FACTORS ASSOCIATED WITH COVERAGE AND ACCEPTABILITY OF INDOOR RESIDUAL SPRAYING (IRS) FOR MALARIA PREVENTION IN NASSARAWA EGGON LGA OF NASSARAWA STATE, NIGERIA

BY

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DECLARATION

I declare that the work in the dissertation entitled factors associated with and acceptability of indoor residual spraying (IRS) for malaria prevention in NasarawaEggon LGA of Nasarawa state, 2014 has been performed by me in the department of community medicine under the supervision of Prof. M.N. Sambo. The information from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at any university.

_____ _____

Dimas, HannatuJanada Date

CERTIFICATION

This thesis titled **"FACTORS ASSOCIATED WITH AND ACCEPTABILITY OF INDOOR RESIDUAL SPRAYING (IRS) FOR MALARIA PREVENTION IN NASARAWA EGGON LGA OF NASARAWA STATE, NIGERIA"** by Dimas, Hannatu Janada meets regulations governing the award of the degree of master in public Health of Ahmadu Bello University, and is Approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my late mother Mrs. Salome-Vicky Istifanus Mangga.

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LIST OF ABBREVIATIONS

AFENET	-	Africa Field Epidemiology Network
CDC	-	Centers for Disease Control and Prevention
DDT	-	Dichlorodiphenyltrichloroethane
EIS	-	Epidemic Intelligence Service
FGD	-	Focused Group Discussion
FMOH	-	Federal Ministry of Health
IPT	-	Intermittent Preventive Treatment
IRS	-	Indoor Residual Spraying
ITN	-	Insecticide Treated Nets
IVM	-	Integrated Vector Management
KII	-	Key Informant Interview
LC	-	Lethal Concentration
LLIN	-	Long Lasting Insecticidal treated nets
NFELTP	-	Nigeria Field Epidemiology and Laboratory Training Programme
NMEP	-	National Malaria Elimination Programme
PBO	-	Piperonyl B
PMI	-	President's Malaria Initiative
RBM	-	Roll Back Malaria
WHO	-	World Health Organization

SUMMARY

Malaria is endemic in Nigeria with 97% of the population at risk. It accounts for 60% of outpatient visits and 30% of hospitalizations among children under five years of age in Nigeria. Indoor residual spraying (IRS) is one of the major strategies recommended by the World Health Organization (WHO) for malaria control in endemic populations. It played a major role in control and eradication of malaria in some countries in the past. The success of malaria control interventions requires high coverage and utilization at individual and community levels. It is important to understand community's perceptions on this available intervention. The study was carried out to determine key factors responsible for acceptability and/or refusal of IRS the selected communities.

A cross-sectional study in NasarawaEggon LGA, Nasarawa state, was conducted from March to October 2014. A sequential explanatory mixed method was used and multistage sampling technique was employed. A structured questionnaire was used to collect data on socio-demographic characteristics of household heads or their representatives. Data on perceptions on IRS, history and cost of malaria prevention in relation to periods before and after IRS introduction was also collected. Key informant interviews were also conducted to determine acceptability and reasons for refusal of IRS.

There was a near universal (99.3%) IRS coverage within the selected communities. Acceptability in case of future spraying was however lower (68%). Perceived effectiveness was the major factor associated with IRS acceptability with adjusted odds ratio(AOR): 21and (95% confidence interval (CI) 6.9-68.8). Majority of respondents that would accept IRS in case of future spraying had lower household cost of other malaria preventive practices after IRS;OR: 5.0 (95%CI: 1.1-21.8).Furthermore, age, main occupation, lower number of fever episodes, are other factors that affect IRS acceptability. Majority of side effects were not health related. However, among the health related side effects, skin reactions were the most reported. The relationship between having health related side effects and acceptability of IRS was not statistically significant. This study destablished that IRS was widely accepted and the coverage was in agreement with the World Health Organization's (WHO) recommendation of at least 80% within the targeted communities.

CHAPTER ONE: INTRODUCTION

1.1 Background

Malaria is caused by a parasite, Plasmodium. There are 5 species known to affect humans; *P. Falciparum, P. ovale (sub-species P. ovale_curtisi, P. ovale_wallikeri) P. malariae, P. knowlesi and P. vivax*. It is transmitted by the bite of female anopheles mosquito. It may also be transmitted vertically from a pregnant mother to the unborn child.

The World Health Organization estimates 216 million cases of malaria occurred in 2010, 81% in the African region.[1]Thirty countries in Sub-Saharan Africa account for 90% of global malaria deaths. Nigeria, Democratic Republic of Congo (DRC), Ethiopia, and Uganda account for nearly 50% of the global malaria deaths.[1]

Malaria is a public health problem in Nigeria. It has been eliminated in some countries but yet to be controlled in Nigeria. Malaria has been found to be endemic in Nigeria with 97% of the population at risk. The remaining 3% of the population live in the malaria free highlands.[1]This problem is responsible for 60% of outpatient visits and 30% of hospitalizations among children less than five years of age in Nigeria.[1] Pregnant women are also affected by the disease. Malaria in pregnancy leads to several complications affecting both the pregnant mother and the unborn child.

In Nigeria, 11% of maternal deaths are due to Malaria. In 2010, an estimated 655,000 people died of malaria - most were young children in sub-Saharan Africa.[1]An estimated 65% of Nigeria's population lives in poverty, and poverty is a major factor in malaria

prevention and treatment.[1] There is an estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria.[1]

The general objective of Integrated Vector Management is the reduction of vector-borne disease particularly, malaria via the utilization of multiple control measures in a compatible manner. As its name implies, Indoor Residual Spraying (IRS) involves coating the walls and other surfaces of a house with a residual insecticide. A dilute solution of insecticide is sprayed on the inside walls of certain types of dwellings - those with walls made from porous materials such as mud or wood but not plastered concrete as in city dwellings. For several months, depending on the chemical composition and concentration, the insecticide will kill mosquitoes and other insects that come in contact with these surfaces. The effective period of most commonly used insecticides range from 4 to 6 months. The Mosquitoes are either killed or repelled by the spray. IRS however, does not directly prevent people from being bitten by mosquitoes but succeeds in preventing transmission of the disease by eliminating mosquitos-usually while resting. Within the last decade, increasing numbers of partners and resources have rapidly increased malaria control efforts. This scale-up of interventions has led to decreased morbidity and mortality in a number of countries, and there are hopes that ultimately malaria can be eradicated. Inadequate coverage of IRS spraying gives little or no protection at all.[2]It is therefore generally recommended that IRS should be provided where possible.

Integrated Vector Management has been recommended by World health organization African regional office (WHO/AFRO) as the main vector control strategy in Nigeria. The concept of IVM is built on selected vector control strategies and it involves the targeted

use of different vector control methods alone or in combination. This is to prevent or reduce vector populations and human- vector contact cost-effectively and in a sustainable manner. This is clearly in consonance with the Roll Back Malaria (RBM) multiple vector control strategies. In carrying out IVM, efforts are made to apply environmentally sound interventions in order to control vector populations. Most of the recent and historical reductions in malaria cases have been attributed to insecticide treated nets (ITNs), and IRS.[3] Indoor residual insecticide spraying, while typically used for low malaria risk or epidemic prone regions has been further advocated for use in high and medium malaria transmission setting.[4] In 2008, 44 countries employed IRS as a malaria control strategy. The World Health Organization (WHO) recommends IRS as one of three primary means of malaria control, the others being use of insecticide treated bed nets (ITNs) and prompt treatment of confirmed cases with artemisinin-based combination therapies (ACTs).[4] While previously the WHO had recommended IRS only in areas of sporadic malaria transmission, in 2006 it began recommending IRS in areas of endemic, stable transmission as well. For IRS to be effective, at least 80% of homes and barns in an area must be sprayed.[4]

The success of malaria control interventions requires high coverage and utilization at individual and community levels.[6]It is important to understand community's perceptions on available interventions. Negative perceptions about an intervention have been found to be a major setback to the appropriate use and adequate coverage of such interventions.

The health belief model is on the assumption that adherence to health interventions is linked to the positive expectation that a negative health condition will be averted by taking the recommended action.[7] Many health interventions are dependent on this model.

Indoor residual spraying is also expected to acceptable where it is believed to reduce disease caused or transmitted by the vector it is meant to control. In this case, there should be a reduction in mosquitoes which transmit the malaria parasite.

This study focused on the beliefs of community members towards IRS and how it affects their acceptability of the intervention prior to the first spray and for subsequent rounds. In addition, types of undesired effects experienced and all possible reasons for refusal were also obtained.

1.2 Statement of Problem

Malaria is a disease of public health importance. It is prevalent in 50% of Nasarawa state population.[8] In 2011, children under the age of Five years accounted for 32% of all malaria cases and 73% of all severe cases of malaria while mortality among cases was 3.3%.[8]Several control measures have been adopted by the National malaria control programme, however malaria is yet to be controlled in Nasarawa and in Nigeria as a whole. In some countries like America however, malaria has already been eradicated. An effective mechanism needs to be put in place to do away with the malaria burden.

Nasarawa has stable malaria transmission pattern. Cases are seen all year round. The vector is always present with a frequent man-biting habit. This is due to favourable temperatures which encourage rapid completion of the sporogonic cycle. Epidemics are however very unlikely but may be seen among incoming non-immune populations arriving to the area. This is unlike unstable malaria where the vector feeds on humans only infrequently and epidemics occur when the conditions for transmission become favourable. It is a holoendemic malaria zone with intense transmission which occurs all

year round. It affects all age groups without sex predilection. However, pregnant women and children under the age of five are said to be more at risk due to decreased immunity in those groups.[9] Other conditions with decreased immunity such as Acquired Immunodeficiency Syndrome, Malnutrition and Tuberculosis have also been found to predispose to malaria infection. These conditions are also found in NasarawaEggon communities.

The economic cost of malaria may be as high as 1.3% of economic growth per annum.[10]This is an estimated N132 billion being lost to malaria annually in form of treatment cost, prevention and loss of man hours In Nigeria.[5]It leads to absenteeism among school children and loss of working hours among caregivers. In pregnancy, it may lead to several complications which include; anemia in pregnancy, intra-uterine growth retardation, and intra-uterine foetal death. Other complications include low birth weight, congenital malaria and still birth.[22]

High rainfall in Nasarawa contributes to the provision of breeding sites for the vector. Poor level of preventive measures due to the rural nature of the study area may also be a contributing factor to the high malaria burden.

Generally, active vector control has been found to be effective in malaria control. Use of Insecticide treated nets (ITN's) and IRS are the two major strategies recommended by the World Health Organization (WHO) for malaria control in endemic populations. Studies have shown household members who were exposed to both ITNs and IRS had significantly greater protection against malaria infection than those who only used ITNs. However, these studies did not include a comparison group of IRS-only users.[28]

1.3 Justification

This study will provide information that will be used to address community concerns about IRS which will ensure that misperceptions are corrected. This will be used for appropriate responsiveness to the community needs which is likely to be the basis of increased acceptability and uptake of IRS. Coverage of IRS is dependent on the perceived benefits of the intervention as regards effectiveness against the vector and extent of undesired side effects by the community members.[11]It is therefore essential to understand the community beliefs to enable better implementation of a vector control strategy.

In Nasarawa, no study of such has been done, as IRS was launched about 3 years prior to this study in the state. A study to illustrate how effective IRS is in control of malaria in Nasarawa state is therefore necessary. Nasarawa state is a high transmission zone and has had a number of ITN campaigns in the past but IRS is relatively new, even in the country as a whole. This study will be able to reveal how effective IRS is as a preventive/control practice for malaria. It will also show how much influence being a beneficiary of IRS has guided the practices of the population towards malaria prevention. Due to the significance of the community members perception about interventions like IRS to its acceptability and coverage, results of this study will assists in revealing possible reasons for rejection and how best these issues can be addressed.

