleep under it, so I think poverty is one of the reasons why most people do not sleep under mosquito net" [Household participant 1; Daffiama FGD2: recent status: IRS only].

The householders were aware of the distribution system targeting pregnant women and children. However, it was reported by household participants that this strategy did not include the aged, and ITNs were not readily available in their community for purchase.

> "The ITNs are not so available. Right now, I can't give birth; my mosquito net is torn but I still use it like that, if you are pregnant you get a new one but I can't get pregnant. So, for me malaria is always in my blood and I know that I cannot become pregnant and go to the hospital for the ITN. The ITNs are also not sold everywhere for me to be able to get it to buy" [Household participant 7; Daffiama FGD1: recent status: IRS only].

The study found that that the distribution of ITNs to pregnant women at health facilities was not reliable.

> "Truly, I also sleep under the ITN but when it expires I don't know how to get one again. My wife became pregnant and I understand that ITNs are given to pregnant women at the clinic but when she went to the hospital she was not given one. When I asked, she told me that the nurse said the ITNs have finished or so" [Household participant 8; Sombo FGD2: recent status: IRS & ITN].

A few householders in Daffiama suggested that ITNs should be made available to all individuals at a subsidized price to enable them to buy them when needed.

> "The ITNs are expensive for us to buy so they should have been giving ITNs to every household even if we have to pay some small amount for it so that if the ITNs are available at the health centre for people to go and buy at a reduced price, then even if you are not a pregnant woman, you can still go there and buy one" [Household participant 1; Daffiama FGD1; recent status: IRS & ITN].

#### *4.3.2.10 Insufficient ITNs for household use*

Insufficient ITNs for use by all household members was found to be a critical factor affecting usage in the rural communities of Daffiama and Busie. In many householders' view, insufficient ITNs per household resulted in intra-household sharing, a situation that affected ITN use. The shortages may have occurred because of the criteria used for ITN distribution. The hang-up campaign and free ITN

distribution involved the distribution of one ITN per two household members, but the concept of 'number of sleeping' places was also used, and the number of ITNs provided did not exceed the number of available sleeping places. In these rural communities, household members, particularly children, may sleep together on floor mats. The concept of sleeping place ensured that only the number of ITNs required to cover the available number of sleeping places (measurable in floor size) were provided regardless of the number of household members sleeping together on that floor. The quotation below illustrates householders' concerns about sharing ITNs.

> "Another reason why we do not use the ITN is that you could have ten people sleeping in one room with one ITN so who will sleep under the net and who should not or whether the use should be rotational. If you could even have one ITN for every five people it could even be helpful" [Household participant 3; Busie FGD1; recent status: IRS & ITN].

The sharing of ITNs was reported by several householders to expose people to malaria infection because overcrowding may lead to some people leaning against the ITN during their sleep.

> "If you are so many sleeping under one mosquito net, your body can touch the mosquito net during your sleep and a mosquito can bite you and give you malaria. You can have about three to four people sleeping under one ITN" [Household participant 9; Busie FGD2; recent status: ITN only].

A few household participants were unhappy with the idea of having to share ITNs with their partners and children because of occasional disagreements in their relationships and/or having to put children elsewhere out of the ITN when wishing to engage in sexual activities.

> "Moreover, the ITNs distribution if they were giving us one ITN per person it will be better; right now, you as a man and your wife are given one ITN and you may have disagreements and anger may let you not want to come close to each other so how can you sleep under one ITN?" [Household participant 6; Busie FGD1; recent status: ITN only].

> "The ITNs may not be big enough but you have to share it with others. If you need to use ITN with your wife and partner, how can you do that? Sometimes when you and your wife want to have sex you need to take the child out of the mosquito net" [Household participant 3; Busie FGD1; recent status: IRS & ITN].

For some householder, the sharing of ITNs with children resulted in the early tearing of ITNs because of the increased mobility of children during their sleep.

> "At first when they came to distribute the ITNs, they will give you and your children one ITN. Children also move a lot when they are asleep so all of you

> can't sleep under the net. The children end up tearing the ITN even if you use it so other insects and mosquitoes can enter the ITN" [Household participant 3; Daffiama FGD1; recent status: IRS & ITN].

In some householders' opinion, the challenges with sharing ITNs with children may even result in adults giving the ITNs to the children to use, believing that children are more vulnerable to malaria than adults.

> "My household is made of six members and you decide that the children are more vulnerable so you give the mosquito nets to the children to sleep under it" [Household participant 7; Busie FGD2; recent status: IRS & ITN].

#### *4.3.2.11 Negative impact of culture and tradition on ITN usage*

Several household participants in Daffiama and Busie identified funeral attendance as a contributory factor to the non-use of ITNs. For them, despite owning ITNs, they may be unable to use them when they attend funerals or travel away from home. Funeral attendance may have been raised in Daffiama and Busie because these are essentially Dagaaba communities whose culture and tradition require that funerals be organized for all dead family members at their native home or village from which they hail as a final farewell regardless of where they may die, increasing the frequency of funerals in these communities.

> "When we go to funeral or travel far then we don't sleep under an ITN even though we may have it at home" [Household participant 5; Daffiama FGD3; recent status: IRS & ITN].

#### *4.3.2.12 Seasonal variations in ITN use*

The main reason reported by householders for the non-use of ITNs was that the nets made it hot and uncomfortable for people. The Upper West region has two seasons; rainy season from mid-April to October, and dry season from November to April. Besides this simple division of season, the dry season could be separated into the cold period (November to mid-February) and the hot period (mid-February to mid-April). Most householders said they were very unlikely to use their ITNs during the hot dry season even if they owned one.

> "God said we should say the truth, as for me I have an ITN but I don't sleep under it because the weather heats up and my body does not like heat so I don't sleep in it. So, I have it but I don't sleep in it. I can't sleep in it, if I sleep under it I can't sleep. When I sleep under an ITN the whole place heats up so I don't use it" [Household participant 6; Sombo FGD2; recent status: ITN only].

Many householders reported that the heat during the dry season is sometimes so much that people are compelled to sleep outside, leaving their ITNs in their rooms.

> "In our part of the country we are not used to using fans. Whenever there is heat we just move outside and sleep there without a mosquito net" [Household participant 6; Busie FGD2; recent status: IRS & ITN].

Most householders who refrained from using their ITNs during the dry season did use them during the rainy season to prevent their exposure to mosquito bites.

> "For me what I will say is that if it is not during the dry season, most of us do not use the mosquito net. It's not because of the spraying that we do not sleep under the ITN, … If mosquitoes are not so abundant during the dry season and it is just one or two mosquitoes flying around, we don't use the ITN" [Household participant 4; Busie FGD1; recent status: IRS & ITN].

A few GHS officials believed that heat was responsible for the non-use of ITNs by householders, especially because of the nature of housing where there was limited ventilation. When the weather is cold, ITNs were said to be used as cover cloths, promoting the use of ITNs.

> "Most people don't use mosquito nets because the weather is not favourable but during rainy season people even use bed nets as cover cloth. Let me put it that way, when they hang it and they sleep inside it the cold that they will experience will not be as much as it would have been had they not slept under a net, so during rainy season most people like using ITNs because when they sleep inside it cold doesn't enter them. But in the warm season they believe that it generates heat but we health workers debunk the notion that bed nets generate heat. Because of the nature of our rooms, you see a room without a window but they are supposed to hang a bed net. And those who use to complain about bed nets generating heat, their rooms are not well ventilated" [GHS official 3]

#### *4.3.2.13 Substitution effect of IRS*

The impact of IRS, particularly its effectiveness in killing mosquitoes and insects, was found to be one reason for the non-use of ITNs. Most householders reported it was unnecessary to sleep under ITNs after spraying one's room because both interventions served the same purpose, that is, both interventions offered protection from mosquito bites.

> "As for me, when they spray my house I don't sleep under an ITN because any mosquito coming into the room will go straight to the wall and when it goes there it will die so it will not be able to bite me. At first when they spray I also sleep under the ITN until I realized that even if I don't use the ITN, there are no mosquitoes in the room to bite me" [Household participant 1; Sombo FGD2: recent status: IRS & ITN].

For some householders, the use of ITNs was to prevent mosquito bites so if after spraying their rooms there were still mosquitoes around, then they would continue to use their ITNs.

> "When they spray the room and we do not sleep under the ITNs then it is because the mosquitoes are dead and we no longer see a mosquito around that is why we don't sleep in it but if the mosquitoes are still around, we will be forced to sleep under the ITNs. If the mosquitoes are still there their noise will disturb your sleep and you will feel that you need to use the ITN" [Household participant 4; Busie FGD2; recent status: IRS and ITN].

Most householders reported that it was common for them to stop using their ITNs immediately after room spraying when all mosquitoes were dead, and to revert to the use of their ITNs when the potency of the spray was reduced, accompanied by a corresponding appearance of mosquitoes.

> "Since they sprayed my room some two months now no mosquito can enter into my room. If I lie down very close to the wall I still smell the insecticide so even if sleep I don't even wear anything but no mosquito will dare enter the room. So, for me I have the time I use my ITN when my room is sprayed; about three to four months after they've sprayed my room. So, from that time (since my room was sprayed) onwards I realize that the scent of the insecticide is there up to now I can still smell the insecticide so that is why I don't use the ITN now, but after some time I will tie the ITN and start using it" [Household participant 2; Daffiama FGD3; recent status: IRS & ITN].

GHS officials also believed there was a feeling of duplication in terms of the two vector control interventions, IRS and ITNs, being implemented at the same location.

> "People may feel a monotony, like, if you are coming to spray then why do I need to use the net again, or if I'm already using a net why do I have to spray again because it is purported to have been serving the same purpose. The IRS and ITNs are both against the mosquito; the IRS will not let the mosquitoes settle on the wall; on the other hand, if the mosquito is inside and I tie the net the mosquito can't come near me, it touches the net and it falls back" [GHS official 2].

An AGA Mal official considered the implementation of multiple malaria control interventions as confusing for householders, especially because they served the same purpose.

> "One of the factors is the proliferation of these malaria interventions; we have the IRS; we have the bed nets and now we have what we call the SMC [seasonal malaria chemotherapy] so sometimes they ask you, which is which?" [AGA Mal official 2].

#### *4.3.2.14 Negative impact of superstitious beliefs on ITN use*

The study found that a few householders at Daffiama and Busie had some superstitious beliefs about ITNs. These superstitious beliefs related to their innate feelings that they have sleepless nights or bad dreams when they sleep under ITNs. One householder likened his feeling of sleeping under ITN to sleeping in a casket or coffin.

> "I had bad dreams when I slept under the ITN. Others say when they sleep under an ITN; they are unable to sleep because it appears they are caged. I don't know if it is some perception but I feel that if you sleep under an ITN then it's like someone sleeping inside a coffin/casket" [Household participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

#### *4.3.2.15 Householders' concerns about how IRS is conducted*

Most householders wondered why spraying was conducted only inside the house and not outside, especially in dirty places and stagnant waters. To them, spraying only the inside allowed mosquitoes from outside to come inside the house.

> "They should also spray the outer part of the house too because when they spray only the inside, other mosquitoes and insects may still come near the house and enter our rooms" [Household participant 5; Daffiama FGD3; recent status: IRS & ITN]

Many householders reported that spraying was only conducted in the house, with detached structures such as bathrooms and toilets left out. The householders believed that this provided a temporary hiding place for mosquitoes.

> "When they come to spray our house they should spray all the other structures in the house but some of the spray men will decide not to spray the bathroom, which is normally separate from the house structure. When they spray the rooms this way the mosquitoes will all run into the bathroom and wait there for some days before returning to the bedroom" [Household participant 1; Daffiama FGD3; recent status: ITN only].

### 4.3.3 Recommendations to improve acceptability of IRS and ITN

This sub-theme details the recommendations made by householders about how to improve the acceptance of IRS and ITNs. These recommendations are categorized into six main categories, including frequent use of IRS, health education on IRS and ITNs, IRS sensitization by adherents, regular ITN distribution, need to change current IRS insecticide, and need for health workers to visit homes to inspect how ITNs are installed. These household perspectives are triangulated with perspectives of officials and providers.

#### *4.3.3.1 Frequent IRS spraying*

Several household participants emphasized the need for IRS spraying to be

conducted frequently, and the need for increased funding to help provide insecticides for spraying.

> "If it was possible for them to spray three times in a year I will be glad… What I will add to the discussion is that those people who are sponsoring the spraying to help reduce malaria, and they are coming to spray our rooms without us knowing how they get the insecticides to come and spray. What I will say is that we need other people to emerge and come and join the spray workers so that there will be more insecticides for them to spray our houses for us at all times" [Household participant 8; Busie FGD2; recent status: ITN only].

Other householders suggested that spray schedules should be changed to coincide with the rainy season. They hoped this would optimize the spray effect of killing mosquitoes.

> "I think this rainy season is the most important time to spray the communities. The way they spray the communities, they should let the spraying coincide with the rainy season and the mosquitoes, because that is the insecticide's most potent period" [Household participant 5; Busie FGD1; recent status: IRS & ITN].

#### *4.3.3.2 Health education on IRS and ITNs*

A few householders suggested the need to intensify education to improve acceptance of IRS and ITN. For them, education may be a difficult task given the differences in human understanding, but education needs to continue unabated.

> "The workers need to talk to us, and show us how it works because we are people but we don't sometimes understand. We are human beings but we don't sometimes understand, you can talk to a person and the person will never agree and accept what you are saying but it does not always happen because people are different" [Household participant 2; Sombo FGD1; recent status: ITN only].

Another householder reiterated the importance of prior notification for IRS:

> "If they give prior notice about spraying and let us know the time they are coming like they used to do previously when they used to notify us to prepare" [Household participant 4; Konta FGD1; recent status: neither IRS nor ITN].

Another important suggestion was the need to intensify education on the benefits of ITNs and how to use them correctly.

> "I think if the health workers can come to the community to explain to people about the importance of sleeping under an ITN and the consequences of not sleeping under the net. People may have the ITN but they would not use it because they only got it without knowing its importance but if we could get

> health workers to come and educate us, especially, how to tie the mosquito net. Some people don't know how to tie the net and how to sleep under it and how to keep it in the morning. If they can do that the community members will be serious with sleeping under the net" [Household participant 2; Sombo FGD2; recent status: IRS & ITN].

Another householder felt consistent education could eventually reverse negative perceptions about ITN use and lead to a change in people's attitude towards ITNs.

> "I will say that health workers and AGA Mal workers work together and ensure that when the room is sprayed the householder should also be sensitized that truly the mosquito net which some people say is not good to sleep under is not so. When you go and buy a new trouser and wear it the first day, you can't walk your normal walking but on the second day you are able to walk the way you are used to walking" [Household participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

#### *4.3.3.3 Home visits by health workers to inspect ITN installation*

Some householders suggested that health workers embark on home visits to inspect and teach householders how to hang their ITNs. This was believed to enhance the proper use of ITNs by householders.

> "It appears the ITNs are given to pregnant women; when they are pregnant and they go to the hospital that is where they are given the mosquito nets. They don't come to the house to see how the pregnant women hang the ITNs and how well the net has been hanged so that mosquitoes cannot enter to bite the child. The nurses only tell the pregnant women how to use the nets but they don't trace the pregnant women to the house to see whether they are hanging in a way that can prevent mosquitoes from entering the nets and biting those sleeping under the nets. If they could come to the houses and check how the nets are hanged that can help" [Household participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

#### *4.3.3.4 IRS sensitization by adherents*

Some household participants in this study believed that householders who accepted the spraying exercise had a responsibility to help sensitize other householders, to enhance the sustainability of the programme. For these householders, IRS recipients had a responsibility to sensitize other householders who succumbed to negative perceptions about IRS, thereby ensuring community-wide acceptance of IRS.

> "If we could talk to each other, especially, those who can testify to the benefits of spraying, it will help increase acceptance of the spraying. If they come to spray your house and you don't accept the spraying, yet my child can come to your house and get bitten by mosquitoes there or mosquitoes from your house can come to my house and bite me for me to be infected. If we the community members see this as a good intervention and we sensitize ourselves, to me I think it will help reduce malaria below the current levels" [Household

participant 6; Daffiama FGD1; recent status: neither IRS nor ITN].

#### *4.3.3.5 Need to change current IRS insecticide*

The need to use the previous insecticide (first insecticide used in 2012) for IRS was suggested by almost all householders. It was believed that the previous insecticide was much more effective than the current one.

> "It appears the previous spraying was more effective than the recent one. During the previous spraying, I swept out a lot of dead insects but that did not happen this year. That is what this woman said, a lot of insects are still around…the previous spraying was more effective than this year's so they should try and bring back the previous insecticides" [Household participant 9; Daffiama FGD1; recent status: IRS & ITN].

Another householder said the previous insecticide, if brought back, could help eliminate malaria permanently, as quoted below.

> "What I want is for them to bring back the previous insecticide; that is what will help us. As for this one they just come and spray but nothing, it would have been better they don't even spray. So, they should bring the previous insecticide because that will help us eliminate malaria" [Household participant 10; Daffiama FGD1; recent status: IRS & ITN].

#### *4.3.3.6 Regular ITN distribution*

Several householders at Daffiama and Buse suggested that regular ITN distribution could help improve ITN usage because of the ease with which ITNs get torn.

> "One thing that could be done to help is that the mosquito nets get damaged or torn easily. We should have been getting the ITNs frequently but we don't get them that way. We have to go and buy them but when you go to buy they only sell you the old ones that easily get torn. So, we will plead that if we could get ITNs from the health centre frequently or from the health workers because the ITNs get torn easily" [Household participant 5; Daffiama FGD3; recent status: IRS & ITN].

The third theme of this chapter is presented below in relation to the perspectives of programme implementers about the implementation of IRS and ITNs for malaria vector control.

## 4.4 Programme implementers' perspectives on implementation of vector control interventions

This is the third theme of the findings chapter, and it contains the perspectives of programme officials and implementers about the implementation of IRS and ITNs. They include GHS officials (Government agency in charge of healthcare delivery), AGA Mal officials (private implementers of IRS), and AGA Mal spray operators (IRS spray staff). The results in this theme will be presented under five main sub-sections:

information, education and communication (IEC) as part of IRS intervention, ITN distribution and hang-up campaign, facilitators of IRS and ITN implementation, barriers to implementation of IRS and ITNs, and recommendations to improve IRS and ITN acceptance.

### 4.4.1 Information, education and communication (IEC) intervention

AGA Mal officials' perspectives about the information, education and communications activities conducted by AGA Mal, the content of the IEC activities, and the strategies for IEC are presented in the categories below.

#### *4.4.1.1 Information, education and communication activities*

AGA Mal officials reported that a separate department had been established to conduct information, education and communication (IEC) activities about malaria and malaria prevention. According to the officials, the main task of this department was to educate people about malaria and malaria prevention and promote the acceptability of IRS.

> "We have a department solely responsible for that, that is the information, education and communications department which we call in short IEC. They move around educating them [householders] first about our coming back to the region…about what we do and the effect of what we are doing, with the malaria burden also explained to them. Then the next aspect is also telling them when we are coming to spray, and when we come what they are supposed to do, their roles and responsibilities vis-a-vis the spray operators" [AGA Mal official 1].

> "The most senior IEC officer is the IEC coordinator who supervises the implementers and the advocates. And the implementers and advocates also report to the coordinator for effective management and administration of the IEC aspect of the work" [AGA Mal official 6].

In the view of some officials, the IEC personnel along with community-based volunteers did give prior notice to householders about the scheduled day for spraying. The volunteers were also reportedly on hand to support spray operators during spraying in the communities.

> "The IEC go a day before to notify the householders the day before the spraying takes place. That is, the IEC implementers and volunteers help to pre-notify the households that we are coming to spray" [AGA Mal official 5].

> "AGA Mal normally has volunteers in all the communities. They are always resident in those communities. Normally, they are the people who go around aside the IEC implementers, they reside in the communities, they take it up to go around. The moment you arrive there, they are already on board, informing

households about our coming, which makes it easier for us to operate" [AGA Mal provider 5; Wa Municipal FGD].

The IEC activities were reported by AGA Mal officials to be integral to the success of the IRS intervention because of their role in enhancing community acceptability of IRS by educating the community in the local language.

> "IEC is very important and very critical in our operations; without IEC, the programme will not be successful. It is a way of community sensitization, educating the masses in their various languages or dialects for that matter, especially, Dagaare language" [AGA Mal official 7].

#### *4.4.1.2 Content of IEC activities*

The IEC activities undertaken by AGA Mal went beyond IRS sensitization to encompass broad general education on malaria and malaria prevention. Householders were educated on a variety of preventive interventions, including ITNs, as illustrated below.

> "The IEC is not just for IRS issues but also other interventions which are provided by the GHS that is the LLINs which is distributed by GHS free of charge, we educate them on those issues as well, that particular intervention so that the people will utilize the mosquito nets. And we educate them on other activities; like what to wear at night during the period when mosquitoes can easily bite their victims, need to use mosquito coils, and other things other than relying on IRS alone" [AGA Mal official 7].

AGA Mal officials also reported that malaria education activities included education on the need for householders to accept both IRS and ITNs as complementary interventions. Thus, householders were encouraged to double their protection by not only relying on IRS but also using their ITNs.

> "I think, alongside the IRS that we are doing, we also encourage the householders that apart from the IRS that we do, there are other interventions. The fact that we come to spray your room doesn't mean that you cannot use ITNs, you should use ITNs as well to have double protection, that is what we normally tell them. Double protection is very important than just depending on IRS" [AGA Mal official 3].

#### *4.4.1.3 Strategies for IEC activities*

Several strategies were employed by AGA Mal staff in undertaking IEC activities in the districts and communities. One key strategy for IEC was the community entry, where officials engaged key stakeholders in new districts where IRS was shortly to be expanded to cover. This was done to educate the stakeholders on IRS and secure their support for the implementation of IRS.

> "We have what we call community entry; that is our first visit of the community when AGA Mal is coming in. We visit the new district and talk to the stakeholders like the Ghana Health Service staff and community leaders, district assembly staff, regional minister" [AGA Mal official 2].

Secondly, sensitization and education activities may be undertaken during community forums organized by AGA Mal, or IEC personnel may take advantage of an ongoing event to carry out education, such as visitations to schools, hospitals to educate students and patients [outpatients].

> "We organize community forums in the communities, we call the community people, we gather them then we educate them on malaria. And other times too when there is a durbar we involve ourselves so that we can use that platform to also educate them. We go to schools, hospitals to educate patients and students" [AGA Mal official 3].

In addition, stakeholders' review meetings were occasionally organized to facilitate the sharing of information and ideas that could further enhance the implementation malaria interventions.

> "We also do stakeholders meetings, we engage with the stakeholders and share ideas; the necessary recommendations are taken, the challenges are shared with them and their inputs are taken" [AGA Mal official 8].

Moreover, the use of mass media communication channels such as radio and print media was another strategy for AGA Mal IEC activities. In communities where radio facilities exist, radio discussions were undertaken by AGA Mal officials, sometimes jointly with officials of GHS, with phone-in sessions for addressing householders' concerns.

> "Depending on the kind of community, when we have radio access, the IEC go on radio to announce to them after their normal education, announce to them when they are coming to such communities" [AGA Mal official 4].

> "The use of posters, distribution of fliers, brochures and all that. We go to the radio station, the media, we broadcast our programme to them we educate them on the benefits of IRS, symptoms of malaria, causes of malaria, treatment of malaria" [AGA Mal official 3].

> "We have radio programmes which we share with GHS and engage in discussions about IRS activities, sanitation and environmental issues generally in relation to malaria prevention" [AGA Mal official 7].

Furthermore, quizzes and soccer competitions were sometimes organized as part of community engagement activities. The quiz was said to be intended towards improving students' knowledge about malaria and malaria prevention.

> "We also do quiz, malaria day quiz where we engage schools and we set up a day for that so that the students can improve their knowledge of malaria prevention methods…and along the line too we do football matches as part of the IEC activities to ensure community engagement" [AGA Mal official 8].

Finally, spray operators were also regarded as agents of information dissemination when they educated householders during spraying activities in the communities. Upon approaching a household, it was the duty of the spray operator to educate the householder on malaria to facilitate acceptance.

> "When you [spray operator] get to the house, you need to educate the householder, telling him more about what malaria is and what could happen if the person does not allow us to spray" [AGA Mal provider 4; DBI FGD].

### 4.4.2 Free ITN distribution and hang-up campaign

This sub-theme covers GHS officials' perspectives on the ITNs distribution activities, including the hang-up campaign with the aim of achieving universal coverage. Universal coverage of ITNs refers to coverage levels where at least one ITN is owned by two household members. A unique distribution strategy was adopted whereby the ITNs were not simply given out to householders but were installed for them by volunteers trained for the purpose.

> "In 2012 we decided to come with the hang-up campaign and with the hang-up, we give you the net and hang it for you…the strategy was universal; two people to a net so if they come to your house and you have six people it means they are going to give you three nets" [GHS official 4].

Although universal coverage was the main aim of the hang-up campaign, the number of sleeping places was also considered in the distribution of ITNs. The ITNs were installed to prevent instances where householders owned ITNs and yet did not use them.

> "They [volunteers] will still enter your room and see, how many sleeping places do you have in your room? If you have more than three sleeping places in the room although you are six and they are supposed to give you three, they will still give you the number of sleeping places you have equivalent with the number of nets. So, the volunteers hang it; you will tell them where exactly to hang the net for you just to curb that effect where say you've sprayed your room so you wouldn't go ahead to hang the net or you feel uneasy hanging the net so somebody will come and hang the net for you so that you can derive the benefits from that net" [GHS official 4].

All GHS officials indicated that the nets distributed to householders were Long Lasting Insecticide Treated Nets (LLINs).

> "The LLIN, the long-lasting insecticide treated nets, were the ones we distributed to householders" [GHS official 1].

> "That was the long-lasting insecticide bed nets, that is the LLINs were distributed" [GHS official 3].

Besides the hang-up campaign, another strategy involved the distribution of ITNs to pregnant women and children aged 18 months and below. This strategy was aimed at offering protection to these groups because of their relative vulnerability to malaria infections.

> "The other strategy is that children at 18 months who come to receive their measles vaccination are given ITNs and then pregnant women who come to the facility for the first time. Also, first antenatal care registrants; they are also given ITNs to prevent mosquitoes from biting them" [GHS official 3].

> "You know we have a programme, this free maternal care. So, if a mother comes to a facility the first time pregnant, we have to give them a free ITN. If she is having a child that is less than 18 months, we have to give another net, this is their entitlement" [GHS official 4].

The distribution of ITNs was said to be accompanied by education on how to use the ITNs, and this was done either by health personnel, in the case of pregnant women and children, or by volunteers during the hang-up campaign.

> "We don't give the bed nets to the parents like that we educate them before giving it out…we talk to them to enable them understand the importance of hanging the nets to prevent mosquitoes from biting them" [GHS official 3].

> "The volunteers were orientated so they went into the communities and educated the community members on it [ITN]. And some of the health staff, educated householders on how to use it, how to wash it, how to hang it and so on" [GHS official 1].

In the next section, the perspectives of programme officials and providers (IRS spray operators) on the facilitators of implementation of IRS and ITNs are presented.

### 4.4.3 Facilitators for implementation of IRS and ITNs

This sub-theme relates to the factors facilitating the implementation of IRS and ITNs. These are presented in categories including stakeholder partnerships, assistance in packing household belongings, community sensitization, training of AGA Mal spray operators (providers), training of volunteers and the receptiveness of educated people.

#### *4.4.3.1 Stakeholder partnerships*

The study found that there was collaboration between AGA Mal and GHS to ensure

the effective implementation of IRS and ITNs, and that both organisations engaged community members in diverse ways to improve the acceptability of malaria control interventions. One aspect of the collaboration between AGA Mal and GHS was information dissemination and sensitization, where both institutions distributed information about IRS and ITNs. The quotation below illustrates collaborative efforts between GHS and AGA Mal.

> "We are having a collaboration with GHS whereby any platform that we get we explain other intervention to the people and sometimes we even organize community forums together with the GHS, and the same way whenever we are having a platform we invite them. Sometimes we teach their people on our activities so that they can also go ahead and propagate them so that is the collaboration" [AGA Mal official 1].

> "For GHS what we do is that we collaborate with AGA Mal because they are the organization that is doing the indoor residual spraying so GHS collaborate with them to organize durbars, to go into radio stations to educate the public as to what we can all do to prevent malaria using ITNs and IRS" [GHS official 3].

The study also found that AGA Mal spray operators or providers were recruited from communities within the district of operation. This was said to enhance community acceptability.

> "The spray operators are recruited from the districts or communities they are spraying so once a member of the community or locality is employed in the company the person will also act as an advocate on behalf of AGA Mal to also advocate to the people, thereby enhancing the acceptance level in the communities" [AGA Mal official 8].

Another aspect of partnerships with householders was the involvement of community-based volunteers.

> "And mostly in every community we have the advocates who are key people who are known by everyone" [AGA Mal official 5].

Moreover, AGA Mal spray operators developed rapport with householders during their spraying activities in the communities, and this was said to enhance community acceptability.

> "When we get to a household, we will politely greet the person and explain that if he or she wants his house to spray. And then you find out from him whether he has gathered all his belongings that needed to be taken out, and when that is done you go ahead and spray the house" [AGA Mal spray operator 3; DBI FGD].

> After that you [spray operator] go to the first house you, you introduce yourself to them [householders], whom you are and where you're from. Let them know that you have come to spray their house. Do you want to spray? Even if they say no we try to convince them to know what we have come to do is meant to help him and not to harm them. That is what we do before we start spraying" [AGA Mal spray operator 3; Wa Municipal FGD].

#### *4.4.3.2 Assistance in packing household belongings*

Assisting householders in packing household belongings outside for spraying was a key facilitator of IRS interventions. This support was provided by AGA Mal spray operators, given the need for householders to move or pack belongings prior to spraying.

> "When you [spray operator] get to the householder and greet him and say whatever you need to say and he accepts, but if the householder is not able to pack all the things, you have to help the householder to pack the things before you go in to spray" [AGA Mal spray operator 5; Wa Municipal FGD].

#### *4.4.3.3 Community sensitization activities by spray operators*

Community sensitization activities was another facilitator for the implementation of IRS and ITNs. Spray operators were directly engaged in IEC activities as a supportive role in addition to their spray duties.

> "After the IEC implementers have done their job, you have to educate them on the importance of the spraying, may be after the IEC implementers have educated them on it, you also have to educate them a bit before they allow you to do the spraying" [AGA Mal spray operator 1; Wa Municipal FGD].

Where IRS refusals were encountered in the field or communities, AGA Mal spray operators adopted several approaches to handling such refusals. One such approach involved the provision of additional education on the benefits, especially the incidental benefits of spraying, to households that were resisting spraying.

> "Yesterday I went to Jejereyiri and one woman said she has mosquito coil, Raid and everything and so if it's about the mosquito we should stop. Then I said it's not only about the mosquitoes but when we spray there are a lot of insects that die. Then she said, what of ants? And I said, oh as for ants the insecticides don't joke with ants, then the woman just allowed me to spray the room" [AGA Mal spray operator 6; Wa Municipal FGD].

Another approach used by providers to convince householders was the use of deception. Householders could be deceived that they would be charged extra for malaria treatment at the hospital in future if they refused IRS spray.

> "Sometimes after explaining the effectiveness of the insecticides and then maybe if they still refuse, sometimes what we do is, we try to deceive them in

> a way like by saying maybe if you refuse to spray and you get malaria and you go to any hospital and it is detected that you have malaria they will charge you extra. We sometimes deceive them by saying after spraying we have some certificates we issue to them so we send some to all the hospitals so when you go and they detect that they came to spray your room and you refused and then you have malaria they charge you extra" [AGA Mal spray operator 5; DBI FGD].

The use of deception was said to be unethical but a very effective strategy to manage refusals. One participant from Wa Municipal said the strategy was adopted from Wa East district, as shown in the quotation below.

> "We use other unofficial means; it is not bad but it is not in line with our practices. But we use it to also convince some of the householders to accept the spray. Especially, the last time we went to Wa East District, we met them with a certain strategy they were using and it works a lot. What they tell them is that, after spraying a spray man is supposed to issue a spray certificate to the householders. So, what we tell them is that, if you don't allow your place to be sprayed and you go to the hospital without the certificate they will question you. And if they find out that your room was not sprayed, they will not treat you. So, with that we put fears in them so they allow you to spray" [AGA Mal spray operator 8; Wa Municipal FGD].

A few AGA Mal spray operators indicated that, when necessary, they took note of the cause of refusal for further discussion with other spray operators during a meeting.

> "Me for instance, when I go to a stand and a person says he or she will not spray, first of all I will ask him or her the reason why the person says he or she will not spray. Then I will take note of it, when we have a meeting or a forum then I will just bring it out and we will come out with solutions" [AGA Mal spray operator 8; Wa Municipal FGD].

Furthermore, AGA Mal spray operators reported that sometimes a spray supervisor or team leader may be invited to intervene when a householder refused spraying.

> "Sometimes after doing all this education and the person is still refusing, and you have your team leader or your supervisor around you call him so that he too will come and intervene. So, after that if maybe the person will allow the spraying" [AGA Mal spray operator 4; DBI FGD].

However, AGA Mal spray operators were not always successful in convincing householders to spray. When the householder insisted on refusing spraying, their decision was respected by AGA Mal spray operators.

> "When you get to a householder and the householder refuses to spray, all you need to do is to try to explain to that very person the benefits of what you are coming to do, what he or she is to gain. But normally when you persuade to some extent and the person is still adamant you let go because you can't force

yourself into a person's house when he or she is not willing" [AGA Mal spray operator 2; Wa Municipal FGD].

