

**EFFECTS OF COMMUNITY PERCEPTION AND INVOLVEMENT
ON MALARIA CONTROL USING INDOOR RESIDUAL SPRAYING
WITH LAMBDA- CYHALOTHRIN IN SIGOR BOMET DISTRICT
KENYA //**

BY
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DEGREE OF A MASTER'S OF PUBLIC HEALTH IN THE SCHOOL OF
HEALTH SCIENCES OF KENYATTA UNIVERSITY**

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*Effects of community
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DECLARATION

This thesis is my original work and has not been presented for an award of degree in any other university.

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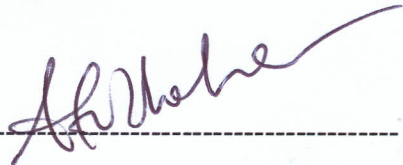
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DEDICATION

To the lord my God, who is my light and my salvation, my joy and blessing, I give you the sacrifice of thanks giving. To my beloved wife Loice Jeruto Korir and lovely children Faridah Cherotich, Judith Chemutai, Ezra Kipkirui and Sheila Chepkirui without their co-operation and assistance this work would have been impossible to accomplish. All in all, in loving memory of my revered mother the fountain of inspiration.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CBS	Central Bureau of Statistics
CSM	Community Spray Men.
DDP	District Development Plan
DDT	Dichlorodiphenyltrichloroethane.
DHS	District Health System.
Dr.	Doctor.
FGD	Focus Group Discussion.
GDP	Gross Domestic Products.
GOK	Government of Kenya.
HH	HouseHold
HND	Higher National Diploma.
IRS	Indoor Residual Spraying.
KEPH	Kenya Essential Package for Health.
ITNs	Insecticide Treated Nets.
M. Ed.	Medical Education.
MEWS	Malaria Early Warning System.
MOH	Ministry of Health.
NHSSP II	The Second National Health Sector Strategic Plan of Kenya
NGO	Non Governmental Organization.
NMS	National Malaria Control.
PAHO	Pan America Health Organization.
PHC	Primary Health Care.
POPs	Persistent Organic Pollutants.
PRSP	Poverty Reduction Strategy Paper.
RBM	Roll Back Malaria.
SP	Sulfadoxine Pyremethamine.
UNICEF	United Nation International Children Education Funds.
WHOPES	World Health Organization Pesticides Evaluation Schemes
WHO	World Health Organization.
WP	Wetable powder.

DEFINITION OF TERMS

Household: person or group of people, who live within the same compound, fenced or unfenced and share meals, have a common provision for other essentials of general livelihood. This is what constitutes a sampling-unit in a sub-location.

Cluster: according to this study, it is defined as the number of household group together in the same sub-location.

Community Spray Men: men or women appointed by communities in a Chief's baraza to conduct house unit spraying after they have been trained.

Location: the provincial administrative area under the chief.

Indoor Residual Spraying: involves coating the inside walls and other surfaces of a house with a residual insecticide.

Roll Back Malaria: Is a global initiative of World Health Organization against malaria. It was launched in October 1998.

Transmission points: sites of stagnant water those which are conducive for laying of eggs by mosquitoes and subsequent larval development into adult. These may be swamps, dams, and ponds.

Sprayed House: A house that has been recently sprayed with insecticide and six months has not elapsed.

Head of household: the key decision maker in the household whose authority is acknowledged by other members.

Lambda-cyhalothrin (Icon) - This are the synthetic Pyrethroids insecticides used for indoor residual spraying for mosquitoes control.

ABSTRACT

Indoor Residual Spraying with insecticides is a key tool in global efforts to control Malaria morbidity and mortality, particularly in epidemic prone areas. The main objective of this study was to investigate the effects of community perception and involvement in Malaria control using Indoor Residual Spraying with lambda-cyhalothrin (Icon 10 WP). Cross-sectional survey and a retrospective design were used in this study. The design was primarily interview survey since many of the informants were not sufficiently literate to read and interpret the research questions by themselves. It was retrospective because the data from the health facilities records were used. Multi-stage sampling was used to select the study area, after which stratified and systematic sampling were used to identify households. Finally, interviews were conducted with 301 heads of households. The study findings indicated that the community has multiple etiologies for Malaria. Of the 301 heads of households interviewed, 288 (96%) associated the cause of the disease to the mosquito. The incidence of malaria before and after the use of IRS showed no statistical difference ($P > 0.05$, $t = 0.106$, $df = 7$). Over 79 per cent of the respondents indicated lack of Icon 10 WP as a major constraint. However, the study observed that the community was willing and able to pay for Icon 10 WP. The study concluded that community perception on etiology of malaria was high and it is an important step towards the control of the disease. There was no reduction of malaria incidence after the use of IRS with Icon. Supply of Icon was a major constraint. The study recommends that the government to decentralize and introduce cost sharing scheme in the supply and purchase of Icon.

CHAPTER ONE: INTRODUCTION

1.1. Background Information.

The World Health Organization (WHO) spearheads the 30-year anti-malaria Initiative, whose goal is reducing annual malaria deaths by half by the year 2010 (WHO, 2003).

The idea of eradicating malaria globally was first initiated by the 14th World Health Assembly in 1955. The global effort was based on large-scale spraying with the insecticide Dichlorodiphenyltrichloroethane (DDT) to kill mosquitoes. The campaign pushed the disease out of Southern Europe and Russia before the vector developed resistance to the insecticides (Rosendaal, 1997). Nevertheless, Indoor Residual Spraying remains a vital Malaria control tool in many parts of Africa, Asia and Latin America. For instance, South Africa has successfully used IRS with DDT to keep Malaria under control for more than 50 years (Black, 2004).

In Kenya, recent trials on the effectiveness of Indoor Residual house Spraying (IRS) with lambda-cyhalothrin (Icon) in the highlands of Nandi and Kisii districts, demonstrated that IRS with Icon could significantly reduce the prevalence of infection to below 3 % in the affected areas (MOH, 2001). More still, the mid-1950's successful control of malaria transmission in Nandi was manifested through the use of IRS with Dieldrin (Robert, 1964). But the cost, the human and environmental concerns of the insecticides led to the introduction of other measures (MOH, 2001). Moreover, the utilization of the programme at community levels might not have been adequately addressed. However, Snow *et al*, (2002) in their study suggested that IRS as an intervention method whichever the insecticides used is both more effective and cheaper than ITNs in communities subjected

to low seasonal risks of infection and as such should be considered as part of the control measures for Malaria prevention by the communities.

Mosquito control in the form of IRS intervention method is a practical measure, which gives the greatest benefit in the shortest time to the largest number of individuals in a community. Mosquitoes can be attacked in several ways, but the most effective is to spray the interior walls and ceilings of houses with persistent insecticides (Knell, 1991).

1.2. Problem Statement.

Malaria is a major cause of illness and death in Africa causing between 350 and 500 million clinical cases annually (WHO, and UNICEF, 2005). This is a debilitating disease, affecting millions of Kenyans each year and fatal to many thousands. It accounts for 30 % of all outpatient attendants and 19 % of all admissions to our health facilities. Malaria fatality rate is around 6 % in health care facilities (MOH, 2001). The under five mortality due to Malaria is of great concern and Kenya's Health Policy Framework of 1994 proposed strengthening of activities geared towards reduction of mortality and morbidity due to Malaria (MOH, 2003). However, several intervention measures failed to achieve some of the set targets. For example, if nets are torn and re-treatments are not occasionally done, mosquitoes will gain entry into the net and bite the person thus causing infection (GOK, 2004). The challenge of malaria parasites continuously developing resistance to newer drugs, and high cost have added impetus to the search for alternative ways to response to the disease. Possible alternatives are the use of Indoor Residual Spraying (IRS) with insecticides preferably Icon and Insecticide Treated Bed-nets (ITNs) as recommended by the National Malaria Strategy (NMS) (2001-2010) approaches (MOH, 2001). In the short-term, the strategies are expected to substantially

lower the morbidity levels associated with malaria. In the long term, they are expected to possibly eradicate the disease altogether.

However, it is felt that acceptability of the IRS with ICON interventions could be at stake because operation and maintenance consideration were lacking. Infact, the government gives Icon at no cost to the community. These are decisions from the donors and/or governments which are far from that of communities'. It has been assumed that what the donors/government have advice or given has been accepted and will be done, only to be realized latter that no change has taken place in terms of behavior or practice and therefore health outcomes. This has led to loss of trust as local efforts and initiatives are ignored or displaced by temporary actions that fizzle away. These challenges raise some serious concern bearing in mind that 20 million (70%) Kenyans are at constant risk of malaria infections which is preventable (MOH, 2004). Malaria infections top the list of ten major diseases in Bomet District. Statistics show that malaria is the leading disease accounting for about 35.3 % of the cases recorded at the outpatients' clinics in the district (GOK, 2002).

1.3. Justification of the Study.

Bomet is prone to Malaria epidemics and has been using IRS with Icon for vector control activities (MOH, 2001). IRS with Icon has been going on in the district since 2004. The intervention has been targeting high-risk areas putting in consideration the transmission pockets (Annual Report, 2004). Malaria epidemics have disastrous consequences at the individual, household and community level where it can:

- a) Cause considerable malaria morbidity and mortality in the affected community.
- b) Make vulnerable groups more susceptible to diseases other than malaria.

- c) Cause long-term effect of unborn children.
- d) Add to cost at the household of both curative and preventive health care provision.
- e) Cause school and work absenteeism (WHO and RBM, 2001).
- f) Prolonged drought before the onset of rains lead to hunger and people's immunity level decreased.

The significant incidence of malaria in the study area is attributed to abnormal heavy and prolonged rains usually experienced in the division. The cumulative human suffering and economic damages caused by malaria is immense (WHO, 2002). However, this situation can be brought under control by applying the right strategies at the right time and also applying the appropriate strategies in a sustainable basis. A problem of malaria will continue to evolve and that malaria control strategies must evolve too. There is therefore need for continuous research and development including basic operational research to develop better and more appropriate tools for malaria control for use in different communities. Since malaria burden is a challenge to all, there is a need for such a study in this community to address the appropriateness of the use of IRS with Icon and its sustainability. Breman (2001) argues that without widespread implementation of effective control measures malaria cases will double over the next 20 years.