The success of malaria control interventions requires high coverage and utilization at individual and community levels.[6] Understanding community's perceptions on the available interventions is of great significance. Most studies on people's practices as regards malaria in Africa have focused on acceptability of drugs and ITN's while published information on reception and acceptance of IRS is usually limited to reports on

coverage levels.[7]Only a few published studies identified reasons for acceptance or refusal and motives of satisfaction. Negative perceptions about an intervention have been found to be a major setback to the appropriate use and adequate coverage of such interventions. There are however limited studies done on IRS and its effects in the study site, since implementation of the intervention.

The study is coming at an end of a phase of implementation of the strategy as the donor agency United States President's Malaria Initiative (PMI) sponsoring it has already had the last round of project which has come to an end. There has been limited number of studies that have taken into account the adverse health and environmental effects of the insecticides used for IRS in the location. IRS is relatively new as an intervention in Nasarawa state and Nigeria as a whole.

1.4 Research Questions

What is the level of coverage of IRS in NasarawaEggon?

What is the level of acceptability of IRS inNasarawaEggon?

Is there any difference in the number of malaria cases using fever presumed to be malaria before and after introduction of IRS in households in NasarawaEggon?

Is there any difference in the household cost of malaria prevention before and after the introduction of IRS in NasarawaEggon?

1.5 Objectives

1.5.1 General objective

To assess coverage, acceptability and retrospective effect of IRS in NasarawaEggon LGA

1.5.2 Specific objectives:

1. To determine the acceptability of IRS as a malaria control strategy in NasarawaEggon.
2. To determine coverage of IRS among selected communities in NasarawaEggon.
3. To determine effect of IRS on fever presumed to be malaria as a proxy within households in NasarawaEggon.
4. To determine effect of IRS on household cost of malaria prevention within households in NasarawaEggon.
5. To identify factors associated with acceptability of IRS.

1.6 Hypothesis

1.6.1 Null hypothesis (H_0)

Acceptability of IRS does not affect coverage of IRS among residents of communities in NasarawaEggon LGA of Nasarawa state.

1.6.2 Alternative hypothesis(H_A)

Acceptability of IRS affects coverage of IRS among residents of communities in NasarawaEggon LGA of Nasarawa state.

CHAPTER TWO: LITERATURE REVIEW

2.1 Background

Malaria being a vector borne disease represents a challenge of public health, globally. It is also found to affect the low income class who are commonly underserved[7]. In sub-Saharan Africa, Nigeria inclusive, the potential benefits of vector control strategies are not being fully explored. In the United States, IVM strategies have been used over time past.[12] Community–wide benefits of IVM has also been recorded in Kenya[6] and Nigeria[10].

The burden of Malaria has been enormous in Nigeria. Malaria, being a parasitic disease which can only be transmitted through a vector has made it easy to be controlled by targeting the vector. Mosquitos have particular lifestyle patterns, depending on the species. It has only been prudent to make the vector targets for the control of the disease. Vector management in Nigeria the National Malaria Elimination Programme (NMEP) is managed under the integrated vector management unit. Indoor residual spraying is the process of spraying the inside of dwellings with an insecticide to kill mosquitoes that spread malaria. It is in conjunction with the use of LLIN'S considered most effective in malaria prevention and control.

The general objective of Integrated Vector Management (IVM) is the reduction of vector-borne disease particularly, malaria morbidity and mortality, through the prevention, reduction and or interruption of disease transmission, via the utilization of multiple control measures in a compatible manner.

The major malaria intervention tools now include long lasting insecticide treated nets (LLIN), Artemisinin-Based Combination Therapy (ACT), Indoor Residual Spraying of insecticides (IRS), and Intermittent Preventive Treatment in Pregnancy (IPTp) [13.] In addition to these programmatic control strategies, improvements in living conditions can lead to reduction in Malaria.[14]

The IRS has come to lime light considering the fact that many vectors are considered endophilic because they rest and feed indoors. This characteristic has made the mosquitoes vulnerable to IRS as a means of control.The insecticide is sprayed on walls and surfaces of the house, coating them with a residual insecticide. The insecticide is expected to have an effect for several months killing the mosquitoes when in contact with the coated surfaces. IRS is therefore only effective on mosquitoes that come in contact with the insecticide on the surfaces but doesnot prevent the mosquito from biting the susceptible host. This effect is meant to prevent the transmission of the infection from one person to another.

It is however important to note that despite the effectiveness of IRS, the key limitation is that when mosquitoes enter dwellings, they head directly to their host for a blood meal. It is only after the blood meal that they come in contact with the insecticide on the wall when they rest on the walls.[15]interestingly, IRS mechanism works contrary to interventions like ITN's and prophylactic medications (IPT) where protection is conferred on the primary recipients alone. The coverage does not have to be complete (100%) for IRS to be functional. IRS can provide community-wide benefits with persons who have not received personal protection benefitting from the interventions in their communities.[16]The effect of IRS on malaria transmission has been found to vary across

malaria transmission levels. IRS appears to be most effective in medium and low transmission zones.[17]

Several pesticides have historically been used for IRS, the first and most well-known being Dichlorodiphenyltrichloroethane (DDT). With regard to the cost effectiveness of various pesticides vis-à-vis each other for IRS, DDT has been considered the most cost effective, mainly because it lasts longer than alternatives and therefore dwellings can be sprayed less frequently.

The specific objectives of IVM include: To reduce vector breeding sites to the strictest minimum and within the shortest possible time, to reduce abundance and sustenance of disease vectors to a minimal level at which transmission is no longer effective and to reduce human-vector contact. Several Studies have shown clear decline in malaria related outcomes even to the extent of local elimination in some communities due to effective IVM.[11, 17]

The WHO has made certain recommendations to national governments in order to make IRS most effective. In countries where available data indicates that IRS can be effective towards achieving malaria targets, the governments should introduce and/or scale up coverage of targeted IRS as a primary malaria control intervention. High IRS coverage should also be maintained by using appropriate insecticides and choosing good timing for spraying. The WHO also recommended that the managerial capacity of national malaria control programmes be strengthened and human, technical and financial resources for the timely delivery and high coverage of effective interventions be improved.

Furthermore, certain conditions must be fulfilled for IRS to be effective. The sprayable surfaces must occupy a large proportion of the houses. It is also important the species of mosquitoes rest indoors and must be susceptible to the insecticides used.[4]The WHO further states that "insecticide susceptibility and vector behavior; safety for humans and the environment; and efficacy and cost-effectiveness" are factors that must be considered when selecting an insecticide for IRS.

2.2 History of Indoor Residual Spraying

Effectiveness of IRS in reducing malaria transmission and disease was first demonstrated in the 1930's in South Africa and India.[18] Several regions/countries that lauched IRS did so with the intention of eradicating malaria. In South Africa, the first trial of IRS was done in KwaZulu-Natal where malaria was later eradicated in 1931.[19]There was marked reduction in morbidity and mortality. Scientific evidence of IRS efficacy in malaria control has been available since the 1940's and 1950's.[18]Pilots have been launched in tropical Africa in Benin, Burkina Faso, Burundi, Cameroon, Kenya, Liberia, Madagascar, Rwanda, Senegal, Uganda, and Tanzania in the 1950's up to the 1970's.After cessation of IRS, transmission and mortality rates increased in the intervention areas.[18]

In Africa IRS was completely abandoned in many countries except in some southern and eastern parts of Africa. This has led to a significant resurgence of malaria incidence in countries like Ethiopia and Sao Tome and Principe. This resurgence was seen as a most hit in Madagascar where there was a record of 10,000 deaths with a single epidemic in 1987-1988.[18]

At least 42 countries use IRS. Main insecticides used for IRS are DDT and pyrethroids (Deltamethrin and cypermethrin). Presently a study is going on in Limpopo, South Africa to check the neuro-developmental effects of pyrethroids at 12 and 24 months of age of babies born to exposed mothers.[20] Animal studies report effects on reflexes, locomotor activity, learning and memory. Human studies of acute exposure also found neurological effects (parasthesia, numbness, vertigo and rarely coma and death).[20]

2.3 IRS in Nigeria

IRS was first implemented in Garki district of the Federal Capital Territory of Nigeria. Propoxur, a Carbamate was used with a significant reduction in malaria transmission and an improvement in infant and child mortality.[18]

There has been a renewed interest in implementing IRS programmes as a key component of Malaria control since 2005. The WHO produced a position statement on the application of IRS for Malaria control in 2006. This highlighted IRS as being one of the primary vector control interventions for reducing and interrupting malaria transmission and recommended that it should be a major component of national malaria control strategies in areas where it is feasible and can be implemented effectively. This singular statement by WHO has resulted in many countries opting to include IRS in their national malaria control strategies.

The table below shows a list of WHO approved insecticides for IRS use.

Table 1: List of insecticides approved by WHO

Insecticide	Class	Recommended dosage of active ingredient (g/m^2)	Duration of effective action (months)	Estimated cost per house per 6 months (US$)	WHO toxicity rating
DDT	Organochlorine	1–2	>6	1.60	II
Fenitrothion	Organophosphate	2	3–6	14.80	II
Malathion	Organophosphate	2	2–3	8.20	III
Pirimiphos-methyl	Organophosphate	1–2	2–3		III
Propoxur	Carbamate	1–2	3–6	18.80	II
Bendiocarb	Carbamate	0.1–0.4	2–6	13.80	II
Alpha-cypermethrin	Pyrethroid	0.02–0.03	4–6		II
Cyfluthrin	Pyrethroid	0.02–0.05	3–6		II
Deltamethrin	Pyrethroid	0.02–0.025	3–6	1.60	II
Etofenprox	Pyrethroid	0.1–0.3	3–6		U
Lambda-cyhalothrin	Pyrethroid	0.02–0.03	3–6	8.60	III
Bifenthrin	Pyrethroid	0.025–0.05	3–6		II

The NMEP discussed the results of October 2012 spraying together with implementing partners, considered other factors such as the cost and reported residual life of insecticides, and recommended the use of pyrethroid insecticides. Pyerethroids are the dominant insecticides used for the control of malaria, there are only a few other replacement options.[21]

2.4 Pyrethroids

2.4.1 Introduction

The term Pryethroid is similar to the name of the natural insecticide mixture known as pyrethrum or pyrethrins. Purified pyrethrum, called pyrethrins, has been very useful in insect control. It kills a variety of insects and mites, knocking them off very quickly. For this

reason, and because of its relatively low toxicity to people, pyrethrins remain very popular nowadays. Pyrethrins also have the desirable environmental characteristic that they break down quickly (minutes to hours) when outdoors but lasts a long time (days to weeks) when protected from sunlight.

In 1949, was the first artificial pyrethrin-like insecticide synthesized in the lab called allethrin. Once chemists figured out the techniques for synthesizing this class of insecticide, many different versions were created. In the 1960s a number of new, "second-generation" pyrethroids were patented, including tetramethrin, resmethrin, bioallethrin and phenothrin.[18] These new compounds were many times as toxic to insects as natural pyrethrum and still have many uses today, including household insecticides. Since the 1960s, further advances in synthesis have created new, useful insecticides that resemble the original pyrethrin molecules less and less. These new Pryethroid insecticides have become more toxic to insects and last longer in the environment than the early compounds.

2.4.2 Side effects of Pryethroids

Pyrethroids have been found to have irritant and/or sensitizing properties. Their absorption is through the skin, gastrointestinal tract and pulmonary membrane. Absorption through the skin is limited. Some pyrethroids have low toxicity while some have high toxicity, depending on the specificity of their formulations. Those with low toxicity are because they are rapidly biodegradable by mammalian liver enzymes. This process is however absent in insects because they lack this liver function.

