IMPACT OF STRENGTHENING COMMUNITY HEALTH SERVICES ON UTILIZATION OF MALARIA PREVENTION AND CONTROL INTERVENTIONS IN MIGORI COUNTY

ATHUMAN NYAE CHIGUZO

DOCTOR OF PHILOSOPHY

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Impact of Strengthening Community Health Services on Utilization of Malaria Prevention and Control Interventions in Migori County

Athuman Nyae Chiguzo

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DECLARATION

This thesis is my original work and has not been presented for a degree any other University

Signature…………..Date……………………………

Athuman Nyae Chiguzo

This thesis has been submitted for examination with our approval as University Supervisors.

Signature…………..Date……………………………

Dr. Evan Mathenge, PhD

KEMRI, Kenya

Signature…………..Date……………………………

Prof. Helen Lydiah Kutima, PhD

JKUAT, Kenya

Signature…………..Date……………………………

Prof. Charles N. M. Mbogo, PhD

KEMRI-Wellcome Trust Research Programme

DEDICATION

I dedicate this thesis to my beloved Mother, Mchenyumba wa Tsuma and Father, Mzee Chiguzo Chikophe ***(Foleni*)**.

***"……… Ye be kind to thy parents. Whether one or both of them attain old age in thy life, say not to them a word of contempt, nor repel them, but address them in terms of honour. And out of kindness, lower to them the wing of humility, and say: 'My Lord, bestow on them Thy Mercy even as they cherished me in childhood"* (Al-Qur'an, 17: 23-24).**

Finally, I dedicate this thesis to my beloved children Mustafa Mwarua, Lulu Luvuno and Malik Nyiro who persevered throughout the course of this thesis. As your beloved father, I have shown you the way, follow my footprints, this is your heritage and the Almighty Allah will shower you with his abundant blessings in your lives.

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ACRONYMS AND ABBREVIATIONS

AMF	Affordable Medicine Facility for Malaria
ANNOVA	Analysis of Variance
CCMM	Community Case Management of Malaria
CHAs	Community Health Assistants
CHC	Community Health Committee
CHU	Community Health Unit
CHV	Community Health Volunteer
CHW	Community Health Worker
CI	Confidence Interval
CSFP	Community Strategy Focal Person
CSS	Community System Strengthening
DHMT	District Health Management Team
DiD	Difference in Difference
DMCC	District Malaria Control Co-ordinator
DMOH	District Medical Officer of Health
ERC	Ethical Review Committee
FGD	Focus Group Discussion

HBHI	High Burden High Impact
HMM	Home Management of Malaria
IDI	In-Depth Interview
IPTp	Intermittent Presumptive Treatment in Pregnancy
IPTp1	First dose of IPTp
IPTp2	Second dose of IPTp
IPTp3	Third dose of IPTp
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
KDHS	Kenya Demographic and Health Survey
KECHN	Kenya Community Health Nurse
KEMRI	Kenya Medical Research Institute
KeNAAM	Kenya NGOs Alliance Against Malaria
KEPH	Kenya Essential Package for Health
KII	Key Informant Interview
KMIS	Kenya Malaria Indicator Survey
KNBS	Kenya National Bureau of Statistics
KNMS	Kenya National Malaria Strategy
LLINs	Long Lasting Insecticidal Nets

MDGs	Millennium Development Goals
MIS	Malaria Indicator Survey
MUERC	Maseno University Ethical Research Committee
NHSSP	National Health Sector Strategic Plan
NMCP	National Malaria Control Programme
NMS	National Malaria Strategy
NTD	Neglected Tropical Diseases
OR	Odds Ratio
PHO	Public Health Officer
PLWHA	People Living With HIV/AIDS
SDGs	Sustainable Development Goals
SPHT	Senior Public Health Technician
SPSS	Statistical Package for Social Science
SSA	Sub-Saharan Africa
SSC	Scientific Steering Committee
STH	Soil Transmitted Helminthes
WHA	World Health Assembly
WHO	World Health Organization

DEFINITION OF OPERATIONAL TERMS

Artemisinin-Based Combination Therapy The combination of an Artemisinin derivative with a longer acting antimalarial drug that has a different mode of action.

Community-Based Approach Is the mechanism through which households and communities strengthen their role in health and health-related development issues, by increasing their knowledge and skills in disease control and planning for health interventions.

Community Health Services Refers to health improvement activities with people's participation to promote health, prevent disease and provision curative services at the community level.

Community Health Unit (CHU) Is an administrative area with population coverage of approximate 5,000 people with an average of 1,000 households.

Community Health Volunteers (CHVs) Individuals chosen by the community and trained to address health issues of individuals, households and communities in their localities, working in collaboration with community leaders and link healthcare facilities staff.

Community Health Assistant (CHA) Formerly known as Public Health Technicians / Officers, or Community Health Officers), employed as part of the formal health system to provide training and technical support to CHVs, support the community-facility linkage and are in-charge of the community health units.

Community Health Committee (CHC) This is the governance organ for a community health unit and has 9-13 members representing different villages, diverse demographic and interest groups within the community.

Difference-in-Differences (DiD) method is a quasi-experimental approach that compares the changes in outcomes over time between a population enrolled in a program (the treatment group) and a population that is not (the comparison group).

Endemic Area An area in which there is an ongoing, measurable incidence of malaria infection and mosquito-borne transmission over a succession of years**.**

Indoor Residual Spraying (IRS) Operational procedure and strategy for malaria vector control that involves spraying interior surfaces of dwellings with a residual insecticide to kill or repel endophilic mosquitoes.

Malaria Control Reduction of disease incidence, prevalence, morbidity or mortality to a locally acceptable level because of deliberate efforts. Continued interventions are required to sustain control.

Malaria incidence Number of newly diagnosed malaria cases during a defined period in a specified population.

Malaria Prevalence (Parasite Prevalence) Proportion of a specified population with malaria infection at one time OR number of newly diagnosed malaria cases during a defined period in a specified population.

Universal Coverage	Access to and utilization of appropriate interventions by the entire population at risk of malaria
Vector Control	Measures of any kind against malaria-transmitting mosquitoes, intended to limit their ability to transmit the disease.

ABSTRACT

Malaria was the leading cause of morbidity and mortality and accounted for 40% and 30-40% of the outpatient attendance in 2011 in Migori and Kwale counties. Some studies have attributed this to inadequate capacity to deliver malaria interventions to all who need them. This study aimed at evaluating the impact of strengthening community health services on utilization of malaria prevention and control intervention in Migori County. A Quasi experimental study design was employed at baseline (zero years) and at endline (after four years) to measure the impact in Migori, with Kwale county as the Control. In the intervention group (Migori), CHVs were trained on malaria prevention and control strategies. A baseline and endline Household Surveys in each of the counties were conducted to act as the pre-data and post data respectively. The difference-in-differences method (DiD) was applied for comparing the outcomes at the intervention and control. A p value of less than 0.05 was considered significant. Health facility data on malaria morbidity were gathered on monthly basis and aggregated annually from four new established Community Health Units each in the intervention and Control sites between January 2013 to December 2016. Stratified random sampling was applied at baseline and endline surveys. The interventions were training of CHVs on community health strategy and community case management of malaria based on national training guidelines. Data were collected on utilization of malaria prevention and control interventions and malaria morbidity at CHUs during baseline and endline surveys. The study got ethical approval from Maseno University Ethical Review Committee. All study participants signed written consent forms. A sample size for each county (Migori and Kwale) was calculated as 384 households per county for both the pre-intervention and post-intervention periods. However, in Migori, a total of 1206 and 578 households were involved in the research in the baseline and endline survey respectively, while in Kwale, a total of 878 and 430 households were involved in the research in the baseline and endline survey respectively. Net ownership among households gave a significant increase (OR of 8.29 (95% CI: 4.82 to 14.28, $p < 0.001$) in net ownership in the Intervention area. The study found there was a significant increase in nets use the night before the survey among household members with an OR of 7.92 (95% CI: 4.33 to 14.49, $p < 0.001$), children <5 years (OR of 6.05 (95% CI: 4.27 to 8.57, $p < 0.001$) and pregnant women (OR of 1.53 (95% CI: 1.11 to 2.10, $p = 0.0094$) in Migori compared to Kwale. In Migori for > 5 Years**,** there was a reduction in malaria rates (mean difference = 85.03/1000 population), but not statistically significant ($p = 0.06767$), CI (-11.49975, 181.55689). For **<** 5 Years, there was a significant reduction in malaria rates (mean difference = 697.8 /1000, $p = 0.01566$), CI (250.8067, 1144.7933). In Kwale for >5 Years, there was a slight increase in malaria rates (mean difference = -42.88571/1000, but the change was not statistically significant ($p = 0.3912$) CI (-179.43945 to 93.66802). For <5 years, there was a slight increase in malaria rates (mean difference = -57.5/1000, but the change was not statistically significant ($p = 0.6221$), CI (-391.6629 to 276.6629). The statistical significance of this difference emphasizes the success of the intervention in improving testing accessibility and coverage. The timing of ACT administration also showed significant improvements in Migori with an OR of 1.92 (95% CI: 1.24 to 2.98, $p = 0.0035$). In conclusion and collectively, these findings provide compelling evidence that the intervention had a meaningful and statistically significant impact on net ownership, use, and the proper hanging of nets across multiple target groups as well as malaria morbidity especially in <5 years. The study found out that the main challenges faced by CHVs were inadequate remuneration, lack of working tools, supplies, transport, motivation as well as poor referral processes while delivering community health services. This study recommends that County Government Departments of Health Services should provide adequate budget allocation to enhance the capacity of CHVs to provide community-based health service. Finally, this study recommends further research to be conducted on the economic evaluation of the community health services as well as cost benefit analysis on the remuneration of CHVs.

CHAPTER ONE

INTRODUCTION

1.1 Background

Malaria is a preventable and treatable mosquito-borne disease, whose main victims are children under five years of age in Africa. The *World Malaria Report 2012* summarizes data received from 104 malaria-endemic countries and territories for 2011. Ninety-nine of these countries had on-going malaria transmission. According to the latest WHO estimates, there were about 219 million cases of malaria in 2010 and an estimated 660 000 deaths (WHO, 2011). Africa is the most affected continent with more than 90% of all malaria deaths occurring. Between 2000 and 2010, malaria mortality rates fell by 26% around the world (WHO, 2011). In the WHO African Region, the decrease was 33%. During this period, an estimated 1.1 million malaria deaths were averted globally, primarily as a result of a scale-up of interventions (WHO, 2012).

In 2018, an estimated 228 million cases of malaria occurred worldwide (95% confidence interval [CI]: 206–258 million), compared with 251 million cases in 2010 (95% CI: 231–278 million) and 231 million cases in 2017 (95% CI: 211–259 million). In 2018, there were an estimated 405 000 deaths from malaria globally, compared with 416 000 estimated deaths in 2017, and 585 000 in 2010. Children aged under 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272 000) of all malaria deaths worldwide (WHO, 2019). According to the WHO (2020) world malaria report, globally, the malaria mortality rate (i.e. deaths per 100,000 population at risk) reduced from about 25 in 2000 to 12 in 2015 and 10 in 2019, with the slowing of the rate of decline in the latter years.

About 95% of malaria deaths globally were in 31 countries. Nigeria (23%), the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), Mozambique (4%), Niger (4%) and Burkina Faso (4%) accounted for about 51% of all malaria deaths globally in 2019. Malaria deaths in the WHO African Region reduced by 44%, from 680 000 in 2000 to 384 000 in 2019, and the malaria mortality rate reduced by 67% over the same period, from 121 to 40 deaths per 100 000 populations at risk (WHO, 2020).

Combating malaria in the long run requires continued efforts to implement a comprehensive malaria control strategy. The Global Malaria strategy follows a four-pronged approach and includes access to prompt diagnosis and appropriate treatment; prevention of malaria in pregnancy; vector control through the use of Long-Lasting Insecticidal Nets (LLINs), Indoor Residual Spraying (IRS) and other control methods as well as a swift response to emergencies and epidemics.

Health system according to WHO (2007) consists of all the organizations, institutions, resources and people whose primary purpose is to improve health, plays an important role in the fight against malaria (WHO, 2007). A country's health system is central to the delivery of health services to the neediest communities, more so in regions where the burden of specific diseases ravages the most vulnerable groups. To function effectively, a health system must find a balance between primary (community services), secondary (specialized services) and tertiary (highly specialized services) health care. Without reliable and accessible primary health care, the health system will not reach the targeted population. At the same time, secondary and tertiary care, mostly in hospitals or specialized units, is necessary to save lives and support the primary health care system (Health Action, 1991) (MOH, 2007).

Strengthening health systems means addressing key constraints related to health worker staffing, skills and knowledge, infrastructure, provision of health services, procurement and delivery of health commodities (such as equipment and medicines), logistics, health information systems, governance and effective financing. Nevertheless, there is no single set of good practices for strengthening health systems since they are highly context specific (WHO, 2007).

The role of CHVs, now commonly known as CHPs, is important in the delivery of Community Health Services. Communities are the foundation of affordable, equitable and effective health care, and are the core of the Kenya Essential Package for Health (KEPH) proposed in the second National Health Sector Strategic Plan 2005-2010 (NHSSP II) extended to 2012) and the Ministry of Public Health and Sanitation Strategic Plan 2008–2012. The overall goal of the community strategy (2006) was to enhance community access to health care to improve productivity and thus reduce poverty, hunger, and child and maternal deaths, as well as improve education performance. The goal was to be accomplished by establishing sustainable level 1 services aimed at promoting dignified livelihoods across all the stages of the life cycles, through decentralization of services, as well as enhanced accountability and responsibility among all concerned partners.