1.4. Research Questions.

This study was addressing the following research questions.

- 1.4.1. What was the community's perceived cause of malaria.
- 1.4.2 What were the malaria-control methods known by the community in the study area?
- 1.4.3. What was the incidence of malaria after the partial use of IRS with Icon among the study population?

1.4.4. What was the communities' willingness and ability to pay for Icon?

1.5. Hypotheses.

1.5.1. Community's perceived cause of malaria does not influence the use of IRS with Icon in Malaria control.

1.5.2. There is no difference in the incidence of malaria after the use of IRS with Icon among the study population.

1.5.3. Willingness and ability to pay for Icon are not related with the use of Indoor Residual Spraying with Icon.

1.6. Broad Objective.

This study seeks to investigate the effects of community perception and involvement in Malaria control using Indoor Residual Spraying with Icon.

1.6.1. Specific Objectives.

1.6.1.1 To determine the community perception on the cause of malaria.

1.6.1.2 To identify malaria-control measures as known by community members in the study area

1.6.1.3 To find out whether there is any change in malaria incidence before and after IRS with Icon in the study area.

1.6.1.4 To identify the constraints the community faces in using IRS with Icon

1.6.1.5 To determine the communities' willingness and ability to pay for Icon.

1.7. Significance and Anticipated Output of the Study.

1.7.1 The study will be useful in filling the gaps in existing knowledge on the use of IRS with Icon in mosquito control in the study area and help form the basis for future references

1.7.2 The findings of the study will be useful in setting strategies for intervention with the overall objective of improving the implementation and sustainability of future programmes.

1.8. Conceptual Framework.

This study is conceptualized on a fact that the discovery of residual insecticides and their rapid effectiveness in controlling malaria transmission led to the complete eradication of malaria in the 2nd half of the 20th century in the countries which utilized the method (Lengeler, et al 2004). Literature indicates that due to the enormous resources involved in running the programme, poor countries abandoned the method. However, IRS with insecticides continues to be the most important measure for controlling malaria transmission (Black, 2004). The goal of reducing health inequities can only be achieved effectively by involving the population in decisions and in the mobilization and allocation of resources and thereby promoting community ownership and control in the context in which they live their lives. Effective community health services require well thought out theoretical and practical approach for it to be sustained.

The second National Health Sector Strategic Plan of Kenya/ taking the Kenya Essential Package for Health to the community (NHSSP II/KEPH) (MOH, 2006b) recommended that acceptability and sustainability is promoted when community-based activities are built into existing initiatives and based on available resources. Friedman (2004) argues

that large centrally managed Community Own Resource Persons (CORP) programmes have failed, whilst true community-based ones work well.

Given an adequate level of transparency in decision making, the community can play a leading role in processes of joint action for health and management of funds. Ways to enhancing resource generation in a programme like the one in the study area may include buying / selling of the IRS essentials commodities. The prices can be made affordable to the community through a social franchise set up. Communities can participate in cost-sharing and external contributions can be added to their account to cover gaps in costs as well as households that are unable to pay. Communities are thus able to maintain a regular supply of essentials commodities for the programme and sustained the same. It was for this reason that the overall thrust of this study was to investigate the effects of community perception and involvement in Malaria control using Indoor Residual Spraying with Icon.

CHAPTER TWO: LITERATURE REVIEW

2.1. Global Status of Malaria.

Nearly one-third to one-half of the world's population is potentially at risk of exposure to vector-borne diseases, which accounts for more than 1.2 to 1.7 million deaths annually.

Of these vector borne diseases, Malaria represents the biggest share with more than 1.1 million deaths and 2.4 billion people are at risk (Listorti, and Doumani, 2001)

Roughly, 350 to 500 million clinical cases of Malaria occur annually with over 1.2 to 1.7 million deaths. 90% of these occur in sub-Saharan African (WHO, and UNICEF, 2005).

Pregnant mothers and children are particularly at risk from Malaria worldwide. It's estimated that over 1 million children annually die of Malaria (Roberts and Campbell, 1997 and Roitt, *et al* 2001).

However, the effectiveness of Dichlorodiphenyltrichloroethane (DDT) against indoor resting mosquito led to the adoption of Global Eradication programme of Malaria in 1955. For the first 10 years (1957-66) the result was spectacular: Malaria was completely eradicated in the United States, former Soviet Union and European countries (Lengeler, *et al* 2004).

2.2. Situation in Africa.

Malaria in sub-Saharan African is a problem of dimensions unlike those seen anywhere else in the world today. The magnitude of malaria in Africa is affected by a variety of factors, none of which when addressed alone is likely to effect a resolution. It is further coupled with the generally poor social and economic conditions in sub-Saharan African (WHO, 2004b). Approximately 80 % of malaria cases and 90 % to 95% of malaria deaths

in the world are estimated to be in Africa (WHO, 2004b). As in all endemic areas, deaths occur most among the young. Malaria, therefore, remains one of the most difficult epidemiological, pharmacological, and immunological challenges in the African region. Moreover, the epidemiological situation appears to be changing for the worse in many African states. According to estimates by Roll Back Malaria (RBM), Africa's Gross Domestic Products (GDP) would be 32 % greater today if Malaria had been effectively controlled (WHO, 2000). The disease afflicts pregnant women, young children, and migratory populations particularly severely because of their low or non-existing immunity to the disease. Each year between 675,000 and 1 million deaths among children in sub Saharan Africa are attributed to Malaria. Malaria imposes a harsh economic burden in African countries, which must use scarce hard currency on drugs, bed nets, and insecticides in an effort to control it (WHO 2000). WHO and its development partners have particularly recognized insecticide treated bed nets (ITNs) in Roll Back Malaria initiatives as an effective measure in reducing malaria burden. However, sleeping under a treated net reduced the risk of malaria infection by 63% (58%-68%) and sleeping in a sprayed room with insecticide (Icon) reduced the risk by 75% (73%-76%) (Snow, *et al*, 2002). These comparative study findings endorsed the used of IRS with insecticides (Icon) as an effective measure for reducing morbidity due to Malaria.

2.3. Situation in Kenya.

The level of endemicity of Malaria in Kenya varies from region to region. It ranges from hyper-holoendemic areas of the coastal and lake regions to the malaria free area on the very high grounds on Aberdare Ranges and Mt. Kenya (MOH, 2003). More than half (70%) of the entire population in Kenya are regularly affected by the most deadly malaria

parasite *P. falciparum* (MOH, 2004). Each year, an estimated 34,000 children (that is 93 per day) die from the direct consequences of malaria infection (WHO, 2004a). For this reason, Mosquito control programme have been emphasized in more than half of Kenyan Districts considered to be endemic zones. Already there are a number of government, NGO and private sector activities directed against Malaria under the auspices of Malaria Control Unit (MCU) (MOH, 2001). In Bomet, Mosquito control has been going on at individual household level till the government introduced IRS with Icon programme. The programme aims at strengthening community based actions in the control of mosquitoes using IRS with Icon. Bomet is prone to Malaria epidemics and it has an economic impact on families who are least able to pay for treatment and prevention costs (GOK, 2002).

2.4. Economic losses due to Malaria.

If the malaria parasites had remained unchanged, the steadily increasing availability of anti-malaria drugs at health care facilities and shops and consequently in the homes would probably have led to a progressive decrease in malaria mortality. However, the spread of drugs resistance strains of *P. falciparum* is greatly altering this optimistic picture (Feachem and Jamison, 1991). In Africa, malaria cost an estimated US\$ 12 billion in lost Gross Domestic Product (GPD) annually and consumes 40% of public health spending (Correia, *et al*; 2004). In East Africa and part of Central –Southern Africa, *sulfadoxine pyrimethamine* (SP) resistance has widely been documented. It is a challenging outcome, which calls for a more proactive means of preventing man-mosquito contact through intervention such as IRS with insecticides Icon. Various study findings indicate that the scanty number of new drugs that will be available in the future may not stop the mortality from Malaria (Feachem and Jamison, 1991).

In its Poverty Reduction Strategy Paper (PRSP) Presented to world health organization (WHO) in January 2003, Kenya identified Malaria as a significant contributor to poverty and emphasized the importance of malaria control for sustainable development (WHO, 2003). In view of the forgoing facts, there is need to redefine the prominent role of household in malaria control. For instance, if household expenditures were made only on appropriate and effective malaria prevention and treatment commodities, current spending could make a significant impact on the malaria burden (Correia *et al*; 2004).

2.5. Causes of Malaria.

Malaria is a disease caused by the parasite of the genus plasmodium. It is transmitted when a female Anopheles mosquito bites a person. Symptoms of the disease vary considerably in severity and include fever, headaches, aching joints, loss of appetite and sometimes diarrhea, nausea and vomiting. Delay in treatment can lead to much more severe illness, including convulsions, breathing difficulties, unconsciousness and severe anemia. In these serious cases, unless the victim receives immediate hospital treatments, death can be rapid (MOH, 2006). According to the study conducted by Agyepong (1992) in Ghana, Asra (Adangbe term for malaria) was believed to be caused by prolonged contact with excessive heat. Other ideas, includes eating too much food e.g. Oily foods and fatty meat. Consequently Illchamus and Tugen in Baringo District Kenya were found to share the same beliefs that malaria is caused through consumption of fresh unboiled milk, dirt water and being rained on (Munguti, 1998).

2.6. Intervention Measures for Mosquito Control to prevent malaria.

Vector control aims to decrease contact between humans and vectors of human diseases.

Control of mosquitoes will prevent malaria as well as several other mosquito-borne diseases. Vector control for the prevention of malaria includes:

- a) Indoor Residual spraying with Icon.
- b) Source reduction (larval control).
- c) Insecticide treated bed nets (PAHO, 2003).

2.6.1. Indoor Residual Spraying with Icon.

Many malaria vectors are *endophilic* resting inside houses after taking a blood meal. These mosquitoes are particularly susceptible to control through IRS with Icon. House spraying with residual insecticides involves coating the walls internally and eave of a house with residual insecticides. Its residual action kills mosquitoes and other insects that come in contact with these surfaces for several months. To be effective IRS with Icon must be applied to a large proportion of households in an area (usually >70%) (PAHO, 2003). According to World Malaria Report 2005 (WHO and UNICEF, 2005) IRS with Icon is a highly effective method for Malaria vector control that is particularly useful for achieving a rapid reduction in transmission during epidemics and other emergency situations provided it is well timed and high coverage is achieved. However, Rosendaal (1997) suggested that efficacy of wall-spraying is determined by factors such as:

Mosquito resting behaviors -: the longer the period, the higher the efficacy. However, a resting period of a few hours is sufficient to kill most mosquitoes. It is also important to know the preferred resting sites. E.g. lower parts of walls and on roofs. Clearly, only the resting areas need to be sprayed. This way environmental impact is minimized.