There is a resultant interference with ionic conductance of nerve membranes as a result of prolonging the sodium current. This leads to hyper-excitability due repeated discharge by the

stimulated nerve in the poisoned animal. The World Health Organization states that synthetic pyrethroids are neuropoisons acting on the axons in the peripheral and central nervous systems by interacting with sodium channels in mammals and/or insects. The main systems for metabolism include breakage of the ester bond by esterase action and oxidation at various parts of the molecule. Induction of liver microsomal enzymes has also been observed.[26]

2.4.3 Pyrethroid poisoning in humans

Pyrethroid poisoning presents differently in humans. The symptoms may present as either respiratory or dermal allergens presenting as asthma-like reactions and contact dermatitis. These presentations are mostly seen among asthmatics and persons with history of allergies or anaphylactic reactions. Severe reactions however occur rarely. Other symptoms of acute toxicity due to inhalation include sneezing, nasal stuffiness, headache, nausea, incoordination, tremors, convulsions, facial flushing and swelling, and burning and itching sensations. There have been reports of severe poisonings in children which has even resulted in death due to their inability to efficiently break down pyrethroids.[6]

Pyrethroids have also been implicated in the development of breast cancer. This is reportedly due to its link to the disruption of the endocrine system leading to altered reproduction and sexual development and interfering with the immune system. When tested, certain pyrethroids demonstrate significant estrogenicity and increase the levels of estrogen in breast cancer cells.[6] Because increased cell division enhances the chances for the formation of a malignant tumor in the breast, artificial hormones, like those found in pyrethroids, may increase breast cancer risk.[6] Some pyrethroids are classified possible human carcinogens. Birds can also be indirectly affected by pyrethroids, because of the threat to their food supply.

While the development of the synthetic pyrethroids was heralded with claims of selective toxicity to insects, both pyrethroids and pyrethrins are extremely toxic to aquatic organisms, including fish. Mosquito, black fly and tsetse fly larvae which are often the actual target of pyrethroid application are also susceptible with LC50 values less than 1.0 part per billion.

Because pyrethroids are toxic to all insects, both beneficial insects and pests are affected by pyrethroid applications. In some cases, predator insects may be susceptible to a lower dose than the pest, disrupting the predator-prey relationship.

2.4.4 Synergists

These are added to pyrethroids which are often formulated with oils or petroleum distillates. They are added to increase the potency of the pesticides. Piperonylbutoxide (PBO) and n-octylbicycloheptenedicarboximide.PBO which is commonly used inhibits important liver enzymes responsible for breakdown of some toxins, including the active ingredients of pesticides. A heavy exposure to an insecticidal synergist may make a person temporarily vulnerable to a variety of toxic insults that would normally be easily tolerated. Symptoms of PBO poisoning include anorexia, vomiting, diarrhea, intestinal inflammation, pulmonary hemorrhage and perhaps mild central nervous system depression. Repeated contact may cause slight skin irritation.

2.4.5 IRS operations in NasarawaEggon

Activities were carried out according to the WHO guidelines by the implementers. First there was of all, geographical reconnaissance (GR) of NassarawaEggon LGAs was carried out to define spatial distribution of target populations and map out the terrain, natural water bodies, and road infrastructure in order to plan effective and efficient

implementation of the IRS campaign. Micro-planning took place in February 2012.[23] The project staff facilitated the meetings and worked closely with officials of the NMEP, the State Ministry of Health (SMOH), and NassarawaEggon LGAs. The logistics needs assessment started with the development of the 2012 IRS work plan and Communities provided the storage spaces at no cost.

The project deployed seasonal workers, 16.4 percent of whom were female, for the IRS operation and mobilization/enumeration.[23] Workers were recruited in March 2012. Candidates who passed the health check and a written exam attended the trainings. The project added a 6 percent buffer to the number of spray operators invited for training.

Effective training is essential to successful IRS operations (IRS training). Training of trainers was conducted for central, state, and district government partners who in turn trained the seasonal workers on the components of IRS.

Over the course of the pre-spray and spray period, the project organized advocacy events, and in collaboration with the mass media, produced and distributed various promotional materials, and directly reached out to communities. Post-spray radio messages were aired to remind the communities of the need to avoid behaviors that will negate the spray campaign such as repainting, re-plastering, and covering the sprayed walls with objects.

2.5 Knowledge and Perceptions about IRS

In a study conducted in Mexico, where a questionnaire was administered to assess the acceptability and perceived side effects of IRS, most of the interviewees (83.7%) welcomed spraying with commonest reason for refusal being the smell of insecticides and having to remove furniture from houses. A significantly high percentage of people had

blurred vision, dizziness, sneezing, coughing numbness, watery eyes and itching. A very small percentage (2.1%) of the interviewees attributed the symptoms to the spraying. It was concluded that acceptability correlated with IRS spray coverage.[24]

In a community survey in eastern Uganda, where IRS has not been implemented, 61.4% of the respondents had heard of IRS.IRS was said to be important by 92.4% of the respondents. About the benefits of IRS, 74.4% reported that IRS will be beneficial and 9.5% did not know whether or not it will be beneficial. The highest percentage of benefits of IRS reported is reduction of mosquitoes (85.8%) and reduction of malaria episodes (82.7%). Negative health effects of IRS reported include Cancers and respiratory tract infections.[11]

In a qualitative study conducted in Tanzania, 2006, some household residents were passive receivers of IRS, not in control of the fate of their house regarding the intervention while some would even warn the spraying teams not to skip their houses.[7]There were high hopes by communities who had positive expectations that the intervention would reduce the nuisance created by the vectors.[7] Despite perceived limitations, community members were willing to accept IRS to experiment and experience the alleged disadvantages themselves. There were however awareness that IRS may have some limitations.[7]

In another survey of households in Ethiopia, where women were interviewed about malaria and control interventions, 798 (27.8%) of houses had IRS 12months prior to the survey out of which 7.4% re-plaster their walls.[6]The main reasons for not spraying include: the spray team not visiting the household(61.4%), dislike of the insecticide and the fear that it may kill their

livestock and honeybees(31.1%), and the absence of the household head or elder members at the time of the spray team visit (3.2%).[6] For those that re-plastered their walls, majority (77.9%) were due to societal reasons like holy days or New Year.[6]

A qualitative study conducted in Tanzania and Zanzibar in 2012, revealed that only a small percentage of the population refused to accept IRS.[25] Most of those that refused were the more knowledgeable among the people such as teachers and other civil servants who are not compliant with orders from the Local government and have doubts about the safety of the intervention. There were basically three forms of refusal reported: refusing partially until after thorough explanations are provided, accepting spray to be done a few rooms only and outright refusal.

Reasons for refusal among others included; initial ignorance about the reason for the spray, uncertainty about its effectiveness, increased prevalence of other insects, potential side effects, odour, rumours about the chemical affecting fertility, embarrassment about moving poor quality possessions out of the house, and belief that the spray was politically motivated.[25]

2.6 Effectiveness of IRS

Effectiveness of IRS in reducing malaria transmission and disease was first demonstrated in the 1930's South Africa and India. In India malaria incidence decreases from 75million to about 100000 cases per year and in Sri-lanka child mortality was reduced by 50% between 1946 and 1956.[26] In Guyana malaria specific mortality was eliminated between 1945 and 1952 following introduction of IRS. [26]

In Zanzibar, a study carried out where records of malaria burden were assessed at six out of seven in-patient health facilities after scaling up of interventions for malaria control. The intervention period was 1999-2003. Results of this study showed that there was a decline in the slide positivity rate for malaria and also for anaemia amongst in-patients, out-patients and deaths.[23] There was an initial slope when the scaling up of the interventions commenced. When IRS was introduced as the last intervention, a sharp decline was observed. ACT's were introduced first then the conventional ITN. The LLIN was then introduced and then 4 rounds of IRS were done. The records showed a fairly stable number of malaria in-patient cases between 1999 and 2002.[23]This was followed by a decline which was also seen for anemia cases amongst<5 in-patients there was 80% decline in malaria (44-93)95%CI and 85% decline in anaemia (39-97)95%CI.For<5 out-patient cases, the decline in malaria and anaemia was 99.6%(93-99.98)95%CI and 45%(-60-81)95%CI respectively.[27]

A study where data from demographic and health survey data and malaria indicator survey data of sub Saharan African countries were analyzed, data from Madagascar, Rwanda Senegal Uganda Zambia, Zimbabwe, Burundi were analyzed. The results revealed 20% (95%CI 3%-34%, P=0.022) risk reduction in malaria pararsitaemia among respondents who used IRS only, in a medium transmission area. In low transmission, the risk reduction for malaria parasitaemia was 66% (95% CI 17%-86%, P=0.018). [28] In high transmission zones, IRS was not associated with a statistically significant effect against parasitaemia9% (95% CI -30% t0 36%, p> 0.05).[28] The bivariate analysis of parasitaemia prevalence by urbanity showed 44% risk reduction (95%CI10%TO42%, P<0.0001) in rural areas and 25% risk reduction (95%CI 4% TO 40%, P=0.021) in urban sites.[28] A

study carried out in western Kenya, Density of mosquitoes reduced after IRS campaign, this was not so prior to the campaigns where the (RR=0.91 CI=0.67) After the campaign, the district with IRS had lower Anophiline mosquitoes (RR=0.40, 95%CI=0.22-0.72, P<0.001).[29]

In a study carried out by Kigozi et al in Uganda, Routine data were collected on more than 90,000 patient visits at a single health facility over a 56 month period covering five rounds of IRS using three different insecticides. Their findings were that during the 1st 6 months following the 1st round of IRS revealed a significant reduction in the odds of having malaria(OR=0.76, 95%CI=0.67-0.86) and those >=5 years (OR=0.70, 95%CI0.60-0.79). [30] The effect was most following several rounds of IRS spraying. In those below the age of 5 years the odds of having malaria was (OR 0.16, 95%CI 0.14-0.19).[30]

In Tanzania, Mashauri et al found that after two rounds of IRS intervention there was a significant reduction of malaria parasitological indices in both two villages. In IRS villages overall, parasitemia prevalence was reduced by 67.2%, splenomegaly was reduced by 75.8%, whereas anemia was reduced by 50.5%.[16]

Multiple variable analysis done by ImmoKleinschmidt et al in 2009 show that living in an IRS treated house was protective against malaria infection with an odds ratio of 0.68, 95% CI=0.48-0.94 in Bioko and 0.49, 95% CI=0.28-0.88 in Zambezi without consideration of sleeping under a bed net.[29]

A quantitative review carried out in which data from several countries was used, it was discovered that for sites that had IRS in Tanzania, and Kenya, the mean Hb for the intervention group was 11.4% while that of the control group was 9.8%.[31]

In Malawi, reduction in malaria parasitaemia with direct IRS and indirect IRS was 33%(95%CI=1-54%) and 46%95%CI=20-64%) respectively while reduction in anaemia was 21%(95%CI=4-34%) and 30%(95%CI=12-45% respectively.[16]

In a study carried out in Benin, West Africa, in 2011, four districts which have 2 types of environment - a plateau and a swampy area were used. IRS was found to have significantly been associated with a decrease in lifespan of the vector (An. gambiae). There was a reduction in the parous rate from 77.1% to 22.94% and blood feeding index of the mosquitos on humans. These findings indicate a probable reduction in transmission of malaria.[32]

2.7 Effect of IRS on mosquito density

In a Study in Benin where the density of mosquitoes was assessed prior to and after IRS was introduced to 4 districts, there was a significant reduction of endophily rates in the IRS arm from 67.13% before intervention to 4.5% after intervention. In areas without IRS however, the rates remained stable at 51.67%.[17]

In a study where the impact of IRS was assessed in the highlands of Kenya, seasonal changes in mosquito densities was monitored quarterly on randomly selected houses. The results showed a reduction in densities of Anopheles gambiae by 96.8% in the

intervention valley and 51.6% in the intervention uphill.[24] There was also a decline of malaria parasite density from 896.4 at baseline to 128.8 in a study in Tanzania.[28]

CHAPTER THREE: METHODOLOGY

3.1 Study Area

The study was carried out in selected communities of NasarawaEggon LGA of Nasarawa state which is in the North-Central geopolitical zone of Nigeria. The headquarters is in the town of NasarawaEggon. It is situated north-west of Lafia, the state capital with an estimated population of 182,125 occupying an area of 1,208 km² over the 14 political wards. The LGA is semi- urban area which comprises of various ethnic groups but the main language spoken is Eggon. The main occupation of the residents is farming but other occupations include trading and fishing.