The community-based approach, as set out in this strategy, is the mechanism through which households and communities strengthen their role in health and health-related development issues, by increasing their knowledge and skills in disease control and planning for health interventions. The intention is to strengthen the capacity of communities to assess, analyze, plan, implement and manage health and health related development initiatives, for them to contribute effectively to the country's socio-economic development.

The approach recognizes that all communities are already actively engaged in health activities for the survival of their households, and this could be enhanced through an increased knowledge and skills base on actions to take. In addition, the approach recognizes the pivotal role of the health system in supporting community efforts. It is through partnership between the system and the communities that improvement can be realized and sustained. It is therefore critical to integrate level 1-health activities by all stakeholders into the health care system. Integrating level 1 into the health care system requires mechanisms and structures that provide that linkage. Such structures would enhance and enable effective participation of communities in decision-making processes related to matters of health at the community level, as well as at the interface between levels 1, 2 and 3. Community Health Volunteers/Promoters (CHVs / CHPs) and

Community Health Workers (CHWs) are critical in the delivery and maintenance of community health systems.

Community organizations and networks have unique ability to interact with affected communities, react quickly to community needs and issues and engage with affected and vulnerable groups. They provide direct services to communities and advocate for improved programming and policy environments. This enables them to build a community's contribution to health, and to influence the development, reach, implementation and oversight of public systems and policies (CSS Framework, 2010). Community systems strengthening initiatives have the aim of achieving improved outcomes for interventions to deal with major health challenges such as HIV, tuberculosis, malaria and many others. An improvement in health outcomes can be greatly enhanced through mobilization of key affected populations and community networks and an emphasis on strengthening community based and community led systems for: prevention, treatment, care and support; advocacy; and development of an enabling and responsive environment.

1.2 Statement of the Problem

Malaria was the leading cause of morbidity and mortality in Kenya, accounting for 34% of the outpatient attendance in 2010 (MIS, 2010). Despite considerable efforts to control and treat the disease, the then most recent Kenya Demographic and Health Survey (KDHS) (KNBS 2010) estimated that about 24 million Kenyans were at risk of infection each year, with the most affected being pregnant women and children. Malaria in pregnant women contributes significantly to negative outcomes for the mother and baby, including anaemia, low birth weight and infant deaths, and it is one of the most common causes of spontaneous abortion. In addition, the ill health associated with the disease exacts a devastating toll on social and economic productivity, undermining local development in some communities (DOMC, 2010).

Malaria was the leading cause of morbidity and mortality and accounted for 40% and 30% of the outpatient attendance in 2011 in Migori and Kwale counties respectively (Migori and Kwale counties malaria profiles, 2012). Perhaps, one reason for this high morbidity is the lack of capacity to deliver malaria interventions to all who need them. This inadequacy is not only because of lack of commodities, but also due to weak local health systems and failure to involve local communities in malaria prevention and treatment. At the same time high coverage and efficacy of malaria prevention and control interventions would essentially contribute to strengthen local health systems, particularly level 1 service and help to address other public health issues.

A country's health system is central to the delivery of health services to the neediest communities. To function effectively, a health system must find a balance between primary (community services), secondary (specialized services) and tertiary (highly specialized services) health care.

According to the 2012 evaluation report on the 2011 mass LLINs distribution phase1 &2, LLIN use is lower among children less than five years in Lake Endemic region (15.8%) compared with Highland Epidemic areas (25.1%). At the same time, a comparatively smaller proportion of households use LLIN in Lake Endemic malaria transmission areas (29.9%) compared to the Highland Epidemic areas. These observations are not only because of lack of commodities, but also due to weak local health systems and failure to involve local communities in malaria prevention and treatment. Effective participation of communities in decision making processes related to health matters would essentially contribute to strengthening local health systems, particularly level one (community health Services) as well as the interface between levels 2 and 3.

1.3 Justification for the Study

To achieve and surpass the SDGs, the country needs to adopt an approach that will ensure that all vulnerable communities have access to and get the necessary preventive and control measures against malaria and other diseases. In 2011, both Migori and Kwale counties had not established Community Health Units and had not trained Community Health Volunteers on Community Health Strategy as well as malaria prevention and control intervention even though the Community Health Strategy had been launched in 2006.

The two approaches of providing access to prompt diagnosis and appropriate treatment; as well as vector control through the use of LLINs, IRS and other control methods have been successful to some degree in delivering these interventions to communities in specific areas of coverage. However, with the country focusing on being "a malaria free country" through the new strategy (NMS, 2009-2017), it is imperative that these services reach most of the people who need them.

There is a need to understand the best combination of approaches that will sustainably reach the neediest and vulnerable people in an appropriate and effective manner and at a cost that is acceptable to them. This will improve the utilization of malaria prevention and control among communities, thus reducing the incidence and mortality emanating from malaria.

1.4 Research Questions

i. What is the influence of trained CHVs on utilization of malaria prevention and control intervention in Migori county?
ii. What are the proportions of malaria cases seen at a health facility that receives prompt and effective malaria treatment in Migori county?
iii. Does the use of trained CHVs influence demand of malaria prevention and control interventions by communities in Migori County?
iv. What are the challenges of Community Health Volunteers in provision of Community Health Services?

1.5 Study Objectives

1.5.1 Broad Objective

The overall objective of this study was to evaluate the impact of strengthening Community Health Services on utilization of malaria prevention and control intervention in Migori County

1.5.2 Specific Objectives

The specific objectives of this study were to:

i. Determine the influence of the use of trained CHVs on utilization of malaria prevention and control intervention in Migori County
ii. Assess the proportion of malaria cases seen at health facilities that receive prompt and effective malaria treatment in Migori County**.**
iii. Determine the influence of use of trained CHVs on the awareness and demand of malaria Prevention and control interventions by communities in Migori County.
iv. Identify the challenges Community Health Volunteers experience during the provision of Community Health Services in Migori County.

1.6 Null Hypothesis

Strengthening Community Health Services has no impact on community utilization of malaria prevention and control interventions.

1.7 Limitations and Delimitations of the Study

i. Establishing Community Health Units (CHUs) is expensive and expansive by nature. To address that, the study had to ride on support from the KeNAAM Global Fund round ten Malaria Project. The study intervention was therefore carried out in only 4 established CHUs.
ii. The investigators do not have full control over pre-existing health initiatives in terms of advocacy for establishment of community health units (CHUs) as well as use of malaria prevention and control interventions by the community. The study intervention was training of CHVs to promote use of malaria prevention and control interventions by the community. To address that limitation, the study sought to measure variables whose effects were within the scope of the goal and objectives of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Malaria Burden

In 2010-2011, an estimated 1.13 and 1.44 billion people worldwide were at risk of unstable emanating from stable P. falciparum malaria, respectively. 'Malaria transmission affects almost all spheres of malaria epidemiology, including community prevalence, incidence, type of disease syndromes, and mortality among human populations (Gething *et al.,* 2011).

Kenya's 2009 population was approximately 39.4 million people, with an estimated population (KNBS 2009). According to Presidential Malaria Initiative (2010), by 2010, malaria's situation had plasmodium falciparum accounting for 98% of all malaria infections, causing the most severe form of the disease among Kenya's population, 29% of whom live in a malaria endemic zone and 70% live in endemic, epidemic or seasonal transmission areas combined.

2.1.1 Global Burden of Malaria

Globally, in 2018, an estimated 228 million cases of malaria occurred worldwide (95% confidence interval [CI]: 206–258 million), compared with 251 million cases in 2010 (95% CI: 231–278 million) and 231 million cases in 2017 (95% CI: 211–259 million) (WHO, 2019).

Most malaria cases in 2018 were in the World Health Organization (WHO) African Region (213 million or 93%), followed by the WHO South-East Asia Region with 3.4% of the cases and the WHO Eastern Mediterranean Region with 2.1% (Chia *et al., 2017)*

Nineteen countries in sub-Saharan Africa and India carried almost 85% of the global malaria burden. Six countries accounted for more than half of all malaria cases worldwide, Nigeria (25%), the Democratic Republic of the Congo (12%), Uganda (5%), and Côte d'Ivoire, Mozambique and Niger (4% each). The incidence rate of malaria declined globally between 2010 and 2018, from 71 to 57 cases per 1000 population at risk. However, from 2014 to 2018, the rate of change slowed dramatically, reducing to 57 in 2014 and remaining at similar levels through to 2018 (WHO, 2019).

The WHO South-East Asia Region continued to see its incidence rate fall – from 17 cases of the disease per 1000 population at risk in 2010 to five cases in 2018 (a 70% decrease). In the WHO African Region, case incidence levels also declined from 294 in 2010 to 229 in 2018, representing a 22% reduction. All other WHO regions recorded either little progress or an increase in incidence rate. The WHO Region of the Americas recorded a rise, largely due to increases in malaria transmission in the Bolivarian Republic of Venezuela (WHO, 2019).

Between 2015 and 2018, only 31 countries, where malaria is still endemic, reduced case incidence significantly and were on track to reduce incidence by 40% or more by 2020. Without accelerated change, the *Global technical strategy for malaria 2016–2030* (GTS) milestones for morbidity in 2025 and 2030 will not be achieved (WHO, 2019).

Plasmodium falciparum is the most prevalent malaria parasite in the WHO African Region, accounting for 99.7% of estimated malaria cases in 2018, as well as in the WHO South-East Asia Region (50%), the WHO Eastern Mediterranean Region (71%) and the WHO Western Pacific Region (65%). Globally, 53% of the *Plasmodium vivax* burden is in the WHO South-East Asia Region, with the majority being in India (47%). *Plasmodium vivax* is the predominant parasite in the WHO Region of the Americas, representing 75% of malaria cases (Yang *et al*., 2019).

In 2018, there were an estimated 405 000 deaths from malaria globally, compared with 416 000 estimated deaths in 2017, and 585 000 in 2010 (WHO, 2019).

2.1.2 Continental Burden of malaria

In 2018, only the WHO African Region and the WHO South-East Asia Region showed reductions in malaria deaths compared with 2010. The WHO African Region had the largest absolute reduction in malaria deaths, from 533 000 in 2010 to 380 000 in 2018. Despite these gains, the malaria mortality reduction rate has also slowed since 2016 (WHO, 2019). However, nearly 85% of global malaria deaths in 2018 were concentrated in 20 countries in the WHO African Region and India; Nigeria accounted for almost 24% of all global malaria deaths, followed by the Democratic Republic of the Congo (11%), the United Republic of Tanzania (5%), and Angola, Mozambique and Niger (4% each).

Though the burden of malaria remains high, there have been some promising gains in the past few years from malaria control efforts led by the Global Fund to Fight AIDS, Tuberculosis and Malaria, the United States Government's President's Malaria Initiative (PMI), other major funders, and host country governments (WHO, 2019).

WHO reports that global malaria mortality rates have declined by 25% from 2000 to 2010 and by 33% within Africa (WHO, 2013). Reductions are largely attributed to four key interventions: (1) indoor residual spraying (IRS) of households with insecticide, (2) insecticide-treated nets (ITNs), (3) increase in rapid diagnosis, and (4) effective treatment of cases with antimalarial drugs (WHO, 2013). There were about 155 million malaria cases in the 11-high burden to high impact (HBHI) countries in 2018, compared with 177 million in 2010. The Democratic Republic of the Congo and Nigeria accounted for 84 million (54%) of total cases.

Of the 10 highest burden countries in Africa, Ghana and Nigeria reported the highest absolute increases in cases of malaria in 2018 compared with 2017. The burden in 2018 was similar to that of 2017 in all other countries, apart from in Uganda and India, where there were reported reductions of 1.5 and 2.6 million malaria cases, respectively, in 2018 compared with 2017 (WHO, 2019). Malaria deaths reduced from about 400 000 in 2010 to about 260 000 in 2018, the largest reduction being in Nigeria, from almost 153 000 deaths in 2010 to about 95 000 deaths in 2018. By 2018, in all of the 11 HBHI countries, at least 40% of the population at risk were sleeping under long-lasting insecticidal nets (LLINs), the highest percentage being in Uganda (80%) and the lowest in Nigeria (40%) (WHO, 2019).

Only Burkina Faso and the United Republic of Tanzania were estimated as having more than half of pregnant women receiving three doses of intermittent preventive treatment in pregnancy (IPTp3) in 2018. In Cameroon, Nigeria and Uganda, the estimated coverage was about 30% or less. Six countries in Africa's Sahel sub region implemented seasonal malaria chemoprevention (SMC) in 2018; a mean total of 17 million children, out of the 26 million targeted, were treated per SMC cycle.

The percentage of children aged under 5 years with fever seeking treatment varied from 58% in Mali to 82% in Uganda. In the Democratic Republic of the Congo and Mali, more than 40% of children were not brought for care at all. Testing was also worryingly low in children who were brought for care, with 30% or less being tested in Cameroon, the Democratic Republic of the Congo and Nigeria. Except for India, direct domestic investment remains very low relative to international funding in the HBHI countries (WHO, 2019).

Children aged under 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272 000) of all malaria deaths worldwide. The WHO African Region accounted for 94% of all malaria deaths in 2018. Although this region was home to the highest number of malaria deaths in 2018, it also accounted for 85% of the 180 000 fewer global malaria deaths reported in 2018 compared with 2010 (WHO, 2019).