Mosquito susceptibility to insecticides -: resistance should be suspected if repeated observation is made of mosquitoes that survive after resting on a sprayed surface for at least half an hour.

Suitability of wall or roof surfaces for spraying -: walls made of unrendered earth or mud absorbs much insecticide at the surface where mosquito rest. Some Soil walls contain chemicals that increase the PH, causing rapid breakdown of some insecticides. Roofs made of thatch or brushwood provides openings within which insects rest but where sprays cannot reach them.

Suitability of insecticides -: should not have repellent action or airborne effects.

Cooperation of house owners -: misunderstanding between spray teams and house owners should be minimized through good health education.

2.6.1.1. Characteristics of Good Residual Insecticides.

The dwindling availability of low-risk and cost effective insecticides is a threat to malaria vector. This is a result of increasing vector resistance to the insecticides. In May 2004, the Stockholm convention on Persistent Organic Pollutants (POPs) became operational. The convention enforced strict measures to reduce environmental damages from POPs (WHO, and UNICEF, 2005). However, WHO recommends that countries select the insecticides for IRS based on local analysis, for instance, a good residual insecticide is that which possesses the following characteristics:

- a) Highly toxic to target insect
- b) Long-lasting on a given surface
- c) Not repellent or irritant to target insects.
- d) Safe to humans and domestic animals

- e) Acceptable to house owners
- f) Stable during storage and transportation
- g) Mix well with water
- h) Harmless to spraying equipment
- i) Cost-effective (WHO, 2004c)

Table 2.1. Insecticides recommended by WHOPES for indoor residual spraying against malaria vectors.

Insecticides compounds and formulation	class	Dosage(g/m ²)	Effectiveness (months)
Alpha-cypermethrin WP and SC	P	0.02-0.03	4 - 6
Bendiocarb WP	C	0.1-0.4	2-6
Bifenthrin WP	P	0.025-0.05	3-6
Cyfluthrin WP	P	0.02-0.05	3-6
DDT WP	OC	1-2	>6
Deltamethrin WP, WG	P	0.02-0.025	3-6
Etofenprox WP	P	0.1-0.3	3-6
Fenitrothion WP	OP	2	3-6
Lambda-cyhalothrin WP	P	0.02-0.03	3-6
Malathion WP	OP	2	2-3
Pirimiphos-methyl WP and EC	OP	1-2	2-3
Propoxur WP	C	1-2	3-6

EC: emulsifiable concentrate; WG: water-dispersible granules; WP: wettable powder; SC: suspension concentrate; OC: organochlorine; OP: organophosphate; C: carbamate; P: pyrethroid

Source: Najera and Zaim, (2002)

The commonly used insecticides are the synthetic pyrethroid. These groups of residual insecticides are the most recently developed. The compound has been tested for wall – spraying and mostly used where resistance occurs against the previous groups of insecticides. Pyrethroids under normal condition of use are safe for spray personnel and house owners. Among the Pyrethroids, deltamethrine 50 g/kg (K-othrine WP 50) and lambdacyhalothrin 100g/kg (Icon) are considered to have high efficacy against malaria mosquitoes (Rosendaal, 1997).

2.6.2. Larval Control or Source Reduction.

The larval habitats may be destroyed by filling depressions that collect water, draining of swamps, ditching marshy areas to remove standing water just but to mention a few. However, some mosquitoes' species habitats may not be possible to eliminate. For these species, chemical insecticides can be applied directly to the larval habitats. For example high spreading oils may be applied to water surfaces. Other methods of control include using biological agents and insect's growths regulators (WHO, 1982).

2.6.3. Insecticides Treated Bed nets.

Many individual and communities have used Mosquito/ bed nets during the last century to prevent malaria. However, untreated nets and sometimes torn often-allowed mosquitoes to enter or feed on the part of the body adjacent to the netting fabric during the night (Lines, *et.al.* 1987). The impact of insecticides-treated nets on overall mortality has been clearly established. However there is a need to monitor their long-term effect on the immunity of the human population and the resistance and behavior of mosquito population (PAHO, 2003).

2.7. The use of IRS with Icon for Malaria Control at House Level.

Developing community capacity can enhance the success of any community-based programme. This can be done by involving them early. This will help to create ownership, allow resources to be mobilized, increase the motivation of providers and make the programme sustainable (WHO, 2005a). However, malaria varies throughout the world and no single prescription can be made for its control in all countries (WHO and UNICEF, 2005). Methods that are suitable in one place are not necessarily so elsewhere, even if the characteristics of the disease and its vectors are unchanged. Most communities

in Africa are not accustomed to use of IRS with Icon and may not readily appreciate their importance even if effective. This is because; past control measures have been mainly technical and biomedical endeavors (Agyepong, 1992). Communities have therefore, been passive participants and have not been actively involved. In order, therefore, to ensure maximum community participation in vector control by use of IRS with Icon, it is important that the programme is linked to existing community based intervention and be integrated with a variety of local health promotion messages. Accordingly, timely prevention of Malaria epidemics will be enhanced. Katz et al (2000) argue that if communities are empowered with necessary skills they can take charge of their own health and this can translate into sustainable health practices. There is therefore an overwhelming need to negotiate with people and households head as partners in health care, giving them a chance to influence the way care is delivered and thus restore their confidence in the health system. Meeting this need means focusing attention on enhancing the capacity of households to play their role in action for health effectively (MOH, 2006).

2.8. The community acceptance of IRS with Icon as a method of malaria control.

IRS with Icon exercise must be done by trained personnel. Effective IRS with Icon is subject to public acceptance, and access to homes will be granted only to personnel who are seen as trustworthy. Spraying personnel should therefore be carefully selected and made aware of relevant cultural issues (WHO, 2005b). There can be no meaningful involvement of local communities in malaria control where their cultural medical perceptions and that of the biomedical teams are so divergent. In some community they do not believe mosquitoes is a vector of malaria and they do not see how the spray of the

houses would stop the disease. The best, which can be hoped for in malaria control programme under such circumstances, is a passive compliance or non-resistance by community members. In Surinam, conflict arose between the community and the control programme due to cultural beliefs (Agyepong, 1992). Vector control methods suitable for community involvement and which the communities may accept with ease should:

- a) Be effective
- b) Be affordable
- c) Use equipment and materials that can be obtained locally
- d) Be simple to understand and apply
- e) Be acceptable and compatible with local customs, attitudes and beliefs
- f) Be safe to the user and the environment (Rosendaal, 1997).

However, indoor house spraying has given rise to many problems and misunderstanding between spray teams and house owners due to local customs and beliefs. Some insecticides formulations are less acceptable because they leave unattractive deposits on the walls (Rosendaal, 1997). The spraying coverage, which aims at being total, complete and sufficient to the targeted households, is difficult to fulfill in actual practice because of lack of enough chemicals, unskilled personnel and inadequate spray pumps. Personnel are not willing to work because of poor remuneration. Social economic factors that might influence the acquisition of IRS pesticides, equipments and payment of CSM are not easy to identify, as indicators of economic status are difficult to define. Combination of many factors including lack of knowledge (about IRS with Icon) coupled with expense or that mosquito though a nuisance is not associated with malaria has made the implementation difficult. Studies by MacCormack (1989) in Gambian found out that though communities

accepted the use of bed nets the cost remain a prohibitive factor. Studies conducted by Francisco and Adolfo (2005) show that poor developed health infrastructure coupled with inequitable, inefficiency and bad quality health service are to blame for poor implementation of health intervention.

2.9 The constraints faced by the community on the used of IRS with Icon.

Affordability of Icon is a major concern and to improve this, appropriate measures for instances, tax exemption, price control and exceptional inclusion of insecticides in a list of essential drugs need to be considered. It is also important that public sector ensure quality assurance for insecticides by developing simple test for monitoring the efficacy (MOH, 2008).

CHAPTER THREE: MATERIALS AND METHODS

3.1. Research Design.

This research was a cross-sectional survey and a retrospective design carried out to investigate the effects of community perception and involvement in Malaria control using Indoor Residual Spraying with Icon. The design was primarily interview survey since many of the informants were not sufficiently literate to read and interpret the research questions by themselves. It was retrospective because the data from the health records were used to compare the incidence of malaria before and after the partial implementation of IRS with Icon in the study area.

3.2. Study Variables.

Independent variable: Malaria control using IRS with Icon.

Dependent variables were: community acceptance and uptake of IRS with Icon, willingness and ability to pay for Icon.

3.3. Study Area.

This case study was done in Bomet District one of the eighteen Districts in the Rift Valley Province. The District is one of the malaria epidemics prone and the government of Kenya through the Ministry of Health has been supplying Icon and spray pumps at no cost to the community. The District lies between $0^{\circ} 29'$ and $1^{\circ} 03'$ South of the equator (latitudes $35^{\circ} 05'$ and $0^{\circ} 35'$). Narok borders the district to the East and South East, Bureti district to the North, Nyamira to the West, and Transmara to the Southwest (see figure 1). The total area of the district is $1,416.2 \text{ km}^2$ and the altitudes ranges from 9000-1,850 above sea level. The mean monthly temperatures are 18°c and rainfall of between

1,100 mm and 1,500 mm. The long rains are experienced in the months of March and May and short rains from August to October. The District has 6 divisions, 38 locations, and 109 sub-locations. The settlement patterns of the population in the district are determined by the natural and socio-economic condition of the areas. Bomet central division has the highest population density of 388 persons per km² and Mutarakwa the least with 207 persons per km². In the District, poverty is prevalence in all divisions, but the degrees and causes vary. The most affected divisions are Sigor, lower parts of Longisa, Siongiroi, Ndanai and slum areas of Bomet town. The proportion of household living in poverty is 58.4 per cent whereas for individuals living below the poverty line is 62.5 per cent of the population (GOK, 2002).