Centrally located NasarawaEggon is generally hilly and rocky, with numerous rivers and streams that empty into the Benue River. It is in the Sudan savannah belt with high rainfall records. Malaria cases therefore seen all year round with peaks recorded at the beginning and towards the end of the raining season which spans from March to October. The LGA which has rural and semi- urban settings are divided into 3 development areas. The 14 political wards and number of spray teams are: NasarawaEggon-4,Alogani-2, Ogbagi/Agunji-1, Umme-2, Kagbu-2, Lambaga/Arikpa-1, Alushi/Ginda-2, Wakama-2, Ende-2, Ubbe/Ogba-1, Iggah/BurumBurum-2, Mada Station-2, Ikka/Wangibi-2, and Lizzen/Keffi-1. IRS was introduced in 2012, 3 years prior to this study. There were 4 rounds of spraying carried out at 6months interval each. The last round was in April/May 2013. The total number of structures enumerated was 37,775 and Structures found to be ineligible for spraying in 2012 since they were not sleeping structures. 6,603. A total of 31,172 structures were sprayed.

This LGA was selected for the study because it is one of the 2 LGA's in the state that have benefited from PMI on the IRS project. There have been several rounds of spaying done using specified guidelines and best practices. It is expected that the community members would have a good understanding of the processes and effect of the intervention.

3.2 Study Design

A cross-sectional community based survey was conducted. It was a sequential explanatory mixed method study. The quantitative was carried out using a structured questionnaire after which Key informant interviews were carried out for the qualitative aspect.

3.3 Study Population

All Residents of the study area, at least 18 years of age, irrespective of IRS status of household made up the study population.

3.3.1 Inclusion criteria

Any Household head or their representative 18 years and above who has been residing in the study area before the last IRS spray round and consents to participate.

3.3.2 Exclusion criteria

- Soldiers, refugees, industrial workers and other special groups that are not representative of the general population were not included.
- Persons who were not residing in the communities prior to the last round of IRS spraying were also excluded.
- Persons who are too sick or too old to comprehend and respond to questions from interviewers were excluded.

3.4 Sample Size

Sample sizes were calculated using 95% confidence interval, with an assumption that IRS coverage is up to 41%.

- Using p=41%[7]
- $n = \frac{Z^2 pq}{d^2}$

Where n= Estimated minimum sample size

Z= 1.96 {Standard normal deviate corresponding to 95% confidence interval}

p=41% = 0.41 {IRS coverage of a previous study (Munguambe et al, 2011)}

q= 0.59 {Complimentary probability (1-p); 1-0.41}

d= 0.05 {Desired level of accuracy}

$$n = \frac{1.96^2 \times 0.41 \times 0.59}{(0.05)^2}$$

$n = 371.6 \approx 372$

10% maximum anticipated non-response rate (37) added

372+37 =409

3.5 Sampling Technique

Multi-stage sampling technique was employed.

Stage 1: NasarawaEggon LGA was randomly selected from the two LGAs (NasarawaEggon and Doma) that had IRS in Nasarawa state.

Stage 2: Selection of settlement per ward: Simple random sampling was used to select 1 settlement from each of the 14wards in NasarawaEggon LGA using the list of all settlements. A list of all the settlements per ward was obtained and allocated numbers. The reference numbers was cut into pieces of paper and placed in a container. The settlements that were visited were selected after vigorously shaking the container. There were 14 settlements used from the 14 wards. From each settlement, 30 questionnaires were administered at the household level.

Stage 3: Selection of streets in each settlement: From the list of streets in each settlement, 1 street was randomly selected using balloting technique

Stage 4: Selection of the households to be visited in a street: bottle was spinning was done at the centre of the street to determine the starting point. The household most directly related to the bottle top was selected as the first household to be visited. After the first house, contiguous (the household whose entrance was closest) houses were visited until the sample size for that settlement is completed. In cases where there were no more contiguous houses and sample size not completed, the bottle spinning process was repeated. Any household that refused to participate or did not have a representative was passed over.

3.6 Study instruments

3.6.1 Questionnaire

A structured questionnaire was used for the quantitative data collection. The first section of the questionnaire included information on socio-demographic characteristics of the participants. There was a section that assessed household heads/representative's knowledge on malaria transmission and preventive measures. Another section dealt with history of febrile illnesses before and after spraying periods within the household. Participants' responses on perceived direct and secondary benefits of IRS were collected in another section. This included household cost of malaria prevention before and after spraying. Responses bothering on perception and beliefs on malaria and on IRS were collected.

3.7 Data Collection

Study research assistants were recruited from residents of the study neighborhoods who were familiar with and participated in the communities day to day activities. The questionnaire was pre-tested in non-selected settlements for assessing content validity, appropriateness and question comprehensibility. Data collectors were trained by the researcher on how to administer the questionnaire. The study comprised of a quantitative and qualitative aspect. The quantitative aspect was carried out using a structured questionnaire which sourced data on socio-demographic characteristics, attitude and practices on Malaria and IRS. Data was collected using a structured questionnaire that was interviewer administered at the household level. The head of household or the representative of the head was required to respond to the questions. Additionally, Key Informant Interviews were carried out to obtained detailed information on the activities

carried out by implementers of the intervention. Leaders of spraying teams were interviewed with the aim of getting response bothering on the detailed reasons for refusal or acceptance of the intervention.

3.8 Data Management

3.8.1 Management of variables

All completed questionnaires were checked for completeness and consistencies of variables. Variables were entered, summarized in frequencies, percentages, proportions and rates. Key indicators assessed were:

- Proportion of households that accepted IRS in the past
- Proportion of households willing to accept IRS in future
- Proportion of households that had less fever episodes among household members after introduction of IRS as compared to period before IRS
- Proportion of households that had to spend less on other malaria control interventions after introduction of IRS

3.8.2 Statistical Analysis

Quantitative data was entered, cleaned and analyzed using Epi-Info version 3.5.4 to generate tables and charts for data representation. Data was presented using proportions and the 95% confidence intervals were calculated. Univariate, Bi-variate and multivariate (logistic regression) analysis was performed, odds ratios and p-values were calculated for the studied variables and the statistical significance was determined with p value <0.05.

3.9 Quality control

Data collectors were selected from the communities and could understand the local language and cultures. They were trained by the researcher. Questionnaires were pre-tested in a community which was not part of those chosen for the study. The completed questionnaires were examined on the field on daily bases by the team lead for accuracy and completeness. Consistency checks were carried out.

3.10 Ethical Considerations

Verbal and written consent were obtained from the participants. The purpose and importance of the study was explained to participants in the language they understood best before the filling of the questionnaires. All respondents were given the opportunity to opt out of the study after explaining what was expected of them. Personal identifiers were not used for data storage. All data collected was secured and kept in a password enabled computer. Ethical clearance was obtained from Nasarawa state Research ethics committee of Nasarawa State Ministry of health.

3.11 Funding Strategy

Funds for this study were provided by the principal investigator and Nigeria field epidemiology and laboratory training programme, NFELTP.

3.12 Limitations of the Study

- The study may not able to conclude on the effect of IRS in relation to history of fever as a proxy for malaria and also cost of malaria prevention in the past due to recall bias.
- Data collectors being members of the communities, tried to use certain reference events to remind them of the time frame within which the information was required.

- Data collectors could not go into all houses to asses claims of respondents that IRS was carried out in their households.

CHAPTER FOUR: RESULTS

4.0 Results

This section describes highlights of results obtained from the quantitative analysis of 409 respondents. The uni-variate analysis presents frequencies and percentages of their responses. The results are that of the socio-demographic characteristics of respondents and findings regarding coverage and acceptability of IRS in the studied communities. Bivariate analysis results are presented to show the relationship between the socio-demographic characteristics of respondents, spraying related factors and malaria related factors to IRS acceptability. Multivariate analysis (logistic regression) was carried out to isolate independent factors associated with IRS acceptability.

4.1. Socio-demographic Characteristics

Table 2: Socio-demographic characteristics of respondents in NasarawaEggon LGA of Nasarawa state, April 2014 (i)

Characteristic	Frequency (%)
Age group	
≤19	3(0.7%)
20-29	86(21.1%)
30-39	116(28.3%)
40-59	164(40.1%)
≥60	40(9.8%)
Sex	
Male	325(79.7%)
Female	83(20.3%)
Marital status	
Married	338(82.6%)
Unmarried	44(10.8%)
Widow/widower	22(5.4%)
Divorced	5(1.2%)

A total of 409 respondents were interviewed majority were male (79.7%), head of households (75.1%) married (82.6%), and aged 20-39 years.

Table 3: Socio-demographic characteristics of respondent in NasarawaEggon LGA of Nasarawa state, April 2014 (ii)

Characteristic	Frequency (%)
Main Occupation	
Farmer	166(40.6)
Employed	119(29.1)
Small scale business	33(8.1)
House wife	21(5.1)
Others	36(8.8)
Status in household	
Head of Household	307(75.1)
Spouse of Head of Household	64(15.6)
Others	38(9.3)
Highest level of education	
Tertiary	133(32.6)
Secondary	118(28.9)
Primary	73(17.9)
Others	10(2.5)
None	74(18.1)

Majority of those interviewed were farmers (40.6%) head of households (75.1%) and those who attained tertiary education (32.6).

4.2 Knowledge about IRS

Table 4: Respondents who have ever heard about IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Heard of IRS	Frequency (n=409)	Percent (%)
Ever heard about IRS	405	99.0
Never heard about IRS	4	1.0

Almost all (99.0%) of respondents have heard of IRS.

Table 5: Respondents source of information about IRS in NasarawaEggon LGA of Nasarawa state, April 2014 (n=409)

Source of information about IRS	Frequency	Percent (%)
Radio	148	36.2
Television	54	13.2
Health worker	160	39.1
Government Campaign	85	20.8
My house was sprayed	136	33.3
Other sources	7	1.7

*Multiple responses

Respondents that heard about IRS from health workers represented the highest individual group with 39.1%.

4.3 Perceived effectiveness of IRS

Table 6: Respondents perception on the effectiveness of IRSin NasarawaEggon LGA of Nasarawa state, April 2014 (n=409)

Perception on IRS effectiveness	Frequency	Percent (%)
IRS is effective	301	68.7
IRS is not effective	128	31.3

Majority (68.7%) of the respondents perceived IRS to be effective.About a third (31.3%) of respondents did not consider IRS to be effective

4.4 Side effects of IRS

Table 7: Respondents that had IRS in their households and noticed side effects in NasarawaEggon LGA of Nasarawa state, April 2014 (n=394)

Side effects	Frequency	Percent (%)
Noticed side effects	123	31.2
Did not notice side effects	271	68.8

Majority of respondents (68.8%) did not notice side effects.