GHS officials also provided education on the proper usage of ITNs. Like IRS, volunteers were also involved in ITN education and sensitization.

> "First of all, we are concerned about the proper usage of it. How do you hang it, it doesn't matter you could be lying on a mat, a mattress, or on a bed or bed with mattress we have the way we educate them on how to put it round the mattress so that all the ends are down and no mosquito will get near you. So, first of all we are concerned about how to hang the nets, proper hanging of the nets, and in that sense, proper usage of the net. You don't sleep inside and then crumble into it like a cover cloth, it will not work. Sometimes we go to the communities and we see that some small children will be using it to cover themselves like a cover cloth. You have to hang it properly, use the net properly, care for the net; like how many times do you need to wash it…, So, all these are things that we teach the volunteers to teach the users so that with this adequate knowledge on it then it can prolong the life of the net and therefore the use of the nets" [GHS official 1].

GHS officials also provided education on the benefits of ITNs and encouraged householders to overlook the challenges associated with using them.

> "We make [educate] them to know that bed nets don't produce heat and the chemicals they use in manufacturing the bed nets are based on individual differences because some people will experience irritation and others won't experience irritation. But we should forget about the negative aspect of the bed net and think about the positive aspect; that is preventing you from getting malaria. So, those kind of health education is given to them that the bed net is meant from preventing mosquitoes from biting them" [GHS official 3].

According to GHS officials, ITN education was undertaken through several strategies, including during meetings, use of community health officers, at static points, outpatient departments, and home visits, among others, as illustrated below.

> "Our community health nurses, our frontline workers, people who are also at the grassroots; they also go on with education to the public through the home visits I mentioned, through the OPD services" [GHS official 4].

> "There are a lot of strategies that we are using. During our durbars, you know now GHS most of our communities are like we move to the communities and we are using the CHOs (Community Health Officers), that is CHO concept whereby a nurse is trained to take care of a number of communities within an area. So, that nurse will be having an itinerary for the month as to how to go by his/her health education. So, as part of the health educational package, they move out to talk to community members…During world malaria day, we have a health promotion officer who goes to the media, the FM stations just to talk to the public about the importance of ITNs and what they are supposed to

do not to get malaria. Apart from the community durbars and radio stations, at the facility level pregnant women are organized, we have something we call pregnancy classes for pregnant women where the midwives will organize pregnant women and talk to them about the prevention of malaria and other diseases…. Another strategy is called static point strategy. At the CWC sections too they talk to care givers about the prevention of malaria by the use of ITNs. Those are the strategies employed by Ghana Health Service" [GHS official 3].

#### *4.4.3.4 Educated people more receptive to IRS*

Education was found to be an indicator of IRS acceptability in both DBI and Wa Municipal, with AGA Mal spray operators believing that moderate to highly educated householders were more likely to accept IRS.

> "There is something I've observed in the field, most of the educated people they allow us to spray their houses more than even the illiterates. Because when you go in and meet those who are educated small or even well educated, they will allow you to spray their rooms but some of them who are not even educated they will be rejecting you" [AGA Mal spray operator 2; DBI FGD].

#### *4.4.3.5 Training and capacity building for community-based volunteers*

Capacity building for community-based volunteers was found to be a facilitator for the implementation of IRS and ITNs. Both AGA Mal and GHS trained their volunteers to enable them play effective roles. An AGA Mal official indicated that volunteer training was conducted prior to the start of every spray season.

> "Before they go into the communities to start spraying, the IEC department will first train the advocates, we call them the community volunteers. They are specifically selected from the communities; assuming we are going to spray 100 communities, we need to position ourselves in such a way that we will be able to select at least one in each community to enhance acceptance in the community because we believe that the community volunteers have been working with the people in the community and for that matter engaging them to advocate on our behalf will easily penetrate information to the people involved. So, we train the advocates and tell them what AGA Mal stands for, and what they are supposed to do as advocates and what the community people are supposed to do in terms of our activities" [AGA Mal official 8].

GHS also provided training for volunteers to enable them to perform several roles, including providing education on ITN use.

> "We still run some programmes where volunteers are trained. For them their main job is to educate the mothers on how to use the ITNs" [GHS official 4].

#### *4.4.3.6 Training and capacity building for AGA Mal spray operators*

AGA Mal officials and spray operators identified three main types of training programme conducted for spray operators, including seasonal and monthly refresher

training. AGA Mal spray operators were employed on seasonal basis to undertake spraying. Therefore, seasonal training was conducted for operators who were newly recruited or re-employed for the spray season. Monthly refresher training was conducted for spray operators during the spray season to polish their skills.

> "We also have what we call seasonal refresher training, so at every season those days when we were spraying twice a year, if we train you for the first six months and you join the other six months we will still train you again because we believe that some of the concepts you have taken along might have been forgotten so we have to do a refresher training. We also have what we call the monthly refresher training which is also part of community education. The monthly refresher training concept is that once you train people and they go to the field, it's either some might be doing the right thing and some may not be doing the right thing. So, what we do is that we call them back at the end of every month to train them again on some of the lapses that we have realized on the field, then we say that upon your training these are the areas you are deviating from, can we polish on that, so we try to train them on how to do their work perfectly" [AGA Mal official 2].

> "Before the season starts, we have a session with the spray operators, what we call retraining or should I say refresher training because they've already gone to the house to rest for some time so before they come we have to retrain them again" [AGA Mal official 1].

AGA Mal officials indicated that the emphasis of seasonal training was on educating spray operators in the importance of spraying, developing skills in wall spraying (swath wall training), and communication skills. These skills were highlighted during the week-long seasonal training session.

> "The management of the district organize them [spray operators], have a training session with them, educate them on the importance of IRS and how they are going to operate when they go to the field. We take them through the swath wall training, they go through the training for one week and after the training then they are all dispatched to the field to spray… On the IEC, I normally present to them [spray operators] how they [should] relate to householders when they go to the communities; they should watch out with the way they talk to them. You know, we cannot force them [householders] to accept the programme so they are being trained in such a way that when they go to the community, this and how should talk to the householders in this way or this manner for them to understand the programme so that we can spray their homes for them" [AGA Mal official 3].

A few AGA Mal spray operators reported that skills in data collection were included in the seasonal training.

> "It's not only spraying the wall, we also undertake training like filling in some forms to be able to capture the number of people in the community, what we

> call population. We use data like that to be able to cover the people so that we know the number of people who like in each household. That is the training we used to undertake before we go into the communities to spray" [AGA Mal spray operator 2; Wa Municipal FGD].

A few AGA Mal spray operators indicated that a two-day monthly refresher training was organized during which priority was given to developing their technical spraying skills (swath wall training) on the first day, with a classroom session held on the second day where training was given on communication skills and data collection.

> "It's always a two-day training…we go to train on the wall and the last day of the training is always a classroom session where we go to sit then they explain to us what we will do when we go into the communities, especially, when we first go to meet the household, what we have to do. The interaction that has to take place; you introduce yourself, the organisation or department you are coming from, the work you do, you let them know that you do indoor residual spraying, you fight malaria and you tell them that the work you do is for free… That is always the final session we normally have; that is the way the final session we normally have is. They will tell you how to take data from the field and show you the forms to fill and how you are going to take data, the sort of information they will be expecting from you on your return. All that is always part of the training but it comes on the last day, it's always a classroom session" [AGA Mal spray operator 2; Wa Municipal FGD].

Beside the seasonal and monthly refresher trainings, AGA Mal officials considered that the daily safety briefing given before spray operators left their depots for the communities constituted another form of training. These daily safety briefings were intended to educate spray operators on the importance of safety, but also to address spray operators' concerns arising out of their spray activities in the community, such as refusals and how to manage refusals.

> "On any given day we begin with an assembling of the spray operators and we give them a safety brief as to how they can keep themselves safe, keep the environment safe, keep the householders safe. We give them the safety brief because safety is our first value as they say" [AGA Mal official 6].

> "During the daily safety briefings that is conducted, which itself is a training because it is mandatory in AGA Mal operations so these concerns and issues could be raised by the spray operators to be addressed there. Some of the issues like servicing of the pumps, community acceptance, and how to manage resistance in the community or some of the issues they may have encountered during operations could be brought up to be discussed" [AGA Mal official 7].

AGA Mal officials reported that safety briefings were conducted to ensure spray operators adhered to standard operational procedures, thereby ensuring the safety of the spray operators, householders and the environment.

> "AGA Mal also gives them personal hygiene and safety training so that they can also keep themselves safe once they are using chemicals and chemicals can be harmful if misapplied. So, these are some of the trainings that they are given but mostly their safety, the safety of the community and the safety of the environment is what we emphasize on" [AGA Mal official 6].

The importance attached to the daily safety briefings was shown by the fact that they were mandatory for every spray operator working on any given day, without which personnel were barred from working.

> "Safety is part of our operations; we have what we call safety briefs and this safety briefs are compulsory for all officers who are going to embark on activities of IRS on a particular working day. If an officer or operator does not take part in the safety briefs, then they are not supposed to go to the field" [AGA Mal official 2].

The perceived barriers to the implementation of IRS and ITNs from the perspectives of programme staff are presented in the next section.

### 4.4.4 Barriers to implementation of IRS and ITNs

This theme presents the perceived barriers to the implementation of IRS and ITNs from the perspectives of AGA Mal officials, GHS officials and AGA Mal spray operators (providers). The barriers are presented under categories including difficulty of packing belongings for IRS spray, difficulty with meeting set targets, difficulty with mobility, etc.

#### *4.4.4.1 Difficulty with packing belongings for IRS*

The packing required before IRS can be conducted was regarded as a challenging task for householders. AGA Mal officials, therefore, believed that packing was a contributory factor towards householders' refusal of IRS, thereby affecting the implementation of IRS.

> "I can talk of the burden on them packing their items from their rooms because when you are going to spray and they have items in the room it has to be packed. This can be a bit difficult for them, especially, where they have more stuff in the room some people are not willing to spray because they feel reluctant packing and going back to arrange" [AGA Mal official 1].

> "Some people feel reluctant to put their rooms in order for the spraying to be done. Some think the packing is so inconveniencing, so tasking, so time consuming, so time wasting" [AGA Mal official 6].

In AGA Mal providers' (spray operators) view, packing was more of a challenge in urban areas than in rural areas because of the sheer quantity of belongings owned by householders in urban areas. For the spray operators, taking household items

outside for spraying and moving them back inside afterwards was a tedious task for householders, prompting some householders with means to seek other alternatives.

> "Now we are in town, it's very difficult, you enter some house and there will be no place for you to spray, unless you pack things and cover it. So sometimes we let them know that we will pack some of the things, those that we can move we move them out, those that we cannot move we cover them with bedsheets… But the villages sometimes you enter the house and you will not see anything there, they will move everything outside for you to spray but not in the town here because of the congestion" [AGA Mal spray operator 4; Wa Municipal FGD].

> "Sometimes they do compare this insecticide to the normal mosquito spray like the Raid and others. Most at times the main reason why they don't allow is the packing, so for them seeing that they have to pack their things out and you spraying before they pack the things in, they see it to be tedious work. So, if they have the money to afford for this normal spray why do they have to waste their time packing their belongings outside for us to spray?" [AGA Mal spray operator 6; DBI FGD].

A few AGA Mal spray operators noted that the inability of spray teams to complete spraying in some communities on the first spray day might result in householders who had packed for spraying on the first day to have to pack again on the second or subsequent days.

> "Sometimes too, packing and packing! Because like Kaleo here we can't use two days to finish Kaleo but somebody will stay around the dam area [fringes of community] [so] while we are here spraying [main town] the person will pack and we won't get there. The next day, we won't get there again. By the time we get there the person will say he won't pack again" [AGA Mal spray operator 2; DBI FGD].

#### *4.4.4.2 Difficulty with meeting spray targets*

AGA Mal spray operators said they were overburdened by the spray targets given to them and attributed this to the reduction in the spray season or contract periods.

> "There is always a pressure on us too, because we have to cover a lot of communities and all that much, and then we supposed to cover the whole district. The number of chemicals or bottles we are supposed to use in a day sometimes worries us and that is even harmful to our lives" [AGA Mal spray operator 1; DBI FGD].

> "I think that about the contract, at first they used to give us six months and that time it was enough, we normally spray well but now that the period is too small so always there is pressure on us. Sometimes you go to the field and come and you can't sleep because of the way we try to meet our targets in the field" [AGA Mal spray operator 5; DBI FGD].

The stress wrought by the need to achieve spray targets within a shorter period reported compromised the quality of spraying.

> "If you are packed with the chemicals to do the work you might not be able to do a quality work as compared to when you are given lesser insecticides so you take your time to do a quality work" [AGA Mal spray operator 1; DBI FGD].

A few AGA Mal officials reported that targets may be difficult to achieve when pre-spray sensitization or notification was not done well.

> "Sometimes you go to the field and they tell you they have not even heard about us before we came… So, it means that communication, or whatever it is, wasn't effectively done or people are joking with the work and not doing it wholeheartedly and when that happens, it is now the spray operator who definitely will be looking for his structures, his assigned structures [target] for the day, who will be doing all the walking and all the talking to convince people to spray. The spray operator has to be doing the IEC in addition to his work, that is, he has to be convincing the people to get his structures, so it becomes difficult for him to do double work before he can achieve his target" [AGA Mal official 6].

#### *4.4.4.3 Difficulty with access*

When hard-to-reach communities are cut off by the rains [because of bad roads or collapsed bridges], it becomes difficult to conduct IRS activities because of the challenges involved in reaching those communities. AGA Mal officials believed this could affect the kind of education activities that could be undertaken prior to spraying or those communities may not be sprayed at all.

> "During the rainy season, if the spraying does not begin earlier before the rainy season sets in, it makes it difficult for operations to go on due to the fact that some of the areas when it rains the roads get cut-off and vehicles cannot go through them. Due to lack of good road network, or lack of adequate planning at the district level, some of the districts are more deprived than others but in most cases, some of the districts have very hard to reach areas" [AGA Mal official 7].

> "And you also look at it, and the education activities are affected by bad roads. So, it's always a challenge that they are not able to access some of the communities to disseminate information, may be in the rainy season some communities may be cut off by rain, I mean by rivers due to the rains. The bridges may be washed off and the IEC implementer or coordinator may not be able to reach some communities to educate them" [AGA Mal official 8].

Moreover, some AGA Mal officials reported that shortage of vehicles affected the transportation of spray operators to communities for spraying. The movement of operators was also affected by nature of the roads, resulting in late arrivals in some communities and increasing the wear and tear on vehicles.

> "We have a very large number of spray operators in terms of workforce, and these people need to be transported from the soak pits to their respective communities to spray. And these vehicles are not always enough because the last batch might leave very late which they will not be able to meet people at home" [AGA Mal official 2].

> "We are also looking at the bad roads which affect the wear and tear of the vehicles. The roads in the Upper West region are very bad and this has a toll on our vehicles" [AGA Mal official 8].

In AGA Mal spray operators' view, there is sometimes congestion on the buses used to take them to communities and they are transported in batches, occasionally leading to late arrival in the community when householders would have left for their farms already. Difficulties with carrying spray equipment from house to house during spraying was also said to be challenging.

> "Most of the times we are always many in the bus, sometimes the bus has to go and come two times or even more than three times sometimes. When we are going to a far village, by the time the second bus gets there the first bus operators have already finished, and even by then you get there and the people have already gone to farm… There is also another challenge with carrying of our equipment, it's like you have to carry your bag, your bucket, your pump. This is a lot, it's always a lot for us to carry these from one house to another" [AGA Mal spray operator 7; DBI FGD].

#### *4.4.4.4 Exposure of spray operators (or providers) to hazards*

Many AGA Mal spray operators across all the districts were concerned about the availability of charms and amulets which were sometimes left hanging on the wall just above the door in rooms. Removal of these charms and amulets was said to be the prerogative of the man or family head who may not be available to remove them. Women were forbidden to touch the amulets, and thus were unable to get them removed for spraying. Another provider was worried about their inability to identify 'special rooms' or shrines which were considered taboo for strangers to enter. These fears were said to pertain to rural communities.

> "When you get to the rural areas, there are some 'small small things' that hang on the wall that a lady is not supposed to touch… Before you enter the house, there is something that is always hanging at the back of the door that a lady is not supposed to touch it so instead of the head of the family to remove the thing and put it at a convenient place they will leave it. So, when you enter the stand and want to watch what things are left there you realize that one of them is hanging there. Then when you ask them to take it the woman will say that I'm not supposed to pick such a thing and you cannot also touch it. So, it's also a challenge so sometimes you don't attempt to spray that side because you fear for your life… Some of the stands too they have special houses, you may move to a stand and they say that you can move in and spray. But in that

> special houses, when there are idols inside you are not supposed to enter there unless the one who is operating the idols. But they will say that it is free you can enter; last month we went to Piisi, when I moved to a stand the Man told me that oh it's free I should enter. Then I started first, second, third and the Man came and asked if I entered the fourth and I said no. He said if I had entered there something would have happened to me so the special houses create a problem for us. We don't know how to identify them and the householders don't always let us know such houses" [AGA Mal provider 6; Wa Municipal FGD].

Another hazard experienced by spray operators is their exposure to attacks by domestic pets, as illustrated below.

> "Another challenge is wild dogs, especially, those that have given birth. Also, you can find bees in living rooms in the interior Villages and if you don't see them by the time you realize they will attack you in the room" [AGA Mal spray operator 9; Wa Municipal FGD].

The study also found that spraying dark rooms posed visibility challenges to spray operators, exposing them to harm or attack from mentally ill persons. Darkness was also said to affect the spray operators' ability to move around the rooms, with some running into physical objects and hurting themselves in the process. These risks were more associated with rural communities than urban ones.

> "In Wa East, a community called Dabilipuo, our colleague went in to spray a room, not knowing that they chained a mad Man in the room. And the room was dark, and darkness is another challenge, especially in the interior Villages the rooms are always dark. So, when our colleague moved in to spray before he realized he was spraying a mad Man in the room" [AGA Mal spray operator 1; Wa Municipal FGD].

> "Some of the Villages when you go there the room is so dark to the extent that you always use your head to hit the wall, because you can't see. And sometimes without the helmet we would have always experienced headache. For instance, we were going to a Village at Dandafuro, I entered one stand and the place was dark, by the time I wanted to raise up my head I hit my head on the wood that they used to make the mud house, I hit it very hard" [AGA Mal spray operator 6; Wa Municipal FGD].

AGA Mal spray operators also spoke about their exposure to snakes and other reptiles during spraying.

> "Some of the challenges we face as spray operators we are always exposed to reptiles. You'll enter some of the rooms and you are spraying by the time you realize, because of the insecticides something will just, maybe a snake will just fall down chasing you or trying to find its way. So many things you'll be spraying and they will be falling down and it's very scary" [AGA Mal spray operator 3; DBI FGD].

> "One spray season we were at Mangu, there is a School there Mangu Methodist School. I entered the KG to spray not knowing there was a snake in the classroom but children were there. When I entered, I asked them to leave. While spraying, the snake could not stand the chemicals, I realized it was just struggling to die… It could have turned into anything; I could have mistakenly step on it" [AGA Mal spray operator 2; Wa Municipal FGD].

Finally, AGA Mal spray operators were exposed to side effects of the insecticides. In one spray operator's view, these side effects included dizziness and headaches.

> "If in the process of spraying the house you are mistakenly not well dressed and you inhale the chemicals it worries you. Sometimes you have headache, sometimes you feel like vomiting and sometimes you are feeling dizzy" [AGA Mal spray operator 1; DBI FGD].

AGA Mal officials acknowledged that the insecticides may have side effects, citing experiences despite not being in direct contact with insecticides.

> "The chemicals, in fact of late, the chemicals have been having some effect on the spray operators, even including me as I talk to you now. I've got some rashes on my body and it was said that it is due to the chemicals, even though I don't directly deal with the chemicals, but my body chemistry was reacting to the chemicals" [AGA Mal official 6].

#### *4.4.4.5 Inadequate information affects IRS*

Inadequacy of information about IRS was regarded as one barrier to its implementation. One AGA Mal official bemoaned the inadequacy of information, but also felt that a lack of understanding of the available information was the real challenge.

> "It's basically, lack of information. Even as much as we think we are doing our best to disseminate information with respect to IRS, but some of them still do not understand the need, some of them will tell you that… The message of the IRS need to be communicated to the people. The lack of information is still causing acceptance issues; I wouldn't say lack of information but the lack of understanding of the information, the information is quite available to them but they still don't really understand the concept we are talking about" [AGA Mal official 2].

A few AGA Mal officials reported that insufficient notification could have a direct effect on IRS implementation because householders may not be available to spray their rooms.

> "It is true in a sense, if I'm not informed and you come and I'm not there how can I do it then. If I'm not aware you're coming how do I prepare to wait for you, so the prior information is very important and I think it needs to be stepped up if really we want IRS to succeed" [AGA Mal official 6].

It was not unusual for prominent householders whose houses were unsprayed because of lack of information to lodge complaints with AGA Mal officials. When asked about their response to householders' concerns about inadequacy of information, one official did not disagree and laid the blame on AGA Mal workers for not executing the jobs as expected.

> "I believe what they are saying, I look at them as our customers; we are soliciting them even though our activities are free of charge, but if they are giving us this feedback then perhaps some of our workers are not doing their work. When they are supposed to go, and pre-inform householders and they don't do it. It's not an isolated case, it cuts across the board, we've had that, I've had people come to me who are personal friends, who are government workers or business men and women come to me after the spray season and say what happened, when are you guys coming to spray my house. And I say oh but we have just finished spraying, the spraying season has ended and they will say oh but nobody came to me, nobody asked me, nobody approached me. This is not once; this happens several times" [AGA Mal official 7].

However, some officials attributed challenges with information to insufficient IEC staff, noting the large range of duties they had to discharge, thus affecting their ability to give adequate prior notification of spraying.

> "You know they have other duties too aside that so if one team was just responsible for that, the staffing is not adequate. Aside that they have so many other things doing but if it was such that these people are for notification only, these people are for education, these people are for community entry, not one person jumping from one thing to the other" [AGA Mal official 5].

The challenges with information dissemination were reportedly compounded by the pre-spray notification strategy of using megaphones instead of house-to-house notification.

> "Information getting to the householders is also another issue. Because sometimes, mostly the door to door information is not done here, it's always the use of the megaphone to announce to them. Some people might not hear of it because they might not be there at the very time that the announcement was done" [AGA Mal official 4].

For one AGA Mal provider, inadequate information pertained to bigger communities, mostly in Zongo, where IEC personnel focused their notification and sensitization activities on householders living along the streets, excluding those in the inner areas.

> "Sometimes you go and they [householder] say they are not informed and so therefore they will not spray. Places like Zongo and other big big communities

the IEC will inform some along the road but those in the interior will not get the information" [AGA Mal spray operator 8; Wa Municipal FGD].

#### *4.4.4.6 Frequent breakdown of IRS equipment*

The frequent breakdown of spray pumps used for IRS was reported by AGA Mal officials to pose a serious challenge to IRS operations. The unavailability of spare parts for regular repair of the pumps was another challenge which reportedly affected spray coverage.

> "One other challenge we have is the frequent breakdown of our spray equipment, the spray pump. These are things that are not manufactured here in Ghana, they are imported without the necessary spare parts for replacement. It affects the spraying in a sense that, when the equipment is not working you lose production for that day. Assuming you have 25 spray pumps and you have 5 broken down on a particular day, you multiply the daily target for a spray operator by the number of pumps, you are losing that much on daily basis. That eventually affects the coverage, because if you were using three months for spraying and on daily basis you are losing structures; at the end of the day you will not meet the target and you will not spray certain communities" [AGA Mal official 2].

> "The main this thing is the spray pump. That is why the spray operators are complaining issues with the nozzle caps, they keep on clotting and clotting. And I think that one they were supposed to be changing it regularly I don't know how regular but I think they change it once every season or so I'm not very sure but it is really affecting operations" [AGA Mal official 5].

The importation of spare parts is said to cause so much delay that they only arrived after the spray season was over.

> "They [spare parts] don't come in time, by the time they come we might have even finished the programme. This season for instance, we were facing nozzles and other parts of the pump, they weren't coming" [AGA Mal official 3].

Finally, a few AGA Mal officials indicated that although there was frequent repair work done on the spray pumps, there was now a need to replace them.

> "We haven't procured spray pumps which the spray operators use since 2013. The ones we are currently using were procured since 2013, years ago and nothing has been added since then, so we are having problems with nozzle caps and some other parts of the pump. The pumps are consistently being repaired and some of the parts have been procured but the actual pump itself still needs to be replaced. Even though our experienced spray men have been able to work around the challenges, there is the need for us to procure new pumps" [AGA Mal official 6].

#### *4.4.4.7 Poor planning because of poor housing data*

For better communication with householders to ensure higher acceptability, IRS operations require adequate planning. However, IRS plans were said to be frequently affected by a lack of accurate housing data, which had a negative impact on spraying.

> "You might project that we have 34 stands [houses] in this community, you go in there and maybe the stands are either more or less, so it means you either finish earlier than scheduled or it takes more time. So, if you plan it always affects your plan, so giving the information [pre-spray notification to householders], the exact time that you are coming [to spray] becomes a problem. So, it's that gap that we are not getting, most of them it's not that they are refusing, but it's that sometimes if the information doesn't get to them earlier by the time you go there somebody has gotten something that he has to do, and has locked up and has gone" [AGA Mal official 1].

Other officials indicated that AGA Mal collected data on housing by geo-coding houses in the field to create a database for comparison with the 2010 population and census housing data. However, rapid urbanization resulted in the development of many other buildings, which along with makeshift or temporary farm houses frequently resulted in use of inaccurate data for planning purposes.

> "For AGA Mal too we've developed our own database, when we go to the field we number houses, we geo-code the houses and from that we have data on the number of houses or stands in that community. So, that is what we compare with the population and housing census 2010 data." [AGA Mal official 5]

> "We do pre-spraying activities which involves coding all houses in an environment that we are going to spray. So, when we finish coding, we have all the numbers. For example, in Kaleo township we might say that after coding we have 365 stands, and it can happen that when you go there some were settlements for farming purposes, and after it collapses. Or there are places where they say they are cosmopolitan, where people develop faster, so by the next year before you come there are more additions. So always it makes your projections not so specific." [AGA Mal official 1]

Finally, the use of projections seemed to be necessary because the statistical department did not have a reliable database on housing except for the 2010 population and housing census, to which a certain percentage was added annually.

> "You know the statistical service, we have a data from them, that is from the recent census in 2010. But then we have the percentage that they increase every year… The statistical service, they give a percentage, like every year this is the number that will be added to it." [AGA Mal official 5].

#### *4.4.4.8 Partnership difficulties*

A few AGA Mal officials expressed concern about a current policy that forbade certain

kinds of motivation for partners; the policy against the so-called sharing of 'bread and butter'. In his view, partners such as GHS officials and chiefs had become so accustomed to being motivated by other non-government organizations (NGOs) that it was difficult for AGA Mal officials to get the best of their attention without giving similar motivations or rewards.

> "Engagement in our part of the world means you have to be free in giving; by engaging them, you have to share a little bit of bread and butter, but our company has a policy which does not allow it. Don't go and see a chief and give him this, don't go and see a district health director and give him that. It's a token; it's something that a person will consider and respond in some way. Many NGOs in Ghana, let's be bold and I'll be candid with you, many NGOs who come in to the country and engage some of our stakeholders have higher acceptance because they share certain things with them. Even to get information from Ghana Health Service is like pulling teeth, meanwhile they are our landlords in every district and every region that we go to. But due to our policy in terms of engaging them in ways that will encourage them to accept us more does not help." [AGA Mal official 7]

Another challenge that affects AGA Mal partnerships with its partners is the single spray season of three to four months it currently operates at the district level. Previously, spraying was conducted twice in a year, implying that AGA Mal employees worked all year round, but since 2015, operations were changed to only one spray a year (mostly March/April to June/July). The single season results in the annual closure of district offices (July/August to March the next year). This reportedly limits staff–community interactions and affects relations with other stakeholders and partners because only the regional office at Wa remains operational during the closure of the district offices.

> "You see one of the administrative challenges we have is that, previously we used to have consistent spray around so the offices were very active, the offices were active in a sense that officers were in every district as a point of contact or reference, because we need to have what we call post-spray activities. After spray season, somebody might have some challenges after spraying, and the office need to be contacted but presently what they do is that they de-commission all the districts after the end of the spray around, and leave it to the zonal/regional staff to be managing. So, most of the people there they don't know we have a regional office, they only know the district office so when there is a challenge they don't have any point of call. To me administratively it's wrong. One very negative experience we had was that there were rumours that we had vacated our operations simply because they were not seeing officers around in the offices, even to the extent that our partners started taking our offices that they allocated to us because we were not forthcoming and they needed their offices to also do their work so they wanted to take it back because they think that they give it to us and we come and operate for only 4 months, the rest of the months that is about 8 months

we don't use it, so to me administratively that is a challenge" [AGA Mal official 2].

#### *4.4.4.9 Refusal of IRS because of staining of walls*

One challenge with acceptability IRS is refusals because of possible staining of walls. Where spraying is not conducted well, residues may be left that stain the walls and spoil the appearance of an otherwise well painted wall.

> "Some of them [householders] the paint, the white residue left on the wall after spraying. Some of them may have a bright colour and they feel that the wall has been discoloured and they want to maintain the beauty of their paint, the original paint that they have in their rooms. So, by us coming and saying they should take out their items from the wall for us to spray; when it is not evenly done and properly done by the spray operators it discourages householders from accepting our spray men to come in the upcoming season to spray." [AGA Mal official 7]

A few spray providers agreed that the quality of spraying is dependent on the skills of the operator, with different spraying strategies used in spraying different colours of painted walls.

> "The painting on the wall it then depends on the spray operator. If it is blue paint, green or red paint or if it is oil paint it depends on how you move the [spray boom] from the wall to the down. For the white paint, you need to move fast, the green and others so that you can do a perfect job and not the staining of walls" [AGA Mal spray operator 7; Wa Municipal FGD].

#### *4.4.4.10 Inadequate supply of water*

IRS requires the use of clean water for mixing the insecticides to avert the possibility of particles closing the tiny holes in the spray pumps. However, the supply of clean water in the Upper West region presented a challenge because some communities did not have an adequate supply of water.

> "Issues with water, you know IRS deals much with water. And you know in northern Ghana water sometimes becomes a bigger challenge so you go to some communities, people giving their water to mix insecticides becomes an issue. And it's not any other water, even to get clean water, it's not about getting water from any stream lying somewhere no, it's either from the tap or a hand dug well without any particles. Sometimes it becomes difficult getting that water" [AGA Mal official 1].

#### *4.4.4.11 Difficulty with centralised administration and bureaucracy*

The use of a centralised administration system in AGA Mal was said to present a challenge to IRS operations because it required minor procurement to be undertaken at Obuasi, the headquarters. The bureaucratic system was said to result in shortages of insecticides and irregular distribution of soap to spray operators to wash their work

uniforms as required in IRS operations.

> "The other challenge to me is also the way things are centralized in terms of administration. Every bit of procurement, at a point when you needed A4 it had to be transported from Obuasi, until we complained and we had to buy through the petty cash, so that was very wrong… On one particular season we run out of insecticides due to procurement processes in terms of bureaucracies in our systems so we couldn't really meet our target as expected, even though we met our target but there were certain communities we couldn't really reach…The other thing is certain things are consumables, soap procurement. We have to wait, all the processes have to be done in Obuasi, you take an invoice there it will take a long time. It's a requirement that once you spray, on weekly basis the spray operators should be washing their uniforms that is why we provide them with two pairs per season so that they can be washing them and be changing them because of the contamination of insecticides. But sometimes you see them operating for a whole month and soap will not be coming; last season like this we ended the season before the soap came. To me, if the clearance was given for the regional staff to do the procurement they could even do that ahead of time" [AGA Mal official 2].

#### *4.4.4.12 Perceptions about insecticides used for ITN treatment and IRS*

AGA Mal officials believed that the negative perceptions held by householders about the odour of insecticides used was a primary challenge to spraying. In their view, this perception related to a previous insecticide that has since been changed to address householders' concerns about the odour, yet such negative perceptions seemed to persist.

> "Some people have some preconceived mind set about it. It has to do with the previous insecticide we were using so they heard from others that the scent is not good or this and that. So not that they have experienced it but their mind have been tuned to think that way that the insecticides are not good or the programme is not good" [AGA Mal official 5].

In addition, some AGA Mal officials reported that the perceived infectiveness of current IRS insecticides was among the causes of refusals. In their view, there was a general preference for the insecticides that were used in previous spraying.

> "Considering the number of chemicals that we have used, people prefer the initial one, the Vecto-Guard that had the pungent smell people prefer that to any other chemical. One even though the scent was bad and so repulsive, people still enjoy that because that one was repelling the mosquitoes. But what they like most is the Pro-guard because of its efficacy, that is the immediate effect because when Pro-guard is used, cockroaches, lizards, rats, even reptiles like snake die instantly, and even houseflies, they die instantly so people prefer that [insecticide] to any other chemical used. The recent one we used, this actellic 300 CS, well, there have been a lot of complaints even by AGA Mal staff because you spray it and two days afterwards, you hear the

> noise of mosquitoes and you feel that it was a waste of time to even allow it to be sprayed in your room. So, the recent insecticide is not effective; it's not, absolutely so!" [AGA Mal official 7].

AGA Mal operators also suggested that the odour of IRS insecticides was a cause of some refusals. In one provider's view, the unique characteristics of various insecticides that have been used by AGA Mal were well known by householders, and such knowledge may have been responsible for the lingering perceptions about the relative ineffectiveness of the current insecticides.

> "Others too just because of the odour of the insecticides they just say they won't spray" [AGA Mal spray operator 8; DBI FGD].