2.1.3 Situation of Malaria in Kenya

In 2010-2011, an estimated 1.13 and 1.44 billion people worldwide were at risk of unstable emanating from stable P. falciparum malaria, respectively. 'Malaria transmission affects almost all spheres of malaria epidemiology, including community prevalence, incidence, type of disease syndromes, and mortality among human populations (Gething *et al.,* 2011).

Kenya's 2009 population was approximately 39.4 million people, with an estimated population (KNBS 2009). According to PMI (2010), by 2010, malaria's situation had plasmodium falciparum accounting for 98% of all malaria infections, causing the most severe form of the disease among Kenya's population, 29% of whom live in a malaria endemic zone and 70% live in endemic, epidemic or seasonal transmission areas combined.

Malaria is one of the leading causes of morbidity and mortality in Kenya particularly children under 5 years and pregnant women being at greater risk of malaria. According to the Kenya Malaria Indicator Survey (KMIS) (2015), the prevalence of malaria in Kenya was at 8 % with 15-19% of hospital admissions, 3-5% in-patient deaths and 2 % of outpatient clinic visits in Kenya are due to malaria. The National Malaria Control Program estimates that each family spends Kshs.1, 400 or more annually for treating malaria and 170 million working days are lost each year due to Malaria. *Plasmodium falciparum* is the predominant species at 98.2% and commonest cause of malaria in Kenya with *Plasmodium malariae* and *Plasmodium ovale* at 1.8%. None of the three KMIS surveys identified presence of *P. vivax* in the country (MOH, 2016).

In Kenya, nearly 28 million Kenyans live in areas of malaria risk, most of them children under the age of 15 years (KNMS, 2009]. In 2010, clinically diagnosed malaria accounted for 34 per cent of outpatient hospital visits in Kenya. The impact of the investment in malaria control over the past ten years and the gains made in reducing morbidity and mortality are difficult to measure within the routine health system as nearly all fevers are diagnosed and treated as malaria (DOMC, 2012).

Malaria therefore remains a development problem as it has a serious socio-economic impact on families and the nation, through loss of work, absenteeism and high levels of expenditure on malaria treatment. Malaria is recognized as a health and socio-economic burden by the Government of Kenya. Thus, malaria control is a priority investment as articulated in the second National Health Sector Strategic Plan (NHSSP II, 2005–2010, extended to 2012) and the Ministry of Public Health and Sanitation Strategic Plan 2008–2012. The goal of the 2009–2017 National Malaria Strategy (NMS) was to reduce illness and death by two-thirds of the 2008 level. However, the current goal of KMS 2019–2023 is to reduce malaria incidence and deaths by at least 75% of 2016 levels by 2023. On its part, Kenya Vision 2030 includes among its health sector objectives the intention to reduce the proportion of inpatient malaria fatality to 3 per cent (MOH, 2018).

During the last decade, there have been efforts towards malaria control and prevention following global initiatives such as the 1998 Roll back malaria (RBM) initiative. In furtherance of RBM initiative, Kenya has scaled up anti-malaria interventions with a resultant declining of malaria prevalence in the country. This declining trend is largely attributed to the scaling up of long-lasting insecticide treated bed nets (LLIN) and indoor residual house spray (IRS). These results have spurned the NMCP to scale up the two interventions for rapid reduction of malaria burden in endemic malaria areas around Lake Victoria (MOH, 2018).

The phased IRS 2012-2017 Business Plan aimed at directing and coordinating IRS activities in Kenya. In 2018, PMI supported two counties (Homabay and Migori) and covered a population of 1,833,860 people (488,323 structures). The combination of IRS and LLINs in high malaria burden areas aims to reduce malaria burden rapidly and then to sustain the gains by continued use of LLINs complimented by larval source management.

2.1.4 Parasites of Malaria

All the five Plasmodium species infecting man are found in Kenya. The four species of malaria are Plasmodium falciparum, Plasmodium malariae, Plasmodium ovale, Plasmodium vivax and Plasmodium knowlesi. Plasmodium falciparum is the most important and accounts for over 90% of the malaria infection in Kenya. Plasmodium falciparum in Kenya is resistant to most anti-malaria drugs but still responds well to the current first line treatment for uncomplicated malaria, which is Artemisinin-based combination therapy (ACT). However, the high levels of anti-malaria resistance make malaria vector control interventions important for Kenya.

2.1.5 Vectors that Transmit Malaria

Malaria in Kenya is transmitted by *Anopheles gambiae s.s, An. merus, An arabinoses* and *Anopheles funestus*. The three members of *An gambiae* complex; *An gambiae.s.s, An merus* and *An arabiensis* co-exist with *An funestus* in Kenya. However, other members of the *An gambiae* complex have not been documented in Kenya. These include *An. bwabwae*, (name others). However, their distribution shows some variation based on suitability of the breeding conditions. *Anopheles merus* is confined to a few kilometers along the Indian Ocean coastline (Figure 2.4). *Anopheles funestus* complex consists of 9 sibling species namely; *An. parensis* Gillies, *An. aruni* Sobti, *An. confusus* Evans and Leeson, *An. funestus, An. vaneedeni* Gillies and Coetzee, *An. rivulorum* Leeson, *An. fuscivenosus* Leeson, *An. leesoni* Evans, and *An. brucei* Service *An. funestus s.s.* is the predominant, both in numbers and geographical distribution, and also the most anthropophilic. Molecularly confirmed *An. gambiae* s.s. (hereafter An. gambiae) and An. arabiensis collected from 4 different parts of western Kenya were genotyped for kdr from 2011 to 2013. A portion of the samples were submitted for sequencing in order to confirm the Vgsc-1014F genotyping results. The resulting sequence data were deposited in GenBank (Accession numbers: KR867642-KR867651, KT758295-KT758303). Ochomo *et al.*, 2015, observed a single Vgsc-1014F haplotype suggesting, a common origin in both species. This was the first report of Vgsc-1014F in Kenya, which appears to have emerged in both *An. gambiae* and *An. arabiensis* around 2012 and is confirmed via DNA sequencing in multiple samples

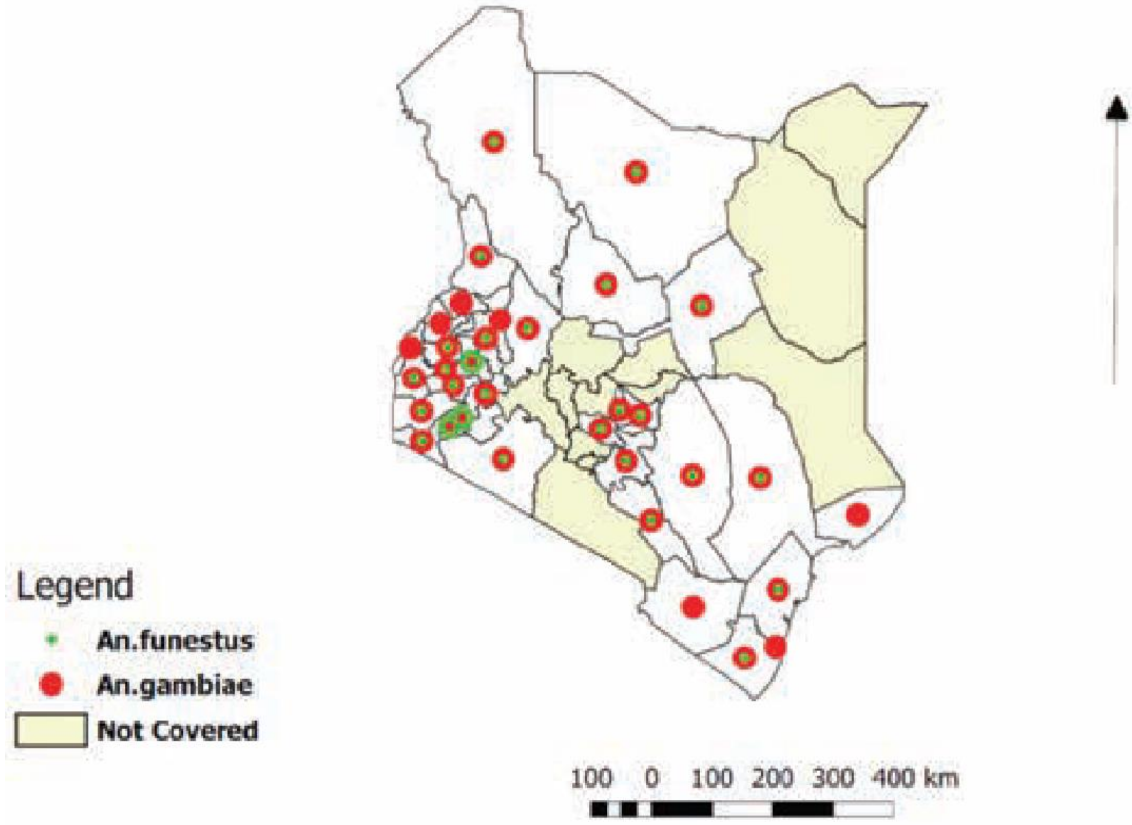

Figure 2.1: Map of Main Malaria Vector Species Distribution in Kenya 2018

Insecticide resistance status among the major malaria vectors in Kenya was reported in all the four classes of insecticides including pyrethroids, carbamates, organochlorines and organophosphates. Resistance to pyrethroids has been detected in *Anopheles gambiae* s.s., *An. arabiensis* and *An. funestus s.s.* while resistance to carbamates was limited to *An. gambiae* s.s. and *An. arabiensis*. Resistance to the organochlorine was reported in *An. gambiae* s.s. and *An. funestus s.s*. while resistance to organophosphates was reported in *An. gambiae* s.*l*. only. The mechanisms of insecticide resistance among malaria vectors reported include the kdr mutations (L 1014S and L 1014F) and elevated activity in carboxylesterase, glutathione S-transferases (GST) and monooxygenases. The kdr mutations L1014S and L1014F were detected in *An. gambiae* s.s. and *An. arabiensis* populations. Elevated activity of monooxygenases has been detected in both *An. arabiensis* and *An. gambiae* s.s. populations while the elevated activity of carboxylesterase and GST has been detected only in *An. arabiensis* populations (Ondeto *et al.*, 2017).

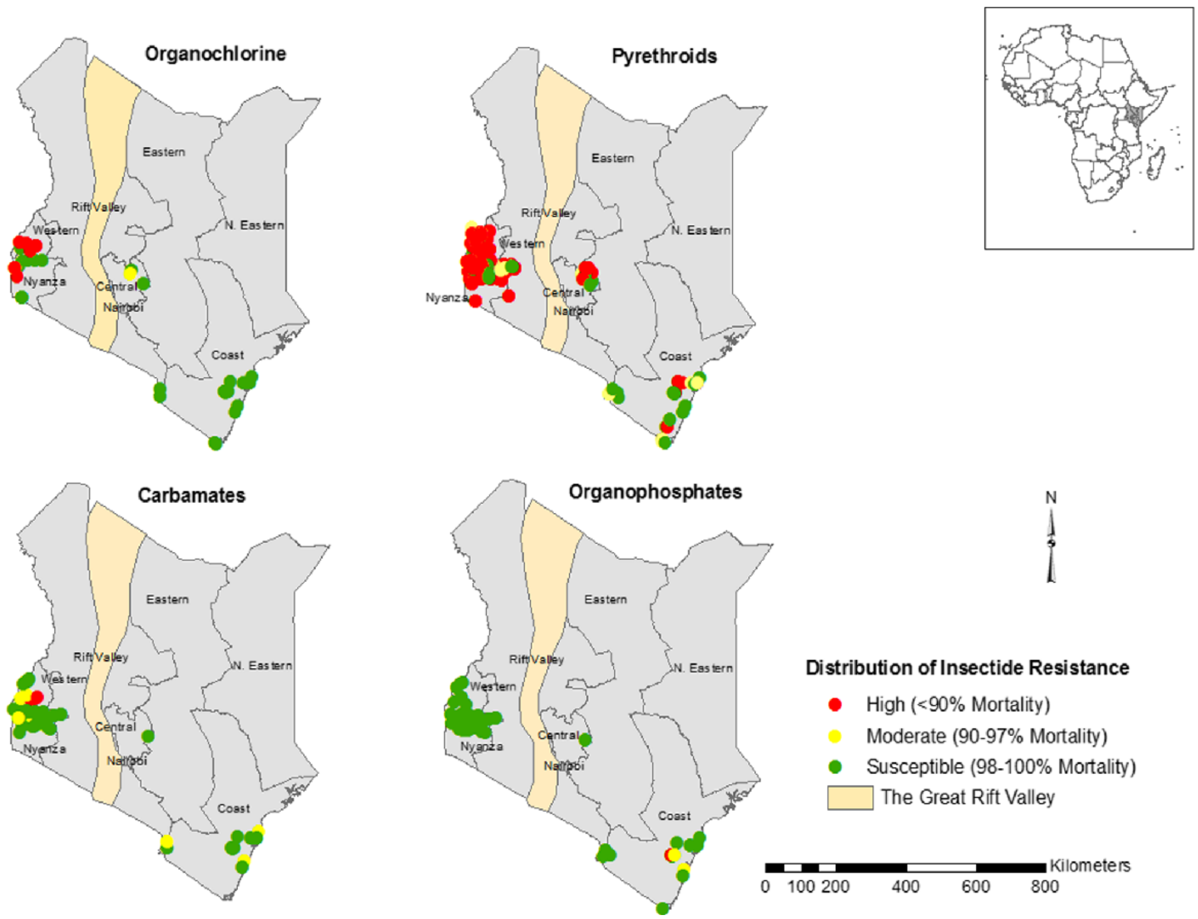

Figure 2.2: Distribution of Insecticide Resistance in Anopheles Species Tested between 1994 and 2015

Source: (Ondeto et al. 2017)

Anopheles species that were tested were mainly resistant to pyrethroids across most regions of the country. Susceptibility to organophosphates, organochlorine and carbamates in Anopheles species tested was mainly observed with a few cases of resistance reported in Kenya (Ondeto *et al*, 2017).