Table 8: Types of side effects of IRS noticed by respondents in NasarawaEggon LGA of Nasarawa state, April 2014 (n=123)

Type of side effect noticed	Frequency	Percent (%)
Non-health linked	93	75.6
Health linked	30	24.4

Among respondents who noticed side effects, health effects were noticed by majority (75.6%).

4.5 Waiting time before entering household after IRS

Table 9: Duration of waiting time after spraying by respondents in NasarawaEggon LGA of Nasarawa state, April 2014 (n=396)

Waiting time after spray	Frequency	Percent (%)
>5hours	8	2.0
2 to 5hours	207	52.3
1 to <2hours	167	42.2
30mins to<1hour	14	3.5

About half (52.3%) of respondents that had IRS wait 2 to 5 hours after spraying before entering household with 2% waiting >5 hours.

4.6 IRS Coverage

Table 10: Availability of IRS in households in NasarawaEggon LGA of Nasarawa state, April 2014(n=409)

Availability of IRS in households	Frequency	Percent (%)
IRS available	406	99.3
IRS not available	3	0.7

Almost all (99.3%) of respondents had IRS in their households.

4.7 Reasons for accepting IRS

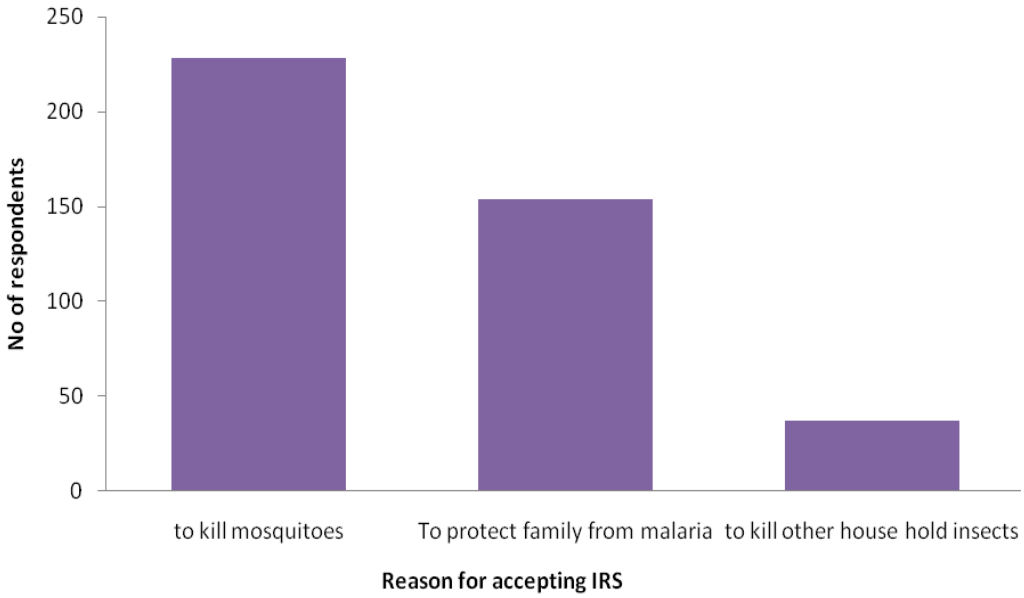


Figure 2: Reasons for accepting IRS by respondents in NasarawaEggon LGA of Nasarawa state, April 2014

4.7 Acceptability of IRS

Table 11: Acceptability of IRS among respondents in NasarawaEggon LGA of Nasarawa state, April 2014 (n=391)

Acceptability of another IRS spray	Frequency	Percent (%)
Will accept IRS	323	82.6
Will not accept IRS	68	17.4

Most of respondents (82.6%) are willing to accept another round of IRS.

4.8 Improvement of IRS Coverage

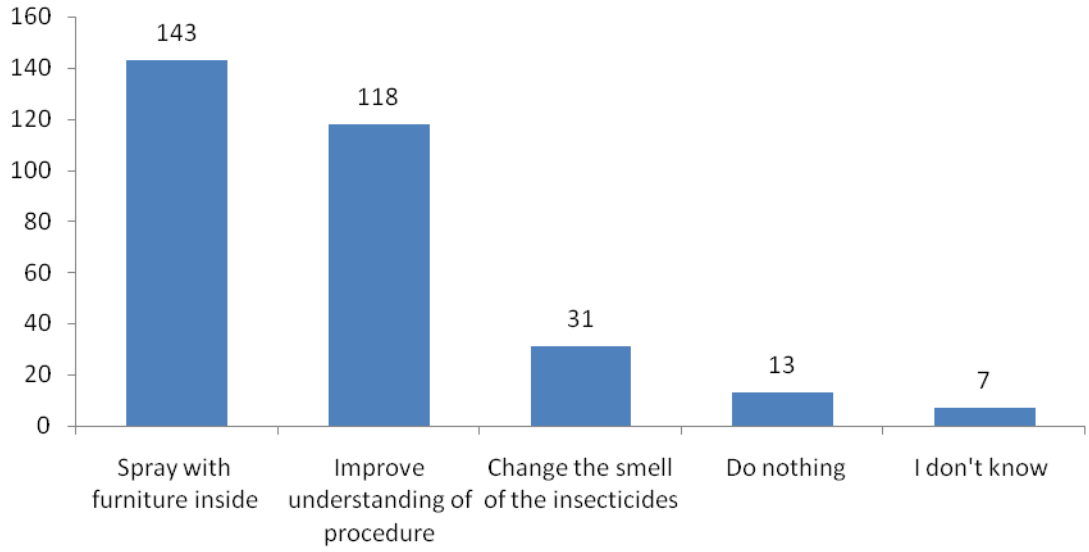


Figure 3: Respondents suggestions on how to improve acceptability (n=318)

About half (45%) of the respondents suggested that spraying with furniture inside would improve acceptability of IRS within their communities.

4.9 Other Methods used to Prevent Malaria Breeding

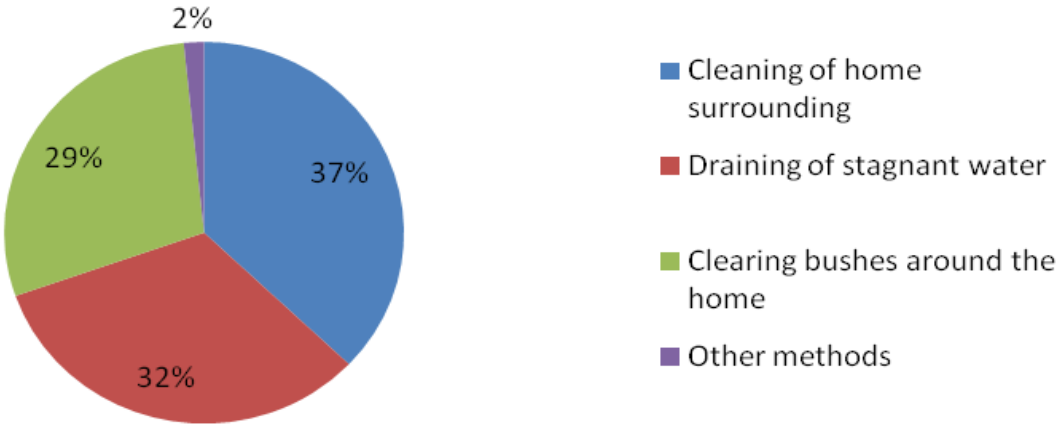


Figure 4: Other methods used by respondents to prevent mosquitoes breeding around their households in NasarawaEggon LGA of Nasarawa state, April 2014

Cleaning of home surrounding was practiced by 37% of respondents as a method of preventing mosquito breeding in their environments.

4.10 Bivariate Analysis

4.10.1 Relationship between socio-demographic factors and acceptability of IRS

Table 12: Relationship between age and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Age	Acceptability of IRS		Total	OR(95%CI)	P-value
	Yes	No			
≥39 years	169(87.6)	24(12.4)	193	2.0 (1.2-3.5)	0.001
<39 years	154(77.8)	44(22.2)	198		
Total	323	68	391		

Respondents aged 39years and above, were 2 times more likely to accept IRS. The relationship was statistically significant.

Table 13: Relationship between educational level and IRS acceptability in NasarawaEggon LGA of Nasarawa state, April 2014

Highest educational level	Acceptability of IRS		Total	OR (95% CI)	P-Value
	Yes n (%)	No n (%)			
Primary and below	126(84.0)	24(16.0)	150	1.2(0.7-2.0)	0.57
Secondary and above	197(81.7)	44(18.3)	241		
Total	323	68	391		

Respondents who had primary education or less were 1.2 times more likely to accept IRS.

However, the relationship is not statistically significant.

Table 14: Relationship between respondents' main occupation and IRS acceptability in NasarawaEggon LGA of Nasarawa state, April 2014

Main occupation	Yes n (%)	No n (%)	Total	OR(95% CI)	P-Value
Others	31(86.6)	37(23.1)	68	0.5(0.3-0.8)	0.25
Farmer	123(76.9**)**	200(13.4)	323		
Total	154	237	391		

Respondents with main occupations other than farming were found to be less likely to accept IRS in a statistically significant relationship.

Table 15: Relationship between status in the household and IRS acceptability in NasarawaEggon LGA of Nasarawa state, April 2014

Status in household	Yes n (%)	No n (%)	Total	OR(95% CI)	P-Value
Head of household	244(83.3)	49(16.7)	293	1.2(0.7-2.2)	0.56
Others	79(80.6)	19(19.4)	98		
Total	323	68	391		

Being the head of the household was found to be 1.2 times more likely to accept IRS than other members of the household, the relationship is however not statistically significant.

Table 16: Relationship between demographic characteristics and acceptance of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Characteristics	Yes	No	Total	Odds ratio (95% CI)	P-value
Age(years)					
≥39	169(87.6)	24(12.4)	193	2.0 (1.2-3.5)	0.01
<39	154(77.8)	44(22.2)	198		
Highest educational level					
Primary and below	126(84.0)	24(16.0)	150	1.2(0.7-2.0)	0.57
Secondary and above	197(81.7)	44(18.3)	241		
Main occupation					
Others	31(86.6)	37(23.1)	68	0.5(0.3-0.8)	0.24
Farmer	123(76.9)	200(13.4)	323		
Status in household					
Head of household	244(83.3)	49(16.7)	293	1.2(0.7-2.2)	0.56
Others	79(80.6)	19(19.4)	98		

Respondents aged ≥39 years are found to be 2 times more likely to accept IRS than those aged <39years. Analysis revealed that not being a farmer makes one less likely to accept IRS. Highest educational level and status in the household are not statistically related to acceptance of IRS.

4.10.2 Relationship between malaria related factors and acceptability of IRS

Table 17: Relationship between differences in fever episodes noticed by respondents and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014(n=388)

Fever episodes before and after IRS	Yes	No	Total	OR(95% CI)	P-Value
Difference in fever episodes noticed	245(91.4)	23(8.6)	268	6.4 (3.6-11.3)	<0.0001
Difference in fever episodes not noticed	76(63.3)	44(36.7)	120		
Total	321	67	388		

The relationship between having a difference in the episodes of fever before and after IRS was significant with a 6.4 times more likelihood of accepting the intervention.

Table 18: Relationship between differences in fever episodes among respondents after IRS and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April in NasarawaEggon LGA of Nasarawa state, April 2014

Number of fever episodes after IRS	Yes n (%)	No n (%)	Total	OR(95% CI)	P-Value
Less fever episodes after IRS	238(93.7)	16(6.3)	254	9.6(5.2-17.8)	<0.0001
More/same fever episodes after IRS	79(60.8)	51(39.2)	130		
Total	317	67	384		

Results show that respondents that had less number of fever episodes before and after IRS were 9.6 times more likely to accept IRS and the relationship was found to statistically significant.