> "Some too due to the odour some will even say that they have mosquito coils and so they won't spray" [AGA Mal spray operator 7; Wa Municipal FGD].

> "We were using some and they know it very well. In 2012, we were using one we call vector guard, and that one I can say 60% of the beneficiaries were denying it because of the scent of it. In 2013, we moved to another one call Pro-Guard and they are taking note of all the insecticides we have been using, but this one they liked it because it was odourless, it was like quick action. The moment you start spraying you see flies and other insects dying instantly and they liked it very well. And that insecticide cost us a lot, because we are facing problems now because of that insecticides. Due to the immediate action that it was having, now the insecticides we are using we are facing another problem with the householders. They're saying that it's not working" [AGA Mal spray operator 1; Wa Municipal FGD].

#### *4.4.4.13 Negative impact of sociocultural factors*

Cultural activities, especially funerals, were reported by several officials to affect IRS operations significantly because of the communal way of life of the people. There is a tradition of mass funeral attendance and where IRS activities coincided with funerals, there was often the need to postpone spraying or education activities.

> "Here the communism is very high where people always want to solidarize and sympathize with people when they are in some situations so they wouldn't even leave that tradition because they say that once it affects somebody it affects you so for that matter when there is a funeral in a particular place, like Nadowli, you see that all the people in other sections will move to the funeral grounds, they need to go and mourn with the people. So, if there is a durbar or spraying at the same time that the funeral is going on you will not get the people spray or talk to them, unless you postpone your spraying or the durbar to a different date when there is no funeral activity" [AGA Mal official 8].

AGA Mal officials also reported that IRS operations in predominantly Muslim communities could result in the non-spraying of a house because of the absence of the family head or husband to give consent for spraying.

> "Some of them too its cultural; when the man is not in the house or may have travelled to the south and not in the house, unless the woman gets the consent of the husband, she will not allow our spray men to spray their rooms. This does not cut across board but there are issues mostly governed by religious affiliation, like in some Muslim communities like Wa here the Wa Municipality, when the man is not there, their wives are reluctant in allowing us to spray. If the head of the household is not there to authorize it, then the woman will not allow us to spray" [AGA Mal official 7].

A few AGA Mal officials believed a perceived invasion of privacy on the part of householders, and their fears and suspicions about any potential ulterior motives on of AGA Mal spray operators, affected the spray exercise.

> "Others also even think that their privacy can be intruded into, and some feel that with the trend of time in society, some people think that the staff are even spies who will come in to spy out their belongings and condone with criminals to come in, we feel, or sometimes we hear things of this sort in the community, and that unfortunately are hindering the effectiveness of the work" [AGA mal official 6].

Some AGA Mal spray operators also mentioned that secrecy about possessions or fear of theft was possibly responsible for some refusals in the communities.

> "It's not easy to see somebody new, like you go into the community and the fellow has never seen you, sometimes it's not easy to allow you to go inside his room to spray because he don't know the kind of person you are, maybe you can enter there and pick something from that room or something like that so because of that some people won't want to allow you to spray" [AGA mal spray operator 5; DBI FGD].

Tribal or political considerations were also reported by AGA Mal spray operators as the basis for IRS refusals by some householders. In the spray operators' view, some householders' inability to gain employment with the implementing company (AGA Mal), or the absence of communities' kinsmen from the spray team led to refusals in some communities. It was also reported that the interplay of inter-ethnic relationships could result in the ethnic background of a spray operator being interpreted in a particular social context, leading to refusal of IRS.

> "When you go to Nakore they refuse you because they don't have a native among us. Because they don't have their Son among you, they feel that the thing is beneficial and they've seen other community members there. Their thought is that how did they recruit these people, is it by tribal consideration or what is the process? No matter how you explain to the Nakore people they will never believe you. It's not only in Nakore, but it is part of their reason and that is due to political considerations. Others assume that maybe they have seen some particular group of people among you and they are affiliated to this particular political party and they just conclude that this party is doing this thing

> so because of that I don't like it and I will not spray my room. Others are saying that your leader is this type of political party member and because of that I will not spray. And the other thing is tribal considerations, some people when you move to their community they ask you which community are you from? The moment you tell them, you may look inferior before them so they will not allow you to enter" [AGA Mal spray operator 1; Wa Municipal FGD].

#### *4.4.4.14 Socio-economic status variations in IRS acceptance*

According to AGA Mal officials, IRS acceptance varied with socio-economic status, with those of high socio-economic status being more likely to accept IRS. Education, well known to be a key covariate of socio-economic status, was reported to be very significant for acceptance.

> "You know back here in Wa, it is the educated and literate ones, the people of high standing, so they understand the work, they keep calling and calling, following up, coming on their motorbike, in their cars for you to come and spray. But those that are not that enlightened they will be telling you stories and they will be giving you problems so education is very very important" [AGA Mal official 6].

However, IRS acceptance by health workers, especially nurses, was reported by AGA Mal officials to be very problematic. Although some health directors were reported to be very receptive of IRS, their nursing staff and other health workers reportedly refused it.

> "Consistently, over the past few years, the biggest hurdle to IRS are GHS personnel, the nurses, in particular, they will not allow our spray men to spray their rooms let alone them to encourage patients who come to hospital to allow AGA Mal to come in and spray their room. They are almost victimizing our spray men, and I think all of that run through to the top, the people at the top may pretend that they are accepting us, but in actual fact after we leave their premises, they don't encourage their co-workers to allow our spray men to come in and spray… However, the health workers have refused our spray men by almost 80% so I don't know where the problem is but when you have a district health director who is pro-IRS but the district health workers have not been accepting our spray men then there is a big challenge" [AGA Mal official 7].

AGA Mal spray operators reported that the less educated people often did spray their rooms as a result of witnessing their relatively educated neighbours accepting IRS.

> "Mostly, those who are not educated, normally they don't understand what we coming in to do, they try to reject us. Unless there is a literate among them who will first allow us to go into his room to spray, when that is done they will then realize that it is not harmful so they open their rooms for us to spray" [AGA Mal spray operator 2; Wa Municipal FGD].

However, AGA Mal spray operators reported that most young nurses refused spraying despite being literate.

> "Sometimes the literates' behaviour is even worse than the illiterates, especially, the young young nurses, they prove difficult, especially the ladies" [AGA Mal spray operator 1; Wa Municipal FGD].

#### *4.4.4.15 Unavailability of householder for IRS activities*

Many spray operators reported that householders were not readily available when the spray operators arrived in the community for spraying. This was reportedly because of householders' early departure for work or that the owner of the house was not resident in the community (e.g., wealthy families building houses in their native community). This result in what was referred to as lock-outs in IRS parlance, as illustrated below.

> "You will get to a stand and before you get there almost 80% or 50% of the members have left for work. In that case, it causes a lot of lockouts. Maybe if you are supposed to spray a stand of 20 structures and 50% have left then you spray 10 structures" [AGA Mal spray operator 1; Wa Municipal FGD].

> "You know, some people maybe he is living in Wa or Accra then he will come and build his house in Kaleo so when we are spraying Kaleo and maybe he has nobody to go and open that stand for us to spray it means after spraying that stand will be left" [AGA Mal spray operator 5; DBI FGD].

Other AGA Mal spray operators, however, attributed some instances of householders' unavailability to a deliberate attempt to avoid IRS.

> "Some of the reasons is that some people lackadaisically decide not to be there when you come to the community. So, when you get there and meet an empty room, the next day you come they are not there, so when you cover 90% or 95% of the community you can't go there because of some two stands or three stands" [AGA Mal provider 8; DBI FGD].

For a few AGA Mal spray operators, the unavailability of householders was largely because of the time that spray men departed for the community which was not suitable for urban workers, and thus presented acceptability challenges in urban areas. For those spray operators, even when they arrived early enough to meet the householder, the householder may still be unable to spray because of the packing, preparations and time required to get rooms sprayed. This was reportedly common in residential areas where most residents go to work on weekdays.

> "One other factor is our timing, the time we leave for the field. Sometimes you get to the household and they are already prepared to leave for work so they wouldn't have the time to wait for you to spray before they leave. They always

> want to go, especially, the week days; that is when we are within town (urban area). For the villages we don't normally encounter this but within town, especially, an area like SSNIT bungalow, if you don't go there on weekends, on any weekday you go there you cannot get any single house to spray. Unless weekends when they are home and they are not leaving they will allow you to spray. Any time you go there on a weekday and the person is preparing to leave for work surely he will not let you spray because he has to arrange the room, let you spray, and after he has to rearrange the room again before he leaves" [AGA Mal spray operator 2; Wa Municipal FGD].

AGA Mal officials raised concerns about how funeral activities and work commitments led to the unavailability of householders for IEC sensitization or education.

> "Mostly in this region the people are farmers so they are not around, even if they are not farmers they will still go to work on a daily basis so they may not be readily available to have information disseminated to them" [AGA Mal official 7].

> "And then funerals and other community activities also affect our mobilization. In some communities because of funeral they will not leave, because they believe in the traditions and customs there they cannot leave those activities and join you in your IEC activities" [AGA Mal official 8].

In rural farming communities, seasonal variation in householders' unavailability was found, with acceptability challenges encountered during the rainy season because householders departed early to their farms before the arrival of spray operators. The absence of householders in these instances did not necessarily reflect their refusal of IRS but rather their unavailability.

> "Assuming the community is distant and we don't get there in time, especially, during the farming season. Some people may want to spray as early as they could so that they could still go and meet their daily targets at the farms. So, if you are not able to meet such people it becomes an acceptance problem because we are not able to meet them at home simply because they don't have the time to wait for us" [AGA Mal official 2].

> "Mostly during the farming season mostly we go to meet empty houses, especially, in the Villages" [AGA Mal spray operator 7; DBI FGD].

The effects of householders' unavailability on spraying is compounded by AGA Mal policy that requires all vehicles to be packed by 5pm, negating the possibility of undertaking some education activities at night when householders may be available.

> "The night time activities violate company policy which requires us to pack the vehicles by 5pm yet that is the time that we can get the householders. So, that is probably a challenge" [AGA Mal official 8].

#### *4.4.4.16 Substitution effect affecting acceptance of IRS and ITNs*

In some AGA Mal officials' view, the non-use of ITN after spraying may be caused by inadequate knowledge or information which made householders reluctant to use ITNs after spraying.

> "You know it has to do with the knowledge or the information because when the IRS is done some [householders] think that there is no need for them to use the ITNs again. So, they are reluctant because they think that they are 100% protected" [AGA Mal official 5].

The confusion generated by multiple interventions was also identified by officials of GHS who intimated that the resulting substitution effect may be negatively affecting the acceptability of IRS and ITNs.

> "People may feel a monotony, like, if you are coming to spray then why do I need to use the net again, or if I'm already using a net why do I have to spray again because it is purported to have been serving the same purpose" [GHS official 2].

> "The householders believe that when they spray, mosquitoes no long harbour in their rooms so they don't hang the ITN for the period that they spray. And because the spray spoils the wall too, some people don't allow them to spray because they have the ITNs" [GHS official 1].

The substitution effect was reported by some GHS officials to be predominant in urban settings and associated with enlightened people whereas rural folk were perceived to deem it a privilege to have both IRS and ITNs. This is the notion of one GHS official quoted below.

> "We are in the urban setting; we are within the municipality. Most people are enlightened, especially, within the Wa township so one will say that last week they came and did spraying in my room, and I have bed net so why should I use the bed net again? But at our local communities, they see it to be an incentive for them, an opportunity for me having my room to be sprayed and the same time me having a bed net… So, at our local settings they accept both, it's at the urban setting that someone will say that I have a bed net why should I spray my room, I can afford buying insecticide spray so I won't allow you to spray my room" [GHS official 3].

#### *4.4.4.17 Limited household space affects ITN use*

A few GHS officials reported that ITNs were perceived by householders to take up their limited space, preventing them from freely moving around in their rooms. In their opinion, the limited space usually made it necessary for ITNs to be removed every morning to allow for free movement and use of space, only to be hung again the next night.

> "Looking at the household size of the various families and the nature of houses that we are having in Africa or in Ghana, or specifically in Upper West, the length of the bed nets if you hang it, the net occupies almost half of the room. So, some people always see it to be like an obstacle for them to be able to move freely in their houses or their rooms. So, when you want to hang them some will tell you that you hang the bed net alright, but after sleeping under it, the following morning they will remove it and do their household chores and later when they are about to sleep they will put it on and sleep under it" [GHS official 3].

From the perspective of a few AGA Mal officials, ITN usage involved the confinement of the user to a restricted space all night.

> "They [householders] feel that they have been confined, and you know the general attitude of people is that you should be able to sleep freely without been confined to a restricted space" [AGA Mal official 7].

#### *4.4.4.18 Poorly ventilated housing*

Some AGA Mal officials reported that the limited ventilation in most housing affected the use of ITNs, and that ITNs were perceived to produce heat, thus making them unsuitable for use. The problem of poor ventilation was reportedly compounded during the hot season (mid-February to mid-April).

> "Because of the nature of our rooms, you see a room without a window but they are supposed to hang a bed net. And those who used to complain about bed nets generating heat, their rooms are not well ventilated" [GHS official 3].

> "The first thing that comes to mind is the heat that it produces, especially, during the heat seasons, they say when you lie under the mosquito net it produces a lot of heat, you don't feel comfortable so people don't want to use it" [GHS official 4].

A few AGA Mal officials reported that the discomfort associated with the use of ITNs may be the rationale behind the non-use of ITNs after IRS as illustrated below.

> "Because normally, being in the net, they provide some heat like you don't feel comfortable like being in an open space where you have fresh air entering or circulating in the room… So, I think people see no reason why the room is protected [with IRS spray] then you go and lie under the net" [AGA Mal official 4].

Recommendations from programme staff about how to improve the acceptance and implementation of IRS and ITNs are presented in the next section.

### 4.4.5 Recommendations to improve IRS and ITN implementation

The recommendations of GHS officials (Government agency in charge of healthcare delivery), AGA Mal officials (private implementers of indoor residual spraying) and

AGA Mal spray operators or providers (IRS spray staff) on how to improve acceptability of IRS and ITN are presented in this sub-theme. These include effective stakeholders' partnerships, need to intensify education, need for regular IRS spray, and use of acceptable insecticides for IRS spray.

#### *4.4.5.1 Effective stakeholders' partnerships*

An AGA Mal official suggested that AGA Mal and GHS strengthen their partnership for effective delivery of the intervention on common grounds. The need for AGA Mal to partner with traditional authorities, local government and religious bodies for effective information dissemination was also emphasized.

> "One of things that will help householders accept IRS more than they are doing now is for our partners to play their part that is the Ghana Health Service. And I don't know whether it's their fault or our fault, the partnership is not well integrated. Because partnership, what I understand should be a vision towards a common goal but I sometimes see ourselves standing in one direction and health service is standing in another direction. It speaks volumes when a health worker speaks about a programme and the health implications than always leaving the message for us to be delivering when we don't sometimes have the health expertise as we are so-called… And aside that I think the local authorities are very key in this programme, they need to be integrated into the programme. Especially the chiefs in this part of our country when the chiefs speak it carries a lot of volume but I also realized that we are not integrating them into our programme. In Wa Municipal, I can say the religious bodies should be part of the programme and should be well integrated into the programme" [AGA Mal official 2].

A few AGA Mal spray operators (or providers) suggested that AGA Mal could collaborate with GHS in such a way that GHS could provide ITNs to be distributed by AGA Mal providers during their spray activities.

> "When we go to the field they ask us to take data on the insecticides nets; when we go [to the field] and take data on the nets, the next time we go the householders are always expecting us to distribute nets alongside our spraying because we come to ask them about the number of nets they are having and whether they are using them. I think there could be a collaboration between AGA Mal and GHS so that when they want to distribute nets, they can give the nets to us so that while we give out the nets then we spray alongside" [AGA Mal spray operator 2; Wa Municipal FGD].

#### *4.4.5.2 Intensify public education*

A few AGA Mal officials recommended that education on malaria control be intensified, and they particularly identified the need to use a door-to-door strategy for information dissemination.

> "What to do to make them accept it more is to intensify education" [AGA Mal

official 4].

> "I think door to door is the best way of educating the people to understand the programme very well. That is the most effective way of educating people, going door to door, going to their houses one on one, to talk to them to explain things to them. You educate them and they get to understand the programme very well than giving our posters and brochures without explaining the actual thing that AGA Mal is doing so I think door to door is the most effective way of making the people accept the programme" [AGA Mal official 3].

A few AGA Mal officials believed that intensifying education could help create awareness about malaria interventions but suggested emphasising the combination of IRS and ITNs as complementary interventions.

> "I think there should be more education, because some people although we've been here for about five years yet some people haven't heard about it. But if the information or education was increased like some community forums, even we can have a float just to create awareness, especially, just before the start of the operations. That one will really help because people don't hear about it so that is why they don't spray… We have to educate them and let them know that they have to use both, they complement each other not that they stand alone" [AGA Mal official 5].

Similarly, a few AGA Mal spray operators suggested the need to give householders notification three days ahead of spraying.

> "Something I also want to suggest is like, let's take it that we are spraying Kaleo and maybe we know that tomorrow we will be finishing Kaleo maybe if they could always send information to the next community we will be going maybe three days before we will go there I think that will also help" [AGA Mal spray operator 5; DBI FGD].

#### *4.4.5.3 Use of acceptable insecticides for IRS spray*

A few AGA Mal spray operators suggested the use of an effective yet odourless insecticide for IRS to improve its acceptability.

> "If they can come out with an insecticide which will be free from odour, because most people refuse because of the odour. If they can get insecticide like if they spray but you enter there and you will not know that the place has been sprayed and yet have effect on mosquitoes" [AGA Mal spray operator 9; Wa Municipal FGD].

In this chapter, the findings from the fieldwork have been presented. The findings included householders' perceptions about malaria, their acceptability of vector control interventions, and program implementers' perspectives on the implementation of IRS and ITNs. These will be discussed in the next chapter.

# 5 CHAPTER FIVE: DISCUSSION

## 5.1 Introduction

Despite intensive implementation of IRS and ITNs, interventions that are known to be effective, malaria remains a serious public health issue in the Upper West region of Ghana. This thesis explores the facilitators and barriers to IRS and ITN interventions for malaria control in this region. To understand the programme's enablers and impediments, stakeholder perspectives were sought from four groups of participants, including, householders (programme recipients), GHS officials (government health officials who implemented ITNs), AGA Mal officials (IRS implementers) and AGA Mal spray operators (IRS providers) in the Upper West region.

This study found several factors that enhanced the acceptance and implementation of IRS and ITNs. Communities' understanding about malaria, their perceptions about the effectiveness of IRS and ITNs, and the incidental benefits conferred by these interventions served as facilitators for acceptability. In addition, stakeholders' partnerships, capacity building and education activities facilitated the implementation of IRS and ITNs.

The study also found that householders had several misconceptions about the causes and prevention of malaria that affected their level of acceptability of IRS and ITN interventions. Additionally, several socio-economic, cultural and religious barriers to the acceptance and implementation of IRS and ITNs were uncovered. The perceived poor efficacy of IRS and negative perceptions about the insecticides used for IRS and ITNs served as serious impediments to the acceptance of these interventions. Moreover, the study found a seasonal variation in IRS and ITN acceptance, with most householders unwilling to use ITNs during the dry season. The findings also indicated that householders' combined use of IRS and ITNs was disrupted by what could be termed a 'substitution effect', a situation where the use of ITNs was temporarily stopped by some householders following their acceptance of IRS. Perceived difficulties about IRS including house preparations, a general mistrust of spray operators and misconceptions about IRS intervention had negative effects on IRS acceptance and implementation. Access, partnership challenges and frequent breakdown of spray equipment impeded the implementation of IRS and ITNs.

These findings are discussed further and grouped thematically as facilitators or barriers to malaria control, and particularly to the acceptability of IRS and ITNs. The HBM, realist evaluation framework and social determinants of health are the main

theoretical frameworks used to guide the discussion. Finally, a critical reflection on the strengths and limitations of this study is presented.

## 5.2 Facilitators of malaria control

Several factors were found to facilitate the acceptance and implementation of IRS and ITNs. These included community understanding about malaria and the perceived effectiveness of IRS and ITNs in killing insects and mosquitoes and thus preventing transmission of malaria. The education and mobilization activities provided by the programmes, training and capacity building, and stakeholder partnerships were also factors that enhanced the acceptance and implementation of the programmes. Details of these are discussed below.

### 5.2.1 Community understanding about malaria

Most householders demonstrated their awareness about the role of mosquitoes in malaria transmission. Although they did not specifically name *Anopheles* mosquitoes as the species responsible for malaria transmission, they spoke of mosquito bites as one of the causes of malaria. Most householders perceived malaria as a common disease that had serious socio-economic and clinical consequences. Malaria was perceived to reduce people's ability to work, thereby reducing their incomes and causing poverty and social exclusion. Moreover, the money spent on malaria treatment was perceived by householders in rural communities to be a major burden, especially when patients were referred to district hospitals. Additionally, malaria was perceived to result in hospitalization and death, with children and pregnant women reported to be at greater risk than other age groups.

The HBM was proposed to explain individual preventive behaviour (Redding et al., 2000). In conformity with this, the perceived severity of malaria (Champion & Skinner, 2008; Janz & Becker, 1984) that is, its perceived socio-economic and clinical consequences, would be critical to acceptance of planned preventative interventions, including IRS and ITNs. Householders' awareness that pregnant women and children were more susceptible to malaria and experienced more severe forms of the illness was encouraging because this may enhance the use IRS and ITNs by pregnant women and children under five years old, reducing the risk of malaria infection in these vulnerable populations (Deribew et al., 2010). Although these are critical and important findings that affected the uptake of the targeted interventions in the current study setting, it is worth noting that these are like findings elsewhere. For example, previous studies in Kenya (Dye et al., 2010) and Rwanda (Ingabire et al., 2015) reported householders' awareness about the role of mosquito bites as the cause of

malaria. In Tanzania, Beer et al. (2012) also found a higher perceived susceptibility to malaria infection during the rainy season when mosquitoes were abundant, influencing the use of ITNs. It is, however, worth noting that, unlike the current study which investigated use of both IRS and ITNs, most previously cited studies were limited in scope by exploring the lay perceptions about malaria causation in relation to ITNs only.

Consistent with the HBM, householders' perceptions of higher susceptibility to malaria infection during the rainy season when mosquito densities are highest may trigger their cue to action (Mikhail, 1981), facilitating their acceptance of IRS and ITNs. Similarly, these findings are important because the necessity of understanding what local people know about health threats has been emphasized by sociological and anthropological studies elsewhere. For example, there is evidence of health interventions that have failed because their designs did not consider the local understandings of the disease (Manderson, 1998; McNaughton, Miller & Tsourtos, 2018). These assertions support earlier research findings from elsewhere, acknowledging that to communicate effectively and reduce malaria prevalence, programmes need to understand how the disease is understood by local people (Agyepong, 1992).

Despite householders' awareness of malaria as a threat, other findings were less encouraging. For example, because mosquito densities were perceived to be higher during the rainy season, there was a perceived low susceptibility to malaria during the dry season which had a negative impact on ITN use. These findings are critical to note because while it is necessary to associate high susceptibility with the high density of mosquitoes, it is well understood that even a single infective mosquito bite could lead to malaria transmission (Beier, Killeen & Githure, 1999) causing severe illness especially in vulnerable populations such as pregnant women and children. Additionally, despite the long-standing malaria education programme by AGA Mal and GHS, many householders had misconceptions about the causes of malaria, with mosquitoes only perceived as one of several causes of malaria including exposure to extreme temperatures (heat or cold), dietary factors and dirty surroundings. These findings confirm findings of previous studies. Researchers in Burkina Faso (Okrah et al., 2002), Liberia (Tarr-Attia et al., 2018), and Upper Eastern Ghana (Adongo, Kirkwood & Kendall, 2005) found that participants' misconceptions about the causes of malaria, such as dirty food, exposure to cold or heat, and engaging in heavy manual labour affected the use of ITNs for malaria control. In the current study, exposure to heat was also associated with engaging in work requiring heavy manual labour such as peasant farming and charcoal burning, demonstrating householders' awareness of

long-standing beliefs about the relationship between poverty and malaria (Gallup & Sachs, 2001).

The misconception that exposure to extreme temperatures causes malaria may be rooted in the many interpretations of what constitutes malaria held by people in the Upper West region. The local terminology '*maron*' is used by people in upper western Ghana to refer to influenza, fever and malaria. Ghana is a tropical country with high temperatures, so exposure to cold may increase the susceptibility to influenza, which is also considered '*maron*'. The realist approach (Ogrinc & Batalden, 2009) suggests that pre-existing contextual factors such as disease identification could influence the outcome of interventions. Therefore, the implementation of IRS and ITNs in a context where malaria identification is subsumed under a local terminology for several diseases could determine the success of the interventions. In other words, subsuming different diseases under one local terminology ('*maron*') may affect malaria prevention efforts by obscuring the boundaries between malaria preventive practices and activities aimed at preventing other types of '*maron'*.

In addition, the perceptions that dietary factors (such as the eating of cold food, contaminated food and hunger) and dirty surroundings (such as dirty sleeping places, gutters and discarded tins) cause malaria are in line with the HBM (Redding et al., 2000) because these misconceptions may limit householders' perceived risk of contracting malaria, increasing the likelihood that they may not use IRS and ITNs for the prevention of malaria. As such, it is reasonable to hypothesize that these misconceptions could be part of the reason why some people did not accept IRS. For instance, some householders reported that malaria could be prevented by keeping their food and surroundings clean. The implementation of IRS and ITN interventions in this context is unlikely to produce a favourable outcome in terms of the uptake of these interventions for malaria prevention. Nevertheless, it is worth noting that dirty surroundings such as stagnant water may contribute to the breeding of *Anopheles* mosquitoes, which could contribute to malaria infections (Herrel et al., 2001).

Despite being largely inaccurate, the misconceptions discussed above may have an indirect relationship with malaria causation and hence, facilitate malaria prevention. Abate, Degarege and Erko (2013) argue that misconceptions about the causes of malaria may be attributable to the occurrence of conditions that may be risk factors for malaria infection. For instance, exposure to cold is more likely to occur during the rainy season when malaria transmission is accelerated (Kebede et al., 2005). Dietary factors may be an indication of poor nutrition which increases susceptibility to malaria infection (Ayele, Zewotir & Mwambi, 2012; Teklehaimanot & Mejia, 2008), and poor

environmental hygiene such as bushy surroundings and stagnant water are more likely to occur in the rainy season when mosquito breeding is enhanced. Therefore, these misconceptions may be useful rather than harmful because householders may be willing to take measures that reduce their exposure to these risk factors for malaria infection.

As stated elsewhere in this thesis, the current study setting has received intensive implementation of malaria control interventions including IRS and ITN and other associated educational programmes, but malaria remains a serious public health threat. AGA Mal and the GHS provide the content and implementation of these programmes. Drawing from the realist framework of theorists Pawson & Tilley 1997a, the contexts or pre-existing characteristics of a place, such as the knowledge or awareness of the people about malaria causation, can determine whether an intervention will work. However, the context, content and effectiveness of education that the AGA Mal and GHS provide may be questionable. For example, despite the intensity of malaria education activities emphasising the use of IRS and ITNs for malaria prevention, the current research findings demonstrate that some householders were not able to achieve the benefits offered by accepting the planned interventions. Despite the importance of local knowledge to the acceptance of these interventions, as far as is known no baseline research was conducted to inform the design of the interventions. This could have led to unforeseen challenges with the acceptability of the interventions if householders did not perceive mosquitoes to be responsible for transmitting malaria. Therefore, despite general awareness about the role of mosquito bites in causing malaria, it would be reasonable to expect that for effective impact, those responsible for implementing IRS and ITNs programmes would consider undertaking initial situation analysis including community consultation to know exactly what would work in this setting and to enhance community acceptance of IRS and ITNs.

### 5.2.2 Perceived effectiveness of IRS and ITNs

Some householders perceived IRS to be generally effective in preventing malaria and killing mosquitoes and insects, with some householders accepting IRS primarily because of the unintended benefits of spraying, such as killing flies, cockroaches, spiders, termites etc. Other householders perceived ITNs to be beneficial in preventing mosquito bites, reducing malaria and providing warmth during the rainy and cold seasons. These views were corroborated by AGA Mal spray operators who reported that the incidental benefits of IRS such as killing of flies motivated some householders to spray their rooms. Similarly, a few GHS officials reported that ITNs were used for warmth during the rainy season. These findings are not unique to the

current study because evidence suggests that the perceived benefits of IRS and ITNs are one of the main motivations for acceptability (Abate, Degarege & Erko, 2013; Adongo, Kirkwood & Kendall, 2005; Ingabire et al., 2015; Kaufman et al., 2012; Vundule & Mharakurwa, 1996). A study in Zimbabwe found that about 26% of householders believed that IRS was intended to kill domestic pests such as lice, cockroaches, bedbugs and lizards (Vundule & Mharakurwa, 1996) while in Ethiopia Abate, Degarege and Erko (2013) found that many respondents perceived IRS to be effective in killing mosquitoes and insects, and preventing malaria. Unlike the Zimbabwean study, however, householders in the current study did not perceive the killing of insects as the main purpose of IRS, although some householders accepted it for this reason. Kaufman et al. (2012) also found that IRS was perceived to be efficacious in killing mosquitoes and preventing malaria. A similar study in Rwanda found that IRS and ITNs were effective in preventing mosquito bites and reducing the incidence of malaria (Ingabire et al., 2015). The findings in the current study shows that the incidental benefits of IRS and ITNs were the primary reasons why some householders accepted the interventions.

The HBM was developed to provide explanations for health preventative behaviours. It states that individuals' likelihood of acting is subject to their beliefs relating to key factors including the perceived benefits of intervention, referring to a person's beliefs about the usefulness of taking an action towards the prevention of a disease or towards dealing with an illness (Janz & Becker, 1984). The current study findings indicate that the perceived benefits of IRS were among the factors promoting IRS acceptability. In addition, the perceived benefits of ITNs in the prevention of mosquito bites especially at night seemed to influence their use. However, further findings suggest that such perceived benefits did not always lead to the acceptance of spray and the use ITNs, because even though householders were aware of the benefits, some of them used ITNs inconsistently or not at all, especially during the hot season.

The fact that some householders accepted IRS primarily for incidental or unintended benefits rather than malaria prevention has major implications for malaria control and may pose a long-term challenge to the sustainability of IRS acceptability. The expectation that IRS would kill insects led to widespread community rejection of spraying in Zimbabwe in the 1980s after the insects developed resistance to spraying (Vundule & Mharakurwa, 1996). This implies that when affordable insecticides are no longer effective in killing insects and conferring these incidental benefits, IRS in the Upper West region may encounter similar acceptability challenges. Nevertheless, the fact that householders were aware of the benefits of IRS and ITNs is encouraging. It shows that the education campaigns run by the GHS and AGA Mal may have

achieved some desirable effects in terms of increasing community awareness. This awareness could facilitate the acceptance of IRS and ITNs because, in the public health literature, awareness has been found to be associated with preventative behaviours (Borland, Hill & Noy, 1990). Therefore, it is reasonable to postulate that such levels of awareness among householders in the Upper West region provide a foothold for policy makers, AGA Mal and the GHS to build on.

Despite the general perception among householders that IRS and ITNs were effective in killing mosquitoes and insects, many householders perceived current spray insecticides to be ineffective in killing mosquitoes and insects. Similarly, AGA Mal officials and spray operators concurred that there was a general preference for insecticides used previously for IRS because of their immediate impact on insects such as cockroaches, lizards. These findings are important because perceived inefficacy of insecticide was reported as a barrier to acceptability by studies in Tanzania and Thailand (Hongvivatana, Leerapan & Smithisampan, 1982; Kaufman et al., 2012). However, unlike these studies in which householders attributed the perceived ineffectiveness of spraying to the over-dilution of spray insecticides, household participants in the current study mainly attributed the perceived ineffectiveness to the use of different insecticides. The realist evaluation framework places emphasis on "what works for whom and in what circumstances" (Pawson & Tilley, 1997b, p. 213). This implies that while IRS may be intended by AGA Mal officials to control malaria, for householders it may only be perceived as effective if it kills mosquitoes and other insects. In that regard, the spray insecticide currently in use did not work for householders for whom the death of mosquitoes and insects may be more important than malaria prevention. Therefore, the perceived ineffectiveness of current spray insecticides in killing mosquitoes and insects is a barrier to spray acceptance.

The tendency for householders to compare recent spray insecticides unfavourably with those used previously may have developed because of the resistance management strategy being implemented by AGA Mal. To manage resistance, four different types of insecticides, Vecto-Guard, Pro-Guard, Actellic 50 EC and Actellic 300 CS have been used for IRS sprays in the Upper West region of Ghana since spraying began in 2012. The changes were made to prevent the prolonged exposure of mosquitoes to one insecticide, a situation that could facilitate the development of resistance to spray insecticides (Abilio et al., 2011; Djègbè et al., 2011; Rafatjah, 1971). However, these resistance management strategies may have been implemented without adequate consultation and involvement of community leaders and householders, as advocated by the Ottawa Charter for health promotion (World

Health Organization, 1986). Thus, the non-involvement of communities in the implementation of these resistance management strategies may have resulted in householders' concerns about the inefficacy of recent spraying. Therefore, it may be reasonable to argue that active stakeholder engagement is required in decision-making relating to the implementation of insecticide resistance management strategies. An evaluation of the impact of IRS on malaria morbidity and mortality in the Upper West region may have been helpful in dispelling householders' perceptions about the inefficacy of spraying**.** However, there has been no comprehensive evaluation of the effectiveness of IRS on malaria morbidity in the region after several years of implementation, despite AGA Mal having a monitoring and evaluation department. One published study by Sarpong et al. (2015) indicated a reduction in parasite prevalence among school children but this does not amount to an evaluation of the overall impact of IRS. Evidence of the effectiveness of IRS may also be useful for education activities aimed at enhancing community acceptability.