2.1.6 Burden of Malaria in Pregnancy and IPTp Implementation

Malaria infection during pregnancy is a major public health problem, with substantial risks to the mother, her foetus and the newborn (MOH, 2016, MOH, 2018).

During pregnancy there is an altered/ suppressed immune response to malaria especially in primi and secondi-gravidae as well and those that are HIV infected. Malaria infection in pregnancy can cause maternal complications, morbidity including anaemia and mortality (MOH, 2016; MOH, 2018).

The level of immunity is determined by immunity status before pregnancy, which in turn is determined by the levels of malaria transmission in the area. In low transmission areas all women are affected while in high transmission areas the adverse events occur especially in primi- and secundi-gravidae. To prevent the irreversible, negative consequences of malaria during pregnancy, it is critical to encourage pregnant women to sleep under LLINs and initiated to the Intermittent Presumptive Treatment in Pregnancy with Sulfadoxine Pyrimethamine (IPTp-SP) regimen as early as possible in the second trimester. WHO and partners recommend initiating malaria prevention efforts beginning at 13 weeks to achieve major benefits. The period between 13 and 20 weeks is critical because this is the time when the placenta is forming, and the parasite densities are highest (MOH, 2016). Malaria in pregnancy can cause maternal and fetal complications as well as maternal complications (MOH, 2018).

In areas of low transmission Malaria in Pregnancy will lead to abortion, hypoglycaemia, miscarriage, pulmonary oedema, cerebral malaria and even progression of uncomplicated Malaria (UM) to severe illness which may lead to death. In areas of high transmission, pregnant women have low levels of asymptomatic parasitaemia which concentrates mainly within the placenta and may lead to maternal anaemia. In fetal complications, parasite sequestration in placenta results in poor transport of nutrients and oxygen to fetus leading to the following complications: Low birth weight, Intrauterine growth retardation, Stillbirth, Congenital infection (rare)-transplacental spread and prematurity (MOH, 2018).

Although the burden of malaria during pregnancy is substantial, and the benefit of IPTp in reducing it has been well established, implementation of IPTp has lagged when compared to that of other malaria control interventions. Analysis of data reported by country programmes and data available through household surveys shows relatively high levels of ANC attendance (88%, IQR 68%–95%) but much lower proportions of women attending ANC receiving IPTp3 (44%, IQR 30%–57%) (WHO, 2012). These findings suggest that there are missed opportunities to deliver preventive therapy and that efforts to overcome barriers to implementation are best focused at the level of antenatal service delivery. Simplified guidelines for administration of IPTp following the revised IPTp policy may help overcome these barriers. Though the recent evidence reviews (MOH, 2018) concluded that SP remains effective for IPTp in areas where it is no longer effective as a therapeutic agent, further recommendations are pending on the best approach to malaria in pregnancy in light of increasing SP resistance and changes in malaria burden. In Kenya, current MOH Policy and strategy on malaria in pregnancy are Intermittent Preventive Treatment in Pregnancy (IPTp), Long Lasting Insecticidal Nets (LLINs) and Effective case management as well as education and communication (MOH, 2016, MOH 2018).

2.1.7 Malaria Endemicity

2.1.7.1 Malaria Endemicity in the World

Malaria is presently endemic in a broad band around the equator, in areas of the Americas, many parts of Asia, and much of Africa; however, it is in sub-Saharan Africa where 85–90% of malaria fatalities occur (Layne, 2007). The geographic distribution of malaria within large regions is complex, and malaria-afflicted and malaria-free areas are often found close to each other (Greenwood et al., 2005).

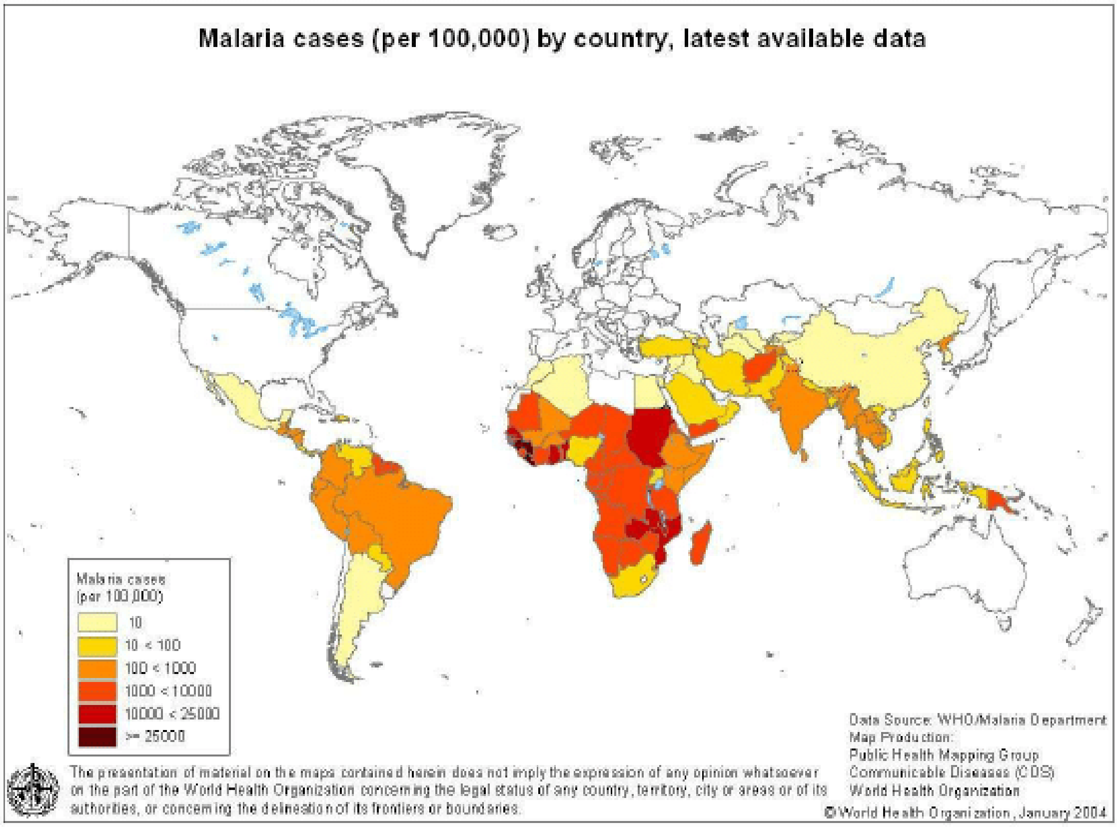

Figure 2.3: Global Prevalence of Malaria –World Malaria Map 2019

2.1.7.2 Malaria Epidemiological Zones in Kenya

Kenya has four main malaria epidemiological zones with diversity in risk determined largely by altitude, rainfall patterns, and temperature, as well as the prevalence of malaria (MOH, 2018; DNMP, 2021).

2.1.7.3 Highland Epidemic Prone Areas

Malaria transmission in the western highlands of Kenya is seasonal, with considerable year-to-year variation. The epidemic phenomenon is experienced when climatic conditions favour sustainability of minimum temperatures around 18°C. This increase in minimum temperatures during periods of long rains favours and sustains vector breeding, resulting in increased intensity of malaria transmission. The whole population is vulnerable, and case fatality rates during an epidemic can be up to 10 times greater than what is experienced in regions where malaria occurs regularly (MOH, 2018; DNMP, 2021).

2.1.7.4 Endemic Areas (Lake and Coast)

These are areas of stable malaria transmission (with altitudes ranging from 0 to 1,300 m) around Lake Victoria in western Kenya and in the coastal regions. Rainfall, temperature, and humidity are the determinants of perennial transmission of malaria. The vector life cycle is usually short with a high survival rate due to the suitable climatic conditions. Transmission is intense throughout the year, with annual entomological inoculation rates1 between 30 and 100) (MOH, 2018; DNMP, 2021).

2.1.7.5 Semi-Arid, Seasonal Malaria Transmission Areas

This zone, in arid and semi-arid areas of the northern and South-Eastern parts of the country, experiences short periods of intense malaria transmission during the rainfall seasons. Temperatures are usually high, and water pools created during the rainy season provide the malaria vectors with breeding sites. Extreme climatic conditions such as the El Niño southern oscillation lead to flooding in these areas, resulting in epidemic outbreaks with high morbidity rates due to the population's low immune status (MOH, 2018; DNMP, 2021).

2.1.7.6 Low Risk Malaria Areas

This zone covers the central highlands of Kenya, including Nairobi. Temperatures are usually too low to allow completion of the sporogonic cycle of the malaria parasite in the vector. However, increasing temperatures and changes in the hydrological cycle associated with climate change are likely to increase the areas suitable for malaria vector breeding and introduce malaria transmission in areas where it did not previously exist. There are four malaria ecological zones in Kenya, which include the hyper-holoendemic (stable malaria transmission zone) around Lake Victoria in western Kenya and coastal regions; the hypo-mesoendemic (unstable malaria transmission zone) areas in the Rift valley, central and eastern regions; the highlands malaria epidemic zone in western Kenya and Rift valley; and the arid epidemic zones in North Eastern region (**Figure *2.4***) (MOH, 2018; DNMP, 2021).

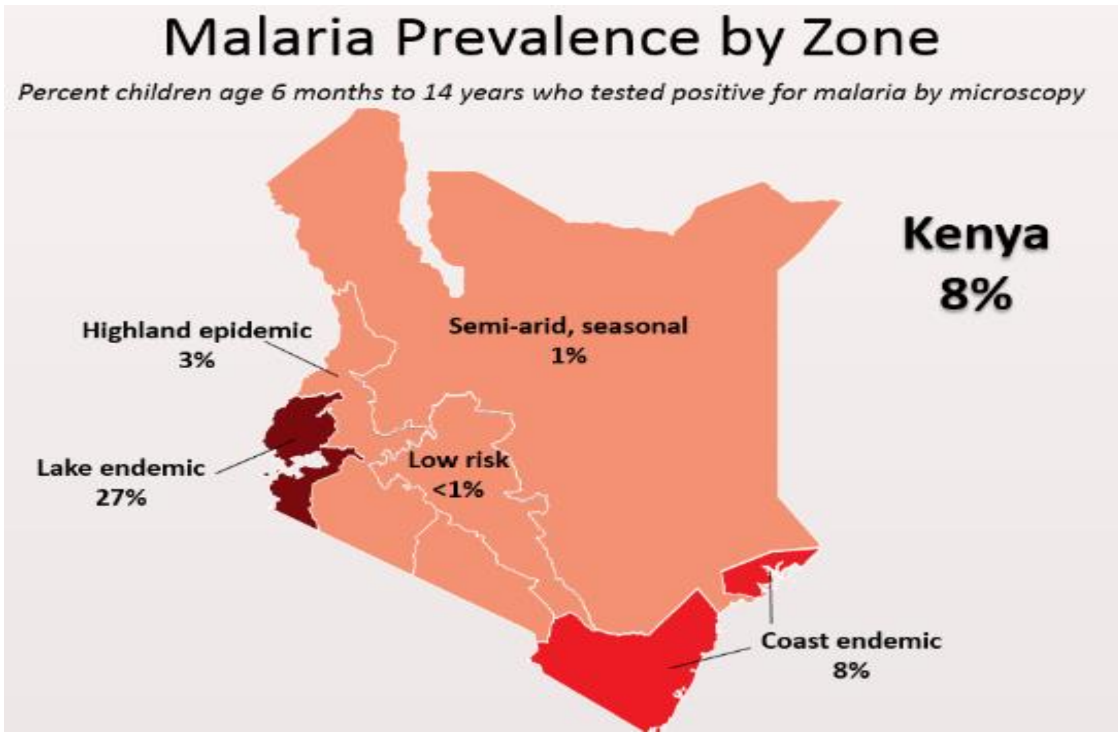

Figure 2.4: The Kenya Malaria Prevalence Map 2018 by Zones

2.1.7.7 Drug and Insecticide Resistance

Antimalarial drug resistance is a major concern for the global effort to control malaria. *P. falciparum* resistance to Artemisinin has been detected in four countries in Southeast Asia: in Cambodia, Myanmar, Thailand and Viet Nam (WHO, 2012). There is an urgent need to expand containment efforts in affected countries. For now, ACTs remain highly effective in almost all settings, so long as the partner drug in the combination is locally effective. Mosquito resistance to at least one insecticide used for malaria control has been identified in 64 countries around the world.