Table 19: Relationship between Differences in cost of malaria prevention before and after commencement of IRS and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Cost of malaria prevention after IRS	Yes n (%)	No n (%)	Total	OR(95% CI)	P-Value
Lower cost after IRS	261(91.9)	23(8.1)	284	8.8(3.0-25.9)	<0.0001
Same/higher cost after IRS	9(56.3)	7(43.8)	16		
Total	270	30	300		

Respondents who spent less for malaria prevention after IRS were found to be 8.8 times more likely to accept IRS than those who spent the same amount or higher after IRS. The relationship is statistically significant.

Table 20: Relationship between respondents practices on use of mosquito breeding control measures and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Usage of other mosquito breeding control measures	Yes n (%)	No n (%)	Total	OR(95% CI)	P-Value
Use other mosquito breeding control measures	282(82.46)	60(17.54)	342	0.96(0.43-2.17)	0.93
Do not use other mosquito breeding control measures	39(82.98)	8(17.02)	47		
Total	321	68	389		

The relationship between using a method to control mosquito breeding and acceptance of IRS did not have a statistically significant relationship.

Table 21: Relationship between use of bed nets and IRS acceptability in NasarawaEggon LGA of Nasarawa state, April 2014(n=391)

Usage of bed nets	Would accept IRS		Total	OR(95% CI)	P-Value
	Yes n (%)	No n (%)			
Do not use bed nets	89(85.6)	15(14.4)	104	1.3(0.7-2.5)	0.35
Use bed nets	234(81.5)	53(18.5)	287	.	
Total	343	68	391		

Respondents who do not use bed nets are 1.3 times more likely to accept IRS however; this relationship is not statistically significant.

Table 22: Summary of bivariate analysis of relationship between malaria related factors and IRS acceptability in NasarawaEggon LGA of Nasarawa state, April 2014

Variable	Yes	No	Total	Crude odds ratio (95% CI)	p-value
Fever episodes before and after IRS					
Difference in fever episodes noticed	245(91.4)	23(8.6)	268	6.4 (3.6-11.3)	<0.0001
Difference in fever episodes not noticed	76(63.3)	44(36.7)	120		
Number of fever episodes after IRS					
Less fever episodes after IRS	238(93.7)	16(6.3)	254	9.6(5.2-17.8)	<0.0001
More/same fever episodes after IRS	79(60.8)	51(39.2)	130		
Cost of malaria prevention					
Lower cost after IRS	261(91.9)	23(8.1)	284	8.8(3.0-25.9)	<0.0001
Same/higher cost after IRS	9(56.3)	7(43.8)	16		
Usage of bed nets					
Use bed nets	89(85.6)	15(14.4)	104	1.3(0.7-2.5)	0.35
Do not use bed nets	234(81.5)	53(18.5)	287	.	
Use of other mosquito breeding control measures					
Use other mosquito breeding control measures	282(82.46)	60(17.54)	243	0.96(0.43-2.17)	0.93
Do not use other mosquito breeding control measures	39(82.98)	8(17.02)	47		

Having different number of fever episodes after IRS makes on 6 times more likely to accept IRS. Majority of respondents that accept IRS had less fever episodes after IRS. They are 10 times more likely to accept IRS. Analysis showed that relationship between

use of bed nets and acceptance of IRS has no statistical significance. Respondents that spend less on malaria prevention after IRS are 9 times more likely to accept IRS.

The relationship between having different fever episodes, having less number of fever episodes, spending less for malaria prevention and acceptability of IRS were all statistically significant.

4.10.3 Relationship between spraying related factors and acceptability of IRS

Table 23: Relationship between perception that spraying is effective and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, 2014

Spraying effectiveness	Acceptability of IRS		Total	OR(95%CI)	P-Value
	Yes	No			
Spraying is effective	260(97.0)	8(3.0)	268	32 (14.5-70.3)	<0.0001
Spraying is not effective	61(50.4)	60(49.6)	121		
Total	321	86	389		

Odds ratio (95% CI):32 (14.5-70.3)

There is a 32 times more likelihood of accepting IRS among respondents who perceived IRS to be effective compared to those that did not perceive it to be effective. The relationship is statistically significant.

Table 24: Relationship between having health related side effects and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Health side effects	Acceptability of IRS		Total	OR(95%CI)	P-Value
	Yes n (%)	No n (%)			
Not noticed	256(83.7)	50(16.3)	306	1.4(0.7-2.5)	0.59
Noticed	67(78.8)	18(21.2)	85		
Total	323	68	391		

The relationship between having health related side effects and acceptability of IRS was not statistically significant.

Table 25: Relationship between duration of waiting period and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Waiting duration after spraying	Acceptability of IRS		Total	OR(95%CI)	P-Value
	Yes n (%)	No n (%)			
≥2 hours	173(83.6)	34(16.4)	207	1.2(0.7-2.0)	0.59
<2 hours	145(81.5)	33(18.5)	178		
Total	318	67	385		

The relationship between waiting time after spraying and acceptability was not statistically significant.

Table 26: Relationship between reason for refusal and acceptability of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Reason for refusal	Acceptability of IRS		Total	OR(95%CI)	P-Value
	Yes n (%)	No n (%)			
Nuisance	310(82.9)	64(17.1)	374	3.2(0.9-11.8)	0.06
Health	6(60)	4(40)	10		
Total	316	68	384		

The relationship between reasons for refusal and acceptability of IRS was not statistically significant.

Table 27: Summary of relationship between Spraying linked features and acceptance of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

Variable	Acceptability of IRS		Total	Crude odds ratio (95% CI)	P-Value
	Yes	No			
Spaying effectiveness					
Spraying is effective	260(97.0)	8(3.0)	268	32 (14.5-70.3)	<0.0001
Spraying is not effective	61(50.4)	60(49.6)	121		
Health side effects					
Not noticed	256(83.7)	50(16.3)	306	1.4(0.7-2.5)	0.59
Noticed	67(78.8)	18(21.2)	85		
Waiting duration after spraying					
≥2 hours	173(83.6)	34(16.4)	207	1.2(0.7-2.0)	0.59
<2 hours	145(81.5)	33(18.5)	178		
Reason for refusal					
Nuisance	310(82.9)	64(17.1)	374	3.2(0.9-11.8)	0.06
Health	6(60)	4(40)	10		

Respondents who perceive IRS to be effective are32 times more likely to accept IRS. Experiencing health side effects has no statistically significant relationship with the acceptance of IRS. There appears to be no statistical significance e between waiting duration after spraying and acceptance of IRS. Acceptance of IRS has no statistically significant relationship with the reasons for refusal ascribed to other community members.

Table 28: Summary of factors associated with acceptance of IRS in NasarawaEggon LGA of Nasarawa state, April 2014

	Variable	Acceptability of IRS		COR(95%CI)
		Yes (%)	No (%)	
	Demographic factors			
1.	Age			
	≥39	169(87.6)	24(12.4)	2.0(1.2-3.5)
	<39	154(77.8)	44(22.2)	
2.	Highest educational level			
	Primary and below	126(84.0)	24(16.0)	
	Secondary and above	197(81.7)	44(18.3)	1.2(0.7-2.0)
3.	Main occupation			
	Others	31(86.6)	37(23.1)	
	Farmer	123(76.9)	200(13.4)	0.5(0.3-0.8)
	Spraying related factors			
4.	Health side effects			
	Not noticed	256(83.7)	50(16.3)	1.4(0.7-2.5)
	Noticed	67(78.8)	18(21.2)	
5.	Spaying effectiveness			
	Spraying is effective	260(97.0)	8(3.0)	32 (14.5-70.3)
	Spraying is not effective	61(50.4)	60(49.6)	
6.	Waiting duration after spraying			
	≥2 hours	173(83.6)	34(16.4)	1.2(0.7-2.0)
	<2 hours	145(81.5)	33(18.5)	
	Malaria related factors			
7.	Any difference if fever episodes			
	Differenced noticed	245(91.4)	23(8.6)	6.4 (3.6-11.3)
	Difference not noticed	76(63.3)	44(36.7)	
8.	Number of fever episodes after IRS			
	Less	238(93.7)	16(6.3)	9.6(5.2-17.8)
	Not less	79(60.8)	51(39.2)	
9.	Cost of malaria prevention			
	Lower	261(91.9)	23(8.1)	
	Not lower	9(56.3)	7(43.8)	8.8(3.0-25.9)
10.	Use of bed nets			
	Do not use bed nets	89(85.6)	15(14.4)	1.3(0.7-2)
	Use bed nets	234(81.5)	53(18.5)	
11.	Reason for refusal			
	Nuisance	310(82.9)	64(17.1)	3.2(0.9-11.8)
	Health	6(60)	4(40)	

4.11 Unconditional Logistic Regression

Table 29: Factors associated with acceptance of IRS

Term		Adjusted Odds Ratio	95%	C.I.	Coefficient	P-value
Age >39	>39years	2.6326	0.9126	7.5945	0.9680	0.0733
	≤39years					
Cost of Malaria prevention after IRS	Lower	4.9597	1.1288	21.7919	1.6014	0.0340
	Not lower					
IRS perceived effectiveness	Effective	21.8138	6.9158	68.8052	3.0825	0.0000
	Not effective					
Main occupation	Farmer	2.0369	0.7200	5.7619	0.7114	0.1800
	Others					

The table shows that having lower household cost of malaria prevention after IRS and perceived effectiveness of IRS remained the independent factors that that are associated with acceptability of IRS. The likelihood of accepting IRS was about 22 times more among respondents that perceived IRS to be effective and about 5 times more among respondents that had lower household cost of malaria prevention after IRS.

CHAPTER FIVE

DISCUSSION

The study has explored mainly the factors that are associated with acceptance and coverage of IRS. It explored demographic, spraying and malaria related factors. Socio-demographic characteristics of respondents studied include age, sex, marital status, main occupation and status in the household. Spraying related factors studied were perceived effectiveness, side effects, waiting time after spraying, source of information about IRS and reasons for refusal. While the malaria linked factors studied were the difference in fever episodes before and after IRS, cost of malaria prevention before and after IRS and use of bed nets.

Our study results indicated that majority of the respondents were male (79.7%), head of households (75.1%) married (82.6%), farmers (40.6%) and aged 20-39 years (49.4%). These findings might have been as a result of the rural/semi urban nature of the region, majority of persons heading households were married men in accord with the traditions of the people that unmarried men are not well respected in the society. There are a lot of land mass, water bodies and high rainfall - as sources of irrigation which boosts farming activities. The characteristics of most of the respondents are therefore not unexpected.

Almost all of the respondents have heard about IRS and only 2.5% of them don't know which part of the household is sprayed while the remaining mentioned several parts of the inner surfaces as sites for spraying the insecticides. These figures differ from another cross-sectional study in Uganda where only 61.4% of respondents have heard of IRS and 24.3% did not know which part of the household is sprayed.[33]This high percentage of knowledgeable community members most likely reflects good information transmission

and sensitization about the intervention. In addition, there could have been significant community participation during the exercise allowing them to have better understanding of the processes.