### 5.2.3 Education and mobilization activities about IRS and ITNs

Education activities were found to be a facilitator of IRS and ITN implementation and acceptance. AGA Mal officials reported that public education activities on malaria prevention were undertaken using several strategies to promote the acceptance of IRS. Similarly, spray operators reported that education activities on the benefits of IRS was undertaken during their interactions with householders on spray days. These education activities were confirmed by householders, who especially identified the education activities usually undertaken a day before spray day (pre-spray education) as facilitators of acceptance. These findings are important because the implementation of an intervention that requires the entry of personnel into beneficiaries' rooms will not only require intensive education but also good community engagement, to enhance householders' readiness for spraying on scheduled spray days. The findings lend credence to previous studies that reported education activities as crucial facilitators of IRS acceptance (Kaufman et al., 2012; Munguambe et al., 2011). In Tanzania (Kaufman et al., 2012) and Mozambique (Munguambe et al., 2011), information dissemination about IRS by community leaders was reported to have enhanced community acceptance of spraying. However, unlike the Tanzanian and Mozambique studies where community leaders seemed to be the primary disseminators of information, the current study found that information dissemination about IRS was much more co-ordinated, with volunteers providing pre-spray notifications and spray operators educating householders by talking to them about malaria and the benefits of IRS during their interactions in the course of spraying. This implies that IRS implementation in the current study setting has a much stronger

education strategy.

These findings are in accordance with the HBM (Champion & Skinner, 2008) because malaria education activities play an important role in triggering householders' cues to action, facilitating their acceptance of IRS. This is because such education activities create awareness in householders about the day spraying is scheduled in each community just ahead of the spray day, thereby reminding householders to be ready for it. The realist evaluation approach holds that the mechanisms of interventions are critical to the outcome (Ogrinc & Batalden, 2009). The findings in this study show that mechanisms or processes of IRS implementation such as education activities, including education about malaria and IRS, which are mostly undertaken in the local languages are very significant to whether IRS intervention will work. Kreuter and McClure (2004) advocate for the adoption of culturally appropriate strategies for health promotion by undertaking health education through local languages to make them more accessible. Thus, conducting education activities in local languages addresses important contextual issues such as language barriers, enhancing public understanding of the education messages, and facilitating the implementation of IRS.

Furthermore, GHS officials reported that householders were educated on how to properly hang and use their ITNs. This was corroborated by a few householders who reported that education on the use of ITNs for malaria prevention was being undertaken by health officials, facilitating their use of ITNs. This finding is important because the living arrangements of households were reported in earlier research to constrain the hanging of ITNs (Galvin et al., 2011). The typical extended family living arrangements in the current study setting (Ghana Statistical Service, 2014a) meant that sleeping arrangements varied for individual household members, hence the importance of education on how to hang ITNs. For instance, the best way to hang ITNs for people sleeping on beds may be different to the way they are hung for those sleeping on mats or mattresses on the floor. The implementation of an intervention in a context where there are different sleeping arrangements for householders in different socio-economic circumstances requires that programme implementers consider the impact of such contextual factors on the outcome of the intervention (Ogrinc & Batalden, 2009). By teaching householders how to hang their ITNs, GHS officials are taking into consideration contextual issues such as the different sleeping places or sleeping materials of householders and how these could influence the outcome of ITNs. Thus, education on ITN use may have a positive impact on the use of ITNs by householders. The proper method of hanging ITNs ensures that mosquitoes are unable to get into the nets to bite householders during their sleep, thereby reducing malaria transmission.

Despite the importance of education to the successful implementation of IRS and ITNs, a lack of information or prior notification about spray schedules was found to be one of the main reasons why many householders could not spray their rooms in the spray season immediately preceding this study. Many householders whose houses were not sprayed reported that although they were willing to accept spraying, the lack of prior notice resulted in their unpreparedness or absence on the spray day. Some householders attributed the lack of information to the fact that a house-to-house pre-spray notification strategy was no longer undertaken while others attributed this to the use of only one volunteer from one section of larger communities to provide spray notices to the entire community. These findings suggest that the education activities about IRS were inadequate, and this has serious implications for IRS acceptance. Similar findings have been documented by researchers elsewhere (Kaufman et al., 2012; Montgomery, Munguambe & Pool, 2010; Munguambe et al., 2011). The lack of prior information about spray schedules was found to have affected some householders' initial acceptance of IRS (Kaufman et al., 2012) and resulted in other householders being unavailable to accept spraying (Montgomery, Munguambe & Pool, 2010). A similar study reported that the provision of little or no notice of spraying led to spray refusal by householders (Munguambe et al., 2011). The current study's findings are more elaborate, giving additional evidence about how contextual factors and the mechanisms of spraying affect spray notifications and the outcome of spraying, as discussed above.

AGA Mal spray operators reported that pre-spray notification by AGA Mal education personnel is sometimes only conducted along the major roads especially in poorly planned communities, thereby excluding householders in the inner parts of communities and affecting spray outcomes. These findings are in line with the realist evaluation framework (Pedersen & Rieper, 2008) because spray mechanisms or processes including the provision of spray notification to all householders, including those in the inner and peripheral parts of communities, is essential in determining whether the spray intervention will work. Contextual issues such as the implementation of IRS in poorly planned communities could influence the outcome of spraying because AGA Mal education personnel may be unable to provide adequate information to all householders. The implementation of IRS in poorly planned communities without considering the specific challenges they pose could lead to different and potentially negative outcomes. Therefore, adequate provision of spray information to householders in poorly planned communities may be required to facilitate the acceptance and implementation of IRS.

Further, a few AGA Mal officials acknowledged that the provision of pre-spray

notification was challenging because of difficulties in planning spray schedules. For most of them, the lack of accurate data on housing facilities and the reliance on projected number of houses during planning made it challenging to provide spray information to householders. This finding is consistent with the realist evaluation framework (Ogrinc & Batalden, 2009) because the processes or mechanisms of IRS including the planning of spray schedules and the provision of spray notices to communities scheduled for spraying are critical to the outcome of the intervention. The reliance on projections rather than on accurate housing data was reported to result in situations where the actual number of houses was higher or lower than the projected number. This could affect the provision of spray notice to householders and influence the outcome of spraying. Implementation of IRS in a context where there is no accurate data about the number of housing facilities could influence the outcome of spraying. Therefore, the Department of Planning, Works and Housing may need to compile current and accurate data on all housing facilities in the Upper West region. This could enhance the planning of spray schedules and facilitate the implementation of IRS.

### 5.2.4 Training and capacity building

AGA Mal officials reported that annual or seasonal training and monthly refresher training was conducted for spray operators to equip them with skills on how to conduct spraying on walls and to develop their communication skills. Similarly, a few spray operators reported that the last days of the week-long seasonal training and two-day monthly training are devoted to developing their skills in communication and spray data collection. These training programmes have a positive impact on the outcome of IRS and confirm previous studies that have shown the importance of spray operators' skills in facilitating IRS implementation (Hongvivatana, Leerapan & Smithisampan, 1982; Munguambe et al., 2011). In Mozambique, Munguambe et al. (2011) found that a ten-day military-style training was conducted with a focus on the physical and technical aspects of spraying instead of the theoretical aspects of IRS. This programme in Mozambique is similar to the spray skills training reported in the current study, although AGA Mal only provide a one-week training course. A similar study in Thailand reported that spray operators received only ninety minutes of training (Hongvivatana, Leerapan & Smithisampan, 1982), a period that is too short compared with the one week of training provided by AGA Mal. Besides the technical training on how to spray walls, the current study's finding that communication skills, and data collection were all considered important aspects of training appears to be unique. Therefore, it may be argued that training programmes for spray operators in the Upper West region are more holistic and equip spray operators with various skill sets

necessary to enhance the implementation of IRS.

The findings are in accordance with the realist evaluation framework (Hunt & Sridharan, 2010) because mechanisms such as the skills of spray operators in conducting spraying on walls, their communication skills in interacting with householders and data collection skills are crucial in determining whether an intervention will work. This shows that mechanisms such as training programmes intended to develop spray operators' skills are crucial to the outcome of IRS and therefore facilitate IRS implementation. Indeed, the importance of communication skills for successful community health work has been highlighted by research on community health workers. Haq and Hafeez (2009) noted that community health workers needed to be culturally sensitive and capable of developing rapport with communities. This means that the development of spray operators' communication skills can enhance their ability to build rapport with communities. However, training programmes need to incorporate contextual factors such as the culture of the people to enable the spray operators to exhibit a sense of respect for the cultural values of communities in a way that facilitates the implementation of IRS as a primary healthcare intervention. This is commensurate with the realist evaluation perspective and would influence the outcome of IRS.

AGA Mal officials reported that compulsory daily safety briefings were held to address spray operators' field concerns such as how to manage refusals under certain circumstances, and to ensure their continued adherence to standard operational procedures. The briefings therefore enhanced the safety of spray operators, householders and the environment. This finding is important because the safety briefings constitute an important aspect of the mechanisms of IRS, which are necessary for a favourable outcome of spraying, as propounded by the realist evaluation framework approach (Pawson & Tilley, 1997b). Safety briefings serve as the mechanism that provided a platform for spray operators to share their field experiences such as spray refusals, and to discuss with AGA Mal officials about how to manage refusals so to enable the spray operators to convince householders to accept spraying. The sharing of spray operators' field experiences implies that specific contextual factors that may have affected spraying activities will be discussed with officials, thereby addressing specific contextual issues affecting the implementation of IRS. Furthermore, the ethics of public health require the avoidance, prevention and removal of harm to the public or citizenry (Childress et al., 2002) in the implementation of health interventions, hence, safety briefings enhance AGA Mal employees' adherence to public health principles.

### 5.2.5 Stakeholder engagement in the implementation of IRS & ITN

The engagement and collaboration of several stakeholders were reported as important facilitators of the implementation of IRS and ITNs interventions. AGA Mal officials reported that the scale-up of IRS to new districts was usually preceded by community entry activities during which key stakeholders such as GHS officials, chiefs and other opinion leaders were consulted or informed and their support sought for the implementation of IRS. AGA Mal officials also reported that review meetings with stakeholders were regularly organized to facilitate the sharing of information and ideas relating to malaria control through the use of IRS and ITNs.

These findings are in accordance with the realist evaluation framewok approach promulgated by Pawson and Tilley (1997b). The processes of IRS implementation are very important because the engagement of, and contribution from, these key stakeholders are critical to the outcome of IRS and ITNs, especially given that the two interventions were implemented by different organizations. However, the current study is not the only research to have reported stakeholder engagement as a facilitator of IRS acceptance and implementation. In Kenya, IRS implementers reportedly engaged community leaders to facilitate the implementation of IRS (Kaufman et al., 2012). However, unlike the current study which found involvement of community leaders, community members (as volunteers or spray operators), GHS and local government officials as partners, the Kenyan intervention reportedly involved community leaders only. Therefore, the model of community engagment being implementeed by AGA Mal may be worthy of emulation by other malaria control programmes.

The engagement of these stakeholders demonstrates AGA Mal's acceptance of community participation, which is one of the key components of the Alma Ata and Jakarta Declarations and the Ottawa Charter for health promotion. These emphasize the need for individuals and communities to be empowered to take part in the planning and implementation of health interventions (World Health Organization, 1978, 1986, 1997). By involving communities and GHS officials, partnerships were fostered between stakeholders in malaria control, as advocated by the Jakarta Declaration on Health Promotion into the 21st Century (World Health Organization, 1997). Arnstein's ladder of citizen participation regards power distribution as an essential element of meaningful participation, wherein partnership is considered to be one of three degrees of citizen power (Arnstein, 1969; Connor, 1988). Thus, these partnerships foster stakeholder empowerment and ownership of IRS and ITNs, facilitating the implementation of these interventions. A consolidation of these collaborations may help maximize the benefits in terms of facilitating implementation of IRS and ITNs in

the Upper West region. This is also commensurate with a realist perspective in that it is likely to shed light on the social context that can often underly the acceptability of interventions (Ogrinc & Batalden, 2009).

Despite the important role played by stakeholder engagement and partnerships in the implementation of IRS and ITNs, a few AGA Mal officials expressed reservations about the policy that prohibited the provision of some form of motivation (financial or in kind) to partners, especially GHS officials and chiefs. This was reported to present some difficulties in partnerships, especially in an era when such partners had become accustomed to motivations from most non-governmental organizations. This implies that the contexts (Pawson & Tilley, 1997b) into which interventions are introduced, such as the prevailing norms and practices where NGOs regularly provide incentives to partners, could be very important in determining the outcome of the intervention. Some authors contend that the provision of incentives for collaborative partners may be a reinforcer that could directly influence the behaviour, commitment and motivations of groups or partners towards the achievement of certain goals (Bresnen & Marshall, 2000). Consequently, AGA Mal's policy that prohibits the provision of incentives to other stakeholders and partners could have detrimental effect on the outcome of spraying.

However, it has also been argued that individual differences make the provision of incentives to individuals and partners problematic. Recent motivation theories have pointed out the subjective nature of individual preferences and the effect of this on the values placed by different individuals on the same incentive (Bresnen & Marshall, 2000). For instance, socio-economic differences may lead to large variations in individual commitment and motivation that are inspired by incentives. Nevertheless, given the norm regarding the provision of incentives in the current study's context, it may be appropriate to provide a standardized incentive package to each category of stakeholder or partner. This could help elicit greater commitment and support from partners for the implementation of IRS, and in turn facilitate the implementation of ITNs with the support of AGA Mal personnel in the short to medium term.

AGA Mal officials reported that almost 80% of health workers refused IRS, which is an indication of partnership difficulties. Similarly, AGA Mal spray operators reported that spray refusals by young nurses in the communities is commonplace. Similar findings were reported in a study in Mozambique where the refusal of spraying by community leaders (who were also partners) was one of the barriers to the acceptability of spraying (Munguambe et al., 2011). This is contrary to the current study in which the partners involved in IRS refusal were health workers and not

community leaders. However, the refusal of spraying by health workers or community leaders could be damaging to the implementation of IRS because refusal by these key stakeholders may create a negative impression about the interventions being implemented. This is because AGA Mal employees and nurses may be perceived by communities as government employees or health workers, hence the refusal of spraying by nurses may be perceived by the public as health workers rejecting the very interventions they are supposed to be implementing. Therefore, there is the need for AGA Mal and GHS to strengthen their partnerships and address any potential concerns of health workers to ensure the acceptance of spraying by all health workers including nurses. This could constitute another form of advocacy that will encourage other people in the communities to accept spraying.

Some AGA Mal officials at the district level reported that the closure of district offices annually during off-spray seasons (July/August to March) negatively affected AGA Mal relationships with their partners and communities at the district level, which is in conformity with the tenets of realist evaluation (Ogrinc & Batalden, 2009). Mechanisms such as the continued availability of AGA Mal officials at district offices for maintaining relations with partners and addressing their concerns are very important to the outcome of IRS. Closing district offices annually may give the impression that AGA Mal has ceased business, affecting the outcome of spraying in the subsequent spray round/season. The temporary closures may imply that community concerns about spraying cannot be readily addressed because of the unavailability of AGA Mal officials. Therefore, during off-seasons it may be necessary for AGA Mal officials at the zonal office to regularly engage stakeholders at the various districts to reassure them of AGA Mal's continued operation at the districts, and to address the concerns of these stakeholders (if any).

## 5.3 Barriers to malaria control

The barriers to the acceptance and implementation of IRS and ITNs have been classified into individual level, community level and health system barriers. For each of these classifications, several barriers to IRS and ITN acceptance and implementation are discussed below beginning with individual level barriers.

### 5.3.1 Individual level barriers

Individual level barriers to the acceptance and implementation of IRS and ITNs include inadequate number and unaffordability of ITNs, religious barriers to IRS and ITNs, and negative perceptions about insecticides used for IRS and ITNs. Other reasons include IRS refusals because of house preparations required for spraying,

substitution effect of combining IRS and ITNs, and householders' mistrust of IRS spray operators. These barriers are discussed in detail below.

#### *5.3.1.1 Inadequate number and unaffordability of insecticide treated nets*

Most householders in rural communities reported that inadequate numbers of ITNs for household use resulted in sharing by several household members. Given that the free ITN distribution and hang-up campaign in the Upper West region of Ghana was undertaken in 2012–13, this finding is hardly surprising because evidence suggests that ITN coverage levels decline over time after a free distribution campaign (Gonahasa et al., 2018). This is an important finding because evidence shows that shortage of ITNs affects their use. In Rwanda, Ingabire et al. (2015) found that some householders did not have enough ITNs because the distribution of ITNs did not always correspond with the number of beds or sleeping places.

Although householders in the current study did not attribute the shortage of ITNs to how they were distributed during the hang-up campaign, it may be argued that these challenges relate to the ITN distribution strategy adopted by the GHS, especially during the hang-up campaign. This is consistent with the realist evaluation framework (Ogrinc & Batalden, 2009) because the distribution criteria used by the GHS for the distribution of ITNs to householders may have been responsible for the inadequate number of ITNs. The distribution criteria provided for the distribution of one ITN for every two household members (otherwise referred to as universal coverage) during the hang-up campaign in 2012–13, and this may have led to some householders not being provided with enough ITNs because households with odd numbers were not considered. A recent study has highlighted the deficiencies of such distribution strategies (Koenker et al., 2018). For instance, a household of seven was provided with only three ITNs, which does not cater for the seventh person. The ITN distribution criteria also required volunteers to ensure that the number of ITNs distributed to each household did not exceed the number of available sleeping places. Given that sleeping arrangements in the current study setting ranged from beds to mats on floors, and perhaps even in kitchens where several household members slept together, this may have resulted in the distribution of fewer ITNs to households, consequently resulting in sharing by several household members.

A few householders were concerned about the feasibility of sharing ITNs with their partners and/or children because of the challenges with sharing ITNs during relationship disagreements and/or sexual activities, which is commensurate with the realist evaluation framework approach (Pawson & Tilley, 1997b). This means that contextual or pre-existing local issues such as adults sleeping with children or

partners sleeping with children could determine the outcome of interventions. Disagreements between a husband and wife may result in their unwillingness to sleep together, and this implies that the available ITN may be used by only one of them. Thus, the implementation of ITNs without due consideration to cultural issues regarding sleeping patterns of households could determine the uptake of ITNs, because such issues could prevent householders from sharing or in extreme cases, not using nets. Hence, the design of future ITN distribution campaigns may need to consider cultural issues relating to the sleeping patterns of householders because some partners may prefer to sleep separately. Separate ITNs could be provided for children to use as and when their parents deem necessary. These could help address the challenges with ITN sharing within households and promote ITN use.

Moreover, a few householders reported that the current system whereby pregnant women were provided with ITNs at health facilities was unreliable because of out-of-stock issues, which is in consonance with the realist evaluation framework approach (Pedersen & Rieper, 2008). In realist evaluation, intervention mechanisms or processes such as the regular supply of ITNs to health facilities determines the outcome of the intervention. Hence, the lack of a constant supply of ITNs to health facilities results in out-of-stock challenges, affecting the distribution of ITNs to pregnant women when required, and subsequently reducing the use of ITNs. A good supply chain may need to be developed to ensure that health facilities have adequate supply of ITNs for onwards distribution to pregnant women. This will help increase the use of ITNs by pregnant women.

Furthermore, many householders lamented their inability to afford ITNs despite their willingness to use them. This may have been caused by householders' reliance on the private sector to buy ITNs in the face of the inadequate numbers of ITNs supplied in the hang-up campaign. Similar findings were reported in north-western Tanzania, where 61% of respondents identified the cost of ITNs as the reason for not owning one (Mazigo et al,. 2010). However, the use of quantitative methods in this Tanzania study makes it impossible to know whether the unaffordability of ITNs was because of low incomes and poverty, as found in the current study, or because of unduly high prices for ITNs. The inability of some householders to afford ITNs in the current study setting may be because over 70% of the people in upper western Ghana are engaged in small scale, subsistence and rain-fed farming (Ghana Statistical Service, 2014a) and have low incomes. The social determinants of health framework (WHO Commission on Social Determinants of Health, 2008) identifies occupation and low income (or poverty) as social factors which govern individual experiences of health and the distribution of health inequality. Because they work in low income jobs, most

householders in the study setting are likely to be poor with detrimental consequences on their health.

The endemic nature of poverty means that householders who do not have ITNs may be unable to afford them, increasing their susceptibility to malaria infection. Matovu et al. (2009) pointed out that when survival is threatened by poverty, expenses associated with preventive efforts may be relegated to the background in favour of more pressing needs. Sen (1992) further argued that relative income as a determinant of what one could do with what one has, is a crucial factor in accessibility to health care. Peters and colleagues' framework on access to health care expresses the relationship between the price of a service and the ability and willingness of potential users to pay (Peters et al., 2008). Therefore, endemic poverty in the Upper West region is a barrier to householders' access to ITNs because they may be unable and unwilling to spend their low incomes on ITNs, exposing them to mosquito bites and malaria infections. Therefore, malaria prevention interventions such as IRS and ITNs are likely to be more successful if implemented alongside measures aimed at reducing poverty and empowering people.

#### *5.3.1.2 Religious barriers to acceptance of IRS and ITN*

The ownership of '*smaller gods*' in rural communities was found to present an important challenge to IRS acceptability. Householders perceived that the refusal of spraying by some community members was because of their unwillingness to reveal their traditional religious secrets, and a worry that spraying might offend their '*smaller gods*' or drive away the spirits of their 'gods'. Similarly, spray operators expressed worry about the potential (spiritual) dangers of charms and amulets hanging in some household rooms, and the possibility of mistakenly entering forbidden '*spirit rooms*' during spraying. A similar study in Surinam discovered household concerns that spray insecticides could anger, weaken or destroy the spirit of their 'gods' (Barnes & Jenkins, 1972). In Mozambique, spraying was reportedly not allowed in the '*spirit houses*' that belonged to traditional healers because traditional rituals and ceremonies were conducted there (Munguambe et al., 2011). Findings from the current study demonstrate that '*smaller gods*', charms and amulets could be owned by any householder (and not only by traditional healers), exacerbating the impact of religious beliefs on acceptance of IRS in the current study's setting.

In an era of Christian dominance in Africa, African traditional religion persists in secrecy, with most practitioners concealing their faith to avoid embarrassment (Kamara, 2000). In her study on the survival of African traditional religion, De Witte (2005) writes of the tendency of African traditional religion to conceal, as compared

with Christianity which is largely based on revelation, and the struggles of African traditional religion to manifest itself in the public sphere. Thus, the secretive nature of traditional religion makes it difficult for household practitioners to allow spray operators into their rooms to conduct spraying because the '*smaller gods*' are kept in some of the household rooms.

The findings are consistent with the tenets of the realist evaluation framework (Pawson & Tilley, 1997b) because the implementation of IRS in the context of rural communities where householders own '*smaller gods*', charms and amulets may affect the outcome of spraying. In other words, the implementation of IRS without due consideration of potential urban/rural differences in religious beliefs may lead to different outcomes between rural and urban communities. Spray operators' concerns about the potential dangers of charms and amulets could affect the processes or mechanisms of spraying in rural communities. Therefore, measures may need to be instituted to ensure a change in spray outcomes in rural communities. The usual one-day pre-spray notification may not be enough. Providing three days' spray notice in advance to householders in rural communities may allow enough time for householders to relocate their '*smaller gods*' or prepare their '*spirit rooms*' before the scheduled spray day. When this is done, it may help improve acceptance among householders owning '*smaller gods*'.

Moreover, religious beliefs may have an influence on people's perceptions about disease or disease interpretation, which is in line with the HBM (Becker & Janz, 1985). Drawing from this, householders' belief in the protective powers of the '*smaller gods*' could lead to a perceived insusceptibility to malaria infections. This may serve as a barrier to the acceptability of IRS and ITNs. Perhaps inadequate health care facilities and general poor living conditions in rural communities may be responsible for some people's dependency on the supernatural powers of the 'gods' and a tendency to preserve their source of protection. Barnes and Jenkins (1972) argue that the unfriendly nature of rural environments encourages a dependency on the supernatural powers of the '*gods*'. Indeed, poor conditions in rural communities are important social determinants of health (WHO Commission on Social Determinants of Health, 2008) that have an indirect impact on the health of householders, particularly in rural communities. Therefore, interventions aimed at promoting health and preventing malaria may be more successful in rural communities if an integrated approach is adopted to address the broader social determinants of health instead of merely focusing on infection control.

#### *5.3.1.3 Negative perceptions about insecticide used for ITNs and IRS*

This research project found that household concerns about the insecticides used for IRS and ITNs were a barrier to acceptability. A few householders expressed their concern about the side effects associated with the use of ITNs, including skin itching and breathing difficulties which were reportedly more intense when using new ITNs. Similar views were reported by a few GHS officials, blaming the chemicals used for ITN treatment as being responsible for the side effects. It is important to note that these findings are not in isolation. In a randomized control trial of ITNs in western Kenya, Alaii et al. (2003) found that the chemicals used for ITN retreatments were perceived to be smelly and harmful, causing breathing difficulties and flu-like symptoms such as runny noses. Given that Long-Lasting Insecticide Treated Nets (referred to as ITNs in this study) were distributed in the Upper West region, the side effects of insecticides may not constitute a recurring barrier to ITN use in the current study's setting because no regular re-treatments of the LLINs will be required, as was the case with the Kenyan study.

The HBM hypothesises that individuals' acceptance of a preventive behaviour or intervention is mediated by several factors including perceived barriers to the intervention (Davidhizar, 1983). The findings in this PhD research show that the perceived physical side effects associated with ITN use constituted a barrier to their uptake. These findings have implications for malaria control practices. Given that the side effects are more intense following the use of new ITNs, householders may need to be educated on the need to remove these from the package and hang or leave them in the open without using them on the first day. This could help reduce the severity of the side effects. Also, major private outlets that sell ITNs may need to be identified and their personnel trained to provide brief education on the use of new ITNs to purchasers.

Some householders reported that IRS insecticides caused physical side effects, including skin itching and inability to eat or sleep. These findings confirm previous studies (Gobena, Berhane & Worku, 2013; Munguambe et al., 2011). In Ethiopia, Gobena, Berhane and Worku (2013) found that a few of the study respondents refused spraying for fear of the death of their livestock and honey bees. Householders in the current study were more concerned about the side effects of spraying on humans, unlike the Ethiopian study in which the safety of livestock was of primary concern. Nevertheless, these side effects constitute a major barrier to spraying and this could be the cause of IRS refusals by some householders, including some who may have accepted spraying during other spray seasons. This is in line with the HBM (Becker & Janz, 1985) because negative side effects such as skin itching and sleeping

difficulties and the discomfort caused by these reactions serve as barriers to the acceptability of IRS. To prevent or reduce the intensity of these side effects, there may be the need to ensure that spray operators expressly advise householders (after spraying each house) to report to health facilities for treatment if they experience any side effects. This could lead to prompt treatment of any physical side effects of spraying.

Additionally, most householders were concerned about the odour of IRS insecticides, although current insecticides were perceived to have less odour. Similarly, AGA Mal officials and spray operators perceived spray odour as a major challenge to spraying. These findings are consistent with prior evidence which indicated that spray odour often served as a barrier to IRS acceptance (Ingabire et al., 2015; Kaufman et al., 2012). Studies in Rwanda (Ingabire et al., 2015) and Tanzania (Kaufman et al., 2012) reported spray odour as a deterrent to acceptance, although the respondents in Tanzania did not consider spray odour to be a major concern. Evidence from the current study shows that spray odour may have been a major barrier to spray acceptance in the first years of IRS implementation because of the insecticide that was used but was of little concern in recent times.

However, the odour of spray insecticides may have featured prominently because most housing facilities in the study setting have small windows or no windows, trapping the odour of spray insecticides for longer periods because of inadequate ventilation. Sekhon and colleagues argued that the acceptance of health interventions by individuals could be subject to their views prior to, during, and after experiencing the intervention (Sekhon, Cartwright & Francis, 2017). Although most householders who expressed concerns about these side effects sprayed their rooms, their views about spray odour were nevertheless unfavourable, which could affect their future acceptance of spraying. Therefore, the use of odourless insecticides for future spraying could help increase and sustain the acceptability of spraying. A new standard operational procedure requiring spray operators to forewarn householders about the potential negative effects of spray odour on people with asthma prior to spraying may help avert any potentially dire consequences of accidentally spraying the rooms of unsuspecting people with asthma.

Another side effect of IRS insecticide reported in this study were stains or residue left on walls after spraying. A few householders reported that residual stains on sprayed walls were aesthetically unattractive and this may affect the acceptance of spraying. AGA Mal spray operators reported that the spray skills of IRS spray operators were a determinant of whether sprayed walls may be stained. Similar studies in Thailand and

South Africa found that wall stains were perceived by householders as a barrier to spray acceptance (Govere et al., 2000; Hongvivatana, Leerapan & Smithisampan, 1982). In Thailand, wall stains were reported to be of major concern to householders with higher socio-economic status, but this can be understood because householders in this category may be more concerned about their room décor than those in the lower socio-economic spectrum. Not only were these socio-economic differences not found in the current study, but wall stains in general were not a major concern for household participants.

These findings conform with the HBM and the realist evaluation approach (Davidhizar, 1983; Lacouture et al., 2015). This is because the perceived barriers of IRS such as stains and insecticide residues left on sprayed walls affect householders' acceptability of spraying. Spray mechanisms or processes such as the wall spraying skills of spray operators affect the outcome of spraying in line with the realist approach (Lacouture et al., 2015). Some spray operators were not aware that only wall surfaces painted with oil paints required spraying at a faster pace to avoid staining the walls and this may have influenced the quality of their spraying. This could lead to poor quality spraying, staining of the indoor walls of householders' rooms and influence the outcome of spraying. Therefore, to avoid staining walls, it is recommended that more emphasis be given to the underlying concepts of spraying during spray operator training. This could improve the skills of spray operators and ensure that good quality spraying is conducted without staining the walls.

#### *5.3.1.4 IRS refusals because of house preparations required for spraying*

Many householders identified packing as a major barrier to IRS acceptability. Similarly, packing was identified by many AGA Mal officials as a barrier to spraying while AGA Mal spray operators reported that packing was especially a challenge in urban communities because householders owned more possessions than their rural counterparts. Previous studies have reported similar findings, with the removal of furniture being regarded as a challenge to spray acceptance in South Africa (Govere et al., 2000). Similarly, Kaufman et al. (2012) found that a few women refused spraying because of their inability to remove household belongings outside to allow spraying to be conducted. The current study shows that both the difficulty involved in packing and the time required for preparing one's house for spraying were of concern to householders, and this was one reason for spray refusals. These findings conform with the HBM (Redding et al., 2000) because householders' evaluation of the difficulty or inconvenience involved in preparing their houses for spraying, such as packing of their belongings outside for spraying, may constitute a barrier to spraying. This inconvenience may be heightened by the fact that householders are usually required

to stay outside for at least one hour after spraying before packing their belongings back into their rooms, increasing the time required for house preparation and spraying.

The findings are also commensurate with the realist evaluation framework (Hunt & Sridharan, 2010) for which programme mechanisms are integral to the outcome of interventions. Drawing from this, mechanisms or the processes of IRS implementation, such as spray operators needing access to walls in rooms are critical to the outcome of spraying. Consequently, incorrect packing or the inability of householders to pack their belongings as required in urban communities could affect the spraying process or the quality of spraying because spray operators may not have adequate access to walls. This finding has major policy implications. Given the difficulties involved in packing, there may be the need for use of insecticides with a longer period of efficacy so that spraying could be conducted once every two or three years, instead of the current annual spraying. There is also the need for the planning and implementation of health interventions to incorporate householder acceptability in relation to how programme beneficiaries can effectively interact with programme implementers. Such interactions and rapport building could enhance beneficiary experience, and influence the perceived quality of service delivery (Gremler, Gwinner & Brown, 2001; Zomerdijk & Voss, 2010). The recognition of this interplay could enhance implementation and improve the coverage and acceptance of house spraying.

Other spray operators reported that some householders were unwilling to pack because spray operators may not have come to spray their rooms on the scheduled spray day despite them packing their belongings, hence their unwillingness to pack on subsequent days for spraying. This situation may be referred to as the difficulty involved in 'packing and repacking'. Packing and repacking on subsequent days may occur because of poor housing data (Wa Municipal Assembly, 2012) which may not allow for the allocation of specific houses to specific spray operators to ensure the coverage of the entire community. Consequently, some householders may be notified to prepare for spraying, but their houses may not be sprayed on the scheduled spray day, especially in bigger communities that cannot be completely sprayed in one day. Therefore, a stronger collaboration between the AGA Mal personnel responsible for providing spray notifications and IRS teams may help avoid instances where spray operators do not arrive to spray some houses that have been scheduled for spraying. This could motivate householders to accept spraying, and facilitate the implementation of IRS.

Moreover, spray operators reported that even within urban communities, packing was particularly challenging for householders living in government estates or bungalows because such householders usually go to work from Monday to Friday, the period when spraying is normally conducted. This is in line with the realist framework approach because contextual factors such as householders' availability for spraying during the week are critical to the outcome of spraying (Pawson & Tilley, 1997b). Because the circumstances of householders living in government bungalows do not make it possible for them to be available during scheduled spray times, this affects the outcome of spraying in such residential areas. Thus, weekday spraying may work for some householders, especially those working in the private or informal sectors, but it is less likely to work for government employees because of their work commitments. The design of IRS spray schedules on weekdays does not consider the circumstances of formal sector employees who may be working during the scheduled times. For this reason, special weekend spraying could be conducted for people living in government bungalows to enable such householders to have their rooms sprayed.