According to the 1999 Population and Housing census, the population of Bomet district was 382,794. The population was expected to rise to 415,091 in 2002 and to 480,088 in 2008. The projection of the female/male sex ratios was estimated at 100: 95 and that 62.9% of the population is below 20 years. These proportions were projected to prevail in the subsequent years (GoK, 2002).

3.4. Target population.

This was the population who had been given Icon by the Government through the Ministry of Health to use during malaria transmission seasons.

3.4.1. Study Population.

The study populations were resident of Sigor Division who had been given Icon by the Government through Ministry of Health to use during malaria transmission seasons.

3.4.2. Inclusion Criteria.

The head of household living in the area during the time of survey.

Any other person acting as head in case the head was absent.



FIGURE 3.1. THE MAP OF KENYA SHOWING THE LOCATION OF BOMET.

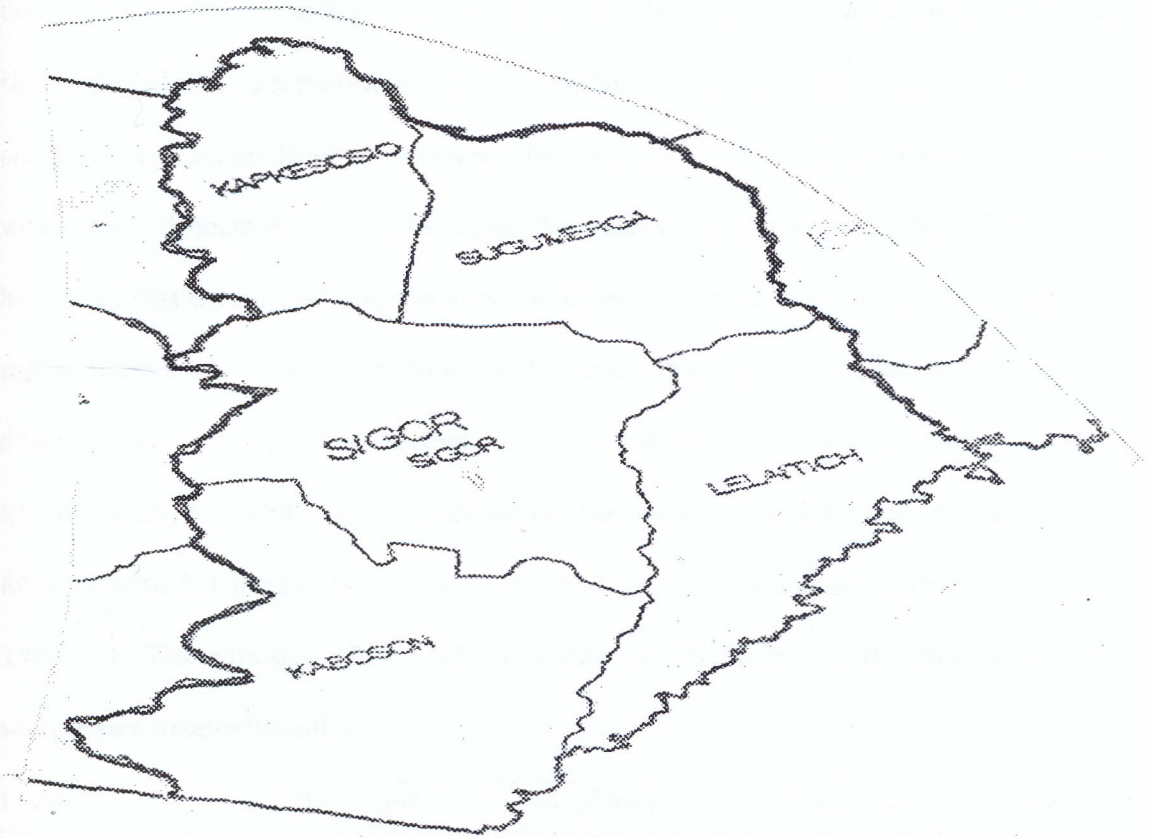


FIGURE 3.3. THE MAP OF SIGOR DIVISION THE STUDY AREA

3.4. 3. Exclusion Criteria.

Visitors who were with the residents of Sigor during the time of survey.

Community members not living in the study area.

3.5. Sampling Techniques and Sample Size.

3.5.1. Sampling Techniques.

Table 3.1 represents the sampling procedures used in obtaining the sampled household for the study. The district, the division was selected using multi-stage sampling techniques and applying stratified sampling technique, the stratum (sub-locations) was

then listed and the percentage of household in each stratum (sub-location) determined. Using probability proportional to size method, the required sample size was proportionally drawn from all stratum (see the table below). Selection of household within the sub-location was done using the systematic sampling method. The index household was determined and the direction of movement selected by randomly picking papers written on East, West, North and South. The first household in the selected direction was visited. The second and the subsequent household were selected systematically, following a predetermined interval number per strata. This procedure was followed until 301 head of households from the 15 sub-location were interviewed.

Table 3.1. The number of Household within the division and the distribution of sample size proportionally.

Location	Sub-location	No. of household	Expected hh	Sampled hh
Kapkessosio	Kapkessosio	358	13	13
	Kimenderit	470	17	17
	Tumoi	465	17	16
Sigor	Areiyet	538	20	19
	Kipkeigei	588	21	21
	Sigor	896	33	32
Cheleget	Chepkosa	601	22	21
	Nogirwet	432	16	15
Sugumerika	Cheptagum	458	17	16
	Nyambugo	695	25	24
	Sugumerika	522	19	18
Lelaitich	Kapsabul	502	18	18
	Lelaitich	508	19	18
	Lugumek	518	19	18
Kaboson	Kaboson	961	35	34
TOTALS	15	8512	311	301

Sources: CBS, 1999 Population Census. Kenya.

3.5.2. Sample Size Determination.

Sample size was based on Kothari (2000), guidelines which take into consideration reasonable estimates of key proportions in the surveyed population, the relative error or precision considered acceptable ($\pm 5\%$) and the level of confidence desired. Based on these factors the mathematical procedures available to make precise estimates of the sample was:

$$(i) \quad n = \frac{z^2 \times p \times q \times N}{e^2 (N-1) + z^2 \times p \times q}$$

Where:

n = the desired sample size

z = the value of standard variate at 95 % (1.96)

p = the sample proportion (70%) (PAHO, 2003)

$q = 1 - p$

N = the estimation of population size (8512).

e = the precision (.05)

$$n = \frac{1.96^2 \times .70 \times .30 \times 8512}{(.05)^2 (8512 - 1) + (1.96)^2 \times .7 \times .30}$$

$$= 310.9429202.$$

= 311 were taken as the sample.

However, there were 97% response rate i.e. 301 responded to the questionnaire.

3.6. Research Instruments and Pilot Study.

Because this study will be used to provide in depth information on investigation of IRS with Icon Malaria intervention in the study area, quantitative and qualitative methods of data collection was used. The questionnaire which was used included structured and unstructured questions for head of households. It generated both quantitative and

qualitative data. The research instruments was developed using the guidelines for constructing an interviewer schedules (Kothari, 2000, Borg and Gall, 1996, Fisher, et al 1998, Mugenda and Mugenda, 1999). A pilot study was conducted to validate the data collection tools. Selected centers for pilot study did not participated in the actual survey. The tool was written and typed in the English language but where they were difficulties proper interpretation of words was done, using the local language. Research assistant was trained on how to administer the tools to ensure reliability and validity of the data.

3.7. Data Collection Procedures.

Clearance research permit was obtained from the relevant authorities. This allowed the researcher to proceed with the study. Rapport was established with the relevant authorities in the district and community leaders to obtain the formal consent. A validated data collection tool was used for data collection and each of the sampled individuals was interviewed. This was crucial because respondent were able to state their valuable experience.

3.8. Data Collection techniques.

The following data collection techniques were used:

3.8.1. Interviews with community members.

A total of 301 household heads were interviewed in the 15 sub-location to investigate malaria control using IRS with Icon, the community's perceived causes of malaria, to identify the malaria control methods known by the community members and to determine their views on the willingness and ability to pay for Icon.

3.8.2. Focus Group Discussions (FGDs).

A total of four (4) focus group discussions each comprising of 9-12 members were carried out in the division. The compositions of the groups included:-

- a) Government administrators i.e. chiefs and assistant chiefs.
- b) Youth leaders (male and female).
- c) Women leaders and Village elders.

Selection of the FGD members was done through simple random sampling procedures. This exercise was conducted in one of the divisional leaders meeting where all the chiefs and assistant chiefs attended. The same also applied to the selection of the youth leaders and community leaders. Gender was put into consideration during the selection. Focus group discussions provided qualitative data for presentation in triangulation with information from questionnaire.

3.8.3. Health Facilities Records and Reports.

Health records were collected from a total of four health facilities in the division. Out of these one was a government sub-district hospital, one mission health center and two government dispensaries. These facilities are situated in the lower semi-arid zone of the District, where malaria is epidemic. Records from the years 2002 to 2006 on malaria cases were collected to determine the trend and prevalence of this disease in the division and to compare the year before and after the partial implementation of IRS with Icon. Since laboratory services in the named health facilities were not operational, the data on confirmed cases of malaria were not available during the time of study. Therefore, the data on clinical cases were used.

3.9. Data Analysis.

Analysis of variance and T-test was used to analyze some of the data while Chi –square test for independence was used to analyze associations of variables. The statistical package for social sciences (SPSS soft ware) was used for calculation of percentages; measures of central tendency and tabulation of Data. Data presentations were done using frequency tables, bar chart and pie charts.

3.10. Logistical and Ethical Consideration.

3.10.1. Clearance was sought from the ethical review committees at Kenyatta University, Ministry of Education and Office of the President.

3.10.2. Confidentiality was maintained on all data and information collected.

3.10.3 The instruments for data collection were coded to instill confidentiality.

CHAPTER FOUR: RESULTS

4.1. Introductions.

This chapter presents the findings of the study. Data was collected from 301 respondents whose Socio-demographic profiles were considered. Information on the basic Socio-demographic profile of the respondents interviewed in the survey is essential for the interpretation of findings presented later in the report (table 4.1).