Results show that almost all households have had IRS during previous spray rounds. There was IRS coverage of 99.3%. This is similar to figures of over 90% from a study in Tanzania.[34] However it was contrary to findings in other studies. A study in Ethiopia reported that coverage was less than a third[6] while Munguambe et al. in Mozambique reported a maximum coverage of 41%.[7]The high coverage seen here might have been due to initial acceptability of the intervention by the community members. There must have been high expectations of a favourable outcome which could have been due to reasonable advocacy, communication and social mobilization appreciated by community members. There were messages tactically constructed by PMI/AIRS for the pre-spraying, spraying and post-spraying periods in order to increase awareness and compliance to the intervention. Figures given by the end of spray report by PMI AIRS Project that 98.7% of the structures seen by the sprayers were sprayed.[35] Due to the persistence of malaria cases in the communities; they might have shown initial anxiety with the belief that the intervention will be an aid to solving the problem.

The study showed that 82.6% of those that had IRS in their households would accept to have another round in the future while17.4% are not willing to accept IRS into their households in future. A study in Tanzania showed that 86.3% would accept IRS,[20] also in a qualitative study by Kaufman et al. in Tanzania only a small percentage of the population refused to accept IRS.[25] In another study in Mexico 83.7% welcomed spraying[24]

Acceptability turned out to be a little lower than the present coverage of IRS. This is contrary to findings in a study in Mexico where acceptability correlated with coverage.[24]In this study, it was discovered that some of the people who had allowed spraying of their houses during previous spray rounds were no longer willing to accept the intervention. This is probably due to certain undesired outcomes they experienced after the exercise. It has also been documented that community acceptability is a factor that has led to a decline in utilization of IRS despite its initial widespread use and contribution to the success of malaria control and eradication in the past.[36]

Respondents that accepted IRS did so for several reasons, majority was to kill mosquitoes, while only 37.7% was to protect family from malaria. None was forced to accept the intervention. Similar observations were made in Uganda[37] and Tanzania[24] where as high as 92.4% of respondents accepted IRS to kill mosquitoes. InMexico,[11] findings were also similar.

More than half (69.1%) of respondents perceived IRS to be effective, while 30% reported that it is not effective. This is in agreement with findings in Kenya.[28] There must have been expected outcomes of reduction in mosquitoes and/or cases of fever or malaria for majority of the respondents to assume that the intervention was effective. Several studies have shown that IRS has been effective in the control of malaria and it was even used in the elimination of malaria in some countries and regions in the past.[1,3,4,13]

This study found out that only about a third (31.3%) of respondents did not consider IRS to be effective. There must have been anticipated outcomes of reduction in mosquitoes and/or cases of fever or malaria within communities which was attributed to the

intervention for majority of the respondents to assume that it was effective. This is however in concurrence with a reduction in malaria cases recorded in those communities after the introduction of IRS.[1,4,13] Several studies have also shown that IRS has been effective in the control of malaria.[1,3,4] and that it has been used in the elimination of malaria in some countries and regions in the past.[3,4]

The perception that previous spray rounds have been effective has high influence on acceptability of IRS. This study established that those with such observation were 32 times more likely to accept IRS 95%CI 14.5-70.3 than those who didn't have similar observation. This observation is in congruence with studies in Uganda.[11] Previous experience of a satisfactory outcome from intervention perceived to be effective would certainly influence beneficiaries to be more inclined to subsequently accepting such an intervention. It is expected that after two years of spraying, villagers will be more aware of the advantages and disadvantages of IRS.[24]

Majority of respondents (68.8%) did not notice side effects. Similar findings were seen in a study in Mexico where side effects was mostly reported only among spraying personnel.[24] In this study also it was reported mainly by sprayers, most of which were not compliant with instructions of wearing protective gear as some of them complained of heat. Household residents had fewer complaints probably because they had minimal contact with the insecticide. They are usually instructed to move out of the household before the spraying commences and to come back only after the smell of the insecticide is minimal or completely wanes off which indicates significant reduction in the insecticides concentration in the atmosphere.

Out of the 123 (31.2%) that noticed side effects, only 24.4% were not health related side effects. It had to do with the long lasting bad smell of the insecticide and the staining of household surfaces. Not having health side effects was 1.4 times more likely to accept IRS but the association was not significant.

This study found out that skin reaction was the most frequently reported health related side effect. Out of the 123 respondents that noticed side effects, majority (75.6%) were health related. Bulk of which was skin reaction. Itching was also the most lasting symptom for some sites.[24]These findings are similar to a study carried out on vector – control personnel in South Africa, of respondents who did not like some aspects of alpha-cypermethrin, their concerns were mainly skin irritation/itchiness and skin burn.[38] Findings by Rodríguez et al. in sites where Pryethroids were used is also similar. Generally, skin reactions have been reported as one of the commonest known side effects of pyrethroids.[24]Our study found that among the sprayers, majority complained of itching. This is not exceptional since the absorption of the insecticides occurs mainly through the skin.[33]

In the opinion of those interviewed the two most common causes of why other villagers refuse insecticides spraying were; having to take furniture outside (35.2%) and that it is a waste of time (27.1%). A study in The Gambia also found the issue of having to take furniture a 'major' argument against IRS.[39]This is similar to findings of a study in Mexico where 35% of respondents identified having to take furniture outside as a reason for refusal.[24] Community members might have disliked taking their furniture outside on the assumption that people outside would see their 'secrets' especially for those that are not comfortable with exposing their possessions. This reason was also given by the spray

team leaders as the main cause for refusal of the intervention by the NasarawaEggon community members. However the guidelines for spraying states that all furniture should be taken out before spraying to avoid contamination and if the guidelines is to be adhered to.

Most of the reasons for refusal deduced from the study were more of due to nuisance than due to health affectation. Respondents having excuses that were not health related were found to be 3.2 times more likely to accept IRS. It was however not a statistically significant relationship 95%CI 0.9-11.8. This is in congruence with the expectation of findings as persons with health related side effects would not be comfortable with the intervention. The people are more likely to accept interventions that would not cause more of harm to them than the perceived benefits.

Age is an important factor that influences the acceptability of IRS. The findings of this study reveal that higher ages i.e. 39 years or more are more likely to accept IRS in their households (0R 2.0). Young people in the community may not find it acceptable considering the stressful process of having to "empty" the household before spraying. Understandably, when issues like this arise the younger people will be expected to do more of the physical labour to take furniture and belongings out before the spraying and back inside after spraying. They will be required to do so for their own household and even for more elderly neighbours and other relatives. This might be responsible for the association noted.

The highest level of education attained by the respondents was not statistically significantly related to acceptability. Results showed a 1.2 times more likelihood of those

with primary education or less to accept IRS. This is contrary to expected findings as it was initially thought that those with higher educational levels will understand the mechanism of the intervention better and also accept it more. This was however not the case. This is contrary to findings of a study in Uganda where respondents with secondary education and above were more likely to accept IRS.[33]

Status in the household was found to be associated with IRS acceptability. The relationship was however not significant. Being the head of the household was 1.2 times more likely to accept IRS, 95%CI 0.7-2.2. The head of households usually have a better understanding of the burden of malaria owing to the fact that all cases of illnesses are reported the household head and often times they have to bear the responsibility of getting the sick person treated. This includes but not exclusively payment of medicals. If there is any intervention that will relive the problem, it is expected that the household heads will be at ease with it.

Acceptability of IRS is influenced by the main occupation of community members. Despite the fact that there has been government campaigns and public education about the intervention to all community members, there are discrepancies of acceptance among different occupational groups. The study found community members with occupations other than farming less likely to accept the intervention. This is a similar finding to another study in Tanzania by Kaufman et al which revealed that persons in the society that were the more knowledgeable among the people were not compliant with orders from the Local government and expressed reservations about the safety of the intervention.[16] Farmers tend to appreciate the effects of insecticides better since they are

familiar with the mechanisms of insecticides for other purposes especially concerning protection of their crops and farm products.

Respondent who waited for 2 hours or more before entering the household after spraying were more likely to accept IRS OR 1.2. However, the relationship was not statistically significant 95%CI 0.7-2.0. This is contrary to expectations that the less time they had to spend outside the household will enhance acceptability of IRS. About half (52.3%) of respondents that had IRS had to wait for 2 to 5 hours after spraying before entering household. This is contrary to findings in a Mexican study where most respondents entered their houses after 1 to 2 hours of spraying.[24] This could either be due to the strong or "bad" smell of the insecticides or because the community members adhered to the instructions from the sprayers that they should stay outside for at least 2 hours as stated in the guidelines.

For malaria related factors, this study sought to ascertain difference in fever cases and costs of malaria prevention before and after the intervention and the use of bed-nets. This study found out that having differences in fever episodes in the household comparing periods before and after the intervention was significantly associated with IRS acceptance. In addition, having less number of fever episodes in household after introduction of IRS was also significantly associated with accepting IRS as a malaria control intervention. There was 6.4 and 9.6 more likelihood to accept IRS among those that noticed difference in fever episodes and among those who noticed less number of fever episodes respectively. Since the intervention was introduced to the community with the aim of controlling malaria, which almost always presents as fever, a reduction in fever episodes noticed would have given them optimism that it is effective. Therefore the

community members would be more willing to consent to having additional sessions in the future.

Outcomes from this study revealed that there was a significant association between cost of malaria prevention in the household before and after the intervention. Respondents that spent less after the intervention were found to be 8.8 times more likely to accept IRS. Economics has stated clearly that resources are always limited; therefore anything that would lead to lower cost and spending would be easily accepted. This is the most probable explanation for the increased acceptability of the intervention among those that ended up spending less.

There appears to be no statistically significant relationship between use of bed nets and acceptance of IRS. It was expected that those who use bed nets are more aware of need to control mosquitoes and would therefore want to adopt all other possible means, IRS inclusive to keep mosquitoes away from their dwellings. This study however found out that those not using bed nets were more likely to accept IRS, odds ratio (95%CI) 1.3(0.7-2.5).

Spaying factors explored are; the respondents' opinion on if the spray is effective, whether side effects were noticed and types of side effects noticed, duration of waiting time after spraying, and reasons for refusal.

Results also show that there is a difference between number of episodes of fever and cost of malaria prevention in household before and after the introduction of IRS into the communities. There were less instances of fever and a decreased cost of malaria prevention noticed in households after the introduction of the intervention. Majority of

the suggestions proffered by respondents on the reasons for refusal by other community members were due to nuisance, however reasons for refusal did not have a statistically significant relationship with acceptance of IRS.

The main factors that were seen to be statistically significant on bi-variate analysis and affect acceptability of IRS among respondents include age, main occupation, perception of IRS being effective, difference in fever episodes and cost of malaria prevention and reasons for refusal of spraying in household. However, the unconditional logistic regression showed only IRS perceived effectiveness and cost of malaria prevention after IRS to be significantly associated with acceptability of IRS.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study discovered that IRS was widely accepted and the coverage was in agreement with the World Health Organization's (WHO) recommendation of more than 80% within the targeted communities. Furthermore age, main occupation, difference in number of fever episodes, having less number of fever episodes, lower cost of malaria prevention, belief that IRS is effective are the major factors that affect acceptability. This study discovered that IRS coverage was in agreement with the World Health Organization's (WHO) recommendation of more than 80% within the targeted communities.[35]

6.2 Recommendations

1. The National Malaria elimination programme and Nasarawa state Roll back malaria team should engage in adequate community mobilization and sensitization prior to introduction of IRS in other parts of the state and country at large.
2. The National Malaria elimination programme and Nasarawa state Roll back malaria team should address local expectations, concerns and misunderstandings should be confronted by providing information that could easily be understood by communities.
3. The Nasarawa state Roll back malaria team should redefine community involvement approaches by encouraging participation at all levels of the activities involved.
4. The NasarawaEggon LGA Roll back malaria team should go through proper channeling of information through tailored behavioral change communication to suit the particular communities involved.
5. Schools in NasarawaEggon should include correct knowledge of the disease and tailored behavioral change communications into their curriculum with emphasis only channeling information about malaria transmission and the relevance of IRS use in malaria control.
6. Community members who have personally recorded benefits from the intervention should be encouraged to stimulate others to accepting the intervention.