#### *5.3.1.5 Substitution effect from combining IRS and ITNs*

The findings in this research suggest that there is a substitution effect with ITNs use because most householders suspended their use of ITNs in the immediate aftermath of spraying because of the perceived effectiveness of IRS in killing mosquitoes. This substitution effect presupposes that the acceptability of an intervention is not only determined by the perceived effectiveness of that intervention alone, but also the availability and comparative efficacy of alternative interventions. Similarly, a few GHS officials reported that householders may feel that IRS and ITNs are duplicates. The current study is the only research to have reported such findings because it is the first study to explore householders' views on the combination of IRS and ITNs. However, one study has shown that householders who accepted spraying were less willing to purchase ITNs (Chase et al., 2009) which constitutes another form of substitution, and confirms the findings of this study. It could be argued that this finding may not be adequately interpreted using the HBM as it stands (Becker & Janz, 1985) because the HBM does not consider the impact of available alternatives on the acceptability of interventions. Therefore, there is the need to integrate the concept of substitution effect into the HBM, a modification that may not only expand the scope of the HBM but also increase the practical applicability of the model.

However, these findings are in conformity with the realist evaluation framework (Pedersen & Rieper, 2008). This is because the implementation of ITNs in the current study's setting where IRS is also implemented significantly changes the context of

ITN implementation in comparison with other parts of Ghana, and this could lead to different outcomes in terms of household acceptability. Hence, the combination of IRS and ITN interventions at the same location accounts for this substitution effect and the non-use of ITNs in the aftermath of spraying. Although IRS officials reported that education on the need for householders to combine IRS and ITNs was being undertaken, it is clearly not sufficient because only a few householders acknowledged having heard such education messages. For these reasons, there is the need to intensify public education on the need for householders to use both IRS and ITNs, especially in the aftermath of spraying. This could encourage householders to continue their use of ITNs after spraying their rooms. The temporary nature of the suspension of ITN use by householders found in this research implies that the implementation of both IRS and ITNs in the Upper West region may still be beneficial because universal coverage of ITNs remains a challenge in the region.

#### *5.3.1.6 Householders' mistrust of AGA Mal spray operators*

Some householders refused spray operators entry to their homes to protect their privacy, and this was particularly so where householders' room contents were perceived by the householder to be below an acceptable standard in terms of being poor in quality and/or presented in a disorganized manner. On the contrary, AGA Mal officials reported that spray operators were sometimes perceived as persons with ulterior motives who may either go in to steal householders' possessions during spraying or collaborate with criminal gangs to rob householders. Similar findings have been reported in a few previous studies (Ediau et al., 2013; Hongvivatana, Leerapan & Smithisampan, 1982; Kaufman et al., 2012). A study in Tanzania found that householders were suspicious about the motives of spray operators, while other householders were resistant to spraying for fear of being ridiculed by neighbours for having poor quality possessions (Kaufman et al., 2012). Unlike the Tanzanian study where householders were suspicious of the motives of spray operators, householders in the current study were not suspicious about the motives of spray operators. A feasibility study in Uganda found that breach of privacy and insecurity because of possible interference with household possessions were major concerns raised by householders (Ediau et al., 2013). Another study in Thailand found that the theft of household possessions by spray operators was commonplace, raising suspicions about the actual intent of spraying (Hongvivatana, Leerapan & Smithisampan, 1982). However, insecurity of household possessions as reported in Uganda and Thailand may not be a barrier to IRS implementation in the current study's setting because this was only reported by AGA Mal officials speculating on householders' beliefs as a potential barrier to spraying.

It has been argued that feelings of shame and stigma are fundamental to how the poor respond to social demands on them (Chase & Walker, 2013; Mickelson & Williams, 2008). This shows that the rejection of IRS by some householders in the current study may be intended to save them from the embarrassment of what they perceived as owning poor quality possessions. Perhaps the recruitment of spray operators from within the operational districts may have given householders the impression that the contents of their rooms could be revealed to other members of their community, harming their reputation. Therefore, there is an element here of mistrust of spray operators if they were well-known community members.

Supporting Luhmann's concept of trust (1979), Meyer and Ward (2009) have reiterated the assumption that trust is only necessary when risk is involved. The use of insecticides for spraying makes it necessary for householders to stay outside during spraying and to remain outside for a minimum one hour after spraying to prevent exposure to insecticides, thus adding to the potential of perceived risks of sprayers' dishonesty by householders. Additionally, Marsh and Dibben (2005) have also argued that distrust engenders the need for verification. In the context of IRS, this may only be done by listing all possessions that will be left inside the room during spraying. However, this is unlikely to be a practical solution in the process of spraying because of the time and effort required of householders. In conformity with Luhmann's functional notion of trust, which Meyer and Ward also thought may be useful, spraying may be easily conducted if householders trust spray operators. The benefits of IRS may be fully realized if there is trust between householders and officials, hence there is the need for programme implementers to build rapport with householders. Some scholars contend that the connection, care, and familiarity between personnel and customers in service delivery have a positive relationship with trust (Gremler, Gwinner & Brown, 2001). The use of community-based volunteers and the recruitment of spray operators from operational districts may be enhancing community participation and empowerment. However, IRS implementers may need to recruit respected community members to help foster householder trust.

### 5.3.2 Community level barriers

The community level barriers that were found in this study include cultural barriers to acceptance of IRS and ITNs, non-use of ITNs during the dry season, and community misconceptions about IRS. Details of these barriers are discussed below.

#### *5.3.2.1 Cultural barriers to acceptance of IRS and ITN*

The findings in this study showed that cultural beliefs and practices had a negative impact on malaria transmission and the acceptance of IRS and ITNs. Some

householders from rural communities expressed their concern about how funeral attendance exposed people to mosquito bites despite owning ITNs. Similarly, funeral attendance has been reported by a few previous studies as one of the perceived barriers to ITN use (Alaii et al., 2003; Koenker et al., 2013; Monroe et al., 2015; Monroe et al., 2014; Moshi et al., 2018). Studies in Tanzania and Kenya found that householders were concerned about the impracticality of using ITNs at funeral grounds (Alaii et al., 2003; Koenker et al., 2013). Unlike these Kenyan and Tanzanian studies, the current study suggests that householders were more concerned about how funeral attendance exposed them to mosquito bites and malaria infection and affected their use of ITNs. In Uganda, Monroe et al. (2014) found that funerals and other night-time social activities posed a barrier to ITN use because people who used ITNs at funerals were perceived to be proud. Moshi et al. (2018) also found that unlike other social activities which recorded optimal attendance in the post-harvest period—usually during the dry season when there is less farm work—funeral events could occur at any time. However, a similar study in the current study's setting found that funerals were more frequent during the dry season and attendance was reported to be in the hundreds, starting from the early evening until dawn (Monroe et al., 2015), exposing people to outdoor malaria transmission. However, it is worth mentioning that this PhD research was the first study to find funeral attendance as a barrier to the implementation of IRS, and this is a major contribution to the literature.

This finding is in consonance with the HBM (Redding et al., 2000). This is because the outdoor nature of funerals and the fact that funeral rituals are usually performed during overnight wake-keeping may inhibit householders' cues to action, resulting in the non-use of ITNs by householders. It could, therefore, be argued that householders' conformity to social values such as funeral attendance may be responsible for the persistence of malaria in the Upper West region because of the role of funerals in exposing them to mosquito bites and malaria infections. Thus, cultural practices such as funerals constitute part of the social determinants of health that affect the health of the people of Upper West region, and contribute to the region's high prevalence of malaria (WHO Commission on Social Determinants of Health, 2008).

Given the impact of contexts on the outcome of interventions, as postulated by the realist evaluation framework (Pedersen & Rieper, 2008), contextual factors such as funeral practices and the importance attached to them may influence the uptake of ITNs. In the Upper West region and Ghana more generally, funeral attendance is considered so important that friends and family from far and wide must attend to pay their last respects. Funerals are status-linked events wherein the status of the family

may be estimated by the size and scale of the crowd during a bereavement, thus making funeral attendance mutually reciprocal, largely communal, and increasingly frequent. Therefore, funerals as a contextual factor influence the outcome of ITN use by preventing householders from using ITNs. This situation calls for communities to identify specific enclosed areas where night-time outdoor activities such as funerals could be organized. If this is done, those identified areas could be sprayed with IRS during spray season to provide protection for people during funerals.

Another important finding in this research is that AGA Mal officials reported that funeral events affected IRS because of the unavailability of householders at home when spray operators arrive for spraying, and this is commensurate with the realist evaluation framework (Pawson & Tilley, 1997b). From this standpoint, the mechanisms or processes through which IRS is implemented, such as householders' availability at home, their consent to spraying, and the provision of spray notifications to householders are all critical to the outcome of spraying. Despite the importance of these mechanisms or processes, funeral attendance by householders may mean that householders may not be available at home to receive spray notification or provide their consent for spraying, resulting in the non-spraying of their houses. For these reasons, it is recommended that where IRS in some communities coincides with funeral activities, a mop-up spraying could be organized a few days later in the affected communities instead of the current practice where mop-up sprays are conducted at the end of the spray season. This may enable householders who could not spray their houses to do so, increasing acceptance levels.

#### *5.3.2.2 Non-use of insecticide treated nets (ITNs) in the dry season*

Most householders reported that excessive heat and outdoor sleeping in the dry season were major barriers to use of ITNs during the hot season. Similar sentiments were expressed by some GHS officials who blamed the non-use of ITNs during the hot season on the limited or lack of ventilation in most housing facilities in the region. The perceived heat associated with ITN use has been reported in the literature as a barrier to the use of ITNs (Astatkie, 2010; Chukwuocha et al., 2010; Galvin et al., 2011; Mazigo et al., 2010). Studies in Nigeria found that ITNs were perceived to restrict ventilation (Chukwuocha et al., 2010; Galvin et al., 2011), and that outdoor sleeping in the hot season resulted in the non-use of ITNs (Galvin et al., 2011). A similar study in Tanzania found that heat was the reason for the non-ownership of ITNs given by 4.8% of participants (Mazigo et al., 2010), while another study in Ethiopia found that 6.4% of participants perceived heat as a barrier to ITN use (Astatkie, 2010). This shows that the perceived heat associated with ITNs may not be a significant barrier to ITN use in Ethiopia and Tanzania, as it could be in the current

study's setting.

These findings conform to the principles of the HBM (Mikhail, 1981). The perceived barriers such as excessive heat prevented householders from using ITNs in the dry season, thereby exposing them to malaria infections. The findings further demonstrate the relevance of contextual factors and intervention mechanisms on the outcome of interventions, in line with the realist framework (Ogrinc & Batalden, 2009). This means that the context, or pre-existing characteristics of a locality where interventions are introduced, such as weather, temperature and level of ventilation in housing facilities are important factors that could determine the success or failure of the interventions. Therefore, the excessive heat caused by high temperatures and the resulting outdoor sleeping negatively affect the use of ITNs during the dry season. Also, intervention mechanisms such as the processes involved in tying ITNs for use are important to the outcome of interventions. However, the stand-less nature of the ITNs that are in use means that householders may encounter some difficulties trying to hang or tie their ITNs in open space outdoors for use during outdoor sleeping. These are indications that policy makers may not have considered the possible effects of these factors on ITN use prior to the implementation of the free ITN distribution and hang-up campaign in 2012/2013. Therefore, future ITN distribution campaigns should involve the distribution of stand-embedded ITNs to facilitate the outdoor hanging and utilization of ITNs during outdoor sleeping.

#### *5.3.2.3 Community misconceptions about IRS*

Most householders questioned why spraying was only conducted inside the house and excluded detached toilets, bathrooms, and dirty surroundings such as stagnant water. This finding is similar to the findings of a previous study in Mozambique (Montgomery, Munguambe & Pool, 2010) in which householders questioned why spraying was undertaken inside the house when mosquitoes were found outside in the bushes. Thus, householders in both the current and Mozambique studies were interested in outdoor spraying, though the specific outdoor areas or places they wanted to be sprayed differed. This difference may be because of the differences in context between the current and Mozambique studies' settings. In the current study's setting, most old houses were more likely to be built with detached bathrooms and toilets, possibly leading to householders' concerns about the non-spraying of these toilets and bathrooms.

This finding is in accordance with the realist framework approach (Pawson & Tilley, 1997b) because, for householders, the spraying of detached toilets, bathrooms and dirty surroundings in addition to indoor wall spraying is important for the effectiveness

of IRS in killing mosquitoes. Although IRS in Upper West is usually conducted indoors in compliance with the World Health Organization's (WHO) operational guidelines which excludes structures such as detached toilets and bathrooms that do not have rooftops (World Health Organization, 2013), this may only satisfy IRS officials and not householders for whom outdoor spraying of all toilets, bathrooms, and dirty surroundings constitute an essential part of spraying. Although these misconceptions were not found to contribute to spray refusals, they nevertheless demonstrate householders' misunderstandings about the mode of operation of IRS that may need to be overcome to encourage householders' continued acceptance of spraying. In other words, it shows that some householders may be unaware that IRS interventions are based on the indoor biting behaviour of mosquitoes. Therefore, there is the need for more public education on the mode of operation of IRS. This could enhance public knowledge and understanding about how IRS interventions work to prevent malaria and facilitate their acceptance of spraying.

### 5.3.3 Health system barriers

The health system barriers include mobility challenges affecting spray activities and breakdown of spray equipment, as discussed below.

#### *5.3.3.1 Mobility challenges affecting spray activities*

AGA Mal officials reported that IRS activities in hard-to-reach communities are seriously affected during the rainy season and this is commensurate with the realist evaluation framework (Pawson & Tilley, 1997b). The context, or local features such as bad road networks linking rural and remotely located communities, can make the transportation of spray operators to hard-to-reach communities very challenging during the rainy season and this could determine the outcome of interventions. This is because the transportation challenges could increase travel time, resulting in the late arrival of spray operators for spraying. Because most householders in rural communities engage in peasant farming (Ghana Statistical Service, 2014a), the late arrival of spray operators means that many householders in remote communities may have left home for their farm activities (as they rely on rain-fed farming), and hence be unavailable to accept spraying. When these happen, IRS related education may not be adequately conducted, and spray coverage or outcome may be well below targeted levels.

Phase two of Thaddeus and Maine's three-phase delay framework relates to the physical accessibility challenges that cause delays in reaching health care facilities (Thaddeus & Maine, 1994). The findings in this study indicate that physical accessibility challenges such as bad roads and increased travel time to communities

tend to delay or prevent spray operators from arriving in remote communities early enough to conduct spraying. In the current study, these challenges impede the implementation of house spraying intervention in rural and hard-to-reach communities, rather than householders experiencing these challenges in their bid to access health preventive services. Therefore, these delays may reduce spray coverage in hard-to-reach communities.

Ellis (1998) argues that resource constraints and the need to demonstrate short-term results may lead to the concentration of efforts in easy-to-reach populations at the expense of hard-to-reach communities. In his view, when dealing with hard-to-reach populations, providers often risk over-providing to those who are easiest to reach while at the same time under-providing to those who are difficult to reach. However, the principles of equity and social justice as espoused by the Alma Ata declaration on primary health care require that preventive care be made available to all communities (World Health Organization, 1978). Therefore, measures may be required to facilitate the coverage of remote communities with IRS during the rainy season. IRS spray schedules may need to be designed in such a way that hard-to-reach communities are sprayed in the initial stages of the spray season (April/May) before the rain intensifies. Such a measure could influence the outcome of IRS in hard-to-reach communities and ensure that people in hard-to-reach communities are protected with IRS. The government of Ghana could also improve the condition of roads linking rural communities to urban areas to facilitate the implementation of IRS and empower rural communities.

In addition, many AGA Mal officials reported that a major challenge to spraying was the shortage of vehicles for transporting spray operators to communities. Similarly, spray operators reported that buses were occasionally congested, and that the transportation of spray operators in batches usually resulted in late arrivals in communities when householders may already have left home. Difficulties with physical access to health care have been reported as a challenge to utilization in several previous studies (Arcury et al., 2005; Nemet & Bailey, 2000). However, the access challenges reported in most previous studies relate to the physical transportation difficulties experienced by patients or persons in their bid to reach healthcare facilities, unlike the current findings which relate to the delivery of preventive care (IRS) to communities. In that regard, the current study is the first to report transportation challenges as a barrier to the implementation of IRS, highlighting how seasonal variations affect the outcome of interventions, particularly in remote communities.

These findings are in line with the realist evaluation framework approach (Ogrinc & Batalden, 2009) because the mechanisms of programme implementation such as the transportation of spray operators is an important determinant of the success or failure of the programme. Therefore, the shortage of vehicles and transportation challenges resulting in late arrival in communities have a negative effect on the outcome of spraying and may lead to the non-spraying of some houses. For this reason, measures are required to address the transportation challenges bedevilling the operations of AGA Mal. Additional vehicles may need to be procured to ensure that spray operators are not transported in batches or in congested buses. This could ensure that spray operators safely arrive in communities early enough to conduct spraying when householders may still be at home.

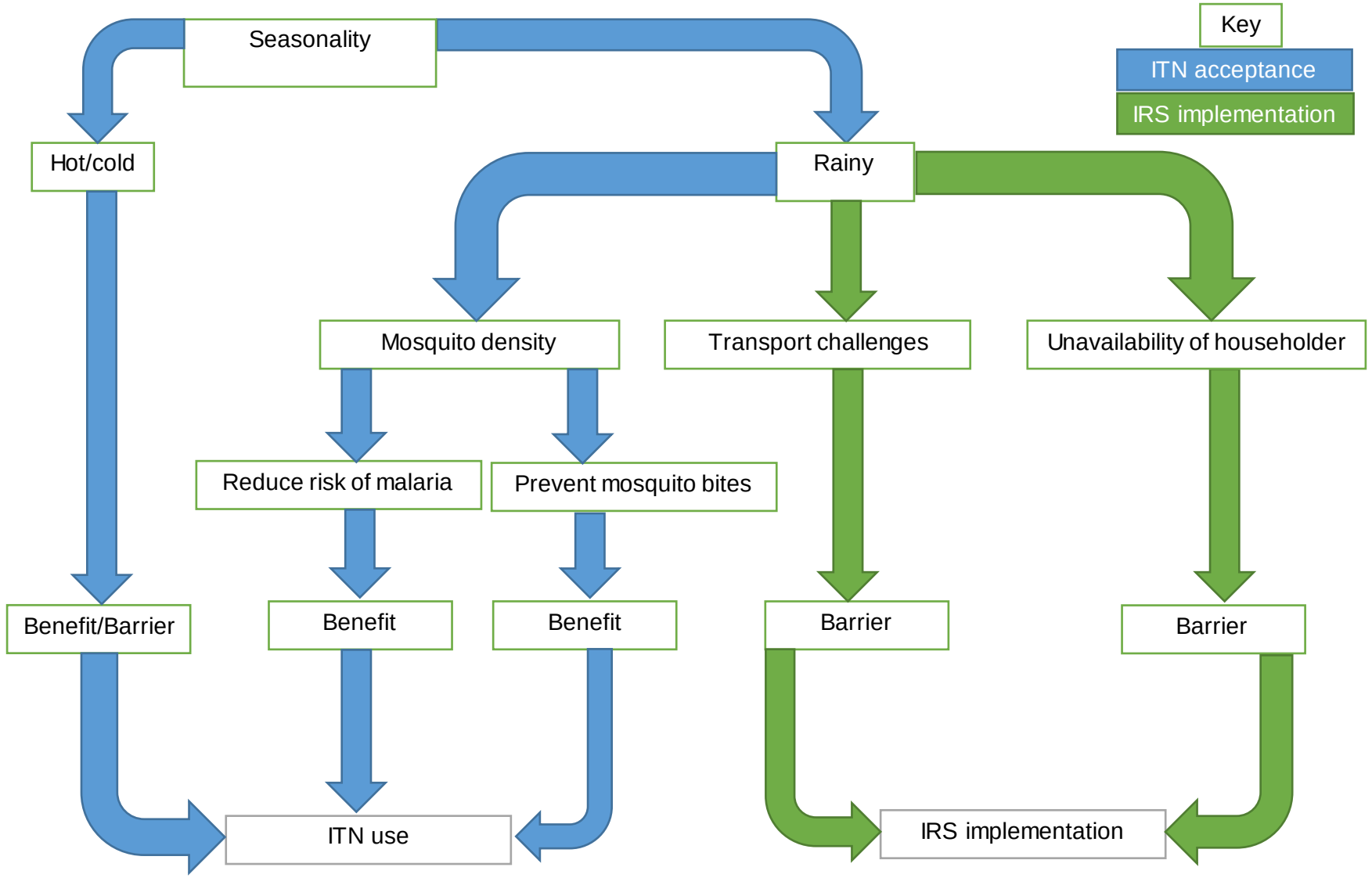
AGA Mal spray operators reported that their movement (walking) from house to house to conduct spraying was challenging because of the need to carry spray equipment and other materials such as buckets, insecticides and personal protective equipment. The realist evaluation framework (Pawson & Tilley, 1997b) highlights the importance of contextual factors such as the distance between buildings in communities where interventions are implemented because of the role of these factors in mediating intervention mechanisms and outcomes. This suggests that the mode of implementation of IRS in the Upper West region could determine its outcome. In the region, some houses, especially in rural communities, are widely dispersed because of people's engagement in peasant farming, with their farmlands around their houses. Hence, the burden of carrying spray equipment from house to house could reduce the output of spray operators and affect the outcome of spraying. Therefore, measures may be required to address this mobility challenge. The daily targets of spray operators could be reduced when dispersed communities are being sprayed to compensate for the time spent in moving from house to house. Lightweight equipment could be used for IRS operations in place of the current heavy equipment. These measures could reduce the mobility challenges encountered by spray operators and facilitate the implementation of IRS.

The effect of seasonality on the acceptability and implementation of IRS and ITNs is illustrated in figure 4 below. The figure builds on the work of Beer et al. (2012) which was primarily based on the impact of seasonality on ITN using components of the HBM (as indicated by the blue arrows or signs). In the hot season, ITN use may be low because of perceived low density of mosquitoes and discomfort associated with ITN use, and these may serve as barriers to ITN use. However, the cold and rainy seasons may favour ITN use because of the warmth provided by ITNs, the perceived benefits of ITNs in reducing mosquito bites, and the perceived susceptibility to malaria

infection because of the perceived increase in mosquito density as discussed earlier.

The current study adds to this original work by introducing components of the realist evaluation framework (as shown by the orange arrows or signs) to illustrate how seasonality affects the implementation of IRS. Intensive rains during the rainy season serves as a barrier to the implementation of IRS because of the challenges with transporting spray operators to hard-to-reach communities. Similarly, because householders in rural communities are largely peasant farmers who engage in rain-fed farming, this often results in householders departing for their farms early during the rainy season and may be unavailable to accept spraying when the spray operators arrive in the communities. Hence, the contexts of rural communities negatively affect IRS implementation.

**FIGURE 4: EFFECT OF SEASONAL VARIATIONS ON THE ACCEPTANCE AND IMPLEMENTATION OF IRS AND ITNs**



#### *5.3.3.2 Breakdown of spray equipment*

A few AGA Mal officials reported that the use of old spray equipment led to frequent breakdowns of spray pumps, negatively affecting IRS. The negative impact of breakdown of equipment on productivity has largely been the concern of the manufacturing sector where machines and equipment are mostly in use (Dal, Tugwell & Greatbanks, 2000). This implies that the current study is the only known study that has reported equipment breakdown as a barrier to IRS implementation, making this finding one of the major contributions of this PhD research to the literature on malaria control. This finding is consistent with the realist evaluation framework (Lacouture et al., 2015). The mechanisms of IRS, such as the condition of the spray pumps and other equipment used for spraying, could determine its outcome because they influence the number of houses that could be covered by each spray operator. This implies that frequent breakdown of spray equipment may reduce the number of houses that could be sprayed, thereby reducing spray coverage. Therefore, measures may be required to reduce the frequency of spray equipment breakdown. Given that the current spray pumps were reported to have been used for several years, it may be necessary to procure new spray equipment, especially pumps. This could help reduce the breakdown of spray equipment, and facilitate the implementation of IRS.

A few AGA Mal officials reported that delays in the importation of spare parts affected regular maintenance of spray equipment. This suggests that a breakdown maintenance system, in which equipment is serviced only after a breakdown (Venkatesh, 2007), is used by AGA Mal and this does not maximize the effective use of spray equipment. Venkatesh (2007) argues that such a system should only be used when equipment breakdown does not have a significant effect on operations or output, other than repair costs. However, the breakdown or malfunctioning of spray equipment could reduce spray output, lead to lost time when spray operators cannot work, and potentially affect the quality of spraying. This calls for the adoption of a Total Production Management maintenance system that prescribes a synergy between production and maintenance and in which maintenance is regarded as an integral part of the production process (Ahuja & Khamba, 2008). This could help maximize the effective use of spray equipment and increase the outcome of spraying. An adequate inventory of spare parts should always be available to facilitate maintenance. Moreover, essential parts such as the pump nozzles could be taken to communities so that maintenance work can be quickly carried out on site in case of breakdown. These will ensure that spray equipment is always in good condition for spraying and enhance the implementation of IRS.

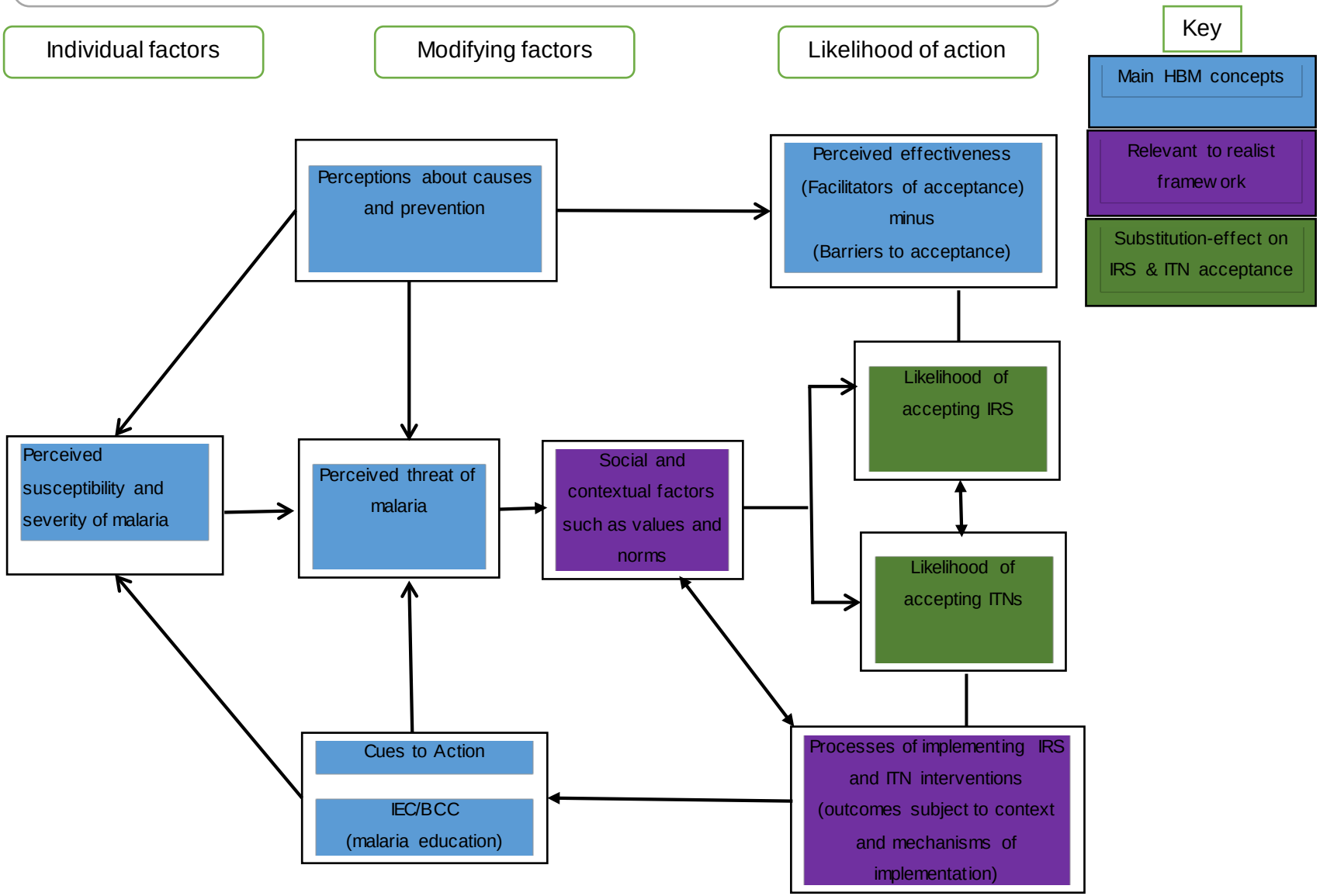
Based on the discussions in this chapter, it is important to note that none of the

theoretical frameworks used in this study independently provide explanations for the findings. Therefore, modifications are suggested to the HBM to increase its applicability to malaria control using IRS and ITNs. Three key modifications are the introduction of the substitution effect between IRS and ITNs, the processes and mechanisms of implementation, and the social and contextual factors that influence the acceptance and implementation of interventions.

Firstly, the modified theory recognizes the possibility that the substitution effect influences the acceptance of interventions by individuals by suggesting that IRS and ITNs are separate interventions that could be accepted by householders for the same purpose, that is, malaria prevention. Separating the two interventions implies that each one could be accepted independent of the other, while some householders may combine these interventions. The recognition of the substitution effect in the modified model could help provide explanations for the refusal of otherwise beneficial interventions which nevertheless have more viable and competitive alternatives. Secondly, the modified theory incorporates the assumption that the individual is subject to the influence of social and contextual factors in society. As members of society, individuals are subject to the influence of contextual factors such as societal norms, values, religious and cultural beliefs, and the physical environment which all affect their health and influence their adoption of preventive interventions such as IRS and ITNs. Moreover, the modified theory recognizes that social and contextual factors have a significant effect on the outcome of interventions as posited by the realist evaluation framework (Pawson & Tilley, 1997b), and as such are important determinants of health as postulated by the social determinants of health framework (WHO Commission on Social Determinants of Health, 2008).

Finally, the modified theory encompasses the idea that the processes or mechanisms involved in the implementation of interventions such as training, partnerships, education, and transportation of personnel affect the outcome of the intervention, and as such could influence the delivery of interventions or reduce individual accessibility to them. Apart from these modifications or additions to the HBM, most of the other findings such as the perceived efficacy of spraying can be explained by the HBM that was initially adopted for this study (see Figure 1). Figure 5 below illustrates the modifications to the HBM for applicability to malaria control. The blue colour illustrates aspects of the HBM that was adopted for this study (please refer to Figure 1 in chapter 2), the purple colour indicates the addition of social and contextual factors that influence the acceptance of interventions and the outcome of implementation. The green colour represents the separation of IRS and ITNs as viable alternative interventions for malaria prevention.

**FIGURE 5: MODIFICATIONS TO HEALTH BELIEF MODEL FOR APPLICABILITY TO MALARIA CONTROL**



## 5.4 Strengths and limitations of the study

The focus of discussion in this section will be on the strengths and limitations of this research, including the methods used for data collection. The first part will cover the strengths of the study and the second part will encompass the limitations of this research.

### 5.4.1 Strengths

This study is the first to explore householders' acceptance of IRS and ITNs in a setting where both interventions are implemented. This makes the study a highly relevant one because the effectiveness of these interventions depends on community acceptability (Rodríguez et al., 2006). Although previous studies have explored the acceptance of IRS alone or ITN alone, the WHO recommendation for the combined use of IRS and ITNs for malaria vector control in targeted endemic areas (World Health Organization, 2013) makes it necessary for an exploratory study on the acceptability of combining these interventions. This study is therefore very relevant in providing qualitative evidence on the combination of IRS and ITNs by householders and could guide policy making in the implementation of IRS and ITNs at the same location.

In addition, most previous studies on the acceptability of malaria control interventions have not explored how implementation processes affects their outcome. However, the regimented nature of malaria control interventions such as IRS necessitates the adoption of implementation research (Nilsen, 2015), with the aim of understanding how the context and mechanisms of implementation affect the outcome. Therefore, by using the realist evaluation framework to explore how the context and mechanisms of implementation could influence the outcome, this study recognises that acceptability is subject to factors beyond beneficiary willingness to adhere to interventions. Previous studies on the acceptance of IRS interventions (Montgomery, Munguambe & Pool, 2010) only sought to explore barriers to coverage and use from the perspectives of householders, with only a few studies (Hongvivatana, Leerapan & Smithisampan, 1982; Munguambe et al., 2011) providing limited insight into the barriers to implementation. Evidence from this study suggests that there are many programmatic barriers to IRS implementation with consequential impact on acceptance and coverage levels.

While the use of the HBM as a theoretical framework helped to explain the research findings, numerous findings in this study significantly contributed to the expansion of the scope of the model. The findings in this study provide the basis for a modification

to the HBM for applicability to malaria control using IRS and ITNs. Such contributions to theory development enhance the practical applicability of the model.

Methodologically, the use of a qualitative interpretivist approach in this study enabled the researcher to address the research questions adequately. This is because the use of a qualitative method allowed for the exploration of the world view of the participants (Merriam, 2002), thereby addressing the exploratory nature of the research questions. This process was facilitated by the collection of data using focus group discussions and semi-structured interviews. The use of focus groups was particularly suitable for the study because it enabled the researcher to explore the perceptions (Trilling, 1999) of householders who were the beneficiaries of the interventions under study.