In May 2012, WHO and the Roll Back Malaria Partnership released the *Global Plan for Insecticide Resistance Management in malaria vectors*, a five-pillar strategy for managing the threat of insecticide resistance. The World malaria report 2019 highlights that *PfKelch13* mutations have been identified as molecular markers of partial Artemisinin resistance. *PfKelch13* mutations associated with Artemisinin resistance are widespread in the GMS and have also been detected at a significant prevalence (over 5%) in Guyana, Papua New Guinea and Rwanda. In the case of Rwanda, the presence of *PfKelch13* mutations does not affect efficacy of first-line treatment (WHO, 2019).

In the WHO Western Pacific Region, Artemisinin resistance has been confirmed in Cambodia, Lao People's Democratic Republic and Viet Nam through several studies conducted between 2001 and 2018. Treatment efficacy for *P. vivax* remains high across all countries where treatment failure rates are below 10% (WHO, 2019). In the WHO African Region, the efficacy rates of Artemether-Lumefantrine (AL), artesunate-amodiaquine (AS-AQ) and Dihydroartemisinin-Piperaquine (DHA-PPQ) for *P. falciparum* were more than 98%, and efficacy has remained high over time. Treatment efficacy with first-line treatment remains high for *P. falciparum* and *P. vivax* in the WHO Region of the Americas. In the WHO South-East Asia Region, the presence of molecular markers of Artemisinin resistance has been reported in Bangladesh, India, Myanmar and Thailand.

Except for Myanmar, failure rates of *P. falciparum* to first-line ACTs were found to be above 10% and were as high as 93% in Thailand. For *P. vivax* most countries continue to demonstrate high efficacy of chloroquine (CQ), except for Myanmar and Timor-Leste. In the WHO Eastern Mediterranean Region, high failure rates of treatment with artesunate-Sulfadoxine-Pyrimethamine (AS-SP) for *P. falciparum* in Somalia and Sudan led to a change in first-line treatment policy to AL.

For *P. vivax* there is high treatment efficacy with AL and CQ in all countries where a therapeutic efficacy study (TES) has been conducted (WHO, 2019).

According to World malaria report 2019, from 2010 through 2018, some 81 countries reported data on insecticide resistance monitoring to WHO. Of the 81 malaria endemic countries that provided data for 2010–2018, resistance to at least one of the four insecticide classes in one malaria vector from one collection site was detected in 73 countries, an increase of five countries compared with the previous reporting period 2010–2017(WHO, 2019).

In 26 countries, resistance was reported to all main insecticide classes. Resistance to pyrethroids – the only insecticide class currently used in ITNs – is widespread and was detected in at least one malaria vector in more than two thirds of the sites tested and was highest in the WHO African Region and in the WHO Eastern Mediterranean Region. Resistance to organochlorines was detected for at least one malaria vector in almost two thirds of the sites. Resistance to carbamates and organophosphates was less prevalent and was detected in 31% and 26% of the tested sites, respectively. Prevalence was highest for carbamates in the WHO South-East Asia Region and for organophosphates in the WHO South-East Asia Region and in the WHO Western Pacific Region (WHO, 2019). All the standard insecticide resistance data reported to WHO are included in the WHO Global Insecticide Resistance database and are available for exploration via the Malaria Threats Map (WHO, 2019). This online tool was extended in 2019 to cover invasive mosquito species and currently shows the geographical extent of reports on the detection of *Anopheles stephensi*. To guide resistance management, countries should develop and implement a national plan for insecticide-resistance monitoring and management, drawing on the WHO Framework for a national plan for monitoring and management of insecticide resistance in malaria vector (WHO, 2019).

In 2018, a total of 45 countries reported having completed plans for resistance monitoring and management and 36 were currently in the process of developing them. NMCPs and their partners should consider the deployment of pyrethroid-piperonyl butoxide nets in geographical areas where the main malaria vectors meet the criteria recommended by WHO in 2017, rather than being based on whether the whole country meets the criteria (WHO, 2019).

2.2 Community Units and Utilization of Malaria Intervention

Community health workers (CHWs) operate in level one of the Kenyan healthcare services provisions, a central pillar of primary health care delivery system at the community level. Kenya's Community Health Strategy (2006) outlines the provision of preventive health services by CHWs and clearly provides structures and operationalization guidelines in service provision at community level. CHWs provide a link between community health facilities and community members, having responsibility for disease prevention, health promotion and treatment of specific diseases, such as uncomplicated malaria (Kisia *et al* (2011). Occasionally, community health units lack capacity (structural, commodity, policy, guidelines and staffing), coupled by a shortage of CHWs, which significantly contributes to lack of quality malaria and general healthcare services at the communality level.

2.2.1 Malaria Interventions

To achieve universal access to long-lasting insecticidal nets (LLINs), 780 million people at risk would need to have access to LLINs in sub-Saharan Africa, and approximately 150 million bed nets would need to be delivered each year (WHO, 2012). The number of LLINs delivered to endemic countries in sub-Saharan Africa dropped from a peak of 145 million in 2010 to an estimated 66 million in 2012. This will not be enough to fully replace the LLINs delivered 3 years earlier, indicating that total bed net coverage will decrease unless there is a massive scale-up in 2013 (WHO, 2012). A decrease in LLIN coverage is likely to lead to major resurgences in the disease. In 2011, 153 million people were protected by indoor residual spraying (IRS) around the world, or 5% of the total global population at risk. In the WHO African Region, 77 million people, or 11% of the population at risk were protected through IRS in 2011.

The number of rapid diagnostic tests delivered to endemic countries increased dramatically from 88 million in 2010 to 155 million in 2011. This was complemented by a significant improvement in the quality of tests overtime. In 2011, 278 million courses of Artemisinin-based Combination Therapies (ACTs) were procured by the public and private sectors in endemic countries – up from 182 million in 2010, and just 11 million in 2005 (WHO, 2012). ACTs are recommended as the first-line treatment for malaria caused by *Plasmodium falciparum*, the deadliest *Plasmodium* species that infects humans. This increase was largely driven by the scale-up of subsidized ACTs in the private sector through the AMFm initiative, managed by the Global Fund to Fight AIDS, Tuberculosis and Malaria (WHO, 2012).

In 2018, an estimated 228 million cases of malaria occurred worldwide (95% confidence interval [CI]: 206–258 million), compared with 251 million cases in 2010 (95% CI: 231–278 million) and 231 million cases in 2017 (95% CI: 211–259 million). Most malaria cases in 2018 were in the World Health Organization (WHO) African Region (213 million or 93%), followed by the WHO South-East Asia Region with 3.4% of the cases and the WHO Eastern Mediterranean Region with 2.1%. (WHO, 2019).

Globally, the elimination net is widening, with more countries moving towards zero indigenous cases: in 2018, 49 countries reported fewer than 10 000 such cases, up from 46 countries in 2017 and 40 countries in 2010. The number of countries with fewer than 100 indigenous cases – a strong indicator that elimination is within reach – increased from 17 countries in 2010, to 25 countries in 2017 and 27 countries in 2018 (WHO, 2019).

Between 2016 and 2018, a total of 578 million insecticide-treated mosquito nets (ITNs), mainly LLINs, were reported by manufacturers as having been delivered globally, with 50% going to Côte d'Ivoire, the Democratic Republic of Congo, Ethiopia, Ghana, India, Nigeria, Uganda and the United Republic of Tanzania. In 2018 about 197 million ITNs were delivered by manufacturers, of which more than 87% were delivered to countries in sub-Saharan Africa. Globally, 80% of ITNs were distributed through mass distribution campaigns, 10% in antenatal care facilities and 6% as part of immunization programmes.

Half of people at risk of malaria in sub-Saharan Africa are sleeping under an ITN; in 2018, 50% of the populations were protected by this intervention, an increase from 29% in 2010.

Furthermore, the percentage of the population with access to ITN increased from 33% in 2010 to 57% in 2018.

However, coverage has improved only marginally since 2015 and has been at a standstill since 2016. Households with at least one ITN for every two people increased to 72% in 2018, from 47% in 2010. However, this figure represents only a modest increase over the past 3 years and remains far from the target of universal coverage.

Fewer people at risk of malaria are being protected by indoor residual spraying (IRS), a prevention method that involves spraying the inside walls of dwellings with insecticides. Globally, IRS protection declined from a peak of 5% in 2010 to 2% in 2018, with declining trends seen across all WHO regions apart from the WHO Eastern Mediterranean Region where IRS protection increased between 2016 and 2018. Although IRS coverage dropped from 180 million people at risk protected globally in 2010 to 93 million in 2018, the 2018 figure was a decrease of 13 million compared with 2017. The declines in IRS coverage may be due to the switch from pyrethroids to more expensive insecticides in response to increasing pyrethroid resistance, or changes in operational strategies (e.g. at-risk populations decreasing in countries aiming for elimination of malaria).

Currently, a core set of intervention and treatment options are recommended by the World Health Organization for use against falciparum malaria. These are treatment, long-lasting insecticide-treated bed nets, indoor residual spraying, and chemoprevention options. A combination of prevention, via vector control (here LLINs), and treatment is important as the cornerstone of malaria control in SSA (Winskill *et al,* 2019). Additional currently recommended interventions (chemoprevention) and tools in development (RTS, S vaccine) will be valuable in those many areas where vector control and treatment are themselves not enough to bring about a transition to elimination. When resources are limited the prioritization of the use of available tools can help to maximize the impact of available finances, reducing malaria morbidity and mortality in a cost-effective manner (Winskill *et al*, 2019).

2.2.2 Fogging or Area Spraying

It is primarily reserved for emergency situations: halting epidemics or rapidly reducing adult mosquito populations when they have become severe pests. Fogging and area sprays must be properly timed to coincide with the time of peak of the adult activity, because resting mosquitoes are often found in areas that are difficult for the insecticide to reach (e.g., under leaves, in small crevices) (Stevens, 1984).

2.2.3 Chemoprophylaxis in the Non-immune Population

Chemoprophylaxis is recommended for the high- risk groups (elderly, patients with end organ failure, children below five years and pregnant women). For the non-immune visitors' mefloquine, atovaquine, proguanil or doxycycline is recommended. Patients with sickle cell, tropical Spleenomegaly or hyper immune malaria Splenomegaly should take proguanil as a chemoprophylaxis (Steketee, 2009; DeVos and Dunn, 2023).

2.2.4 Research findings on Effectiveness of SP for IPTp

In Southern Ghana, placental malaria and maternal anaemia have decline substantially and birth weight has increased after the implementation of IPTp-SP. Likely, these effects can further be increased by improving IPTp-SP coverage and adherence. However, the remnant prevalence of infection in women having taken three doses of IPTp-SP suggests that additional antimalarial measures are needed to prevent malaria in pregnancy in this region (Hommerich *et al*., 2007).

In Burkina Faso Intermittent preventive treatment with SP has shown clear superiority in reducing adverse outcome at delivery, as compared with intermittent preventive treatment with CQ and classical chemoprophylaxis with CQ (Tiono *et al*., 2009).

In Ashanti region, Ghana, Overall, both intermittent screening and treatment and intermittent preventive treatment appear equally acceptable to pregnant women as strategies for the control of malaria in pregnancy. The women were more concerned about quality of services received, in particular the polite and patient attitude of health staff, and positive health implications for themselves and their babies rather than the nature of intervention (Smith *et al.,* 2010). The review of literature suggests chemoprophylaxis or IPT reduces antenatal parasites prevalence and placental malaria when given to women in all parity groups. They have positive effects on birth weight and possibly on perinatal death in low-parity women (MOH, 2016).

Recent studies in East and Central Africa show that the ability of SP to clear peripheral parasites and to prevent new infections during pregnancy is compromised in areas with >90% prevalence of Plasmodium *falciparum dihydopterase* synthetase mutations (Pfdhps) (MOH, 2018). In addition, recent studies have shown that SP is protective against curable STIs/RTIs and other unspecified causes of adverse birth outcomes (Chico *et al., 2017).*

2.2.5 Disparities in the Delivery of IPTp

IPTp is an Anti-malarial given in treatment doses at defined intervals. It assumes every woman in a malaria endemic area has malaria parasites in blood or placenta. IPTp prevents placental malaria infection, low birth weight associated with early infant mortality (MOH, 2016). In available household surveys, the proportion of pregnant women receiving the second dose of IPTp was higher in urban than in rural areas, and in the highest wealth quintile compared with the lowest wealth quintile (WHO, 2012).

This may be due to better access to antenatal services in urban areas, although in several more recent surveys, the difference in receipt of IPTp between pregnant women in urban and rural areas was negligible. Further investigation is needed to understand why there are greater differences between urban and rural areas, or between wealth quintiles, in some countries than in others and how the approach for a more equitable scale-up of IPTp can be replicated in other countries (WHO, 2012).

In Kenya, MoH policy recommends implementation of IPTp in all endemic counties/sub counties. Currently Sulfadoxine-Pyrimethamine (SP) is the most effective medicine for IPTp despite its increased resistance to *P. falciparum*. IPTp is recommended for all pregnant women in areas of moderate-to-high malaria transmission. The Policy recommends IPTp dosage as SP single dose of three tablets under directly observed therapy (DOT) in Antenatal Care Clinic (ANC). It can be taken on an empty stomach, and is safe and effective (MOH, 2018).