4.2. Socio-demographic profile of the respondents.

The mean age for the respondents was 39 years. On gender, 172 (57 %) of the respondents were male while female respondents were 129 (43 %). On religion 252 (83 %) of the respondents were Christian, traditionalist were 20 (7 %) and those who do not belong to any religion were 28 (9 %). 240 (79 %) of the respondent were married while 29 (10 %) were single and the rest were widow 23 (8%), separated 6 (2 %) and divorced 3 (1%). The level of education attained by respondents showed that around half 152 (50 %) of the respondent have attained primary level of education while those who have secondary level of education were 83 (28 %) and those who never went to school were 38 (13 %). Adult educations were 11 (4 %) and College or university levels of education were only 17 (5 %). 209 (69 %) of the respondents were small scale earners that is their monthly income were less than Ksh. 3000 per month and those whose monthly income were ranging from Ksh.3000 and not greater than Ksh. 5000 were 54 (18 %) and 38 (13 %) of the respondents were having monthly income of Ksh. 5000 and above (table 4:1)

Table 4.1. Distribution of respondents by Socio-demographic profile

Characteristics	Description	Frequencies	Percentage
Age	18-24	38	12.62
	25-31	47	15.62
	32-38	54	18
	39-45	78	26
	46-52	52	17.3
	53-60	32	10.63
	Totals	301	100
Gender	Male	172	57.1
	Female	129	42.9
	Totals	301	100
Religion	Christian	252	83.1
	Muslim	1	0.3
	Traditional	20	6.6
	No-religion	28	9.3
	Totals	301	100
Marital status	Single	29	9.6
	Married	240	79.7
	Divorced	3.0	1.0
	Separated	6.0	2.0
	Widowed	23.0	7.6
	Totals	301	100
Level of education	None	38	12.6
	Primary	152	50.5
	Secondary	83	27.6
	Adult education	11	3.7
	College/university	17	5.6
	Totals	301	100
Monthly household income in Kenya shillings.	0-3000	209	69.4
	3001-5000	54	18
	5000 – Plus.	38	12.6
	Totals	301	100

4.3. Communities' Perceived Causes of Malaria.

95.6 % of the respondents knew that malaria was caused through mosquito bites. However, together with mosquito bites other irrelevant causes were also mentioned climate change 3.0%, green maize 0.7 % and flies 0.7 %. This is an indication of a gap in knowledge and misconception of ideas (table 4. 2).

Table 4.2. Distribution of Respondents' perceived cause of Malaria.

Perceived Causes of Malaria	Frequencies	Percent
Mosquito bites	288	95.6
Green maize	2	0.7
Change in climate	9	3.0
Flies	2	0.7
Total	301	100.0

4.3.1. The relationship between the use of IRS with Icon and Community's perceived causes of malaria.

Comparison made between perceived causes of malaria showed that there is no significant difference in the use of IRS with Icon. The result, thus, support the hypothesis and it can be concluded that the community perceived cause of malaria is not related with the use of IRS with Icon in malaria control (figure 4.1) ($p > 0.05$ ($\chi^2 = 0.380$, $df = 1$)).

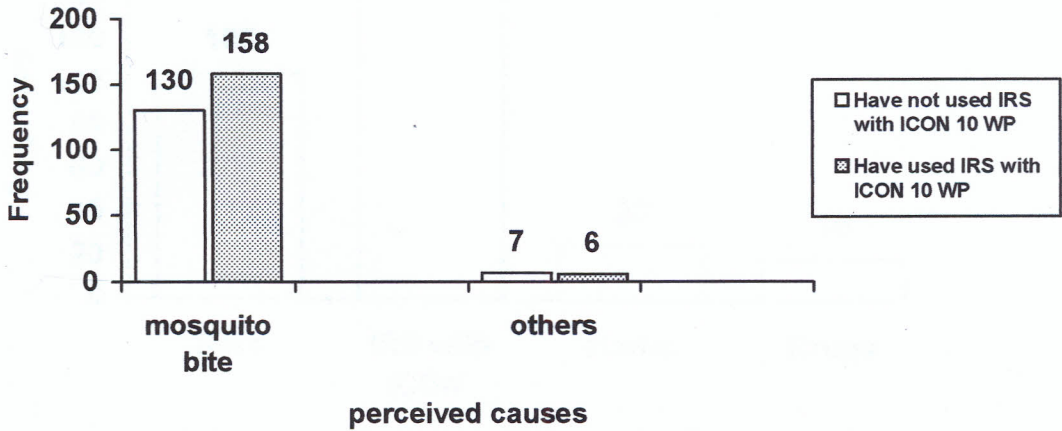


Figure 4.1. The relationship between the use of IRS with Icon and Community's perceived causes of malaria.

4.4. Community's known Methods of Malaria control.

Community members were asked whether they know methods of malaria control. They came up with 4 control methods, which are commonly in use in their areas of residence as shown in (figure 4:2). A substantial percentage of 50.5 % (152) and 34.9 % (104) of the respondents rated IRS with insecticides (Icon) and mosquito nets. The least control methods known include use of Herbs 8.3 % and drugs 6.3 %. These findings showed that the community has been exposed to malaria control concepts and there seems to be no much difference between the ethno medical perceptions and practices relating to malaria control and the biomedical on which malaria control is based.

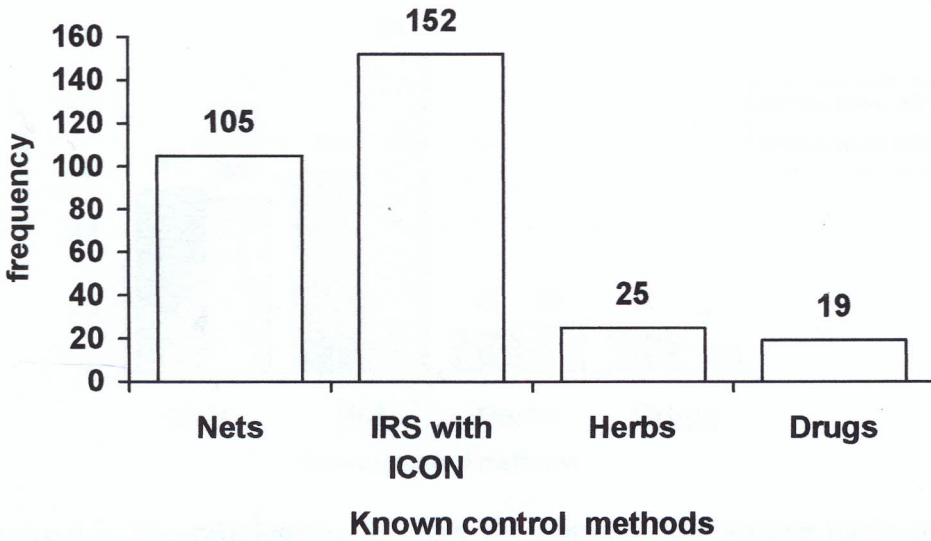


Figure 4.2. Distribution of Respondents known Methods of Malaria control.

4.4.1. The Relationship between the Communities' Known Methods of Malaria Control and the Used of IRS with Icon.

The relationship between the known methods of malaria control and the use of IRS with Icon was tested using chi-square. The result showed that there was no significant difference ($p > 0.05$ ($\chi^2 = 6.679$, $df = 3$)). It can be inferred that the community's knowledge of methods of malaria control did not influence the use of IRS with Icon (Figure 4.3).

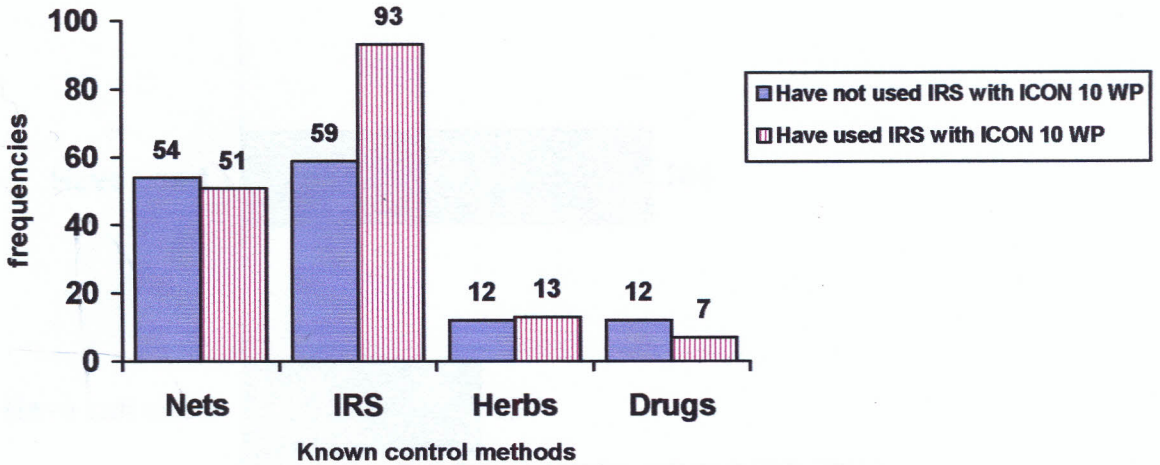


Figure 4.3. The relationship between the communities' known methods of malaria control and the used of IRS with Icon.

4.5. Community Use of IRS with Icon.

54.5 % (164) of the respondents mentioned that they used IRS with Icon intervention in malaria control and the outcome was satisfactory while 46 % (137) said that they have not used it for the last six months preceding the survey. However, most of the respondents during focus group discussion accepted the use of IRS with Icon because apart from killing mosquitoes, the Icon assist in eliminating house flies, bed bugs, cockroaches and other domestics pests (figure 4.4).