Several types of triangulation were used to increase the rigour of this PhD research, thereby strengthening validity and dependability of the findings. A methods triangulation was achieved by collecting data using semi-structured interviews and focus group discussions. Collection of data from different participant groups, including householders, GHS officials, AGA Mal officials and AGA Mal spray operators constituted a form of data source triangulation that enhanced the comprehensiveness of the findings (Lambert & Loiselle, 2008). Finally, investigator triangulation was adopted by involving other researchers in this study at different stages, especially during data analysis, to improve the internal validity and credibility of the findings (Krefting, 1991). Besides triangulation, the supervision provided by two established researchers immensely improved the quality of this research work.

Finally, the research was conducted by a researcher who has in-depth knowledge about Ghana and the study setting. He had worked with AGA Mal for over three years and served on district committees that spearheaded the hang-up campaign in 2012–13 in the Upper West region. Consequently, he understood Ghana's malaria control strategies and this enabled him to establish relevant networks that proved very useful throughout this research process. Without prior exposure to the study setting, data collection would not have been possible within the limited time frame allocated for field work, especially because it was conducted in Ghana rather than in Australia. The researcher is competent in the local language of the people of the Upper West region and this aided data collection because focus group discussions were conducted in the local language (Dagaare). These enabled householders to express themselves very well during the focus group discussions, providing the evidence needed for this study.

### 5.4.2 Limitations

Despite the strengths above, there are some weaknesses in this study. Since the study objectives seek to explore the facilitators and barriers to indoor residual spraying (IRS) and insecticides treated nets (ITNs) acceptance, a separate focus group discussion (FGD) with householders who accepted or refused these could have helped provide the actual reasons for refusals or acceptance. By mixings FGDs for both householders who accepted IRS and ITNs and those who do not limits the credibility of the evidence. However, given the limited time and resources available for this study, conducting separate FGDs for IRS acceptors, refusers, ITN users, and ITN non-users would not have been feasible. Besides, it is unlikely that some householders may be accepting IRS always or using ITNs always (from whom data on facilitators could be collected), or always rejected ITNs and IRS altogether (from whom data on barriers could be collected). Also, as the findings from this study indicates, some houses were not sprayed not because of actual household refusal, but due to other barriers such as the spray operators not showing up to spray.

The coverage levels of IRS in the Upper West region were based on Ghana Demographic and Health Survey data (Ghana Statistical Service, 2014) because the programme implementers (AGA Mal Ltd.) refused to supply data on IRS coverage. If spray coverage data from implementers were available, they could provide useful insights into the patterns of acceptability, especially given that some studies have found partial acceptability to be a major problem of some IRS interventions (Hongvivatana, Leerapan & Smithisampan, 1982). This could have changed the study design. However, the evidence on IRS coverage from the survey (Ghana Statistical Service, 2014) helped provide evidence on acceptance levels which provided the basis for this research. Future research on IRS acceptance in the Upper West region may need to give more attention to the patterns of acceptance.

In addition, although the study sought to explore the acceptability of combining IRS and ITNs, the reasons for householders' acceptance or refusal of the combination of them did not seem to be different from those for either intervention alone. The only outstanding finding on householders' combination of IRS and ITNs relates to the substitution effect wherein some householders stopped using ITNs following IRS. Despite this, the findings from this study provide evidence on household practices relating to their combination of IRS and ITNs which could be crucial for policy making given the very high costs of these interventions, especially IRS.

Most previous studies on acceptability of ITNs were conducted immediately after distribution of nets, but the current study was conducted in 2016, two to three years

following the distribution of ITNs in 2012–13. It is possible that most of the ITNs distributed at that time may have been damaged by the time of data collection and unavailable for use. Although another round of ITN distribution campaign was conducted in late 2016, the uncertainty about the exact timing meant that data collection could not be delayed. Nevertheless, this study achieved its aim given that it was intended to explore the barriers to ITN use in general, rather than exploring the barriers to ITN use by ITN-owning households only.

Furthermore, most of the study findings are on IRS with fewer findings about ITNs. This has introduced an imbalance in the study, making the research seem more like a pro-IRS study. Although this may seem to be a weakness, it is not at all surprising. This is because the regimented nature of IRS interventions (Winch et al., 1994) means that activities required for spraying must be much more coordinated because they are conducted over a period of three to four months, compared with ITNs which are only distributed once to householders every few years. The less complex nature of ITN distribution also meant that less information could be obtained from GHS officials regarding the implementation of the hang-up campaign and free ITN distribution for malaria control. Therefore, the findings in this study may be proportional to the range of issues relating to the acceptability of each intervention.

By conducting focus group discussions and semi-structured interviews concurrently, the researcher missed the opportunity to enrich the data collected from programme officials. If the focus groups had been conducted first, they could have provided the researcher with useful insights into aspects of householders' concerns that could be further probed during the interviews with officials. This may have increased the depth of data from officials, which could have enhanced the comparison of data from different participant groups and provide stronger evidence for the study. However, focus groups and interviews were conducted concurrently because of time constraints, and the fact that AGA Mal spray season for 2016 was soon to end after which district officials would be unavailable for participation.

The researcher had no prior experience in qualitative data collection using focus group discussions. However, he addressed this inexperience by attending seminars on the technique and he also organized practice sessions with a few householders before conducting the actual focus groups. Although these measures helped equip the researcher with very useful and practical experience, the researcher's skills in conducting group discussions only developed gradually over the course of data collection.

The pre-selection of specific officials based on their field of expertise or position for inclusion in the semi-structured interviews affected the depth of data collected from GHS officials. This is because some disease control officials and malaria focal persons in selected districts were not in their current posts when the hang-up campaign and free ITN distribution was undertaken in 2012–13. Unlike IRS which is conducted annually over three to four months, ITN distribution campaigns may be shorter and with a few years between distribution periods. For this reason, those GHS officials who were not in their posts could not respond to questions about what was done during the hang-up campaign.

The use of the qualitative method for this study limits the transferability of the findings. This is because qualitative studies, including the current study, focus on depth rather than breadth, and often do not use statistical measures that allow for generalisations (Schwandt, 2001). However, the evidence from this study has some level of credibility, and may have practical applicability in similar contexts, including many malaria endemic countries in Africa where most malaria cases are recorded.

Finally, given that focus group discussions were conducted in Dagaare language, translation into English was required during the transcription of audio recordings. At the time of transcription, there were no exact English terms or phrases for literal translation of some Dagaare words during the process of transcription. Although a few recordings were transcribed by two researchers (including the primary researcher) for internal validity, some meaning may have been lost in the process. This could have affected data interpretation, and consequently the evidence produced from this study. The conclusions drawn from this study are presented in the next chapter.

# 6 CHAPTER SIX: CONCLUSION

## 6.1 Introduction

Indoor residual spraying (IRS) and insecticide treated nets (ITNs) have had minimal impact on malaria in the Upper West region of Ghana because of the low levels of acceptability of the interventions. For interventions that require community acceptance to be effective, evidence on the facilitators and barriers to acceptability will be of immense importance to policy and practice. This study investigates the facilitators and barriers to malaria control in the Upper West region of Ghana, the key findings and implications of which are summarized below.

## 6.2 Summary of key findings

This study revealed several facilitators to malaria control in the Upper West region of Ghana, including householders' knowledge about the role of mosquitoes in transmitting malaria. Linking malaria with mosquitoes increases householders perceived susceptibility to malaria (Champion & Skinner, 2008) and facilitates their acceptance of vector control interventions such as IRS and ITNs, especially during the rainy season when mosquito densities are perceived to be high. Although householders' association of malaria with mosquitoes provided the fundamental requirement for the use of malaria vector control interventions, they had several misconceptions about malaria transmission and prevention which constituted significant barriers to malaria prevention. In addition, aspects of programme implementation including malaria education activities, training and capacity building, and stakeholder partnerships were found to facilitate the acceptance and implementation of IRS and ITNs interventions. This is in conformity with the realist evaluation framework (Pawson & Tilley, 1997b) because programme mechanisms such as partnerships, training and education have a significant impact on the outcome of programmes and help determine whether an intervention will work. However, inadequacy of (or challenges with) these aspects of programme implementation such as partnership difficulties were found to constrain the implementation of IRS and ITNs.

This study discovered several barriers to the acceptance and implementation of IRS and ITN interventions. Key among these are the social determinants of health (WHO Commission on Social Determinants of Health, 2008) including poverty, religious and cultural beliefs, and the condition of the physical environment (such as bad roads and high temperatures) which were found to have a significant impact on the health of people by exposing them to malaria infections and affecting the acceptance of IRS

and ITNs. This suggests that measures aimed at addressing malaria will require an integrated effort beyond the health sector, lending credence to the political nature of health promotion (Signal, 1998). Other barriers included programme operational issues such as insufficient vehicles for the transportation of spray operators to communities for spraying, frequent breakdown of spray equipment, and inadequate pre-spray information dissemination, among others. However, some of these operational issues are also affected by lack of funds, which constitutes a general challenge to malaria control in most endemic countries (Korenromp et al., 2013). The findings also revealed a substitution effect in householders' combination of IRS and ITNs, with most householders suspending their use of ITNs in the immediate aftermath of spraying. This highlights the effect of alternative interventions on the acceptance of preventive interventions. The implications of these findings are numerous.

## 6.3 **Implications of findings**

The findings in this study have several implications for policy and practice. The findings revealed that although some householders deliberately refused to accept or use these interventions, there were several other factors that contributed to the non-spraying of some houses and the non-use of ITNs by householders. Several Programme related challenges affected the implementation of IRS and ITNs and may have accounted for the low levels of acceptance. This implies that there is room to improve acceptance levels. Hence, efforts to address the challenges to programme implementation (such as inadequacy of information, equipment breakdown, inadequacy of ITNs, mobility challenges) are required to increase the coverage and acceptance of IRS and ITNs.

The findings also revealed that the challenges to malaria control in the Upper West region extend well beyond the scope of the health sector, and efforts to improve malaria control may require intersectoral collaboration. Such intersectoral collaborations could encompass measures to empower householders economically and address the social determinants of health to enhance the acceptance and implementation of IRS and ITNs. For instance, if householders are empowered, this will enable them to afford new ITNs (when their ITNs are damaged), ensuring constant access to and use of ITNs.

Additionally, householders were not combining IRS and ITNs for a significant period of each year largely because of the non-use of ITNs during the dry season and the temporary suspension of ITN use in the aftermath of spraying. However, the implementation of both IRS and ITNs in the Upper West region may still be beneficial

in increasing the overall acceptance of malaria vector control interventions in the region. This is because householders who may not have ITNs may have the option of spraying their rooms (which is conducted free of charge) whereas those whose houses may not be sprayed may be able to rely on their ITNs (if they have them) for malaria prevention. The continued implementation of both interventions will also conform to WHO guidelines which recommend the combination of IRS and ITNs in targeted areas or regions (World Health Organization, 2015b).

The evidence from this study also suggests that the HBM may have limited applicability to malaria control and especially to the use of malaria vector control interventions. There is a need for health practitioners to recognize this in the design and implementation of health interventions. For this reason, the HBM was slightly modified in a way that could help health practitioners design and implement IRS and ITNs, and possibly other related health interventions. This could enhance householders' acceptance and combination of IRS and ITN interventions.

The qualitative design of this study means that the findings may have limited applicability in different settings. In other words, the findings from this study may only be transferable to similar settings of resource scarcity and context because of the interpretivist nature of the study. However, given that over 90% of malaria morbidity and mortality cases occur in SSA (World Health Organization, 2017), the transferability of the findings is increased because the current study's setting may not be very different from other settings in SSA. Evidence from this study indicate that changes to policy and practice are required to enhance the implementation of IRS and ITN interventions. For this reason, the following recommendations are made.

## 6.4 **Recommendations**

The following recommendations are made to the various stakeholders in malaria control, including AGA Mal Ltd., GHS, the government of Ghana, and communities. The recommendations are presented in relation to the evidence that has been discussed earlier.

It is recommended that malaria education campaigns by AGA Mal and GHS should highlight the causes of malaria with emphasis on mosquitoes as the only vector responsible for malaria transmission. This could facilitate householders' awareness about the causes of malaria and enhance their acceptance of vector control interventions. In other words, if householders were aware that mosquitoes are the only vectors responsible for malaria transmission, this could increase their use of IRS and ITNs to prevent mosquito bites and malaria.

AGA Mal should provide adequate dissemination of information about spray schedules in all communities prior to spraying, including all households in poorly planned communities. The dissemination of information about spray schedules needs to be conducted house-to-house because this ensures that every household is informed. In rural communities, notice of spraying should be provided three days in advance to allow adequate time for householders to prepare their rooms for spraying, including relocating their 'smaller gods', for those who may have them. These steps could address the challenges with IRS acceptability resulting from inadequate information about spraying and facilitate the implementation and acceptance of IRS.

Given that the use of new ITNs was perceived to be associated with side effects, it is recommended that ITN education should be designed to inform householders to remove new ITNs from their packing and allow at least twenty-four hours before using them. This could reduce the intensity of the insecticides used in treating ITNs, and hence reduce the severity of potential side effects resulting from insecticides. Moreover, personnel at private outlets selling ITNs could to be trained to provide brief education to purchasers. These steps could ensure that householders use their new ITNs properly, which in effect should reduce the occurrence or intensity of side effects and encourage householders to use their ITNs. Further, AGA Mal and GHS should intensify their education to the community about the need for householders to combine IRS with ITN use to prevent the substitution effect, which often led to the non-use of ITNs by householders after IRS was conducted.

Given that the social determinants of health were found to play a significant role in exposing people to malaria and affecting the acceptance and implementation of ITNs and IRS, it is recommended that an intersectoral approach be adopted by the government of Ghana to address the broader determinants of health by reducing poverty and increasing access to education (school/formal education), which will empower people in rural communities. This could reduce rural communities' dependence on "*smaller gods*" and enhance the acceptance and implementation of health interventions including IRS and ITNs. Furthermore, the difficulties involved in planning spray schedules because of poor housing data should be addressed by the Department of Works and Housing by compiling accurate data on housing facilities. AGA Mal could then rely on the data for the planning of spray schedules, facilitating the implementation of IRS. Householders' exposure to mosquito bites during funeral events could be addressed if communities identified specific enclosed areas to hold (or organize) their funerals events. This will ensure that these enclosed areas are sprayed during the communities' spray schedules to protect people from being bitten by mosquitoes during funeral events. Also, householders may need to be educated

by AGA Mal and GHS to use mosquito repellents during funerals to prevent their exposure to mosquito bites.

Additionally, entirely new strategies are required to enhance the implementation and acceptance of ITNs. In future, the free ITN distribution campaigns by GHS need to involve the distribution of one ITN for every household member. This will avoid the challenges associated with distributing one net for every two household members (which does not consider odd numbers), sometimes resulting in ITN sharing by several household members. Distributing one ITN for every household member will facilitate the regular use of ITNs by every household member regardless of cultural issues relating to household sleeping arrangements. The frequent out-of-stock challenges at health centres which affect the distribution of ITNs to pregnant women and children could be addressed by the GHS by developing a good supply chain. This will ensure the constant availability of ITNs for distribution. Additionally, practical measures such as redesigning ITNs to incorporate stands could avert the challenges with using ITNs during outdoor sleeping, facilitate the hanging and use of ITNs outdoors during the dry season, and accelerate the achievement of the goals of the Global Technical Strategy for Malaria 2016–2030 (World Health Organization 2015a).

Furthermore, new operational strategies are required to address the operational challenges affecting the implementation of IRS. Spraying in remote and hard-to-reach communities could be conducted earlier in the spray season before the mid to late periods of the rainy season to avoid the transportation difficulties often associated with the rains. Because of householders perceived difficulties with packing for spraying, it is recommended that insecticides with a longer period of efficacy should be used for IRS to reduce the burden of annual packing on householders. Householders living in government bungalows are often unavailable to pack their belongings and accept spraying during the weekdays, so it is recommended that AGA Mal organizes special weekend spraying for government residential areas. This will ensure that householders living in these bungalows are available to pack their belongings and prepare their houses for spraying.

Securing additional equipment and resources could enhance the implementation of IRS and ITN interventions. AGA Mal's challenges with transporting spray operators to communities should be addressed by procuring additional vehicles. This will prevent the transportation of spray operators in batches and ensure that spray operators arrive in communities before householders leave for work. Given the difficulties spray operators have with carrying their equipment in communities with dispersed housing, it is recommended that AGA Mal procure lightweight spray equipment and personal protective equipment to facilitate the movement of spray operators from one house to

the next during spraying in the community. Similarly, it is recommended that the old spray equipment which has been in use since 2012 be replaced to reduce the occurrence of spray equipment breakdown. There is also an urgent need for AGA Mal to adopt a total production management system which can ensure the regular maintenance of spray equipment. This will require the importation of essential spare parts on regular basis to ensure their constant availability.

Arguably, evidence on the implementation of both IRS and ITNs at the same location is still limited, with few prior studies investigating the efficacy of implementing both interventions at the same place (West et al., 2014). This means that the current study's exploration of householders' acceptability of combining IRS and ITNs is an important new research perspective. However, given the importance of cost effectiveness in the selection of interventions for implementation (White et al., 2011), it is recommended that future research should focus on the cost effectiveness of implementing both IRS and ITNs interventions at the same location.

# 7 APPENDIX

## 7.1 Appendix I: Verbal script for community volunteers

**VERBAL SCRIPT FOR VOLUNTEER**

A PhD student from Flinders University in Australia, Mr. Vitalis Mwinyuri, is currently investigating the facilitators and barriers to malaria control in the Upper West region of Ghana. He is seeking to recruit eligible participants to participate in a focus group discussion. Information you need to know about this study is provided in an information package that will be given to you by me right now.

If you are eligible and willing to participate, you will be asked a few questions about malaria, indoor residual spraying, insecticide treated nets and combining indoor residual spraying and insecticide treated nets. The discussions will be recorded using a digital voice recorder to assure data accuracy.

Your participation is voluntary and you may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the focus group discussion/semi-structured interview at any time without effect or consequences. We do not need your name and you will be anonymous in the study. However, given that the study involves a focus group discussion; there is the possibility that your anonymity may not be guaranteed. Therefore, investigator will seek verbal agreement between all participants that they will maintain the anonymity of other participants. The investigator anticipates no risks or discomforts from your involvement in this study. Should you experience any emotional distress or discomforts, please drop-in at your community health centre for free counselling service.

I'm providing you with an introductory letter, information sheet and consent forms to enable you read further details about the study and make an informed decision regarding your potential participation. You can read through the information package and decide whether you would want to participate in the study or not. You can contact the investigator using the details on the information sheet. If you consent to participate in the study, a convenient date will be scheduled for the focus group discussion. Thank you for your time

## 7.2 Appendix II: Focus group discussions guide for householders

**QUESTIONS/PROBES**

**Theme one: Knowledge about the causes, symptoms and prevention of malaria**

1. What are the most important health challenges in this community?
    - What about malaria?
    - Why do you think they are the most important?
2. What do you think the causes of malaria might be?
    - Why do you think so?
3. Can malaria be prevented?
    - If so how?
4. Do you know of any interventions that are aimed at preventing malaria; if so can you tell me about them?
5. Is there anything you do to prevent malaria? If so what is it?

**Theme two: Perceived susceptibility and severity of malaria**

6. Have you had malaria before, if so when and how often?
7. Has anyone in your family had malaria before?
8. How many times could you or any other family members get infected by malaria in a year?
9. How likely do you think it is that you will be infected with malaria? Why?
10. What are the consequences/effects of malaria?
    - What about the social consequences of malaria?
11. How severe are the effects of malaria?
    - What is the source of your information?

**Theme three: Facilitators and barriers to IRS acceptability**

12. Did you spray your house during the recent spraying?
    - If yes, why did you spray your house?
    - If no, why didn't you spray your house?
    - Why wouldn't some householders spray their houses?
13. Do you want the spraying exercise to continue?
14. Is there anything that could be done to improve the spraying exercise?
    - If so what?

**Theme four: Facilitators and barriers to ITN use**

15. Do you sleep under an ITN?
    - If so why?
    - If not why not?
    - Why wouldn't some people sleep under their ITNs?
16. Do all your family members sleep under an ITN?
    - If not why?
17. Is there anything that could be done to improve ITN use?
    - If so what?

**Theme five: Facilitators and barriers to combining IRS and ITNs**

18. Do you sleep under an ITN after you've sprayed your house?
    - If yes, why?
    - If no, why not?
19. Why will you sleep under an ITN after spraying your house?
20. Why will you not sleep under an ITN after spraying your house?

**Theme six: Information, education and communication activities on malaria**

21. Have you ever received public health information (such as messages on TV, News Papers and Radio) on malaria and malaria prevention?
    - If so where did you acquire this information?
22. Can you tell me what this information was specifically about?
23. Did this information say anything about IRS, ITNs, or their combination?
    - If so what did it say exactly?

## 7.3 **Appendix III: Introductory letter to AGA Mal Director**

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

Health Sciences Building, Sturt Road,
Bedford Park, SA 5042

GPO Box 2100

Adelaide SA 5001

Tel: 08 72218417

lillian.mwanri@flinders.edu.au

2/02/2016

Dear Sir/Madam

LETTER OF INTRODUCTION

This letter is to introduce Vitalis Mwinyuri who is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University. He will produce his student card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the topic "***community knowledge about malaria and acceptability of vector control interventions in Ghana***".

Given the significant role of AGA Mal Ltd. as a partner in the fight against malaria in the upper west region of Ghana, he would like to invite you to assist with this project by allowing your district staff (in Wa Municipal and Daffiama-Busie-Issa districts) to be involved in an in-depth interview (with staff) and focus group discussions (with spray operators and team leaders) which covers certain aspects of this topic. No more than 60 minutes on one occasion will be required for the in-depth interviews, and 70 minutes on one occasion would be required for focus group discussions.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications.

Since he intends to make a tape recording of the interviews and focus group discussions, he will seek the consent of all potential participants to undertake the recording, and to use the recording or transcription in preparing the thesis, report or other publications, on condition that their name or identity is not revealed.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on +61 8 72218417 or e-mail

(lillian.mwanri@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.4 Appendix IV: Request for permission letter to AGA Mal Director

MR VITALIS MWINYURI
School of Health Sciences,
Public Health
Faculty of Medicine, Nursing and Health Sciences
Level 2, Health Sciences Building
Sturt Road, Bedford Park, SA 5042
GPO Box 2100
Adelaide SA 5001
Tel: +61 451 582 481
Swwr0001@flinders.edu.au

2/02/2016

The Director,

AGA Mal Ltd

Obuasi, Ghana

Dear Sir,

REQUEST FOR PERMISSION TO UNDERTAKE RESEARCH

I am a Doctor of Philosophy (PhD) student at Flinders University Australia, and I'm currently undertaking research on a project entitled "community knowledge about malaria and acceptability of vector control interventions in Ghana". The research aims to understand the facilitators and barriers to malaria control in the upper west region of Ghana.

This study is being conducted with ethical approval from Flinders University Social and Behavioural Research Ethics Committee, as well as the Navrongo Health Research Centre Ethics Review Board.

AGA Mal staff at Wa Municipal and Daffiama-Busie-Issa Districts will be participating in this study alongside other participants. Therefore, I would like to ask your permission to involve AGA Mal staff (in in-depth interviews) and spray operators (in focus group discussion) in the selected districts in this research.

I really enjoyed talking to you about my PhD research and hope this request will receive your kind consideration and approval.

Sincerely Yours,

Vitalis Mwinyuri

Student

School of Health Sciences, Public Health

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.5 Appendix V: Flyer for AGA Mal spray operators

Flinders UNIVERSITY
ADELAIDE • AUSTRALIA

# COMMUNITY KNOWLEDGE ABOUT MALARIA AND ACCEPTABILITY OF VECTOR CONTROL INTERVENTIONS IN GHANA

*SEEKING PARTICIPANTS FOR FOCUS GROUP DISCUSSION*

Researchers from Flinders University are exploring people's knowledge about causes, symptoms and prevention of malaria, and their acceptability of malaria control interventions in the upper west region. This study will facilitate the design of new strategies that will enhance the fight against malaria.

Given your experiences in the community as a spray operator or team leader of AGA Mal Ltd, we are interested in talking to you about your everyday experiences in the community during spraying activities.

### What's involved?

One focus group discussion of no more than one hour and thirty minutes, at the Community Centre

You will receive a $5 reimbursement for your time.

Any information provided will be treated in the strictest confidence.

The study is independent of any service providers.

No participant will be individually identifiable in resulting reports or publications.

Focus group discussions will be conducted in English.

It is anticipated that the research will lead to a report with recommendations about how improve upon malaria control in the upper west region.

For more information and participation, please contact:

Vitalis Mwinyuri

Mobile: 0246670502

## 7.6 Appendix VI: Semi-structured topic guide for AGA Mal spray operators

**QUESTIONS/PROBES**

**Theme one: IRS spray operations**

1. What training have you undertaken to facilitate your work in the community?
2. How do you approach householders in order to spray their houses?
3. What are the attitudes of the householders towards the spraying?
4. What do you think might be the reasons why community members do not spray their houses?
    - What makes you think so?
5. Are there challenges experienced by you during spraying?
    - If so, what are they?

**Theme two: Facilitators and barriers to IRS acceptability**

6. What are the common reasons why some houses are not re-sprayed/sprayed after you've sprayed?
7. What do you usually do when a householder refuses to allow you to spray their home?
8. Do you have any suggestions on how to improve community acceptance of the spraying programme?

## 7.7 Appendix VII: Interview guide for AGA Mal officials

**QUESTIONS/PROBES**

**Theme one: Process/mechanisms of IRS implementation**

1. How many times do you spray in a year, when and why?
2. How many times did AGA Mal spray in 2012, 2013, 2014 and 2015, if any differences, why?
3. On a given day, what processes are involved in IRS operations?
4. What training does AGA Mal provide its spraying operators in order to enhance community acceptability?
5. What are the components of the IRS intervention that were implemented in the Obuasi model?
6. What are the components that are being implemented in the upper west region?
7. What are some of the logistical and administrative factors affecting the implementation of IRS?

**Theme two: Facilitators and barriers to IRS acceptability**

8. What do you think might help householders accept IRS more?
9. What do you think limits the prospects of householders accepting IRS?

**Theme three: Information, Education and communication about IRS**

10. How do you inform communities about AGA Mal's intervention?
11. What strategies do AGA Mal employ in informing communities about IRS?
12. How does the community in general react to the IRS intervention?

**Theme four: Facilitators and barriers to combining IRS and ITNs**

13. What are some of the barriers to combining IRS and ITNs by householders?
14. What does AGA Mal Ltd do to promote the combination of IRS and ITNs by householders?

## 7.8 Appendix VIII: Introductory letter to Upper West Regional Director of Health

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

Health Sciences Building, Sturt Road, Bedford Park, SA 5042

GPO Box 2100

Adelaide SA 5001

Tel: 08 72218417

lillian.mwanri@flinders.edu.au

2/02/2016

Dear Sir/Madam

LETTER OF INTRODUCTION

This letter is to introduce Vitalis Mwinyuri who is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University. He will produce his student card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the topic "***community knowledge about malaria and acceptability of vector control interventions in Ghana***".

He would like to invite you to assist with this project by agreeing for staff members in Wa Municipal and Daffiama-Busie-Issa Districts to be involved in in-depth interviews which cover certain aspects of this topic. No more than 60 minutes on one occasion would be required for the in-depth interviews.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time.

Since he intends to make a tape recording of the interviews, he will seek the consent of all potential participants to record the interview, to use the recording or a transcription in preparing the thesis, report or other publications, on condition that their name or identity is not revealed.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on +61 8 72218417 or e-mail (lillian.mwanri@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

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## 7.9 Appendix IX: Letter of approval from Upper west regional health directorate

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

My Ref. No GHS/UWR-S1
Your Ref. No.....

Tel: +233 07 SG 22 204 or 22 016
Fax: +233 07 56 22 471
Email: ghs-uwr@africaonline.com.gh


GHANA HEALTH SERVICE
REGIONAL HEALTH ADMIN
P. O. BOX 298
WA UWR
GHANA

April 20, 2016

THE DDHS, DAFFIAMA-BUSSIE-ISSA
THE MDHS, WA

THE DDHS,
DAFFIAMA-
BUSSIE-ISSA THE
MDHS, WA

INTRODUCTORY LETTER: MR VITALIS MWINYURI

The above named candidate is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University.

As part of the requirement of his Programme of study, he has chosen to conduct a study in your district on "Community knowledge about malaria and acceptability of vector control interventions in Ghana".

Kindly accord him the necessary support and cooperation and take the necessary steps to ensure that the privacy and confidentiality of staff/ clients who will be participating in the study are gt1a.ra.ntecd.

Thank you.

[redacted]

BASADI RICHARD
DEPUTY CHIEF HEALTH RESEARCH OFFICER
FOR AG. REGIONAL DIRECTOR OF HEALTH SERVICES

Cc: Research file
Mr. Vitalis Mwinyuri

## 7.10 Appendix X: Introductory letter to Ghana health service (GHS) District Directors

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

Health Sciences Building, Sturt Road, Bedford Park, SA 5042

GPO Box 2100

Adelaide SA 5001

Tel: 08 72218417

lillian.mwanri@flinders.edu.au

2/02/2016

Dear Sir/Madam

LETTER OF INTRODUCTION

This letter is to introduce Vitalis Mwinyuri who is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University. He will produce his student card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the topic "***community knowledge about malaria and acceptability of vector control interventions in Ghana***".

He would like to invite you to assist with this project by agreeing for your district staff members (in the selected districts) to be involved in an in-depth interview which cover certain aspects of this topic. No more than 60 minutes on one occasion would be required for the in-depth interviews. He is also seeking your express permission to recruit other research participants, mainly householders, through community health volunteers who are a part of the structures of the GHS.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time.

Since he intends to make a tape recording of the interviews, he will seek the consent of all potential participants to record the interview, to use the recording or a transcription in preparing the thesis, report or other publications, on condition that their name or identity is not revealed.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on +61 8 72218417 or e-mail (lillian.mwanri@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

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## 7.11 Appendix XI: Semi-structured interview guide for Ghana health service (GHS) officials

**QUESTIONS/PROBES**

**Theme one: Facilitators and barriers to ITN acceptability**

1. What types of ITNs were distributed during the hang-up campaign in 2012/2013?
2. What corresponding ITN education accompanied the hang-up campaign?
3. What do you think limits the prospects of householders accepting ITNs?
4. What do you think might help householders use ITNs more?

**Theme two: Information, Education and communication about malaria and malaria prevention**

5. What strategies do GHS employ in sensitizing communities about malaria and malaria prevention?
6. What education on ITN use is undertaken by GHS in the communities?
7. What is being done by GHS MaI to promote the combination of IRS and ITNs by householders?

**Theme Three: Facilitators and barriers to combination of IRS and ITNs**

1. What are some of the barriers to combining IRS and ITNs by householders?
2. What does GHS do to promote the combination of IRS and ITNs by householders?