IPTp is administered with each ANC visit after quickening. The doses should be given at least four weeks apart. Women should receive a minimum of three doses of SP during pregnancy. The last dose of IPTp with SP can be administered safely up to the time of delivery (MOH, 2016). If a woman presents to an antenatal care clinic with symptoms of malaria, these symptoms should be investigated before administration of IPTp-SP. If she tests positive for malaria, she should be treated according to the national malaria case management guidelines. If she is negative, she should receive IPTp-SP. It is important that IPTp should not be given with high dose of folic acid (5mg) due to drug interaction effects that increases the chances of parasite survival. Thus, the folic acid should be discontinued for two weeks following SP administration. However, low dose folic acid (0.4, 0.6 mg) may be administered concurrently with SP. HIV positive pregnant women in malaria endemic areas who are on daily cotrimoxazole prophylaxis should NOT be given SP for IPTp (MOH, 2016, (MOH, 2018). In Kenya, there has-been increased IPTp uptake over the years but did not reach national targets of 80% (MOH, 2016). IPTp 1: 56-79% between 2015 and 2017 (DHIS2 data), IPTp2: 47-69% between 2015 and 2017 (DHIS 2 data) and IPTp3: 11-38% (KMIS, 2010/2015 respectively).

2.3 Prompt and Effective Malaria Treatment

Preventative interventions against malaria have potential to contribute to decline in the disease burden among communities where malaria is rampant. The success of malaria control programmes constitutes a major capacity barrier health system to deliver interventions such as first-line treatment at optimal coverage and quality. Promotion and effective malaria treatment is crucial for survival among malaria patients, constituting malaria control as one goal to enhancement of access to prompt and effective treatment (Kisia *et al*., 2011). Risks of malaria morbidity and mortality are highly determined by the performance of prevailing health systems, coupled by Impact of geographical access, treatment seeking, and delays, which is missing thus constituting a gap. Other barriers including geographical distance travelled to access care, reducing stockouts, socioeconomic, cultural perceptions of the attributable cause of malaria, cultural, infrastructure physical, poverty (Silweya, 2014) barriers factors and other systemic barriers, exacerbating lack of timely and effective community case management and facility -based case management of malaria. ‘Several strategies have been proposed to reduce this burden, including improved vector control, intermittent preventive treatment during pregnancy, and standardized case management (Shah *et al*., 2020).

2.3.1 Treating Malaria

Prompt diagnosis and treatment is the most effective way to prevent a mild case of malaria from developing into severe disease and death. Based on national household surveys completed in 20 countries in sub-Saharan Africa between 2015 and 2018, a median of 42% (interquartile range [IQR]: 34–49%) of children with a fever (febrile) were taken to a trained medical provider for care in the public sector compared with 10% (IQR: 8–22%) in the formal private sector and 3% (IQR: 2–7%) in the informal private sector (WHO, 2019). A high proportion of febrile children did not receive any medical attention (median: 36%, IQR: 28–45%). Poor access to health care providers or lack of awareness of malaria symptoms among caregivers are among the contributing factors. (WHO, 2019).

Based on 20 household surveys conducted in sub-Saharan Africa in 2015–2018, the median percentage of febrile children who were treated with any antimalarial drug was higher in the public sector (median: 48%, IQR: 30–69%) than in the formal private sector (median: 40%, IQR: 21–51%) or the informal private sector (median: 18%, IQR: 10–29%) (WHO, 2019).

Data from 20 national surveys conducted in sub-Saharan Africa show that for the period 2015–2018, an estimated 47% (IQR: 29–69%) of febrile children brought for treatment for malaria in the public health sector received antimalarial drugs, compared with 59% (IQR: 53–84%) among those visiting a community health worker and 49% (IQR: 19–55%) in the formal medical private sector. Based on 19 surveys, antimalarial treatments among febrile children who received antimalarial medicine were slightly more likely to be ACTs if treatment was sought in the public sector (median: 80%, IQR: 45–94%) than in the formal private sector (median: 77%, IQR: 43–87%) or the informal private sector (median:60%, IQR: 40–84%) (WHO, 2019). To bridge the treatment gap among children, WHO recommends the uptake of integrated community case management (iCCM). This approach promotes integrated management of common life-threatening conditions in children malaria, pneumonia and diarrhoea at health facility and community levels. In 2018, 30 countries implemented iCCM at different levels, with only a few implementing nationally (WHO, 2019).

2.4 The Awareness and Demand of Malaria Control Interventions by Communities

2.4.1 Malaria Prevention and Control Interventions

Control of malaria involves a complex chain of measures that often complement one another. The control of malaria involves control of three (3) living beings (Man, Mosquitoes, parasite) and their environment. For effective malaria control, we must target man first, control mosquitoes next and keep trying to tackle the parasite with development of effective drugs and vaccines. In recent years, more emphasis has been laid on early diagnosis, treatment, personal protection and on biological vector control (Steketee, 2009).

Malaria control in Kenya is guided by the goal of the National Health Sector Strategic Plan (2005-2012) that aims to reduce under-five mortality from 120 to 33 per 1,000 live births and the proportion of inpatient malaria fatality to 3% and the National Strategic Plan (2009-2017) that aims to reduce mortality and morbidity by two thirds of the

2007/2008 baseline level by 2017. The DOMC implements a malaria control programme that combines universal coverage of LLLINs, targeted IRS, early diagnosis and timely case management using *Artemether-Lumefantrine*, Intermittent Preventive Treatment in pregnancy (IPTp) and Information Education and Communication (IEC) (MOH, 2018).

Awareness of malaria and its ensuing negative effects and demand for requisite services to address any gaps are critical in integrated management of the diseases. occasionally, communities lack proper awareness in relation to various aspects of the disease. These barriers in awareness and demand for malaria include but not limited low education, unavailability of information of malaria and services, myths and attitudes and other factors. Demand for malaria control services is low due to factors such attitudes, self-diagnosis and medication to, and attribution of malaria to other diseases which present with similar symptoms, among others. The gaps in awareness are being addressed by awareness creation through campaigns and health literacy interventions by community health workers (CHWs), enabling demand and utilization of integrated community case management of malaria. However, the effectiveness of the intervention is still experiencing gaps, constituting a knowledge gap this study intends to fill.

2.4.2 Vector Control

Half of people at risk of malaria in sub-Saharan Africa are sleeping under an ITN; in 2018, 50% of the population was protected by this intervention, an increase from 29% in 2010. Furthermore, the percentage of the population with access to ITN increased from 33% in 2010 to 57% in 2018. However, coverage has improved only marginally since 2015 and has been at a standstill since 2016. Households with at least one ITN for every two people increased to 72% in 2018, from 47% in 2010. However, this figure represents only a modest increase over the past 3 years and remains far from the target of universal coverage (WHO, 2019).

Fewer people at risk of malaria are being protected by indoor residual spraying (IRS), a prevention method that involves spraying the inside walls of dwellings with insecticides.

Globally, IRS protection declined from a peak of 5% in 2010 to 2% in 2018, with declining trends seen across all WHO regions apart from the WHO Eastern Mediterranean Region where IRS protection increased between 2016 and 2018. Although IRS coverage dropped from 180 million people at risk protected globally in 2010 to 93 million in 2018, the 2018 figure was a decrease of 13 million compared with 2017. The declines in IRS coverage may be due to the switch from pyrethroids to more expensive insecticides in response to increasing pyrethroid resistance, or changes in operational strategies (e.g. at-risk populations decreasing in countries aiming for elimination of malaria) (WHO, 2019).

2.4.3 Preventive Therapies of Malaria

To protect women in areas of moderate and high malaria transmission in Africa, WHO recommends IPTp with the antimalarial drug Sulfadoxine-Pyrimethamine (SP). Among 36 African countries that reported on IPTp coverage levels in 2018, an estimated 31% of eligible pregnant women received the recommended three or more doses of IPTp, compared with 22% in 2017 and 2% in 2010, indicating considerable improvements in country uptake (WHO, 2019).

About 18% of women who use antenatal care services at least once do not receive any IPTp, representing a missed opportunity that, if harnessed, could considerably and rapidly improve IPTp coverage. In 2018, 31 million children in 12 countries in Africa's Sahel sub region were protected through SMC programmes. All targeted children received treatment in Cameroon, Guinea, Guinea-Bissau and Mali. However, about 12 million children who could have benefited from this intervention were not covered, mainly due to a lack of funding (WHO, 2019).

2.4.4 Diagnostic Testing of Malaria

The percentage of patients suspected of having malaria who are seen in public health facilities and tested with either an RDT or microscopy rose from 36% in 2010 to 84% in 2018. In 71% of moderate to high transmission countries in sub-Saharan Africa, the percentage of suspected cases tested with any parasitological test was greater than 80% in 2018. (WHO, 2019). According to 19 nationally representative household surveys conducted between 2015 and 2018 in sub-Saharan Africa, the median percentage of febrile children brought for care who received a finger or heel stick (suggesting that a malaria diagnostic test may have been performed) was greater in the public sector (median: 66%, IQR: 49–75%) than in the formal private sector (median: 40%, IQR: 16–46%) or the informal private sector (median: 9%, IQR: 5–22%).

Studies carried out by F. Sakari *et al., 2024,* in Kakamega County demonstrated that increased testing coverage through community-based initiatives led to higher detection rates of malaria. The statistical significance of this difference emphasizes the success of the activities of trained CHVs in improving testing accessibility and coverage. The involvement of Community Health Volunteers (CHVs) in malaria testing also showed marked improvements.

According to 61 surveys conducted in 29 sub-Saharan African countries between 2010 and 2018, the percentage of children with a fever that received a diagnostic test before antimalarial treatment in the public health sector increased from a median of 48% (IQR: 30–62%) in 2010–2013 to a median of 76% (IQR: 60–86%) in 2015–2018 (WHO, 2019).

2.4.5 Insecticide Treated Bed Nets (ITNs)

Insecticide-treated bed nets (ITNs) form a protective barrier around persons using them. They have been shown to reduce severe disease and mortality due to malaria in endemic regions (WHO, 2014). Several studies have demonstrated the efficacy of ITNs with an overall reduction in all-cause mortality by 19% (Phillip-Howard *et al.*, 2003, Lengeler & Snow, 1996,). Recently, Shah *et al.,* 2020 showed that users of ITNs were slightly more protected from malaria infection compared to non-users of ITNs.

A 25% reduction in all-cause mortality for children one to nine years of age was detected during the first year of the Gambian National Bed Net Program (D'Alessandro *et al.*, 1995). In Kilifi District, Kenya, a 33% reduction in mortality and a 44% reduction in hospital admissions for severe malaria were also found (Neville *et al.*, 1996). The application of residual insecticide greatly enhances the protective efficacy of bed nets. The insecticides used for treatment kill mosquitoes and other insects and repel mosquitoes. In addition, if high community coverage is achieved, the numbers and longevity of mosquitoes will be reduced, thereby providing community protection, regardless of bed net ownership (Smith and Morrow, 1992).

To achieve such effects, high community coverage is required. Much effort is currently being directed towards stimulating the demand for ITNs in African communities (UNICEF, 2003 and RBM, 2004). One of the key reasons cited for this is that when used properly, intact ITNs provide almost complete protection from mosquito bites (Curtis *et al.*, 1990).

Insecticide-treated bed nets (ITNs) have contributed substantially to declines in malaria morbidity and all-cause mortality across sub-Saharan Africa (Bhatt *et al.*, 2015, Lengeler *et al.*, 2004). ITNs prevent mosquito blood feeding by physically inhibiting human-mosquito contact and by chemically deterring, irritating, and killing mosquitoes (Bhatt *et al.*, 2015).

The physical barrier of the ITN prevents mosquito entry, while the pyrethroid treatment induces mosquito excito-repellency and causes paralysis leading to mosquito death. At high levels of coverage, ITNs reduce the overall density and lifespan of mosquito populations, resulting in community-wide malaria protection both for those sleeping under ITNs and for neighbouring non-users of ITNs (Hawley *et al*, 2003). A study done by Shah *et al*, 2020 among ITN users, showed that malaria incidence was significantly lower in users of ITNs with no holes (of any size) compared to users of ITNs with ≥ 1 hole (RR 0.82, 95% CI 0.69–0.98) (Bhatt *et al*.,2015).

2.4.6 Long Lasting Insecticide Treated Nets (LLINs)

The difference between ITNs and LLINs is that the former requires regular impregnation with an effective insecticide while the latter does not. LLINs are one of today's most effective malaria prevention interventions**.** They have been shown to reduce severe disease and mortality due to malaria in endemic regions among the vulnerable groups (pregnant women, children below five years).

They are mainly recommended for pregnant women, children below five years and HIV positive people since they do not require regular impregnation with an insecticide (Yang *et al.,* 2018, Wunishet *et al*., 2021).

LLIN use is encouraged early and consistently throughout pregnancy and after delivery (Yartey, 2006). They retain lethal concentrations of insecticide for at least 3 years. The LLINs and IRS are the primary vector control interventions in Kenya and are complemented by targeted larval source management (LSM). This has been exhibited mostly in the rice irrigation schemes of Mwea (Kirinyaga County), Ahero (Kisumu County) and Budalangi (Busia County) where breeding sites are few, findable and fixed popularly known as the triple (3) F strategies for larviciding.

Indoor residual spraying has been used to prevent and control malaria epidemics within the Kenya highlands since 2003 and was first introduced in malaria endemic districts of Kenya with support from PMI in 2008 for the reduction of disease burden. Routine targeted distribution of LLINs to pregnant women and children under 5 years of age has been implemented for the last ten years until 2009 when the government adopted the global strategy of universal coverage of 1 LLIN per 2 people. In the year 2011, Kenya distributed about 10 million LLINs to the general population at risk of malaria to achieve universal LLINs ownership of 1 LLIN per 2 people. According to the 2012 evaluation report on the 2011 mass LLINs distribution phase1 and 2, LLIN use is lower among children less than five years in Lake Endemic region (15.8%) compared with Highland Epidemic areas (25.1%). At the same time, a comparatively smaller proportion of households use LLIN in Lake Endemic malaria transmission areas (29.9%) compared to the Highland Epidemic areas (DOMC, 2012).