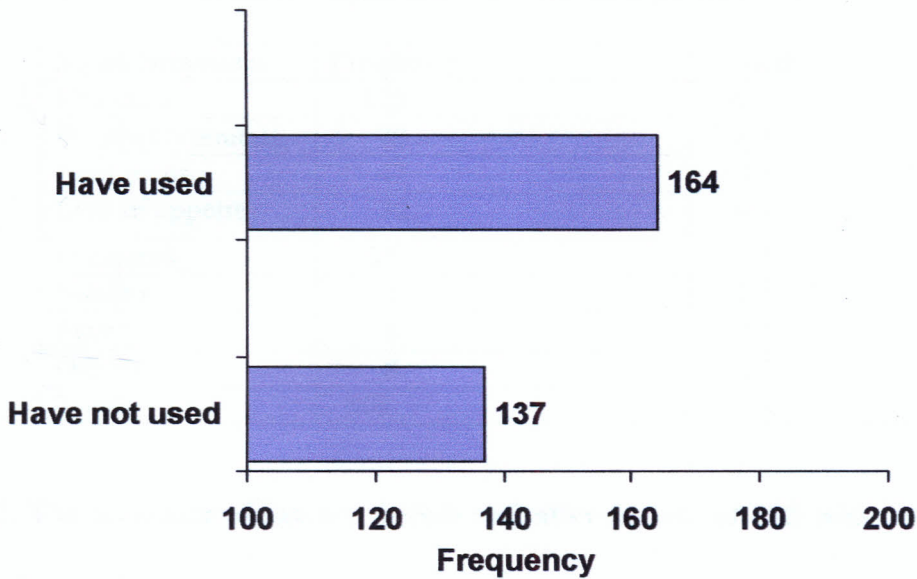


Figure 4.4. Distributions of Respondents on the use of IRS with Icon.

4.6. Community's perceived signs and symptoms of Malaria

The community mostly associates headache with malaria and believes that a patients with headache and diarrhea/vomiting is likely to be suffering from malaria. This could be true because headache 41.5 % and diarrhea/vomiting 23.3% were highly mentioned as signs and symptoms of malaria followed by joint pain 14.3 % and loss of appetite 6.6 % among others. The signs and symptoms of malaria as perceived by the community compares well with those in the National Guideline for Diagnosis, treatment and prevention of malaria, a Ministry of Health manual for health workers. It appears that the community members could differentiate malaria from other illness (table 4.3).

Table 4:3 Distribution of respondents' perceived signs and symptoms of Malaria

Signs/symptoms	Frequency	Percent
Headache	125	41.5
Diarrhea/vomiting	70	23.3
Joint pains	43	14.3
Loss of appetite	20	6.6
Dizziness	16	5.3
Nausea	11	3.7
Fever	8	2.7
Others	8	2.7
Totals	301	100.0

4.7. The incidence of malaria before and after the use of IRS with Icon among the study population.

Analysis of the reported cases of malaria was done using paired T-test. The t-test statistics established that the mean malaria morbidity Two years before the IRS with Icon intervention was 1154 (January 2002 and September 2003) and two years after (January 2005 and September 2006) was 1181.75. This difference in the before and after the intervention shows no statistical significance ($P > 0.05$ ($t = 0.106$, $df = 7$)). It can then be inferred that IRS with Icon intervention was not effective in controlling malaria.

Table 4.4. Reported clinical malaria morbidity data before and after IRS with Icon from Health facilities in Sigor Division.

before and after		Health facilities					T-test means
Year	Sigor	Lugumek	Kapkessosio	Kaboson	Totals		
before	2002	1517	854	825	179	3375	1154
	2003	2358	1134	1259	1106	5857	
	Average	1937.5	994	1042	642.5	4616	
after	2005	3196	600	717	647	5160	1181.75
	2006	1824	822	1138	510	4294	
	Average	2510	711	927.5	578	4727	

The record of reported cases of clinical malaria in the health facilities in Sigor division since 2002 to 2006 is shown in table 4.4. Between 2002 and 2003 there seems to have been a steady increase of malaria cases in the division. In the 2005 and 2006 there was a decline of the reported cases (fig.4.5). The partial implementation of IRS with Icon interventions was introduced in 2004 in the division. ANOVA test was done to determine whether the locality of the health facility played any role in the transmission of the malaria. The results were that the malaria morbidity after IRS with Icon intervention among the four health facilities was not significantly different ($P > 0.05$ ($F = 6.052$, $df = 3$ and 4)). The results observed before the IRS with Icon intervention among the same four health facilities in the division were ($P > 0.05$ ($F = 2.658$, $df = 3$ and 4)).

The results showed that there was no significance difference. This implies that health facility locality was not a factor in the reported malaria incidences in the study area.

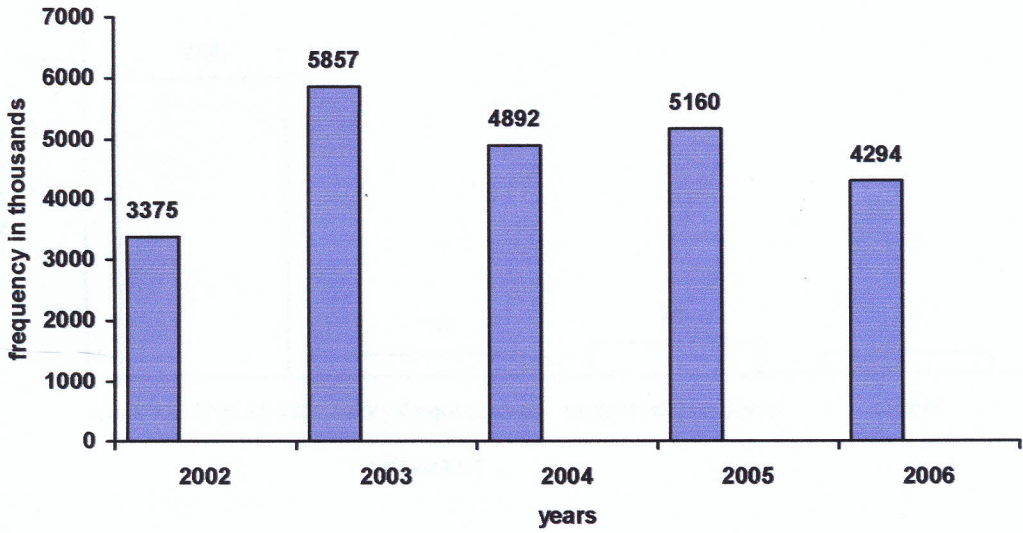


Figure 4.5. Reported Malaria cases in thousands in the years 2002 to 2006 from health facilities in Sigor division.

4.8. The constraints the community faced in using IRS with Icon.

Community members were asked whether there are any constraints when they are using Indoor Residual Spraying with Icon to control mosquitoes at their household level. The major constraint mention by 79.7 % (240) of the respondents was lack of Icon, while unskilled personnel were mention by 8.6 % (26) of the respondents. However, 5.6 % (17) of the respondents indicated other constraint which includes chemical formulation/mixing by CSM.

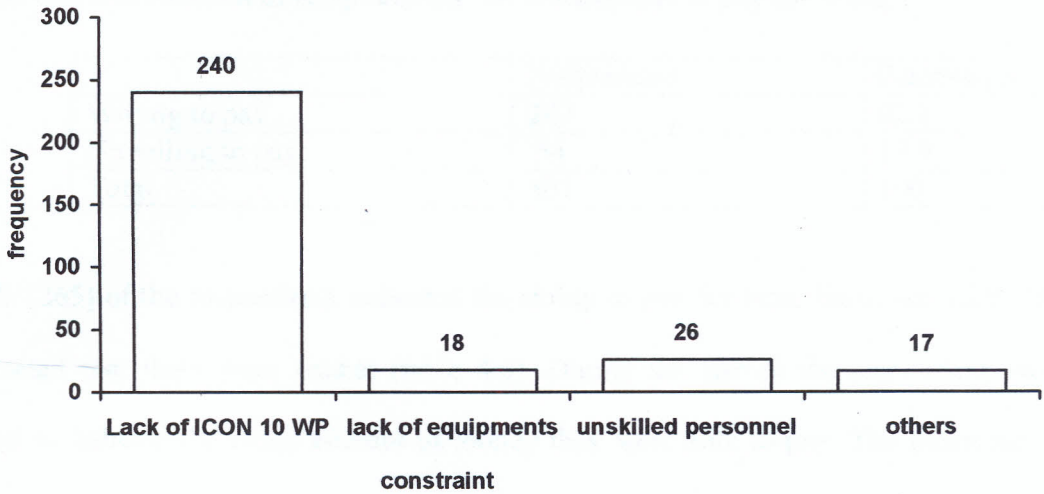


Figure 4.6. Distribution of respondents Constraint on use of IRS with Icon.

4.9. Community's willingness and ability to pay for Icon.

According to NHSSP II, (MOH, 2005) increased utilization of health services will improve the health of the population. In this study in-depth questions on willingness to pay for Icon for used in spraying the households were asked the respondents. This was with a view to overcoming the constraints the respondents had noted. Results showed that a significant proportion of respondents were willing to pay. For example, over 82.1 per cent of the respondents were willing to pay for Icon, compared with just 17.9 per cent who were not willing (Table 4.5). However, a comparison made between the users and non-users of IRS with Icon interventions showed that there is significant difference in the willingness to pay for Icon. This implies that willingness to pay for Icon influences the use of IRS with Icon intervention ($P > 0.05$ ($\chi^2 = 3.938$, $df = 1$)).

Table 4.5. Distribution of Respondents' on Willingness to pay for Icon.

	Frequencies	Percentage
Willing to pay	247	82.1
Unwilling to pay	54	17.9
Total	301	100

88 % (265) of the respondents indicated the ability to pay for Icon. However, 12 % (36) indicated that there were unable (table 4.6). During the survey the respondents were asked to indicate the likely amount of money they were able to pay. The mean for the amount of money they indicate for Icon that they are able to pay was Ksh. 200. When the ability to pay for Icon was tested against the use of IRS with Icon intervention there was no statistical significance observed. Implying that ability to pay for Icon has no influence on the use of IRS with Icon intervention ($P > 0.05$ ($\chi^2 = 2.709$, $df. = 1$).

Table 4.6. Distribution of Respondents' on ability to pay for Icon.

	Frequencies	Percentage
Able to pay	265	88
Unable to pay	36	12
Total	301.0	100

4.10. Gender and ability to pay for Icon.

57 % (172) of the respondents were male while 43 % (129) were female (figure 4:7). Gender has economic and social implication of the household and it has been reflected in health sector reform through a number of different routes: relations of distribution (who gets health care resources?), input into health care delivery (who does what?) and decision making (who has the power to make what choices?). Women are more often constrained in their use of services by heavy workload, lack of transport or inability to pay fees. However, in this study a comparison between the male and female showed no

significance difference in the ability to pay for Icon ($P > 0.05$ ($\chi^2 = 0.024$, $df = 1$). This may imply that gender does not affect the ability to pay for Icon among the study population. This findings does not concur with Doyal (2005) who found out that women were more willing than men to spend money on preventive strategies such as the use of bed nets.