## 7.12 **Appendix XII: Summary of study participant groups and data collection**

| **Study participants** | **Method (Number)** | **Domain** | **District/Community** |
|---|---|---|---|
| Householders | FGD (9) | Perceptions about causes and prevention of malaria, and acceptability of indoor residual spraying (IRS), insecticide treated nets (ITNs) and the combination of IRS and ITNs | Daffiama, Busie (DBI)<br>Sombo, Konta (WM) |
| AGA Mal Ltd spray operators | FGD (2) | Facilitators and barriers to the acceptance and implementation of IRS | Kaleo (DBI)<br>Wa (WM) |
| Staff of AGA Mal Ltd | SSI (8) | Facilitators and barriers to the acceptability and implementation of IRS and acceptability of combining IRS and ITNs | Kaleo (DBI)<br>Wa (WM) |
| Staff of GHS | SSI (5) | Acceptability of ITNs and acceptability of combining IRS and ITNs | Kaleo (DBI)<br>Wa (WM) |

DBI= Daffiama-Busie-Issa District; WM= Wa Municipal; FGD= Focus group discussion; SSI= Semi-structured interviews

## 7.13 Appendix XIII, Table 3: Sociodemographic characteristics of focus group discussion (FGD) participants

| **Householders, Konta FGD1 (47Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
|---|---|---|---|---|---|
| Participant 1 | 30 | Male | Unemployed | Tertiary | IRS & ITN |
| Participant 2 | 46 | Male | Mason | Tertiary | ITN |
| Participant 3 | 80 | Female | Cook | No formal edu. | ITN |
| Participant 4 | 28 | Male | Unemployed | Tertiary | NONE |
| Participant 5 | 30 | Male | Unemployed | SHS | ITN |
| Participant 6 | 56 | Female | Teacher | Tertiary | IRS & ITN |
| Participant 7 | 40 | Female | Cleaner | JHS | IRS & ITN |
| **Householders, Sombo FGD1 (53.36Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 29 | Male | Pastor | Tertiary | IRS |
| Participant 2 | 52 | Male | Trader | No formal educ. | ITN |
| Participant 3 | 52 | Male | Farmer | No formal educ. | IRS |

| | | | | | |
|---|---|---|---|---|---|
| Participant 4 | 45 | Female | Pito seller | No formal educ. | IRS & ITN |
| Participant 5 | 49 | Male | Farmer | No formal educ. | IRS |
| Participant 6 | 51 | Female | Farmer | No formal educ. | ITN |
| Participant 7 | 47 | Male | Carpenter | No formal educ. | NONE |
| **Sombo FGD2 (47.08Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 40 | Female | Designer | JHS | IRS and ITN |
| Participant 2 | 31 | Male | Mason | SHS | IRS and ITN |
| Participant 3 | 36 | Female | Hairdresser | Primary | IRS and ITN |
| Participant 4 | 55 | Female | Trader | No formal educ. | IRS and ITN |
| Participant 5 | 49 | Female | Trader | No formal educ. | IRS and ITN |
| Participant 6 | 43 | Female | Cleaner | No formal educ. | ITN |
| Participant 7 | 22 | Female | Weaver | No formal educ. | IRS |
| Participant 8 | 30 | Male | Pastor | Tertiary | IRS and ITN |
| **Daffiama FGD1 (75Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN** |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | **status** |
| Participant 1 | 43 | Male | Farmer | Primary | ITN |
| Participant 2 | 50 | Female | Cleaner | SHS | IRS |
| Participant 3 | 40 | Female | Trader | No formal educ. | IRS and ITN |
| Participant 4 | 53 | Female | Trader | No formal educ. | IRS and ITN |
| Participant 5 | 37 | Male | Electrician | SHS | ITN |
| Participant 6 | 49 | Male | Farmer | No formal educ. | None |
| Participant 7 | 38 | Female | Cleaner | Primary | IRS |
| Participant 8 | 49 | Female | Trader | Primary | IRS |
| Participant 9 | 45 | Male | Farmer | No formal educ. | IRS and ITN |
| Participant 10 | 27 | Male | Farmer | Primary | IRS and ITN |
| **Daffiama FGD2 (53Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 45 | Male | Electrician | Tertiary | IRS |
| Participant 2 | 47 | Female | Farmer | No formal educ. | IRS |

| | | | | | |
|---|---|---|---|---|---|
| Participant 3 | 75 | Male | Farmer | No formal educ. | ITN |
| Participant 4 | 43 | Female | Farmer | No formal educ. | ITN |
| Participant 5 | 30 | Male | Unemployed | Tertiary | IRS and ITN |
| Participant 6 | 26 | Male | Student | SHS | IRS and ITN |
| Participant 7 | 43 | Male | Farmer | No formal educ. | IRS |
| Participant 8 | 48 | Female | Farmer | No formal educ. | ITN |
| Participant 9 | 28 | Male | Farmer | SHS | ITN |
| **Daffiama FGD3 (55Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 41 | Female | Farmer | JHS | ITN |
| Participant 2 | 42 | Female | Farmer | No formal educ. | IRS and ITN |
| Participant 3 | 75 | Female | Farmer | No formal educ. | IRS and ITN |
| Participant 4 | 70 | Female | Farmer | Primary | IRS and ITN |
| Participant 5 | 30 | Female | Cleaner | SHS | IRS and ITN |
| Participant 6 | 39 | Female | Farmer | No formal educ. | ITN |

| | | | | | |
|---|---|---|---|---|---|
| Participant 7 | 37 | Female | Farmer | No formal educ. | ITN |
| Participant 8 | 38 | Female | Farmer | No formal educ. | IRS and ITN |
| Participant 9 | 20 | Female | Farmer | JHS | ITN |
| Participant 10 | 40 | Female | Farmer | No formal educ. | IRS |
| **Busie FGD1 (66Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 23 | Male | Unemployed | JHS | ITN |
| Participant 2 | 40 | Male | Farmer | No formal educ. | ITN |
| Participant 3 | 37 | Male | Environmental officer | SHS | IRS & ITN |
| Participant 4 | 30 | Male | Unemployed | Tertiary | IRS and ITN |
| Participant 5 | 45 | Male | Farmer | Primary | IRS and ITN |
| Participant 6 | 33 | Male | Mason/farmer | Primary | ITN |
| Participant 7 | 22 | Female | Unemployed | SHS | IRS |
| Participant 8 | 22 | Male | Unemployed | SHS | ITN |

| | | | | | |
|---|---|---|---|---|---|
| Participant 9 | 19 | Male | Farmer | No formal educ. | IRS |
| **Busie FGD2 (51Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 45 | Male | Farmer | SHS | IRS and ITN |
| Participant 2 | 39 | Male | Farmer | No formal educ. | ITN |
| Participant 3 | 30 | Male | Farmer | No formal educ. | ITN |
| Participant 4 | 51 | Male | Trader | Primary | IRS and ITN |
| Participant 5 | 49 | Male | Farmer | Primary | IRS and ITN |
| Participant 6 | 37 | Male | Farmer | No formal educ. | IRS & ITN |
| Participant 7 | 47 | Male | Farmer | No formal educ. | IRS and ITN |
| Participant 8 | 40 | Male | Farmer | No formal educ. | ITN |
| Participant 9 | 36 | Male | Teacher | Tertiary | ITN |
| **Busie FGD3 (58Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **Recent IRS status/ITN status** |
| Participant 1 | 38 | Male | Farmer | JHS | IRS and ITN |

| | | | | | |
|---|---|---|---|---|---|
| Participant 2 | 25 | Male | Farmer | No formal educ. | ITN |
| Participant 3 | 35 | Male | Mason | JHS | ITN |
| Participant 4 | 23 | Male | Farmer | Primary | IRS and ITN |
| Participant 5 | 24 | Male | Trader/retailer | JHS | IRS and ITN |
| Participant 6 | 32 | Male | Farmer | No formal educ. | IRS and ITN |
| Participant 7 | 28 | Male | Phone repairer | JHS | ITN |
| **DBI AGA Mal spray operators FGD (52Mins)** | **Age** | **Sex** | **Occupation** | **Level of education** | **N/A** |
| AGA Mal provider 1 | 30 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 2 | 31 | Male | S. O | JHS | **N/A** |
| AGA Mal provider 3 | 29 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 4 | 28 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 5 | 33 | Male | S. O | JHS | **N/A** |
| AGA Mal provider 6 | 26 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 7 | 24 | Male | S. O | Tertiary | **N/A** |

| | | | | | |
|---|---|---|---|---|---|
| AGA Mal provider 8 | 34 | Male | S. O | Tertiary | **N/A** |
| **W. M. AGA Mal spray operators FGD (77Min)** | **Age** | **Sex** | **Occupation** | **Level of education** | **N/A** |
| AGA Mal provider 1 | 36 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 2 | 36 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 3 | 32 | Male | S. O | SHS | **N/A** |
| AGA Mal provider 4 | 28 | Male | S. O | JHS | **N/A** |
| AGA Mal provider 5 | 34 | Male | S. O | SHS | **N/A** |
| AGA Mal provider 6 | 24 | Male | S. O | Tertiary | **N/A** |
| AGA Mal provider 7 | 29 | Male | S. O | SHS | **N/A** |
| AGA Mal provider 8 | 20 | Male | S. O | SHS | **N/A** |
| AGA Mal provider 9 | 33 | Male | S. O | SHS | **N/A** |

DBI=Daffiama-Busie-Issa District; IRS=Indoor residual spraying; ITN=Insecticide treated nets; JHS=Junior High School; SHS=Senior High School; S. O= Spray Operator; WM=Wa Municipal; educ.=education; FGD=Focus group discussion

## 7.14 Appendix XIV, Table 4: Socio-demographic characteristics of SSI participants

| Organization | Participant identity | Age | Sex | Level of education | Length of SSI |
|---|---|---|---|---|---|
| GHS | Official 1 | 28 | Female | Tertiary | 36 Minutes |
| GHS | Official 2 | 59 | Male | Tertiary | 47 Minutes |
| GHS | Official 3 | 37 | Male | Tertiary | 38 Minutes |
| GHS | Official 4 | 37 | Male | Tertiary | 22 Minutes |
| AGA Mal Ltd | Official 1 | 41 | Male | Tertiary | 36 Minutes |
| AGA Mal Ltd | Official 2 | 33 | Male | Tertiary | 41 Minutes |
| AGA Mal Ltd | Official 3 | 31 | Male | Tertiary | 35 Minutes |
| AGA Mal Ltd | Official 4 | 30 | Male | Tertiary | 38 Minutes |
| AGA Mal Ltd | Official 5 | 29 | Female | Tertiary | 40 Minutes |
| AGA Mal Ltd | Official 6 | 54 | Male | Tertiary | 31 Minutes |
| AGA Mal Ltd | Official 7 | 47 | Male | Tertiary | 53 Minutes |
| AGA Mal Ltd | Official 8 | 32 | Male | Tertiary | 37 Minutes |

GHS=Ghana Health Service; SSI=Semi-structured interview

## 7.15 Appendix XV: First cycle coding for householders Focus groups discussions (FGDs)

**FIRST CYCLE CODING FOR HOUSEHOLDERS FGDs**

All neighbours need bathroom soakaway
bathrooms soakaway to prevent malaria
Clearing bathroom water to prevent malaria
Dig manholes to prevent malaria
Dirty surroundings cause malaria
Eating cold food causes malaria
Exposure to cold causes malaria
Fear of malaria
Fear of odour associated with previous IRS
Frequent treatment of children
Health education at community forums
health education on combining IRS and ITNs
Health workers shd visit homes to see how ITNs are hanged
IRS acceptance for malaria prevention
IRS effective in killing mosquitoes and insects
IRS kills snakes
IRS non-spray due to inadequate information
IRS previous spray more effective than recent
IRS refusal due to carelessness
IRS refusal due to gods
IRS sensitization by adherents to increase acceptance
IRS spray is effective
IRS Spray refusal due to odour
IRS spray restriction to rooms can't kill all mosquitoes
IRS spray shd be frequent
ITN distribution
ITN non-use due to superstition
ITN sharing affecting usage
ITN use for malaria prevention
ITNs not affordable
ITNs provide all time protection but not IRS
Job-related exposure to mosquitoes
keep clean surroundings to prevent malaria
Knowledge about IRS
knowledge about malaria
Malaria being associated with HIV AIDS
Malaria causes bad dreams
Malaria causes lost income
Malaria causes lost man-hour
Malaria causes poverty
Malaria drug abuse
Malaria is common in community
Malaria kills
Malaria more severe in children

Malaria mortality
Malaria resistance
Malaria transmission
Non-combination of IRS ITN due to death of mosquitoes
Packing for IRS spray
Physical work causing malaria
Poverty causes malaria
Prevention of mosquito bites
Preventive practices prior to IRS and ITNs
Protection from cold
Severity of malaria
Stomach diseases
Susceptibility to malaria
Symptoms of malaria
Use of both ITNs and IRS to prevent malaria

## 7.16 Appendix XVI: First cycle coding for AGA Mal Spray Operators focus group discussions (FGDs)

**FIRST CYCLE CODING FOR AGA MAL SPRAY OPERATORS FGD**

Assist in packing householders' belongings
Community sensitization by spray operators
Deceive householders to accept IRS
Difficulty of carrying spray equipment
Difficulty returning to a community to spray
Difficulty with meeting set targets
Educated people more receptive of IRS
Householders attitude towards IRS spray
IEC training for spray operators
Increase education to improve acceptance
Limited use of ITNs by householders
Main training for spray operators
Need effective stakeholders' partnership to improve acceptance
Need for regular spray
Need to carefully select IRS insecticide to improve acceptance
Need to distribute ITNs alongside spraying to increase acceptance
Need to give prior spray notification to increase acceptance
Refusal due lack of prior notice
Refusal due to change of IRS insecticide
Refusal due to inadequate information
Refusal due to odour of the insecticides
Refusal due to ownership of gods
Refusal due to packing difficulty
Refusal due to secrecy of possessions
Refusal due to staining of walls
Refusal due to tribal or political reasons
Refusal for fear of theft
Refusal not a problem
Sensitizing the community members
Spray operators' exposure to danger during spraying
Spray operators' exposure to insecticides
Spray operators trained on data collection
Transportation challenge affects Spraying
Unavailability of householder to accept IRS spray
Use of odourless insecticides could improve acceptance
Warm reception from householders
Deceive householders to accept IRS
Accept householders' decision if they insist
Take note of causes of refusal
Use of persuasion during refusals
Use of threats and coercion for householders to spray
Developing good personal relations with householders
Familiarization with householders during operations
Self-introduction to householders

Sensitizing householders on IRS
Good reception if good understanding of IRS by householder
Nurses not so receptive to IRS
Violation of spray instructions by householders

## 7.17 Appendix XVII: First cycle coding for AGA Mal Officials semi-structured interviews (SSI)

**FIRST CYCLE CODING FOR AGA Mal OFFICIALS SSI**

AGA Mal collaboration with GHS
AGA Mal staff conduct daily safety briefs for spray operators
AGA Mal staff educate people about IRS
AGA Mal-GHS partnership to promote IRS and ITNs
Components of IRS intervention being implemented in upper west
Conducting refresher training for spray operators
Difficulty of packing belongings affects household acceptance of IRS
Educating people on combining IRS and ITNs
Existence of substitution effect between IRS and ITNs
Frequency of IRS spray
General public dislike for ITN
High acceptance of IRS in the region
Inadequate information affects IRS spray
Inadequate supply of water in some communities affects IRS spraying
Irregular distribution of soap to spray operators
IRS coverage affected by frequent breakdown of spray equipment
ITN ownership by householders no guarantee of usage
ITN sharing hinders household usage
ITNs not used by householders due to heat
Limited off-season staff-community interaction affects IRS operations
Multiple interventions confuse public
Need for AGA Mal to feed operators
Need for stakeholders' partnership to enhance combination of IRS and ITNs
Need stakeholders' partnership to enhance IRS acceptance
Need to intensify education to improve ITN and IRS use
Non-use of ITNs by householders due to restriction of space
Odour of previous IRS insecticide affects acceptability
Pre-spray activities
Procurement difficulties in AGA Mal administration
Projecting number of houses in communities difficult
Provision of community entry training for spray operators
Provision of education on malaria prevention
Provision of mandatory training for recruit IRS spray operators
Proximity of buildings affect IRS spraying
Safety briefs important
Seasonal variations in IRS acceptance
Sensitizing the public to increase ITN use
Shortages of IRS insecticides affects spraying
Some householders bitter about exclusion from job IRS jobs
Spray operators conduct daily pre-checks of IRS equipment
Spray operators' main duty
Spray operators sensitize people about IRS
Unavailability of householder to accept IRS
Vehicular constraints affecting IRS spray

Substitution effect affecting ITN use
Absence of larviciding in scale-up
Pilot model as AGA social intervention
Replicating pilot on scale-up
House preparation and spraying
IRS spraying in accordance with SOP
Logistics and PPE collection and pre-checks
Washing pumps & PPEs after spraying
Duties of IEC staff
General education on malaria and malaria prevention
IEC most important to the success of IRS
Strategies for IEC
Entomology related work
Training operators on communication skills
Conduct refresher training for advocates
Provision of mandatory spray training
Recruitment of spray operators from communities to enhance acceptability
Safety briefing
Spray operators develop rapport with householders
Engage stakeholder through review meetings
Difficulty of packing belongings affects IRS acceptance
Difficulty with mobility
Fear of insecticides
Frequent breakdown of spray equipment
Inadequate monitoring by M&E
Partnership difficulties
Refusal due inadequate prior notice
Refusal due staining of walls
Refusal due to perceived ineffectiveness of recent insecticides
Refusal due to perceived risk of theft
Socio-cultural factors
Socio-economic status variations in IRS acceptance
Pre-spray notification may be poorly done
Spray operators' difficulty with meeting target when poor notification
Unavailability of householders for IEC sensitization
Non-use of ITNs due to restriction of space
Need for stakeholders' partnership to enhance IRS acceptance

## 7.18 Appendix XVIII: First cycle coding for Ghana health service officials semi-structured interviews (SSI)

**FIRST CYCLE CODING FOR GHANA HEALTH SERVICE OFFICIALS SSI**

Free ITN distribution to households involves only LLINs
Free ITN distribution to pregnant women and children
Rationale behind hang-up campaign
Rationale behind two per one ITN distribution strategy
ITN sharing hinders household usage
ITNs not used by householders due to heat
Multiple interventions confuse public
Non-use of ITNs by householders due to restriction of space
Perceived householders' complacency about malaria prevention
Perceived inadequate protection from ITN use
Public dislike for ITN
Skin irritation due to ITN use
Skin rashes develop due to ITN use
Substitution effect affecting ITN use
AGA Mal collaboration with GHS
Training volunteers to distribute ITNs
Staining of walls reduces IRS acceptability
ITNs help reduce malaria burden
ITNs provide protection from cold weather

## 7.19 Appendix XIX: First iteration for householders FGD codes

**Perceived malaria preventative strategies**

- All neighbours need bathroom soakaway
- bathrooms soakaway to prevent malaria
- Clearing bathroom water to prevent malaria
- Dig manholes to prevent malaria
- health education on combining IRS and ITNs
- Health education at community forums
- ITN use for malaria prevention
- Use of both ITNs and IRS to prevent malaria
- Protection from cold
- keep clean surroundings to prevent malaria
- Prevention of mosquito bites

**Communities' perceptions of risks (causes) of malaria**

- Dirty surroundings cause malaria
- Eating cold food causes malaria
- Exposure to cold causes malaria
- Poverty causes malaria
- Physical work causing malaria
- Job-related exposure to mosquitoes
- Stomach diseases
-
-

**Community's beliefs about malaria**

- Malaria kills
- Malaria is common in community
- Malaria more severe in children

**Perceptions of severity of malaria and cue for actions against malaria**

- Fear of malaria

**Community's perceptions of barriers to using IRS and ITN**

- Individuals' religious beliefs (religiosity):I RS refusal due to gods
- ITN non-use due to superstition
- IRS refusal due to carelessness
- Lack of adequate information: IRS non-spray due to inadequate information
- Fear of odour associated with previous IRS
- Perceived low efficacy of current IRS: IRS previous spray more effective than recent
- IRS Spray refusal due to odour
- ITN sharing affecting usage

- ITNs not affordable
- Householders misconceptions about IRS spraying

**Facilitators of using ITN and IRS (Community perceptions of benefits and acceptance of IRS and ITN)**

- Health workers shd visit homes to see how ITNs are hanged
- IRS acceptance for malaria prevention
- Child safety/health Frequent treatment of children
- IRS effective in killing mosquitoes and insects
- IRS kills snakes
- Perceived efficacy of IRS:IRS spray is effective

**Strategies to improve IRS acceptability**

IRS sensitization by adherents to increase acceptance
IRS spray restriction to rooms can't kill all mosquitoes
IRS spray shd be frequent
ITN distribution

ITNs provide all time protection but not IRS
Knowledge about IRS
knowledge about malaria
Malaria being associated with HIV AIDS

**Adverse social impact of malaria**

Malaria causes bad dreams
Malaria causes lost income
Malaria causes lost man-hour
Malaria causes poverty

**Community perceived severity of malaria**

Malaria drug abuse
Malaria mortality
Malaria resistance
Malaria transmission
Non-combination of IRS ITN due to death of mosquitoes
Packing for IRS spray
Preventive practices prior to IRS and ITNs

**Community perceived Knowledge of malaria**

Severity of malaria
Susceptibility to malaria
Symptoms of malaria

## 7.20 Appendix XX: Second iteration for householders FGDs codes (Final codebook)

## Perceived malaria preventative strategies

1. Controlling of mosquito breeding
2. Avoiding overworking
3. Keeping food clean
4. ITN use
5. Use of ITNs and IRS
6. Avoiding exposure to extreme temperatures
7. Testing for malaria
8. Clean surroundings
9. Use of mosquito sprays (eg. Raid)
10. Avoiding mosquito bites

**Note:**

- **Avoiding overworking** to be linked with **avoiding physical work** …also link both to **poverty** as a cause of malaria
- Also, **controlling of mosquito breeding** can be linked with **bathroom soakaways**.
- **Use of IRS and ITNs** to be linked with **combination of IRS and ITNs** as a preventive strategy.

## Communities' perceptions of causes of malaria

1. Dirty surroundings
2. Dietary habits
3. Exposure to extreme temperatures
4. Poverty
5. Mosquito bites

## Barriers to IRS acceptance and ITN usage

### A. Impediments to IRS acceptance

1. IRS refusal due to carelessness
2. Spray operators' refusal to spray
3. Individuals' religious beliefs (Religiosity)
4. Lack of adequate information about IRS
5. Perceived low efficacy of current IRS
6. Fear of insecticides used
7. Difficulty in packing household belongings
8. Secrecy of possessions
9. Bitterness about exclusion from IRS jobs**(staff opinion)
10. Unavailability of householder
11. Householders misconceptions about IRS spraying

### B. Impediments to ITN use

1. Non-use of ITNs at funeral grounds
2. Seasonal variations in mosquito density
3. Inaccessibility and unaffordability of ITNs
4. Substitution effect of IRS spray
5. ITN sharing
6. Loss of efficacy of ITNs
7. Perceived odour and side effects of ITNs
8. Restriction of limited household space by ITNs
9. Superstition

## Facilitators of using ITN and IRS (benefits and acceptance)

1. ITNs and IRS help prevent malaria
2. IRS and ITNs help prevent exposure to mosquito bites
3. IRS acceptance due to individuals' respect for authority
4. Incidental benefit of IRS: kills snakes and insects
5. ITN use provides protection from cold weather
6. Efficacy of IRS

## Recommendations to improve IRS and ITN acceptability

1. Health education on IRS and ITNs
2. Health workers shd visit homes to see how ITNs are hanged
3. IRS sensitization by adherents
4. Frequent spraying of IRS
5. Regular ITN distribution
6. Need for a return to previous IRS insecticide

### Adverse social impact of malaria

1. Social exclusion (due to malaria being association with HIV/AIDS)
2. Malaria causes bad dreams***
3. Malaria reduces income
4. Malaria reduces ability to work
5. Malaria causes poverty

## Susceptibility to, and severity of malaria

1. Fear of malaria
2. Malaria is common in the community
3. Hospitalization
4. Malaria kills
5. Malaria more severe in children
6. Malaria associated with mental health problems

## Misconceptions about malaria and malaria prevention

1. Dirty surroundings as a cause malaria
2. Dietary habits as a cause malaria
3. Exposure to extreme temperature as a cause malaria
4. Perceived ineffectiveness of IRS due to indoor-based spraying.

## Others

- ITNs provide all time protection but not IRS
- Stomach diseases
- Preventive practices prior to IRS and ITNs
- Knowledge about IRS
- Malaria drug abuse
- Malaria resistance
- Symptoms of malaria
- ITNs provide all time protection but not IRS
- Stomach diseases
- Preventive practices prior to IRS and ITNs
- Knowledge about IRS
- Symptoms of malaria

## 7.21 Appendix XXI: First iteration for AGA Mal officials SSI codes

**IMPLEMENTATION OF IRS INTERVENTION**

Components of IRS intervention being implemented in upper west
AGA Mal collaboration with GHS
Frequency of IRS spray in a year
High acceptance of IRS in the region
Absence of larviciding in scale-up
Pilot model as AGA social intervention
Replicating pilot on scale-up
House preparation and spraying
IRS spraying in accordance with SOP
Logistics and PPE collection and pre-checks
Washing pumps & PPEs after spraying
Duties of IEC staff
General education on malaria and malaria prevention
IEC most important to the success of IRS
Strategies for IEC
Entomology related work
Spray data collection and management

**DAILY IRS ACTIVITIES**

Spray operators conduct daily pre-checks of IRS equipment
Conducting daily safety briefs for spray operators
Daily safety briefs important
Spray operators' main duty

**TRAINING AND CAPACITY BUILDING FOR SPRAY OPERATORS**

Provision of community entry training for spray operators
Provision of mandatory training for recruit IRS spray operators
Conducting refresher training for spray operators
Training operators on communication skills
Provision of mandatory spray training
Recruitment of spray operators from communities to enhance acceptability
Safety briefing
Spray operators develop rapport with householders

**OPERATIONAL CHALLENGES IN IRS IMPLEMENTATION**

Shortages of IRS insecticides affects spraying
Limited off-season staff-community interaction affects IRS operations
Prior irregularity in soap distribution to spray operators due to procurement issues
IRS coverage affected by frequent breakdown of spray equipment
Inadequate supply of water in some communities affects IRS spraying
Poor IRS spray planning due to difficulty in projecting number of houses

AGA Mal administration fraught with procurement challenges
Inadequate monitoring by M&E
Partnership difficulties
Refusal due to perceived risk of theft
Socio-cultural factors

**FACTORS AFFECTING IRS ACCEPTANCE**

Unavailability of householder to accept IRS when spraying is ongoing
Vehicular constraints affecting IRS spray
Proximity of buildings affect IRS spraying
Offensive odour of previous IRS insecticide
Difficulty of packing belongings affects households' acceptance of IRS
Seasonal variations in IRS acceptance
ITN sharing hinders householders' usage
Non-use of ITNs by householders due to heat
Non-use of ITNs by householders due to restriction of space
ITN ownership by householders no guarantee of usage
Multiple malaria control interventions confuse public
Inadequate information affects IRS spray
Some householders bitter about exclusion from IRS jobs
Public dislike for ITNs
Staff engaging in public education on IRS
Existence of substitution effect between IRS and ITNs
Substitution effect more applicable to urban settings
Staining of walls reduces IRS acceptability

**COMMUNITITY SENSITIZATION ACTIVITIES**

Spray operators sensitize people about IRS during spraying
Staff engaging in public education on IRS
Staff providing public education on combining IRS and ITNs
Public education on malaria prevention
Sensitizing the public to increase ITN use
Conduct refresher training for advocates
Engage stakeholder through review meetings

**RECOMMENDATIONS FOR IRS ACCEPTANCE**

Need for AGA Mal to feed spray operators
Need stakeholders' partnership to enhance IRS and ITN acceptance
Need to intensify education to improve ITN and IRS use

## 7.22 Appendix XXII: Second iterations for AGA Mal officials SSI codes (Final codebook)

**Components of AGA MAL'S integrated malaria control programme**

Indoor residual spraying (IRS)

1. Spray operators' main duty
2. Spray operators conduct daily pre-checks of IRS equipment
3. Washing of spray equipment
4. House preparation for spraying

Infor, education and communication (IEC) campaign

1. General education on malaria and malaria prevention
2. Spray operators sensitize people about IRS
3. Pre-spray notification
4. Community entry activities
5. Community forums
6. Partnership with other key stakeholders
7. Sensitizing the public to increase ITN use

Monitoring and evaluation

1. Post-spray monitoring

Pilot model and scale-up

**Facilitators of IRS Implementation**

AGA Mal collaboration with GHS
Conducting refresher training for spray operators
Provision of community entry training for spray operators
Provision of mandatory spray training for new spray operator recruits

**Barriers to the implementation of IRS and ITN**

**A. General Barriers to IRS and ITN implementation**

Multiple interventions confuse public
Substitution effect affecting ITN use

**B. Barriers to IRS implementation**

Difficulty of packing belongings affects household acceptance of IRS
Difficulty with mobility
Difficulty with centralised administration and bureaucracy
Frequent breakdown of spray equipment
Inadequate information affects IRS spray
Inadequate supply of water in some communities for mixing insecticides
Limited staff-community interaction during off-season
Odour of previous IRS insecticide affects acceptability
Poor planning due to poor housing data
Seasonal variations in IRS acceptance
Some householders bitter about exclusion from job IRS jobs
Unavailability of householder to accept IRS

### C. Barriers to ITN Distribution Campaign

ITN ownership by householders no guarantee of usage
ITN sharing hinders household usage
ITNs not used by householders due to heat

## Recommendations for IRS And ITN Acceptance

Effective AGA Mal-GHS partnership
Need for AGA Mal to feed operators
Need stakeholders' partnership to enhance IRS and ITN acceptance
Need to intensify education to improve ITN and IRS use

## 7.23 Appendix XXIII: First iterations for AGA Mal spray operators FGD codes

**SPRAY OPERATORS' COMMUNITY ENTRY APPROACH**
Developing good personal relations with householders
Familiarization with householders during operations
Self-introduction to householders
Sensitizing householders on IRS

**COMMUNITY RECEPTION OF IRS**
Warm reception from householders
Educated people more receptive of IRS
Good reception if good understanding of IRS by householder
Nurses not so receptive to IRS
Violation of spray instructions by householders

**APPROACH TO HANDLING REFUSALS**
Deceive householders to accept IRS
Accept householders' decision if they insist
Take note of causes of refusal
Use of persuasion during refusals
Use of threats and coercion for householders to spray

**OCCUPATIONAL HAZARDS IN IRS OPERATIONS**
Spray operators' exposure to danger during spraying*
Spray operators' exposure to insecticides

**COMMUNITY ENTRY APPROACH**
Community sensitization by spray operators
Sensitizing the community members
Assist in packing householders' belongings

**BARRIERS TO IRS AND ITN ACCEPTABILITY**
Difficulty of carrying spray equipment
Difficulty returning to a community to spray
Difficulty with meeting set targets
Refusal due lack of prior notice
Refusal due to change of IRS insecticide
Refusal due to inadequate information
Refusal due to odour of the insecticides
Refusal due to ownership of gods
Refusal due to packing difficulty
Refusal due to secrecy of possessions

Refusal due to staining of walls
Refusal due to tribal or political reasons
Refusal for fear of theft
Refusal not a problem
Unavailability of householder to accept IRS spray
Transportation challenge affects Spraying
Limited use of ITNs by householders

**TRAINING AND CAPACITY BUILDING FOR SPRAY OPERATORS**
IEC training for spray operators
Main training for spray operators
Spray operators trained on data collection

**SUGGESTIONS TO IMPROVE IRS AND ITN ACCEPTANCE**
Increase education to improve acceptance
Need effective stakeholders' partnership to improve acceptance
Need for regular spray
Use of odourless insecticides could improve acceptance
Need to carefully select IRS insecticide to improve acceptance
Need to distribute ITNs alongside spraying to increase acceptance
Need to give prior spray notification to increase acceptance

## 7.24 Appendix XXIV: Second iterations for AGA Mal spray operators FGD codes (Final codebook)

**IRS Community Entry Approach**
Assist in packing householders' belongings
Community based volunteers support spray activities
Community sensitization by spray operators
Developing good personal relations with householders
Familiarization with householders upon first contact
Pre-spray sensitization or notification
Self-introduction to householders
Sensitizing householders on IRS
Sensitizing the community members

**Training and Capacity Building for Spray Operators**
IEC training for spray operators
Main training for spray operators
Spray operators trained on data collection

**Community Reception of IRS**
Educated people more receptive of IRS
IRS well accepted
Nurses not so receptive to IRS
Violation of spray instructions by householders
Warm reception from householders

**Barriers to Implementation of IRS**

**A. Refusals**

Refusal due lack of prior notice
Refusal due to change of IRS insecticide
Refusal due to inadequate information
Refusal due to odour of the insecticides
Refusal due to ownership of gods
Refusal due to packing difficulty
Refusal due to secrecy of possessions
Refusal due to staining of walls
Refusal due to tribal or political reasons

**B. Other Barriers**

Difficulty of carrying spray equipment
Difficulty returning to a community to spray
Difficulty with meeting set targets
Risk of theft accusation by householders
Spray operators' exposure to danger during spraying
Spray operators' exposure to insecticides
Transportation challenge affects Spraying
Socio-economic status variations in IRS acceptance
Unavailability of householder to accept IRS spray

**Approaches to Handling Refusals**
Accept householders' decision if they insist
Call for Supervisors intervention
Deceive householders to accept IRS
Emphasise the challenges with ITN-only usage
Provision of additional education
Take note of causes of refusal
Use of threats and coercion for householders to spray

**Recommendations to Improve IRS and ITN Acceptance**
Intensify education
Need effective stakeholders for partnership
Need for AGA Mal to resort to the use of an acceptable insecticide
Need for regular IRS spray
Need to distribute ITNs alongside spraying
Need to give advanced prior spray notification to householders
Need to reduce set targets for spray operators to allow time for sensitization

**Non-categorized**
Limited use of ITNs by householders

## 7.25 Appendix XXV: Iterations for Ghana health service officials SSI codes (Final codebook)

**ITN Distribution and Hang-Up Campaign**
Free ITN distribution to households involves only LLINs
Free ITN distribution to pregnant women and children
Rationale behind hang-up campaign
Rationale behind two per one ITN distribution strategy

**Barriers to ITN Use**
ITN sharing hinders household usage
ITNs not used by householders due to heat
Multiple interventions confuse public
Non-use of ITNs by householders due to restriction of space
Perceived householders' complacency about malaria prevention
Perceived inadequate protection from ITN use
Public dislike for ITN
Skin irritation due to ITN use
Skin rashes develop due to ITN use
Substitution effect affecting ITN use

**Facilitators of ITN Distribution and use**
AGA Mal collaboration with GHS
Training volunteers to distribute ITNs

**Barriers to IRS Acceptance**
Staining of walls reduces IRS acceptability

**Non-categorized**
ITNs help reduce malaria burden
ITNs provide protection from cold weather

## 7.26 Appendix XXVI: Ethics approval from Flinders University

# FINAL APPROVAL NOTICE

| | |
|---|---|
| Project No.: | **7201** |
| Project Title: | Community knowledge about malaria and acceptability of vector control interventions in Ghana |
| Principal Researcher: | Mr Vitalis Mwinyuri |
| Email: | swwr0001@flinders.edu.au |

| | | | |
|---|---|---|---|
| Approval Date: | 29 March 2016 | Ethics Approval Expiry Date: | **15 December 2019** |

The above proposed project has been **approved** on the basis of the information contained in the application, its attachments and the information subsequently provided.

**RESPONSIBILITIES OF RESEARCHERS AND SUPERVISORS**

1. **Participant Documentation**
   Please note that it is the responsibility of researchers and supervisors, in the case of student projects, to ensure that:
   - all participant documents are checked for spelling, grammatical, numbering and formatting errors. The Committee does not accept any responsibility for the above mentioned errors.
   - the Flinders University logo is included on all participant documentation (e.g., letters of Introduction, information Sheets, consent forms, debriefing

information and questionnaires – with the exception of purchased research tools) and the current Flinders University letterhead is included in the header of all letters of introduction. The Flinders University international logo/letterhead should be used and documentation should contain international dialling codes for all telephone and fax numbers listed for all research to be conducted overseas.