Sixty-three percent of all households surveyed in the KMIS 2015 owned at least one LLIN. However, only 40 percent of the households surveyed owned at least one LLIN for every two persons (universal coverage). Close to 37 million LLINs were distributed to people at risk of malaria in the targeted counties between 2014 and 2018 through various channels.

Despite the large number of LLINs distributed, universal coverage remained low at 47 percent. The 2015 KMIS reported that 58 percent of pregnant women ages 15–49 slept under an LLIN (MOH, 2018).

2.4.7 Indoor Residual Spraying (IRS)

Many malaria vectors are endophilic, resting inside the house after taking a blood meal. These mosquitoes are particularly susceptible to control through indoor residual spraying (IRS) (Curtis *et al.*, 1990). Indoor residual spraying involves coating the walls and other surfaces of a house with a residual insecticide. For several months, insecticide kills mosquitoes and other insects that come in contact with these surfaces (WHO, 2006).

Indoor residual spraying does not directly prevent people from being bitten by mosquitoes. Rather, it usually kills mosquitoes that come to rest on the sprayed surfaces. To be effective, IRS must be applied to a very high proportion of households in an area (usually >70%). IRS has been shown to be successful in South Africa where its use reduced malaria cases by more than 80% IRS and LLINs are the major malaria vector interventions in Kenya (MOH, 2010). Anecdotal evidence shows that a combination of IRS and long-lasting insecticide treated nets (LLINs) rapidly reduces malaria burden in high malaria transmission areas (MOH, 2010).

A combination of different vector control options in the context of Integrated Vector Management (IVM) will compensate for the deficiencies of each individual method.

According to the Global Plan for Insecticide Resistance Management in malaria vectors (GPIRM), insecticide resistance is widespread and is now reported in nearly two thirds of countries with malaria transmission, and it affects all major vector species and all classes of insecticides, hence the need to take control measures (WHO, 2012).

Gimnig *et al*., 2016 found out that both IRS and insecticide treated mosquito nets are effective tools for reducing malaria burden and when implemented in an area of moderate to high transmission with moderate ITN coverage, there may be an added benefit of IRS. Kenea *et al.,* 2019, showed that a combination of IRS and LLINs were as effective as IRS alone in reducing densities and human biting rate (HBR) of anopheles *arabiensis*. However, the effects of the two interventions were higher than LLINs alone in reducing densities and HBR of the vector (Kenea *et al.,* 2019).

In collaboration with the Kenya National Malaria Control Program, the Ministry of Health and local authorities, the PMI AIRS Project developed an implementation plan to spray all sleeping structures in six sub-counties in Migori County, which include Rongo, Awendo, Uriri, Suna East, Suna West and Nyatike. A total of 189,228 structures were sprayed in Migori County. The spray coverage was 93.3%. (Abt Associates Inc., 2018). By spraying walls with a long-lasting insecticide that is safe for humans, mosquitoes get a deadly dose and won't survive to bite – and infect – another person. In this way, indoor residual spraying disrupts malaria transmission and reduces the mosquito population (Abt Associates Inc., 2018).

The chemicals are sprayed on the wall because mosquitoes will always rest on a nearby wall until they have digested the blood. If the person bitten carries the malaria parasite, that mosquito will then pass on the parasite to the next person it bites – often a neighbor, child or someone else living nearby.

By spraying walls with a long-lasting insecticide that is safe for humans, mosquitoes get a deadly dose and won't survive to bite – and infect – another person. In this way, indoor residual spraying disrupts malaria transmission and reduces the mosquito population (WHO, 2015).

2.4.8 Source Reduction (Larval Control)

Source reduction is the method of choice for mosquito control when the mosquito species targeted are concentrated in a small number of discrete habitats (Service, 1986). The larval habitats are destroyed by filling depressions that collect water, by draining swamps, or by ditching marshy areas to remove standing water. World Health Organization interim position statement on the role of larviciding for malaria control in Sub-Saharan Africa in 2012 provided guidance that larviciding to be used to complement other malaria interventions and not as a stand-alone intervention.

For some mosquito species, habitat elimination is not possible. For these species, chemical insecticides can be applied directly to larval habitats (Mutero *et al.,* 2004). Other methods, which are less disruptive to the environment, are usually preferred, which include the use of, (i) Oils are applied to the water surface, suffocating the larvae and pupae (Mutero *et al.*, 2004).

Most oils in use are rapidly biodegraded. (ii) Biological control agents include toxins from the bacterium *Bacillus thuringiensis* var. *israelensis* (Bti). These products are applied in the same way as chemical insecticides. They are very specific, affecting only mosquitoes, black flies, and midges. (iii) Insect growth regulators such as methroprene. Methroprene is specific to mosquitoes and can be applied in the same way as chemical insecticides. (iv) Mosquito fish (*Gambusia affinis*) are effective in controlling mosquitoes in larger bodies of water. Other potential biological control agents, such as fungi (e.g., *Laegenidium giganteum*) or mermithid nematodes (e.g., *Romanomer misculicivorax*), are less efficient for mosquito control and are not widely used (CDC, 2024).

2.4.9 Personal Protection Measures

This includes the use of window screens, ITNs, and repellents (such as DEET) and wearing light-colored clothes, long pants and long-sleeved shirts. Well-constructed houses with window screens are effective for preventing biting by mosquitoes that bite indoors. These contributed to the elimination of malaria from the United States and Europe (CDC, 2024).

2.4.10 Sterile Male Release

This has been successfully applied in several small-scale areas. However, the need for large numbers of mosquitoes for release makes this approach impractical for most areas. Genetic modification of malaria vectors aims to develop mosquitoes that are refractory to the parasite. This approach is still several years from application in field settings (CDC, 2024).

2.5 The Roles, Activities and Challenges of Community Health Volunteers

Community Health Workers are critical health agents in various ways. Their function in community health cannot be underestimated since they are effective in undertaking task-shifting activities to fill staffing gaps at community units / level one facilities. CHWs are instrumental community case management (CCM) with evidence suggesting that access to effective malaria treatment has improved, especially where families face barriers to accessing health facilities, occasioned by multiple factors related to affordability, acceptability and availability of access to prompt and effective malaria treatment among the poor. task-shifting to community health workers. it is critical to better understand how to deliver a proven intervention most effectively through the existing system. According to Kisia *et al* (2011) in a study in villages in Lamu & Malindi in Kenya opine that CHWs involvement in malaria activities increases awareness and demand, utilization and reduces barriers to access of malaria services. Challenges that CHWs face in accessing the services include insufficient staffing, cost of hiring sufficient CHWs, unacceptability at the community level, lack of motivation and unavailability and sufficiency of work equipment as stipulated by Kenya's 2006 Community Health Strategy.

2.5.1 Health Systems and the SDGs

A health care system is defined as *all health care institutions, human resources, financing mechanisms, information systems, organizational structures that collectively culminate in a health action* (Lassey *et al.*, 1997). The World Health Report (2000), which was devoted entirely to health systems, describes the objectives of a health system as twofold: goodness (the best attainable average level of health), and fairness (the smallest feasible difference among individuals and groups).

Goodness is achieved when a health system responds well to people's needs while fairness is achieved when it responds equally well to everyone without discrimination (WHO, 2000). Aday and colleagues grouped the overall goals of a health system into effectiveness, efficiency and equity (Aday *et al.*, 1998). Effectiveness examines the benefits of health care measured by improvements in health while efficiency relates these improvements to the resources required to produce them. Equity is concerned with health disparities and the fairness and effectiveness of the procedures for addressing them.

The World Health Report of 2000 used an index of health system performance to rank 191 nations. Of the 50 poorest performing nations, 43 were from Africa (Kenya was ranked 178 of 191). Many causes have been identified to explain the state of health systems in low-income countries. While the low level of available health resources (both in terms of recurrent and household expenditure) is a major problem, mismanagement of scarce resources, rapidly growing populations, an increasing burden of infectious diseases and the resulting cycle of poverty, have been cited as key concerns. In a study into health system constraints that impede the achievement of MDGs, it was concluded that in the 42 countries with 90% of child deaths worldwide in 2000, 63% of these deaths could have been prevented through full implementation of a few known and effective interventions which health systems have failed to deliver (Travis *et al.*, 2004).

An additional problem compounding the failing health systems has been the lack of a clear focus in health systems research aimed at devising ways of improving the performance of health systems. For instance, most international health policy debates in the 1980s and 1990s were dominated by health efficiency issues driven by health financing and resource generation. This promoted aggregate health status as the primary public health policy goal to be pursued through the health system (Gilson, 1998). While these changes resulted in increased health system efficiency, they also revealed considerable potential to harm health equity, although this impact has rarely been evaluated by Gilson & Mills, 1995). It is in recognition of these challenges that renewed efforts have been made to reignite the position of health equity as a major concern in international and national public health (Gilson, 1998; Leon *et al.,* 2001; McIntyre & Gilson, 2000). A more recent task force convened by the WHO showed that in SSA and many other low-income countries, health systems constraints, particularly availability of relevant services and access to these services are impeding the attainment of the MDGs (Task Force on Health Systems Research, 2004). The task force suggested several topics for health systems research and outlined their potential to affect the attainment of each of the 8 MDGs.

Research into organization and delivery of health services, particularly equity, efficiency and effectiveness of the health care system, under which issues of access and use of health services fall, were found to be relevant to at least 4/8 of the MDGs. Most referenced is the WHO Building Blocks model, in which a health system is defined as "all organizations, institutions, resources and people whose primary intent is to improve health" (WHO, 2011). This definition includes efforts to influence determinants of health as well as more direct provision of health services. The system is organized to improve health at all levels with processes that ensure equity, responsiveness, social and financial risk protection, and efficiency.

According to WHO, six basic building blocks comprise a health system (WHO, 2007).

(a) Delivery of effective and safe **health services** to those who need them, when and where they need them;

(b) A **health workforce** responsive to the needs and expectations of individuals and families, which is fair and efficient at achieving the best health outcomes possible within the confines of available resources and circumstances;
(c) A well-functioning **health information system** that ensures reliable health data is collected, analyzed, disseminated and used;
(d) **Essential medical products, vaccines and** technologies are available to all, and are safe, efficacious and cost-effective;
(e) A **health financing** system that raises adequate funds for health and protects people from financial hardship due to poor health;
(f) **Leadership and governance** processes resulting in strategic policy frameworks that provide effective oversight, regulation, coalition-building and accountability for health.

World Health Organization states that a well-functioning health system improves health status of individuals, families and communities and makes it possible for people to participate in decisions affecting their health. However, the WHO Building Blocks model and others proposed to date do not place sufficient emphasis on community actors and activities that play a significant role in improving health outcomes (LeBan *et al*., 2011). The importance of the role of the community has been established in past maternal, newborn, and child health (MNCH) programs, but community involvement in the design and implementation of the program has been limited.

Communities have rarely been considered true partners in the implementation and evaluation of interventions to improve child health. Community-based programs have most used the community as a passive recipient (i.e., a target) rather than as a valued resource and partner with joint ownership of the process of program implementation. Increasing evidence demonstrates that community and women's empowerment can have a remarkable impact on the health of children (Perry & Freeman, 2009). Despite this gap in the existing health system models, the relationship between the formal health sector and the communities they serve determines the pace and degree to which community members and families utilize and support health services. With the renewed interest in strengthening health systems and achieving the vision of the Alma-Ata declaration (WHO, 1978) (universal access for care, equity, community participation, intersectoral collaboration and appropriate use of resources), additional emphasis is needed on a more population-directed approach to health, including the community's role in the formal health system, and the community health system itself (WHO, 1978).

Communities are organized and influenced by larger units, such as municipalities, districts, counties, and local administrative units, but a health system ultimately intersects people's lives in their local community spaces. Powerful external forces, including globalization, the economy, and politics, are the context within which the community functions. Social support, social capital, empowerment to make decisions, and trust between individuals within a community are important determinants of health service usage and outcome, even within the larger categories. These dynamics and relationships within communities and between communities and their environment influence health status most directly (LeBan *et al*., 2011). Powerful external forces, including globalization, the economy, and politics, are the context within which the community functions (LeBan *et al*., 2011). Community contexts are mini universes of complex social, political, associational, economic, power, and cultural dynamics, providing a different theater for providing health services and facilitating behavior change than in a health facility. Some communities may consist of relatively homogenous populations (whether it be the same tribe, cultural group or religious affiliation) while other communities may be quite heterogeneous.

Some communities may be stable, while others have high levels of migration in certain seasons. They present different challenges than standardized health service delivery systems and large-scale public health approaches, as dynamic, evolving entities. Demographics and epidemiology will inevitably change over time. High-impact health prevention and promotion activities, such as exclusive breastfeeding, infant and young child feeding, birth delivery planning, use of an insecticide-treated net for malaria prevention, and essential newborn care, are of particularly high importance in community settings where behavior change approaches are essential, than in facility settings where more complex medical procedures are promoted for maximum impact LeBan *et al*., 2011).