7. Charts and pictorials showing health and economic benefits of IRS should be developed and placed in health centres. It should be included as part of resource materials for health talks usually delivered prior to commencement of ante-natal, family planning and general out-patient clinics.

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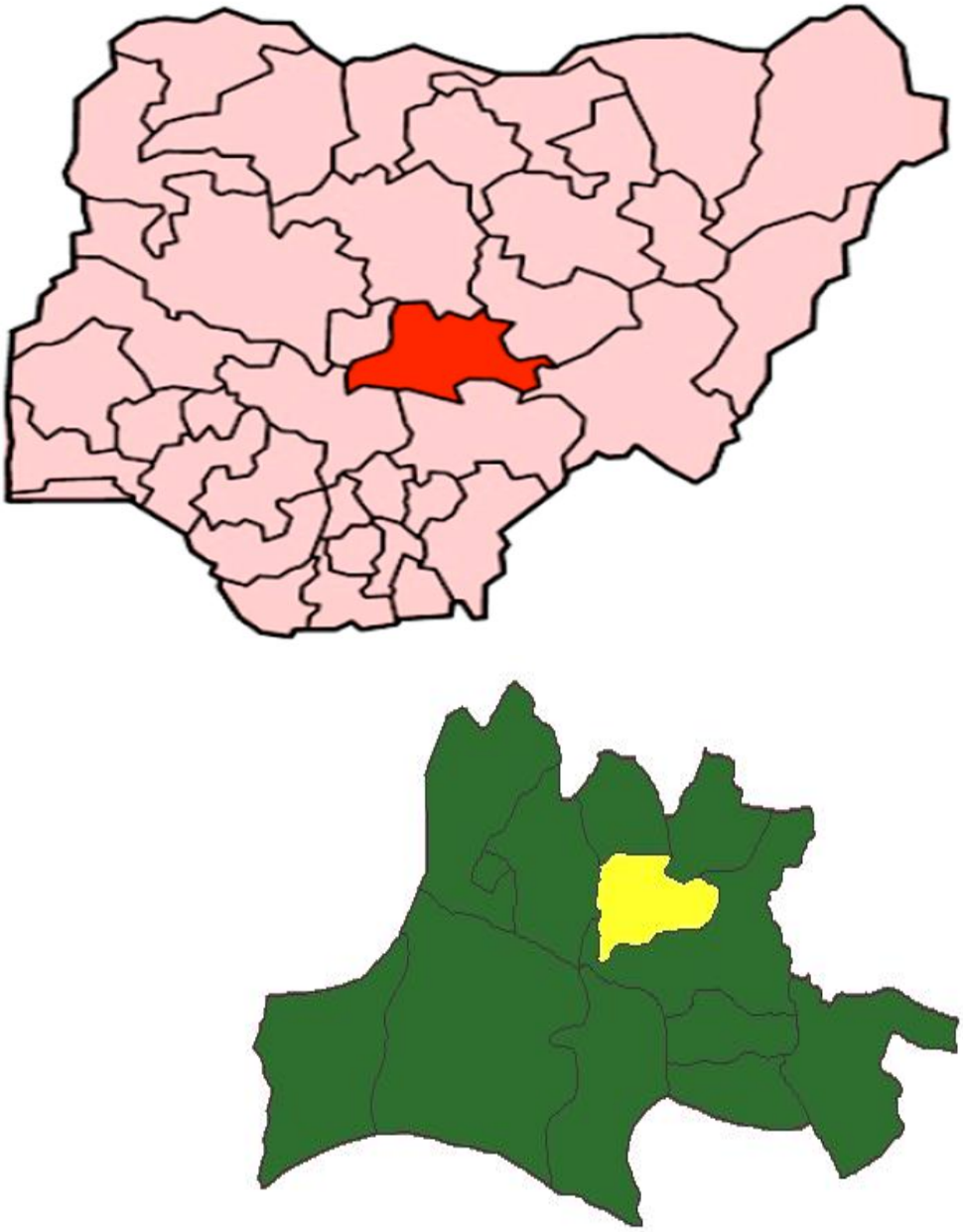


Figure 1: Map of Nigeria with insert of Nasarawa state highlighting NasarawaEggon LGA

Annex 1

Questionnaire

Factors associated with coverage and acceptability of Indoor residual spraying (IRS) in NassarawaEggon LGA of Nassarawa state, 2013

Hello. My name is Hannatu Janada Dimas. I am a resident of the Nigeria field epidemiology and laboratory training programme NFELTP. I am conducting a survey about malaria in NasarawaEggon LGA, Nasarawa state. The information we collect will help the government to plan health services. Your household was selected for the survey. I would like to ask you some questions about your household. The questions usually take about 15 to 20 minutes. All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.

In case you need more information about the survey, you may contact the person listed on this card.

CONSENT: The details of the study have been explained to me and I fully understand. I am hereby willing to participate in the study.

Name of participant Sign/Thumbprint----------

Name of researcher Sign----------

Date----------

Socio-demographic characteristics

1. Age ≤19 [ ] 20-29 [ ] 30-39 [] 40-59 [ ] ≥60 [ ]

2. Gender Male [ ] Female [ ]

3. Marital status Married [ ]Unmarried [ ] Widow/widower [ ] Divorced [ ]

4. Highest level of education Non [ ] Primary [ ] Secondary [ ] Tertiary [ ]Others[ ]

5. Status in household Head of HH [ ] Spouse of HHH [ ]

6. Main occupation Farmer [ ] Small scale business [ ]Employed [ ]Housewife [ ]Unemployed [ ]Others [ ]

Knowledge about Malaria

1. Have you had about malaria? Yes [ ] No [ ]
2. What is the source of your information about Malaria? Home [ ] Radio/TV progaramme [ ] Hospital/Clinic [ ] Health worker [ ]suffered from malaria [ ]others [ ]
3. Mode of transmission - Bite of any mosquito [ ] Bite of mosquito which has bitten a malaria patient [ ]Witchcraft[ ] Don't know [ ]Others [ ]
4. What is the cause of Malaria?

   Germs [ ] Stagnant water [ ] Mosquito bite [ ] Don't know [ ]
5. Is malaria a preventable disease? Yes [ ] No [ ] Don't know[ ]
6. What do you use to prevent Malaria? Use Bed nets [ ] Use of insecticide sprays (fleet) [ ] Use of mosquito coils [ ]IRS [ ] Keeping clean environment [ ] use of medicines[ ]Others[ ] Don't know [ ]

7. What preventive measures have you used in the last 24hours?

   Bed nets [ ] Insecticide Spay [ ] No Method [ ] Others [ ]

8. Do you use any method to prevent mosquito breeding around your environment?

   Yes [ ] No [ ]

9. If yes, what methods were used?

   Clearing bushes around the home [ ] Draining of stagnant water [ ] Cleaning of home surrounding[ ] Others [ ]

History related to Malaria

10. Isthereanybody in your house hold that had febrile illness in the last two months?Yes [ ] No [ ]
11. If yes, how many people? [ ]
12. Are there any children under-five years of age or pregnant women among them?

    Yes [ ] No [ ]

13. If yes, how many under-fives [ ]
14. How many pregnant women [ ]
15. What was the outcome of the febrile illness?Spontaneous recovery [ ] Recovery after treatment [ ] Died [ ]
16. Was there any of these complications?-(Tick for positive response)Extreme weakness[ ] Heart problems [ ]Loss of consciousness [ ]Rapid or difficult breathing[ ] Seizures[ ]Abnormal bleeding [ ]Jaundice or yellow skin[ ] Dark urine[ ]

Knowledge, and practices on IRS

17. Have you ever heard of IRS? Yes [ ] No [ ]
18. What is the source of your information? Radio [ ] TV [ ]Health worker [ ] Government campaign [ ]My house was sprayed [ ] Others [ ]
19. Which part of the house is sprayed during IRS? Roof [ ] Doors[ ] Windows[ ] Walls[ ]
20. Are you ready to have IRS in your home? Yes [ ]No [ ] Don't know [ ]
21. Have you had IRS in your house in the past? Yes[ ] No [ ]
22. If yes, why did you accept IRS? To kill mosquitoes [ ]To kill other household insects [ ]To protect family from malaria [ ] Forced to accept [ ]Others [ ]
23. If yes, has it been effective? Yes [ ] No [ ]
24. Did you notice any side effects? Yes [ ] No [ ]
25. If yes, Which side effects were noticed Long lasting bad smell[ ] Skin reaction [ ] Breathing problems [ ]Staining of household surfaces [ ]
26. Would you accept to have another spray round? Yes [ ] No [ ]
27. If no to question 25, why didn't you accept IRS? Insecticide has a bad smell [ ] Insecticide may kill my children [ ]Insecticide may kill my animals [ ] Insecticide may cause infertility [ ]Having to take furniture outside [ ] Stains on the walls [ ] Creates disorder [ ]It is a waste of time [ ] Insecticide doesn't kill other insects [ ]Others [ ]
28. Have you painted/re-plastered your house since after IRS spraying?
    Yes [ ] No [ ]

29. If yes, was it because of the insecticide that you decided to re-plaster your walls? Yes [ ] No [ ]
30. In your opinion, why do you think other community members refuse insecticide spraying?Insecticide has a bad smell [ ] Insecticide may kill my children [ ] Insecticide may kill my animals [ ] Insecticide may cause infertility [ ] Having to take furniture outside [ ] Stains on the walls [ ] Creates disorder [ ]It is a waste of time [ ]others[ ] Insecticide doesn't kill other insects [ ]
31. After spraying, how long did it take before you entered the house?<30mins[ ] 30mins-<1hour[ ] 1hour -<2hours[ ] 2-5hours [ ]
32. What would you change about the spraying activity to improve acceptability?Improve understanding of procedure in the communities[ ]Change the smell of the insecticides [ ]Spray with furniture inside []Do nothing[ ]Don't know[ ]
33. What do you think are the other benefits of spraying?Reduction in cockroaches[ ]Reduction of multi-insecticide resistance pest[ ]

Cost of malaria prevention

34. Has there been any difference in the amount of money you spend on protecting yourself against malaria before and after the spraying done in your community?Yes [ ]No [ ]
35. If yes what is the difference? Higher [] Lower[ ]

Thank you for your responses. All the information supplied will be kept confidential.

ANNEX 2

Definition

A household is defined as individuals living together with a person identified as a leader and taking meals from same cooking spot. The head of the household is defined as the person who primarily makes decisions in the family. In the absence of the household head, the spouse or a responsible adult appointed by the family was interviewed.

ANNEX 3

APPROVAL FOR THE STUDY

NASARAWA STATE OF NIGERIA

MINISTRY OF HEALTH

In replying, please quote reference and date
All correspondence should be directed to
the Commissioner.



Ministry of Health Headquarters
Private Mail Bag 032
Lafia, Nasarawa State
*Telephone:*_____

S/MOH/843/1

6th March, 2014

Dr. Dimas, Hannatu Janada
Ahmadu Bello University,
Zaria

"STUDY TITLE: FACTORS ASSOCIATED WITH COVERAGE AND ACCEPTABILITY OF INDOOR RESIDUAL SPRAYING (IRS) FOR FOR MALARIA PREVENTION IN NASARAWA EGGON LGA OF NASARAWA STATE, 2013"

Reference to your application of 2nd February, 2014 on the above subject matter, I wish to convey the Ministry's approval of the provisional ethical clearance as your application is been processed for the final approval please.

Dr. Ekom G. Haruna
Ag Director Clinical Services
For: Honourable Commissioner