- the SBREC contact details, listed below, are included in the footer of all letters of introduction and information sheets.

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project Number 'INSERT PROJECT No. here following approval'). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au.*

**2. Annual Progress / Final Reports**

In order to comply with the monitoring requirements of the *National Statement on Ethical Conduct in Human Research (March 2007)* an annual progress report must be submitted each year on the **29 March** (approval anniversary date) for the duration of the ethics approval using the report template available from the Managing Your Ethics Approval SBREC web page. *Please retain this notice for reference when completing annual progress or final reports.*

If the project is completed *before* ethics approval has expired please ensure a final report is submitted immediately. If ethics approval for your project expires please submit either (1) a final report; or (2) an extension of time request and an annual report.

Student Projects

The SBREC recommends that current ethics approval is maintained until a student's thesis has been submitted, reviewed and approved. This is to protect the student in the event that reviewers recommend some changes that may include the collection of additional participant data.

Your first report is due on **29 March 2017** or on completion of the project, whichever is the earliest.

**3. Modifications to Project**

Modifications to the project must not proceed until approval has been obtained from the Ethics Committee. Such proposed changes / modifications include:

- change of project title;
- change to research team (e.g., additions, removals, principal researcher or supervisor change);
- changes to research objectives;
- changes to research protocol;
- changes to participant recruitment methods;
- changes / additions to source(s) of participants;
- changes of procedures used to seek informed consent;
- changes to reimbursements provided to participants;

- changes / additions to information and/or documentation to be provided to potential participants;
- changes to research tools (e.g., questionnaire, interview questions, focus group questions);
- extensions of time.

To notify the Committee of any proposed modifications to the project please complete and submit the *Modification Request Form* which is available from the Managing Your Ethics Approval SBREC web page. Download the form from the website every time a new modification request is submitted to ensure that the most recent form is used. Please note that extension of time requests should be submitted prior to the Ethics Approval Expiry Date listed on this notice.

Change of Contact Details

Please ensure that you notify the Committee if either your mailing or email address changes to ensure that correspondence relating to this project can be sent to you. A modification request is not required to change your contact details.

**4. Adverse Events and/or Complaints**

Researchers should advise the Executive Officer of the Ethics Committee on 08 8201-3116 or human.researchethics@flinders.edu.au immediately if:

- any complaints regarding the research are received;
- a serious or unexpected adverse event occurs that effects participants;
- an unforeseen event occurs that may affect the ethical acceptability of the project.

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.27 Appendix XXVII: Ethics approval from Navrongo Health Centre, Ghana

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

*My Ref. App/MalControl/03/2016*
*Your Ref:*


Navrongo Health Research Centre
**Institutional Review Board**
Ghana Health Service
P. O. Box 114
Navrongo, Ghana
*Tel: +233-20-166-0158*

*Email: irb@navrongo-hrc.org*

**18th March, 2016**

Mr Vitalis Mwinyuri
School of Health Sciences, Public Health
Faculty of Medicine, Nursing and Health Sciences
GPO Box 2100
Adelaide SA 5001

ETHICS APPROVAL ID: NHRCIRB223

Dear Mr. Mwinyuri

Approval of protocol titled *'Community knowledge about malaria and acceptability of vector control interventions in Ghana"*

I write to inform you that following your satisfactory address of the concerns raised by the Navrongo Health Research Centre Institutional Review Board (NHRCIRB) after its review of the above-mentioned protocol, the Board is pleased to grant you approval. The following documents were reviewed and approved:

- Completed New Protocol submission form
- Summary of the Protocol
- Study protocol Version 2 dated 17/03/2016
- Participants' information Sheets:
  i. AGA Mal Spray operators
  11. AGA Mal staff
  1u. GHS staff.
  1v. Household Heads
- Consent forms - English Version 2 dated 17/03/2016
- Interview guides
- Focus group Discussion guides
- Page 1 of2
- Curriculum Vitae of Investigators

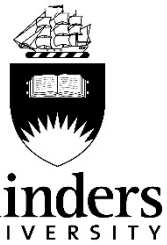
Please note that any amendment to these approved documents must receive ethical clearance from the NHRCIRB before implementation.

Should you require a renewal of your approval, a progress report should be submitted two (2) months before the expiration date. This approval expires on **16111 March, 201 7.** The Board wishes you all the best in this project.

Sincerely,

Dr. Kofi Issah
(Chair, NHRCIRB)
Cc: The Director, NHRC

## 7.28 Appendix XXVIII: Consent forms for householders




CONSENT FORM FOR PARTICIPATION IN RESEARCH

**Community knowledge about malaria and acceptability of vector control interventions in Ghana**

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I ……

being over the age of 18 years hereby consent to participate as requested in the letter of introduction and/or information sheet for the research project on community knowledge about malaria and acceptability of vector control interventions in Ghana.

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I agree to audio recording of my information and participation.
4. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
5. I understand that:

    - I may not directly benefit from taking part in this research.
    - I am free to withdraw from the project at any time and am free to decline to answer particular questions.
    - While the information gained in this study will be published as explained, I will not be identified, and individual information will remain confidential.
    - I may ask that the recording be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.
    - There is the possibility that my anonymity may not be guaranteed given that a focus group discussion is involved.

6. I agree to the transcript being made available to other researchers who are not members of this research team, but who are judged by the research team to be doing related research, on condition that my identity is not revealed.
7. I have had the opportunity to discuss taking part in this research with a family

member or friend.

**Participant's signature (or thumbprint)……Date……**

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

**Researcher's name……**

**Researcher's signature……Date……..**

## 7.29 Appendix XXIX: Information sheets for householders

**Mr Vitalis Mwinyuri**
School of Health Sciences, Public Health
Faculty of Medicine, Nursing and Health Sciences

Level 2, Health Sciences Building
Sturt Road, Bedford Park SA 5042

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Tel: +61 451582481
swwr0001@flinders.edu.au

CRICOS Provider No. 00114A

---

**INFORMATION SHEET**
(For householders)

---

**Title:** ***"community knowledge about malaria and acceptability of vector control interventions in Ghana"***

**Researcher:**

Mr Vitalis Mwinyuri

Department of Public Health

Flinders University

Ph: +61 451582481

**Supervisor(s):**

Dr Lillian Mwanri

Department of Public Health

Flinders University

Ph: +61 872218417

Dr George Tsourtos

Department of Public Health

Flinders University

Ph: +61 872218418

**Description of the study:**

This study is part of the project entitled "*community knowledge about malaria and acceptability of vector control interventions in Ghana*". This project will investigate the facilitators and barriers to malaria control in the upper west region of Ghana.

This project is supported by Flinders University Public Health Department.

**Purpose of the study:**

This project aims to explore:

- Community perceptions about malaria and malaria prevention
- The facilitators and barriers to indoor residual spraying (IRS) acceptability
- The facilitators and barriers to insecticide treated net (ITNs) use
- The facilitators and barriers to combining IRS and ITNs.

**What will I be asked to do?**

You are invited to attend a focus group discussion with a Flinders University postgraduate student who will ask the group a few questions about your views on malaria, indoor residual spraying and insecticide treated nets. The focus group discussion will take about 50 to 70 minutes on one occasion.

**What benefit will I gain from being involved in this study?**

The sharing of your experiences may improve the implementation of malaria prevention programmes, and enhance community acceptability of malaria control programmes in Ghana.

**Will I be identifiable by being involved in this study?**

We do not need to retain your name and you will be anonymous. Given that the study involves a focus group discussion; there is the possibility that your anonymity may not be guaranteed. However, the researcher will seek verbal agreement between all participants that they will maintain the anonymity of other participants. Once the focus group discussion has been transcribed and saved as a file, the audio file will then be destroyed. Any identifying information will be removed and transcription file will be stored on a password protected computer that only the researcher (Mr Vitalis Mwinyuri) will have access to. Your comments will not be linked directly to you. The transcript could be made available to other researchers who are not members of this research team, but who are judged by the research team to be doing related research, on condition that your identity is not revealed.

**Are there any risks or discomforts if I am involved?**

The investigator anticipates minimal risks or discomforts from your involvement in this study. Should you experience any emotional distress or discomforts, please drop-in at your community health centre for free counselling service.

**How do I agree to participate?**

Participation is voluntary. You may answer ‘no comment’ or refuse to answer any

questions and you are free to withdraw from the focus group discussion at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and contact the investigator using the contact details above.

**How will I receive feedback?**

The researcher will not provide you with feedback on the study.

**Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.**

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.30 **Appendix XXX: Introductory letter for householders**

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

Health Sciences Building, Sturt Road,
Bedford Park, SA 5042

GPO Box 2100

Adelaide SA 5001

Tel: 08 72218417

lillian.mwanri@flinders.edu.au

2/02/2016

LETTER OF INTRODUCTION

---

Dear Sir/Madam

This letter is to introduce Vitalis Mwinyuri who is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University. He will produce his student card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the topic "***community knowledge about malaria and acceptability of vector control interventions in Ghana***".

He would like to invite you to assist with this project by agreeing to be involved in a focus group discussion which covers certain aspects of this topic. The focus group discussion will take between 50 to 70 minutes on one occasion.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Since he intends to make a tape recording of the focus group discussions, he will seek your consent, on the attached form, to record the interview, to use the recording or a transcription in preparing the thesis, report or other publications, on condition that your name or identity is not revealed.

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on +61 8 72218417 or e-mail (lillian.mwanri@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201) For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.31 Appendix XXXI: Introductory letter for householders (Dagaare translation)

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

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GPO Box 2100

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lillian.mwanri@flinders.edu.au

2/02/2016

**MEÞƐ DEWULIBU GANE**

Nsɛ/Madam

A gane ŋa na de la Vitalis Mwinyuri naŋ e sakubie naŋ be Nasateŋɛ sakuuri kaŋa ba naŋ boɔlɔ "Flinders University" poɔ, a zanna ka o leɛ Dɔɔta a yi a zannoo bɔgraa na naŋ kyaare nensaaleba laafeeloŋ yɛlɛ. O na wuli la kartalee kaŋa naŋ taa o foto zuŋmaa naŋ sereŋ wuli ka o e la sakubie a sakuuri na poɔ.

O peɛrɛ la yelpeɛraa kaŋa naŋ na wuli o be beebu gansɛgraa kaŋa ka a yelzu e "**Noba teɛroŋ naŋ waa lɛ kyaare donne baaloŋ ane o ŋmɛfɛroo sobie Ghana poɔ ".**

O na boɔrɔ la ka o boɔle yɛ ka fo soŋ ka yɛ gyɛle a yɛlɛ ama naŋ kyaare a yelzu ŋa yelpeɛre mine.

A seŋ ka fo baŋ ka duoro zaa fo naŋ tere na maŋ be la te bayi yoŋ sogaŋ, azuiŋ neɛzaa naŋ e yelzaa bee a yeli yelzaa soŋ a yelpeɛraa ŋa, te na maŋ sɔgle la o soba yuori. Sori be be la ka fo tõɔ yi a yelpeɛraa ŋa poɔ wagre na zaa fo naŋ boɔrɔ bee ka fo zagre ka fo iri soorebie mine nɔɛ fo naŋ ba boɔrɔ.

O naŋ na boɔrɔ ka o de a yɛlɛ yɛ naŋ gyɛle eŋ tepu poɔ zuiŋ, o na sɔre yɛ la, a yi a kartalee na poɔ, ka ka yɛ ko o vuo ka o tõɔ tepu a yelyaga a la gaa te maaleŋ ŋmɛ a ka a tõɔ soŋ ka a yelpeɛraa ŋa tõɔ ŋmɛ-yaare. O na vɛŋ la ka yɛ baŋ ka o na sɔgle la yɛ yoe ka a ta poɔ a yelpeɛraa ŋa ziezaa poɔ.

Ka fooŋ wa taa yelsooraa zaa naŋ kyaare a yelpeɛraa ŋa, de o eŋ a gantoɔle daga na naŋ be a zusogaŋ bee ka fo boɔle ma ne taŋgare miri ŋa

+61872218417 be ɔ e-mail (lillian.mwanri@flinders.edu.au).

Yɛ bareka ne yɛ kyɛlloo ne yɛ sommo.

Yɛ zɔmeŋɛ

Dr Lillian Mwanri.
Senior Lecturer
School of Health Sciences, Public Health

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (*Project number 7201). *For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.32 Appendix XXXII: Information sheets for householders (Dagare translation)

MR VITALIS MWINYURI
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**DUORO KARTAARE**

***Yelzu: "Noba teɛroŋ naŋ waa lɛ kyaare donne baaloŋ ane o ŋmɛfɛroo sobie Ghana poɔ"***

**Peɛrepeɛrɛ:**

N ba Vitalis Mwinyuri
Department of Public Health
Flinders University
Ph: +61 451582481

**Peɛrepeɛrɛ Maal-ennɛ (ennemɛ):**

Dr Lillian Mwanri
Department of Public Health
Flinders University
Ph: +61 872218417

Dr George Tsourtos
Department of Public Health
Flinders University
Ph: +61 872218418

**Zannoo Waaloŋ**

A zannoo ŋa yelzu la "**Noba teɛroŋ naŋ waa lɛ kyaare donne baaloŋ ane o ŋmɛfɛroo sobie Ghana poɔ ".** A yelpeeraa ŋa na peɛre la noba na naŋ maŋ sonna a donne baaloŋ ŋmɛfɛroo yɛlɛ, a wuli bone na naŋ so ka donne baaloŋ ŋmɛfɛroo maŋ e tuo a Ɔpawɛɛs

Irigyin naŋ be Ghana poɔ. Flinders Yunivenite zannoo bɔgraa kaŋa naŋ kyaare nensaaleba laafeeloŋ yɛlɛ la sonna ka a yelpeɛraa ŋa na nyɛ eebo.

**A zannoo ananso**

A zannoo ŋa boɔrɔ ka o bɔ-nyɛ:

- A teŋɛ noba teɛroŋ a kyaare donne baaloŋ ane o ŋmɛfɛroo yɛlɛ
- Lɛnɛɛ noba naŋ ba sage ba mere ba deri ne donne téé a ko donne
- Lɛnɛɛ noba naŋ ba boɔrɔ ka ba gana donne kyoori ba naŋ maŋ mere téé poore
- Lɛnɛɛ noba naŋ ba boɔrɔ ka ba gaŋ donne kyoori ba naŋ mere téé poore kyɛ ba la boɔrɔ ka ba mere ba deri ne donne téé meŋ.

**Boŋ ka ba na soore ma ka Ne?**

Flinders Yuniveniti sakubie kaŋa naŋ boɔrɔ ka o zanne do saa yaga na boɔle yɛ la ka yɛ lantaa gyɛle yɛlɛ mine. O na soore yɛ la ka yɛ wuli yɛ teɛroŋ te kyaare bone na yɛ naŋ baŋ te kyaare ne donne baaloŋ donne kyoori ba na maŋ mere donne téé kyɛ gaŋ yɛlɛ. A yɛlɛ gyɛlebo na kɔɔre seŋ la gbelli boŋyeni ane kyɛlee (Mitiri lezaɛ anaare ne pie)

**Boŋ tɔna ka a zannoo ŋa na taa ko ma?**

Ka fooŋ de fo hakela poŋ ko fo taaba, a lɛ na soŋ la ka fo baŋ donne baaloŋ ŋmɛfɛroo yeltuuri mine kyɛ la soŋ meŋ ka a yeltuuri ama tõɔ nyɛ eebo a Ghana poɔ .

**Ka maaŋ poɔ a zannoo ŋa poɔ, noba na tõɔ baŋ ka n poɔ la be?**

Te koŋ sage ka neɛzaa baŋ ka fo poɔ la a zannoo ŋa poɔ. A zannoo naŋ na kyaare neŋyaga laŋ zeŋ gyɛlebo zuiŋ, bamine pɔge na vɛŋ la ka noba baŋ ka ba taaba poɔ la a yelpeɛraa ŋa poɔ. A lɛ zuiŋ, a peɛrepeɛrɛ na e la ka yɛ de yɛ nɔɛ pollle ko taa ka kaŋazaa na sɔgle la o tɔ zu. Te koŋ sage de neɛzaa yuori eŋ a gane poɔ bee a de eŋ a yelyaga te naŋ na tepu poɔ. Ka teneŋ wa te sɛge neɛzaa noɔre yɛlɛ eŋ benee a naŋ koŋ tõɔ bɔre, te na de ŋmare la bone na te naŋ de nyɔge/teepu ne a yelyaga bare. Bone na zaa naŋ na tõɔ vɛŋ ka noba baŋ neɛzaa kɔkɔre, te na iri o la bare kyɛ de a yelyaga yoŋ eŋ zie na a peɛrepeɛrɛ (N ba Vitalis Mwinyuri) yoŋ naŋ na tõɔ nyɛ a. Ka fooŋ w ate wuli fo teɛroŋ kyaare yelzaa, te na sɔgle la fo yuori ka noba ta baŋka fo.

**Ka maaŋ poɔ a yelpeɛraa ŋa poɔ, dɔgroŋ kaŋa bee toɔra mine na tõɔ pɔge ma la be?**

**A** peɛrepeɛrɛ teɛroŋ wuli o la ka yelwonni koŋ tõɔ pɔge neɛzaa a peɛroo ŋa poɔ

**Wola ka N na e ka a wuli ka N sagɛɛ la na poɔ a yelpeɛraa ŋa poɔ?**

A yelpeɛraa ŋa poɔ kpeɛbo e la poboɔbo yɛlɛ. Ka fooŋ boɔrɔ, fo koŋ yeli yelzaa a yelpeɛraa ŋa poɔ bee a zagre ka fo iri soorebiri kaŋazaa noɔre ba naŋ soore fo. Fo gba na tõɔ iri la fomeŋɛ yi ne a yelpeɛaa ŋa poɔ kyɛ ka yelzaa ba e fo. Kartaa kaŋa na poɔ la a yelpeɛraa kartaare ama

poɔ a na wuli ka fo sagɛɛ la bee fo ba sage. Ka fooŋ wa sage na poɔ a yelpeɛraa ŋa poɔ, kanne a yɛlɛ naŋ be a kartaa poɔ kyɛ pãã golgoli fo yuori bee a neɛ fo nubiri naŋ na wuli ka fo kanne la a yɛlɛ. N na bare o la ko fo ka daare kaŋa ka N wa de.

**Wola ka N naŋ la e woŋ a yelpeɛraa ŋa duoro a peɛre baaroo puoriŋ?**
A peɛrepeɛrɛ koŋ ko fo duoro zaa a yi a yelpeɛraa ŋa puoriŋ.

**Bareka ne fo nang de fo wagre sage kanne ne a y3l3 nang be a kartaa nga poc.**

**Te taa la kyelloo ka fo na sage la a te boclaa a poc a yeli nga poc**

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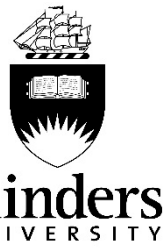
## 7.33 Appendix XXXIII: Consent forms for householders (Dagaare translation)




Kartaa nang wullo a yelpe3raa poc kpe3bo yeltuuri

**Yɛŋ a teŋɛ noba naŋ taa a kyaare donne baaloŋ ane o ŋmɛfɛroo a Ghana poɔ**

Maa……..

naŋ pare yuomo pie ne anii (18) sagɛɛ la ka N na poɔ la a yelpeɛraa na naŋ kyaare donne baaloŋ yɛlɛ ane lɛ ba naŋ na tõɔ de téé mine ŋmɛ ne o fɛre a Ghana poɔ kyɛ, a seŋ a yɛ kyɛyuobu gane na bee a ayelmanne gane yɛ naŋ da daŋ sɛge naŋ wuli lɛ.

1. N kanne la a duoro na naŋ be be.
2. Ba manne la yelzaa ane toɔrɔ na zaa naŋ na tõɔ pɔge ma a yi a toma ama tommo poɔ ka a kyaane ko ma.
3. N sagɛɛ la ka ba de n noɔre yɛlɛ ane n yel-erre zaa naŋ seŋ ne eŋ tepu poɔ.
4. N baŋɛɛ la ka yelyaga zaa N naŋ na yeli ka ba sɛge eŋ a kartaare poɔ, ka ba na ko ma la a kartaa kaŋa ka N biŋ gu ne nandaare kaŋa zuiŋ.
5. N baŋɛɛ la ka :
    - N pɔge koŋ nyɛ tɔna kaŋa daa daa lɛ a yi a yelpeɛraa ŋa poɔ.
    - N taa la sori na tõɔ yeli ka N ba la poɔ a yelpeɛraa ŋa poɔ wagre na zaa N naŋ boɔrɔ bee a zagre ka N iri soorebie mine ba naŋ soore ma nɔɛ.
    - Aneazaa ka ba na e la ka a yelpeɛraa ŋa duoro sãã gbaŋgbale ko neɛzaa aseŋ ba naŋ manne lɛ, kyɛ ba koŋ pore n yuori a yeli ŋa poɔ. Neɛzaa naŋ yeli o noɔre yɛlɛ a yelpeɛraa ŋa poɔ, ba na maŋ sɔgle la o soba yuori.
    - Ka maaŋ poɔ a yelpeɛraa ŋa poɔ bee ka N ba poɔ, bee a kpɛ tasoga a la zagre kyɛ yi, kyɛ a lɛ koŋ taa yelfaa zaa kyaare lɛ ba naŋ na maŋ kaa ma ka maaŋ wa te beɛrɛ.
    - Te naŋ waa neŋyaga zuiŋ, kaapɔge neɛkaŋa na tõɔ vɛŋ la ka noba ba ka N poɔ la a yelpeɛraa ŋa poɔ.

6. N sagɛɛ la ka ba de n yɛlɛ zaa ba naŋ sɛge biŋ bee ba naŋ de eŋ tepu poɔ, ko noba mine meŋ peɛroo naŋ peɛle a yelpeɛraa ŋa ka a noba naŋ na wa tõɔ sɔgle n yuori a yi a ba yelpeɛraa na poɔ.
7. N da nyɛ la vuo a tõɔ gyɛle a a yelpeɛraa ŋa poɔ kpeɛbo yɛlɛ ko n dɔgra kaŋa bee n zɔmeŋɛ kaŋa.

**Nempeɛraa yuori golgoluu (nubidaa neɛbo)** ……. **Bebiri** …….....

N pollɛɛ la ka N manne la a zannoo ŋa yeltuuri zaa ko a nempeɛraa, a pãã de ka o baŋ la yelzaa naŋ kyaare a zannoo ŋa. Omeŋɛ la sage ka o na poɔ la a zannoo ŋa poɔ.

**Peɛrepeɛrɛ yuori**

……..

**Peɛrepeɛrɛ yuori golgoluu** ……**Bebiri** ……..

## 7.34 Appendix XXXIV: Information sheets for AGA Mal spray operators

**Mr Vitalis Mwinyuri**
School of Health Sciences, Public Health
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CRICOS Provider No. 00114A

---

**INFORMATION SHEET**
(For AGA Mal Ltd spray operators)

---

**Title:** "***Community knowledge about malaria and acceptability of vector control interventions in Ghana***"

**Researcher:**

Mr Vitalis Mwinyuri

Department of Public Health

Flinders University

Ph: +61 451582481

**Supervisor(s):**

Dr Lillian Mwanri

Department of Public Health

Flinders University

Ph: +61 872218417

Dr George Tsourtos

Department of Public Health

Flinders University

Ph: +61 872218418

**Description of the study:**

This study is part of the project entitled "*community knowledge about malaria and acceptability of vector control interventions in Ghana*". This project will investigate the facilitators and barriers to malaria control in the upper west region of Ghana. This

project is supported by Flinders University Public Health department.

**Purpose of the study:**

This project aims to explore:

- Community perceptions about malaria and malaria prevention
- The facilitators and barriers to indoor residual spraying (IRS) acceptability
- The facilitators and barriers to insecticide treated net (ITNs) use
- The facilitators and barriers to combining IRS and ITNs.

**What will I be asked to do?**

You are invited to attend a focus group discussion with a Flinders University postgraduate student who will ask the group a few questions about your views on indoor residual spraying and insecticide treated nets. The focus group discussion will take between 50 to 70 minutes on one occasion.

**What benefit will I gain from being involved in this study?**

The sharing of your experiences may improve the implementation of malaria prevention programmes, and enhance community acceptability of malaria control programmes in Ghana.

**Will I be identifiable by being involved in this study?**

We do not need to retain your name and you will be anonymous. Given that the study involves a focus group discussion; there is the possibility that your anonymity may not be guaranteed. However, the researcher will seek verbal agreement between all participants that they will maintain the anonymity of other participants. Once the focus group discussion has been transcribed and saved as a file, the audio file will then be destroyed. Any identifying information will be removed and transcription file will be stored on a password protected computer that only the researcher (Mr Vitalis Mwinyuri) will have access to. Your comments will not be linked directly to you. The transcript could be made available to other researchers who are not members of this research team, but who are judged by the research team to be doing related research, on condition that your identity is not revealed.

**Are there any risks or discomforts if I am involved?**

The investigator anticipates minimal risks or discomforts from your involvement in this study. Should you experience any emotional distress or discomforts, please drop-in at your community health centre for free counselling service.

**How do I agree to participate?**

Participation is voluntary. You may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the focus group discussion at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and contact the investigator using the contact details above.

**How will I receive feedback?**

The researcher will not provide you with feedback on the study.

**Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.**

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.35 Appendix XXXV: Introductory letter for AGA Mal spray operators

Dr Lillian Mwanri
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Tel: 08 72218417
lillian.mwanri@flinders.edu.au

10/02/2016

**LETTER OF INTRODUCTION**
(For Spray operators)

Dear Sir/Madam

This letter is to introduce Vitalis Mwinyuri who is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University. He will produce his student card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the topic "***community knowledge about malaria and acceptability of vector control interventions in Ghana***".

He would like to invite you to assist with this project by agreeing to be involved in a focus group discussion which covers certain aspects of this topic. The focus group discussion will take between 50 to 70 minutes on one occasion.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

*Since he intends to make a tape recording of the focus group discussions, he will seek your consent, on the attached form, to record the interview, to use the recording or a transcription in preparing the thesis, report or other publications, on condition that your name or identity is not revealed.*

Any enquiries you may have concerning this project should be directed to me at the address given above or by telephone on +61 8 72218417 or e-mail (lillian.mwanri@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

[redacted]

Dr Lillian Mwanri
Senior Lecturer
School of Health Sciences, Public Health

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.36 Appendix XXXVI: Consent forms for AGA Mal spray operators

Flinders
UNIVERSITY

**CONSENT FORM FOR PARTICIPATION IN RESEARCH**

| Community knowledge about malaria and acceptability of vector control interventions in Ghana |
|---|

I ……

being over the age of 18 years hereby consent to participate as requested in the letter of introduction and/or information sheet for the research project on community knowledge about malaria and acceptability of vector control interventions in Ghana.

1. I have read the information provided.
2. Details of procedures and any risks have been explained to my satisfaction.
3. I agree to audio recording of my information and participation.
4. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
5. I understand that:
   - I may not directly benefit from taking part in this research.
   - I am free to withdraw from the project at any time and am free to decline to answer particular questions.
   - While the information gained in this study will be published as explained, I will not be identified, and individual information will remain confidential.
   - I may ask that the recording be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.
   - There is the possibility that my anonymity may not be guaranteed given that a focus group discussion is involved.
6. I agree to the transcript being made available to other researchers who are not members of this research team, but who are judged by the research team to be doing related research, on condition that my identity is not revealed.
7. I have had the opportunity to discuss taking part in this research with a family member or friend.

**Participant's signature (or thumbprint)……Date……..**

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

**Researcher's name……**

**Researcher's signature……..……..……..……..Date……..……..……...**

## 7.37 Appendix XXXVII: Consent forms for AGA Mal and Ghana health service officials


CONSENT FORM FOR PARTICIPATION IN RESEARCH

**Community knowledge about malaria and acceptability of vector control interventions in Ghana**

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I ……

being over the age of 18 years hereby consent to participate as requested in the letter of introduction and/or information sheet for the research project on community knowledge about malaria and acceptability of vector control interventions in Ghana.

4. I have read the information provided.
5. Details of procedures and any risks have been explained to my satisfaction.
6. I agree to audio recording of my information and participation.
4. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.

5. I understand that:

- I may not directly benefit from taking part in this research.
- I am free to withdraw from the project at any time and am free to decline to answer particular questions.
- While the information gained in this study will be published as explained, I will not be identified, and my individual information will remain confidential.
- I may ask that the recording be stopped at any time, and that I may withdraw at any time from the session or the research without disadvantage.
- There is the possibility that my anonymity may not be guaranteed given that the interviews will be conducted in my office.

6. I agree to the transcript being made available to other researchers who are not members of this research team, but who are judged by the research team to be doing related research, on condition that my identity is not revealed.

7. I have had the opportunity to discuss taking part in this research with a family member or friend.

**Participant's signature……Date……..**

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

**Researcher's name……..**

**Researcher's signature……..Date……..**

## 7.38 Appendix XXXVIII: Information sheets for AGA Mal and Ghana health service officials

MR VITALIS MWINYURI
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Public Health
Faculty of Medicine, Nursing and Health Sciences
Level 2, Health Sciences Building
Sturt Road, Bedford Park, SA 5042
GPO Box 2100
Adelaide SA 5001
Tel: +61 451 582 481
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# INFORMATION SHEET

**Title:** "***Community knowledge about malaria and acceptability of vector control interventions in Ghana***"

**Researcher:**

Mr Vitalis Mwinyuri
Department of Public Health
Flinders University
Ph: +61 451582481

**Supervisor(s):**

Dr Lillian Mwanri
Department of Public Health
Flinders University
Ph: +61 872218417

Dr George Tsourtos
Department of Public Health
Flinders University
Ph: +61 872218418

**Description of the study:**

This study is part of the project entitled "*community knowledge about malaria and acceptability of vector control interventions in Ghana*". This project will investigate the

facilitators and barriers to malaria control in the upper west region of Ghana. This project is supported by Flinders University Public Health department.

**Purpose of the study:**

This project aims to explore:

- Community perceptions about malaria and malaria prevention
- The facilitators and barriers to indoor residual spraying (IRS) acceptability
- The facilitators and barriers to insecticide treated net (ITNs) use
- The facilitators and barriers to combining IRS and ITNs.

**What will I be asked to do?**

You are invited to attend a one-on- interview with a Flinders University postgraduate student who will ask you a few questions about your views on indoor residual spraying and insecticide treated nets. The interview will take between 45 to 60 minutes on one occasion.

**What benefit will I gain from being involved in this study?**

The sharing of your experiences may improve the implementation of malaria prevention programmes, and enhance community acceptability of malaria control programmes in Ghana.

**Will I be identifiable by being involved in this study?**

We do not need to retain your name and identity. However, given that the interview will may be conducted in your office, there is the possibility that your anonymity may not be guaranteed. Once the interview has been transcribed and saved as a file, the audio file will then be destroyed. Any identifying information will be removed and transcription file will be stored on a password protected computer that only the researcher (Mr Vitalis Mwinyuri) will have access to. Your comments will not be linked directly to you. The transcript could be made available to other researchers who are not members of this research team, but who are judged by the research team to be doing related research, on condition that your identity is not revealed.

**Are there any risks or discomforts if I am involved?**

The investigator anticipates minimal risks or discomforts from your involvement in this study. Should you experience any emotional distress or discomforts, please drop-in at your community health centre for free counselling service.

**How do I agree to participate?**

Participation is voluntary. You may answer 'no comment' or refuse to answer any questions and you are free to withdraw from the in-depth interview at any time without effect or consequences. A consent form accompanies this information sheet. If you agree to participate please read and sign the form and contact the investigator using the contact details above.

**How will I receive feedback?**

Outcomes from the project will be summarised and offered to you by the investigator.

**Thank you for taking the time to read this information sheet and we hope that you will accept our invitation to be involved.**

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

## 7.39 Appendix XXXIX: Introductory letter for AGA Mal and Ghana health service officials

Dr Lillian Mwanri

Senior Lecturer

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Health Sciences Building, Sturt Road, Bedford Park, SA 5042

GPO Box 2100

Adelaide SA 5001

Tel: 08 72218417

lillian.mwanri@flinders.edu.au

2/02/2016

LETTER OF INTRODUCTION

Dear Sir/Madam

This letter is to introduce Vitalis Mwinyuri who is a Doctor of Philosophy (PhD) student in the Department of Public Health at Flinders University, Australia. He will produce his student card, which carries a photograph, as proof of identity.

He is undertaking research leading to the production of a thesis or other publications on the topic "***community knowledge about malaria and acceptability of vector control interventions in Ghana***".

He would like to invite you to assist with this project by agreeing to be involved in an interview which covers certain aspects of this topic. The interviews will take between 45 to 60 minutes on one occasion.

Be assured that any information provided will be treated in the strictest confidence and none of the participants will be individually identifiable in the resulting thesis, report or other publications. You are, of course, entirely free to discontinue your participation at any time or to decline to answer particular questions.

Since he intends to make a tape recording of the interview, he will seek your consent, on the attached form, to record the interview, to use the recording or a transcription in preparing the thesis, report or other publications, on condition that your name or identity is not revealed.

Any enquiries you may have concerning this project should be directed to me at the

address given above or by telephone on +61 8 72218417 or e-mail (lillian.mwanri@flinders.edu.au).

Thank you for your attention and assistance.

Yours sincerely

Dr Lillian Mwanri

Senior Lecturer

School of Health Sciences, Public Health

*This research project has been approved by the Flinders University Social and Behavioural Research Ethics Committee (Project number 7201). For more information regarding ethical approval of the project the Executive Officer of the Committee can be contacted by telephone on 8201 3116, by fax on 8201 2035 or by email human.researchethics@flinders.edu.au*

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