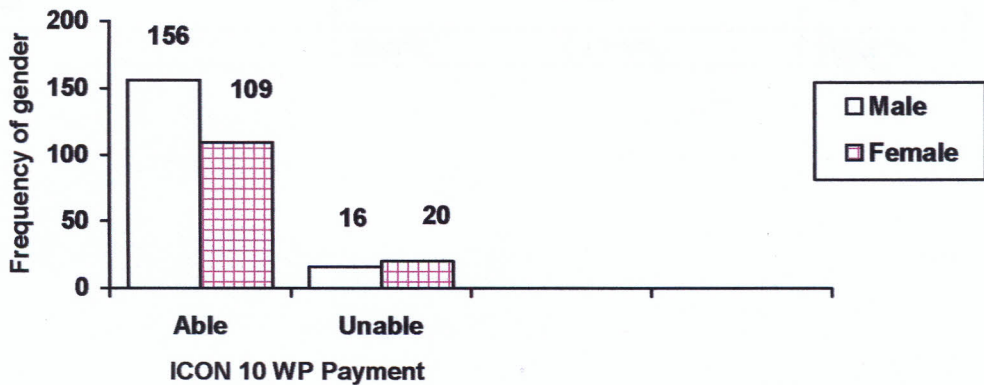


Figure 4.7. Distribution of respondents by gender and ability to pay for Icon.

4.2.7 The relationship between the respondents' monthly earning income and the ability to pay for Icon.

88 % of the respondents were able to pay for Icon while 12 % were unable (table 4.7). The relationship between the respondents' monthly earnings income and the ability to pay for Icon was tested. The results showed that there was a statistical significance. This imply that the income levels influences the ability to pay for Icon ($p < 0.05$, ($\chi^2 = 21.596$, $df = 2$).

Table 4.7. The relationship between the respondents' monthly earning income and the ability to pay for Icon.

Monthly Earnings Income	Ability to pay for Icon		Total
	Able	Not Able	
Less than KShs. 3000	193	16	209
	92.3%	7.7%	100.0%
KShs. 3001 - 5000	47	7	54
	87.0%	13.0%	100.0%
Above KShs. 5000	25	13	38
	65.8%	34.2%	100.0%
Total	265	36	301
	88.0%	12.0%	100.0%

CHAPTER FIVE: DISCUSSION.

5.1. Perceived cause and known methods of malaria control by community.

95.7 % of the respondents were aware of malaria infection. Mosquito bites were the most common perceived cause of infection. However, other irrelevant causes were mentioned such as changing climate and eating of green maize. Agyepong (1992) and Munguti (1998) found similar findings. This is an indication of a gap in knowledge and misconceptions of ideas which can be addressed through health education. The study population knew that malaria was preventable. The methods of malaria control known by the community are similar to those given in the National Malaria Strategy 2001-2010(MOH, 2001). It appears that community members knew some effective control methods as recommended by the Ministry of Health and as such require motivation and follow-up. This is an important area of concern because the knowledge gain appears as if not being translated into action.

Preventive services are a public good for which benefits are for all and increasing their consumption would require substantial motivation and education efforts. Health education is a necessity in Sigor division considering the level of malaria morbidity reported from health facilities. The need for health education in the division and the need to mobilize community members to participate in the recommended preventive measures could reduce the number of malaria infection in the division.

The principles of social marketing can be applied in the implementation of preventive services because according to Ward (1986) health is a consumer product and people can be persuaded and motivated to adopt specific courses of behavior generally accepted as being beneficial. Health services can be placed into three categories:

- a) Emergency or live saving for which neither price nor the consumer's income has any effects on the demand for the requisite care, people will seek for health care whether there is money or not in time of emergency.
- b) Ordinary curative and restorative for which demand is like any commodity in the open market if the price is high or the consumer's income is low demand is less, but if the price is low or the consumer's income is high demand for them can be stimulated.
- c) Preventive services are the least in demand and unless they are free it is doubtful whether demand for it can be stimulated.

The government through the Ministry of Health should take an aggressive stand in preventive services using resources that are available. Funds such as constituency development funds and /or cost-sharing funds may be allocated for this purpose so that they can support the communities and Non-Governmental Organization already involved in these programmer. This way crisis intervention can be avoided during epidemics.

The study population indicated 7 symptoms of malaria to confirm that they were able to differentiate malaria from other diseases. This can be very useful in educating members to recognized malaria infection so that they can seek preventive measures immediately. It has been recognize that malaria is a life threatening disease in individuals with low or impaired immunity and population not normally exposed to high rates of malaria transmissions may suffer explosives epidemics with high case fatality rates affecting all age groups (WHO, 2001). However, in order to be able to prevent or cure the disease in the context of malaria epidemics early detection, containment and prevention are pre-requisite (World Bank, 1993).

The use of insecticides for the control of malaria and other vector-borne diseases acquired great impetus with the discovery of IRS chemicals in the late 1940's (Raghavendra and Subbarao, 2000). However, the development of mosquito resistance to some residual insecticides and the elusive behavior of certain mosquito vectors have diminished the effectiveness of residual spraying and extent of its application (WHO, 1982). This situation may be overcome by ensuring that all sprayable surfaces are covered by an effective dose of insecticides during the entire period of malaria transmission. However, if these measures are not satisfactorily achieved continue existence and presence of malaria episodes among the target population may be experienced. During survey, participant in the FGDs, complained about poor preparation and application of Icon by CSM. Their complaint was that "the chemicals were diluted and insects survived even after the spray". This is an important area of concern which may be cited for increased reported malaria morbidity in health facilities. It is recognized that the effectiveness of IRS with Icon may be undermined if it is not prepared correctly and/or not accepted by the targeted population (WHO, 2005b). However, this study revealed that slightly over half (54 %) of the respondents appreciated its use as the best way of preventing mosquito bites and they also had no complaints about the Icon insecticide.

5.2. The Incidence of Malaria after the Use of IRS with Icon among the Study Population.

The record of reported cases of malaria in the health facilities in Sigor division since 2002 to 2006 was collected. The name of the health facilities were: Sigor sub-district hospital, Lugumek dispensary, Kapkessosio dispensary and Kaboson mission Health centre. Between 2002 and 2003 there seems to have been a steady increase of malaria

cases in the divisions. This is the period before the implementation of IRS with Icon. Studies in the Southern African countries found similar findings before IRS with DDT insecticides (Lengeler, 2004).

In 2004 partial implementation of IRS with Icon was done in Sigor division the study area. However, increase reported cases of clinical malaria were observed in the same year. However, there was a decline of the reported clinical cases in 2005 and 2006 (fig.4.5). Studies done in Swaziland where proven cases of malaria were used reported considerable gains shortly after the implementation of residual spraying with total parasites rates in children 1-5 years being reduced from 75 % to 24 % (Lengeler, 2004).

The same general pattern was shown by other surveys where control measures had been introduced. For example, studies in the Kenya highland districts of Nandi and Kisii by Snow *et al* (2002) demonstrated significant reduction in malaria case burden to below 3 % at health facilities.

Studies done in Pakistan by Rowland *et al* (2000) found out that during the seven month, after Indoor Residual Spraying with *alphacypermethrine* the incidence of *falciparum* and *vivax* malaria were 95 % and 80 % lower than unsprayed sector respectively.

5.3. The Constraints the Community Faced in Using the IRS with Icon Intervention.

The study populations were asked to state some of the constraints they faced while using IRS with Icon as an intervention method of malaria control. The main supplier of Icon for spraying was the government through the Ministry of Health. FGDs observed that lack of Icon for spraying in IRS malaria intervention was due to inequitable distribution by the concerns people i.e. Health workers; Provincial administration and community spray men. This finding concurs with studies carried out by Francisco and Adolfo (2005). In

their study they found out that inequitable distribution of resources and inefficiency among health care providers were factors limiting the implementation of malaria intervention strategy. There is recognizable description of high out of pocket expenditure for malaria treatment which are attributed to inefficiency among the health care providers. Recent studies have shown a strong relationship between ill health and vicious cycle of poverty (Global Forum for Health Research, 2004). The prevalent poverty in Sigor division (household 58.4 % and individual 62.5 %) could be attributed to ill-health (GOK, 2002).

Indoor residual spraying is most effective, whichever insecticides is used, when coverage in a targeted community is high. However, some people may refuse to allow their houses to be sprayed; others may clean or re-plaster sprayed walls to hide white residues left by chemicals and others who may have side effects of the insecticide would not allow house spraying. However, most of the respondents during focus group discussion accepted the IRS methods of malaria control because apart from killing mosquitoes, the Icon assist in eliminating house flies, bed bugs, cockroaches and other domestics' insects.

This study did not find any hindrance to house spraying as reported by 54.5 % of the respondents who mentioned that they used the method. These findings concur with a study done in Pakistan by Rowland *et al* (2000).

5.4. Community's Willingness to pay for Icon.

The study demonstrates some evidence of community's willingness to pay for Icon and spray pump, only if there were available. These services were being provided to the community free and possibly the communities are not obliged to pay. But the

effectiveness of Icon to eliminate some of the pests and mosquitoes has made the community to demand for these services. Studies in Tigray region of Ethiopia by Kindane and Marrow (2000) found similar findings. A similar result on willingness to spend money on preventive strategies such as the use of bed nets was found by Doyal (2005).

5.5. Community's Ability to pay for Icon.

According to NHSSP II/KEPH (MOH 2006b) communities have been found to participate effectively in cost-sharing when they are in control of the money they contribute and can see tangible results.

One focus group participant stated that "the peoples' level of readiness to support the IRS with Icon intervention was not questionable as some of the farms produces could be used". It was observed that if Icon are available and spray pumps are not, people would opt to buy and use any type of sprayer which in most instances was not effective. The use of any type of sprayer could contribute to under-dosing with subsequent vectors' resistance (WHO, 2005b). In general, the effectiveness of the programme is compromised and increased chances of malaria episodes among the community members. The increase clinical malaria morbidity as seen in the health facilities could be attributed to such a scenario.

5.6 Sustainability of IRS with Icon Intervention programme.

Income generating activities have been one of the moves made by policy makers to enhance the economic status of rural population especially the female population. Income generating activities are always organized into social or economic groups and women are mostly involved, active and they form the favorable community entry points. Majority of the respondent's in FGDs were found to be members of such groups. Although the groups

were engaged in various activities none of them addressed the family health status directly. Using such groups would be an important strategy in the promotion and use of IRS with Icon in the community. It would only be useful if such suggestion were discussed exhaustively with the community to determine their applicability. The argument for this is that power and resources will be shifted nearer to users and to those providing the services. Hence the hope is that services will become more responsive to local needs with greater local ownership and accountability (GOK, 2002).

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1. Introduction.

This chapter gives the conclusion of the study base on the findings and it also gives suggestion for future research which may be considered by others interested in malaria control.

6.2. Conclusions.

6.2.1. The community members' perception on cause of malaria and suggested methods of malaria control were accurate and it is important for the control of the disease.

6.2.2. The study has established that IRS with a residual insecticide for example Icon did not significantly reduced clinical malaria in the division.

6.2.3. The major constraint established by the study was lack of enough Icon.

6.2.4. The study showed that the community was willing to pay for Icon if they were available.

6.3. Recommendations.

6.3.1. It is recommended that stakeholders in malaria control should consider community-based communication which will strengthen the existing knowledge on malaria because the communities are already aware of cause, sign and symptoms of malaria.

6.3.2. It is recommended that the Government to provide enough Icon and Spray pumps for IRS with Icon intervention programme and trained community spray men on relevant Icon application skills and proper mixing of the same.

6.3.3. It is recommended that the Government to decentralize Icon chemical supplies and equipments to the community levels.

6.3.4. It is recommended that the government to plan for a cost-sharing scheme for purchase and supply of Icon and spray pumps in the division.

6.4. Suggestion for Further Research.

6.4.1. There is need to carry out a similar research in other endemic districts of Kenya to evaluate the used of IRS with ICON intervention and to come up with recommendation that are specific to different endemic regions with different ecologies and perceptions of malaria control measures.

6.4.2. There is need to do research to look at cost effectiveness of other residual insecticides in the market.

6.4.3. It is suggested that research should be done to discover if locally available natural products could be use to effectively control mosquitoes and a result reduce the malaria burden.

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APPENDIX: 7.1. INFORMED CONSENT

Hello, my Name is RICHARD KIBET KORIR, and I'm working with KENYA MEDICAL TRAINING COLLEGE Nakuru as a lecturer but a student at Kenyatta University. We are conducting a case study about Malaria Control using Indoor residual spraying intervention with Icon 10 WP in this area. we would very much appreciate your participation in this survey. I would like to ask you about causes of Malaria, the constraint you faced when using Indoor residual spraying with Icon 10 WP and whether you're able to pay for the Icon 10 WP.

This information will help the ministry of Health to plan to decrease death of persons as a result of malaria. The interview usually takes between 20 and 30 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be disclosed to other persons. Participation in this survey is voluntary and you can choose not to answer any individual question or all of the questions. However, we hope that you will participate fully in this survey since your views are important.

At this time, do you want to ask me anything about the survey?

May I begin the interview now?

Signature of interviewer: _____

Date: _____

RESPONDENT AGREES TO
BE INTERVIEWED _____

1. CONTINUE

RESPONDENT DOES NOT AGREE
TO BE INTERVIEWED. _____

2. END

APPENDIX 7.2 QUESTIONNAIRE**INTERVIEWER SCHEDULE ON THE EFFECTS OF COMMUNITY PERCEPTION AND INVOLVEMENT IN MALARIA CONTROL USING INDOOR RESIDUAL SPRAYING WITH ICON**

Name of sub location _____

Date of interview _____

Code of the schedule _____

Age of respondent _____

Sex of respondent _____

1. What is your Religion?

(i) Christian [] (ii) Muslim []

(iii) Traditional [] (iv) None []

2. Marital status of respondent

(i) Single [] (ii) Married []

(iii) Divorced [] (iv) Separated []

(v) Widowed []

3. Headship of the household

(i) Female [] (ii) Male []

4. Level of education

(i) None [] (ii) Primary []

(iii) Secondary [] (iv) College/ University []

(v) Adult education []

5. Occupation of respondent
- (i) Employed [] (ii) Farmer []
- (iii) Businessman/ woman []
- (iv) Others (Specify) _____
6. What is your monthly earning income from your occupation?
- (i) 0-3000 [] (ii) 3001-5000 []
- (iii) Above 5000 []
7. What causes malaria?
- (i) Mosquito bites (ii) Green maize
- (iii) Change of climate (iv) Fruits (v) Flies
- (vi) Others (specify) _____
8. What are the signs and symptoms of malaria?
- (i) Diarrhoea/ Vomiting (ii) Nausea (iii) Joint pains
- (iv) Headache (v) Dizziness (vi) Loss of appetite
- (vii) Fever
- (viii) Others (specify) _____
9. Is Malaria preventable?
- (i) Yes (ii) No (iii) Don't know
10. If yes, what are the methods of prevention?
- (i) Control mosquitoes (ii) Use of IRS (iii) Treatment of the sick
- (iv) Take drugs (v) Don't know
- (vi) Others (specify) _____
11. Have you heard about Indoor Residual Spraying using Icon?
- (i) Yes (ii) No

12. If NO, what do you and your family use to protect yourself from mosquito bites?
- (i) Bed nets
 - (ii) Insecticides/ insect repellents
 - (iii) None
 - (iv) Others (Specify) _____
13. If yes, in question 8, when did you use the IRS intervention last?
- (i) Less than 6 months ago
 - (ii) More than 6 months ago
 - (iii) Don't remember the dates
14. If more than six months ago, why has it taken long before you used the intervention?
- (i) Cannot afford Insecticides
 - (ii) Spray pumps not available
 - (iii) Community spray men not willing
 - (iv) Health workers have not provided chemicals
 - (v) Others (Specify) _____
15. What constraints have you been experiencing when using IRS intervention?
- (i) Lack of chemicals
 - (ii) Provision of equipments
 - (iii) Lack of skilled personnel
 - (iv) Others (Specify) _____
16. How do you feel inside your house after it has been sprayed?
- (i) Comfortable
 - (ii) Uncomfortable

(iii) Skin irritation

(iv) Others(Specify) _____

17. Are you willing to pay Icon?

(i) Yes

(ii) No

18. Indicate YES and the amount you are able to pay and NO if not able to pay for Icon in the space provided.

(i) None

(ii) Less than Ksh. 200 per year

(iii) Ksh. 200- Ksh. 400 per year

(iv) Ksh. 401- Ksh. 800 per year

(v) Others (Specify) _____

APPENDIX 7.3 FOCUS GROUP DISCUSSION INTERVIEW GUIDE

1. What benefits do you get from using IRS with Icon?
2. Have you been able to get Icon on time?
3. Do you think the community is willing to purchase Icon?
4. Do you think the community can afford to pay for Icon?
5. How much do you pay to have your household sprayed?
6. Are all the people in the community using IRS with Icon?
7. If no why.
8. What are the causes of Malaria?
9. How does the community prevent itself from malaria?
10. Are there any problems when using IRS with Icon?

APPENDIX 7.4 FOCUS GROUP DISCUSSION RESULT.

A total of four (4) focus group discussions were held with Governments administrator, youth leaders and women/men leaders in the community. The discussions were held on four separate days and at four different venues convenient to the people.

For each group, the discussions were opened and closed with a word of prayer. Climate settings were done and confidentiality of the information assured before the start of the discussion the facilitator guided the discussion according to the questions on the checklist for the FGD. The proceedings were recorded by the secretary and the summary of all the findings from each group were as follows:

The groups comprises of:

- Nine (9) Provincial administrators.
- Ten (10) women/ men leaders.
- Twelve (12) youth leaders.

1. The groups were asked what benefits they had got from using IRS with Icon.

9/9 said IRS Icon prevented them from mosquito bites.

10/10 said frequency of malaria episodes in their families have been reduces.

12/12 said they sleep un-disturbed by mosquito nuisances.

All the groups unanimously agreed that IRS Icon killed other domestics' insects apart from mosquitoes.

2. The groups were asked whether they have been able to get Icon on time.

All the groups were in agreement that they don't get them regularly, although the ministry of health was the supplier.

The groups also said they were not enough for the entire household in the area.

3. The groups were asked whether they have been willing to purchase Icon.

All the groups were in agreement that they were willing only that the chemicals were not locally available.

4. Asked whether they can afford the price of the Icon.

9/9 said they preferred to be given through exchange of the farm produces.

10/10 said they may afford half of the price on installments.

12/12 said that they preferred to purchase through self help groups.

5. The groups were asked how they get the spray pumps.

All the groups were in agreement that the spray pumps were given free and that it was not locally available.

Youth leaders (all) said that the available spray pumps were inadequate and to get a source to supply had been fruitless and sometimes used the local sprayers.

6. Asked whether they pay for their house hold to be sprayed.

All the groups said that they pay either in kind or cash.

In cash was paid 30/=, and in kind was one to three bottles of milk

7. The group was asked whether all other people in the community use IRS with

Icon.

5/9 said not all people.

10/10 said not all people.

12/12 said not all people.

8. Asked why not all people use IRS with Icon.

All the groups were in agreement that some people could not afford the Icon.

9/10 said that food was also a problem in the area and that when little money was earned food became a priority.

All the groups said that some people in the community still did not know about IRS with Icon programme and therefore required to be educated.

9. The group was asked the causes of malaria.

6/9 said mosquito bites.

10/12 said mosquito bites.

9/10 said sometimes climate change.

10. The groups were asked how they prevent malaria.

9/10 said they treat the sick at the health facility.

8/10 said they use herbs from the traditional herbalist.

9/12 said the prevention was through the use of IRS.

11. The group was asked whether they have any problems using IRS with Icon intervention.

9/9 said the Icon ran out of stock before complete spraying of household.

12/12 said that the CSM sometimes dilute the chemicals so that they spray more household and get more money.

10/10 said that the sprayer pumps are not available when they want to do spraying.

All the groups were in agreement that if the chemicals or pumps were locally available they were willing to purchase to supplement the government efforts.