2.5.2 Challenges of Community Based Health Education

Community based health education approaches are often seen as 'soft' compared to vaccine or drug development, but in reality, various approaches are needed in controlling malaria (Feek, 2005). Supporting communities require a solid understanding of social factors, from the individual level to the larger social, economic and political factors that influence the local context. Social factors in malaria have been neglected compared to the focus on mosquitoes and parasites (Heggenhouge *et al.*, 2003). Community based health education needs to be included in the process of malaria control right from the start of activities, not as an afterthought or add-on at the end. This requires thinking strategically about community health education from the planning stages to implementation and evaluation.

Gramiccia, (1981) made observations about the failure of health education in malaria control, and these are still applicable today. Gramiccia (1981) argued that areas endemic with malaria are financially poor, with scarce medical facilities that are difficult to access. Malaria is just one element in part of a socioeconomic complex and local people find it difficult to single it out for concern. It is a complex disease to treat and health education in malaria control is not well adapted (Gramiccia, 1981). Misperceptions of malaria can inhibit prevention and treatment actions, especially when there is little or no association of malaria to mosquito bites (Heggenhouge and Vivek, 2003). However, providing correct information is not the solution. It is now widely accepted that increasing people's knowledge does not necessarily result in changes in perception or behaviour and so any community education around malaria needs to engage sensitively with the entirety of local culture and beliefs (Espino *et al*., 1997).

The quality of health care and health care providers is also critical. If health care workers lack communication skills, lack motivation due to poor working conditions and have negative attitudes towards their patients, malaria services will be ineffective.

2.5.3 The Kenyan Health System

A hierarchical structure, the Kenyan health system is administered from the top down by the Ministry of Health (MOH), an institution which remains split into two sister Ministries since the post-election turmoil of 2007: The Ministry of Medical Services, and the Ministry of Public Health and Sanitation. Health facilities are spread regionally, with the most sophisticated services available in the major cities or only at the national level. At the peak of the service spectrum are the National,

Referral, and Teaching Hospitals (NRTH) such as Kenyatta National Hospital in Nairobi. The provincial hospitals offer the next best level of care, followed by sub-district hospitals. Health centres, dispensaries, and at the bottom of the heap, community health organizations are below the sub-district level. There were 6,190 health facilities in Kenya in 2008, the equivalent of 16 facilities per 100,000 people, or 11 facilities per 1,000 km (Turin, 2010).

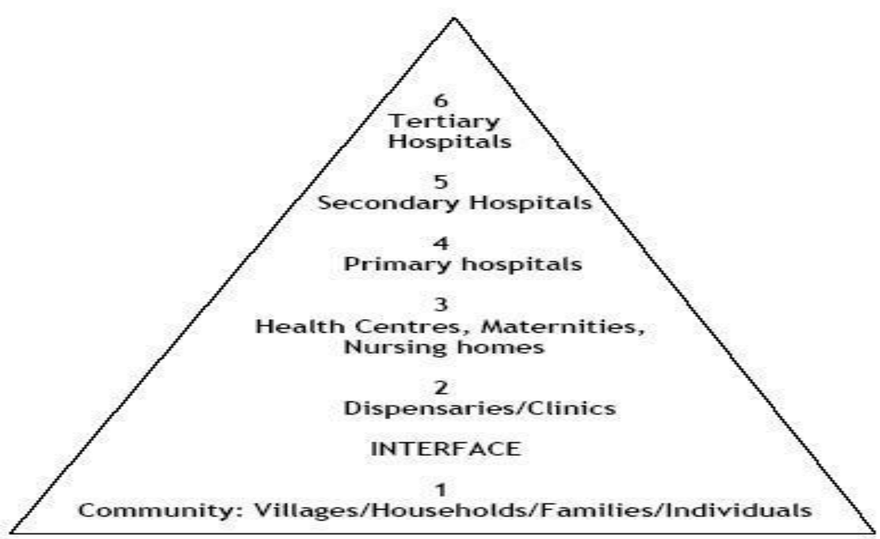

Figure 2.5: Levels of Service Delivery in the Kenyan Health System 2010

Access to health and medical care is unequally spread across the country, as is the fertility rate and the level of education. The Central Province and Nairobi are estimated to have the best facilities, whereas the North-Eastern Province is found to be the most underdeveloped. Poor people in rural areas who are sick and choose to seek care, usually only have the option of treatment at primary care facilities (Turin, 2010)

These facilities are often under-staffed, under-equipped and have inadequate medicines.

Among those Kenyans who are ill and do not opt to seek care, 44% were hindered by cost. Another 18% were hindered by the long distance to the closest health facility. According to the 2009 World Health Statistics Report, Kenya's total expenditure on health as a percentage of GDP was 4.6% or 29 USD per capita on health services in 2006 (WHO, 2007), which is several dollars below the 34 USD the WHO recommends countries spend to provide a minimum health package for their citizens. The under-financing of the health sector has reduced its capacity to ensure an adequate level of healthcare for the population (WHO, 2007). Thus, the provision of health and medical care services in Kenya is partly reliant on donors. More than 16% of the total expenditure on healthcare originated from donors in 2002 (WHO, 2007). There are other causes inhibiting Kenya's ability to provide adequate healthcare for its citizens. These include inefficient utilization of resources, the increasing disease burden and the rapid population growth in Kenya.

2.5.4 Organization of Health Service Delivery around a Four-Tiered Health System

The tiers of the system will be Community, Primary care, primary referral, and tertiary referral services. Community services focus on organizing appropriate demand for services, while Primary Care and referral services focus on responding to this demand.

a) Community *services* comprise of all community-based demand creation activities, organized around the Comprehensive Community Strategy defined by the Health Sector.
b) Primary *care services* be comprised of all dispensaries, health centers and

maternity homes for public and non-public providers. Their capacity be upgraded, to ensure they can all provide appropriate demanded services.

c) The *County referral services* include primary referral facilities (all level 4 / district hospitals) operating in and managed by a given County.

d) Together, all these facilities in each County form its County Referral System, with specific services shared amongst the existing County Referral facilities to form a virtual network of comprehensive services.

e) The *National Referral Services* include the facilities providing tertiary referral services (all Provincial and national level facilities) that provide specialized health care services across several counties, including hospitals, laboratories, blood banks and research institutions. These shall operate under a defined level of autonomy.

i. Implement an Integrated Service Delivery Approach, Based on Clients' Needs

This encompasses preventive, curative and rehabilitative services, and brings together services based on satisfying the clients' needs, as opposed to disease/program-based services.

ii. Provide Quality Emergency Health Services at the Point of Need Regardless of Ability to Pay

These are those health services that respond to disease conditions that: are sudden onset in nature; are beyond the capacity of the individual / community to manage; and are life threatening or will lead to irreversible damage to the health of the individual / community if not addressed.

They will be provided by the nearest health facilities regardless of ownership.

iii. **Institute Emergency Preparedness and Response Systems at All Levels of the Health System**

This is to ensure that health facilities are equipped and ready to adequately respond to health effects of disasters and emergencies.

iv. **Scale up Demand Creation for Health Services**

A community strategy that outlines demand creation, and health service provision priorities in a given time/region shall be defined.

v. **Employ systems for the provision of health services for marginalized and vulnerable populations.**

Such marginalized populations include those in hard-to-reach areas of the country, and those in informal settlements.

vi. **Ensure patient safety in provision of health services**

Quality of care and Patient safety systems shall be prioritized

vii. **Establish integrated supportive supervision, and mentoring processes**

These should enable continuous learning, and capacity improvements at the implementation level

2.5.5 Health Sector Referral System

The referral system links the different levels of care based on the expected services being provided through the system. The levels of care include all facilities public and private, and Faith-Based Organizations (FBO). Figure 2.6 shows the linkages between the levels of care. In emergency cases though, there may be referrals from lower-level facilities (Levels 1, 2 & 3) direct to county referral facilities (Levels 4 & 5).

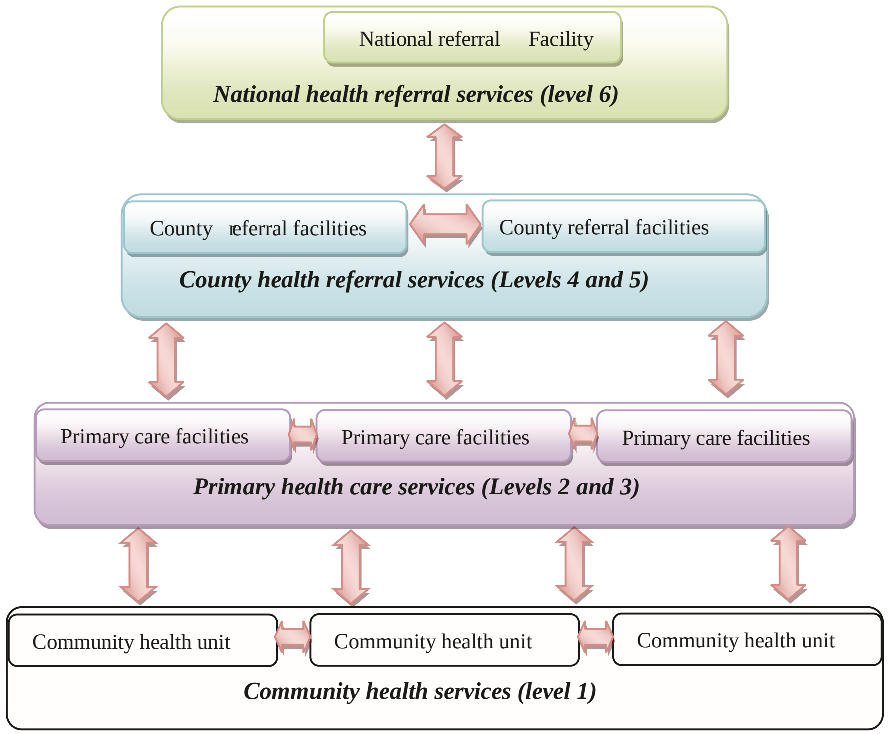

Figure 2.6: Referral Linkages between Different Levels of Care -MOH, 2014.

The referral system has four levels of service: Community, Primary Care, County Referral Services, and National Referral Services. The health service delivery system in Kenya is organized across six levels of care, beginning at the community level and continuing through primary care services, which include dispensaries (level 2) and health centres (level 3), and County Referral Health Services (level 4 & 5) all the way to the national referral health services (level 6). The strengthening of referral linkages across service delivery units is one of the elements in the health policy strategy to achieve an efficient health service delivery system that maximizes health outcomes. A comprehensive referral system in Kenya with effective linkages will ensure continuity of care across all levels.

To strengthen the referral system, the Ministry of Health (MOH) developed the Kenya Health Sector Referral Strategy 2014–2018. The strategy defines referral as a mechanism to comprehensively manage clients' health needs by using resources beyond those available where they access care. The scope of referral services defined in this strategy includes movement of clients, specimens, services and experts, and client parameters (MOH, 2014).

The rationale for a Well-Functioning Referral System is that most of the population of Kenya is rural and poor. An effective referral system will ensure health services to all people in Kenya in the following ways: Coordination and standardization of referral services; Continuity of care across the different levels of care; Cost-effectiveness of health services provided to Kenyan citizens; Promotion of universal coverage and equity in provision of health services and Health care planning through performance monitoring of the referral system (MOH, 2014).

The benefits of a well-functioning referral system are as follows: Maximize efficiency of the health system by ensuring appropriate use of health services; Strengthen lower-level facilities and improve capacity for decision-making by health workers at all levels; Create opportunities for balanced distribution of funds, services, and human resources; Promote linkages across the different levels of care and between public and private entities and Ensure that care is provided at the lowest possible cost (MOH, 2014).

According to Dr. Sharrif, Director of Public Health and Sanitation 2012 says that the slow progress in reducing under five mortalities in Africa has been attributed to different factors with the single most important one being failure to reduce neonatal mortality (death in the first 28 days of life). The critical gap in the continuum of care is evident but overwhelming evidence indicates that community health workers can bridge this gap and make remarkable improvement in both maternal and new borne morbidity and mortality (MOH, 2014).

2.5.6 The Kenyan Community Health Strategy

Communities are at the foundation of affordable, equitable and effective health care, and are the core of the Kenya Essential Package for Health (KEPH) proposed in the second National Health Sector Strategic Plan 2005-2010 (NHSSP II). The overall goal of the community health strategy is to enhance community access to health care to improve productivity and thus reduce poverty, hunger, child and maternal deaths, as well as improve educational performance across all stages of life. The goal is to be accomplished by establishing a sustainable level 1 service aimed at promoting appropriate health services across all the stages of the life cycle throughout the country, through decentralization of services; as well as enhanced accountability and responsibility among all stakeholders.

The community-based approach, as set out in the strategy, *is the mechanism through which households and communities strengthen their role in health and health-related development issues,* by increasing the knowledge and skills in disease control and planning for health interventions (MOH, 2007). It is for this reason that the Ministry of Health developed the Community Health Strategy to provide policy guidance for KEPH, as part of the implementation of NHSSP 2005-2010 with the involvement of communities as key actors and consumers of services. The individuals at the household level are the primary target group as well as the implementers of level 1 services. Household heads are responsible for the day-to-day upkeep of the household affairs as well as participating in community-organized health activities. They are in contact with the Community Health Workers (CHWs) who visit them at home and the formal health system where they seek and utilize health services. The household forms the first level of care that is universally available.

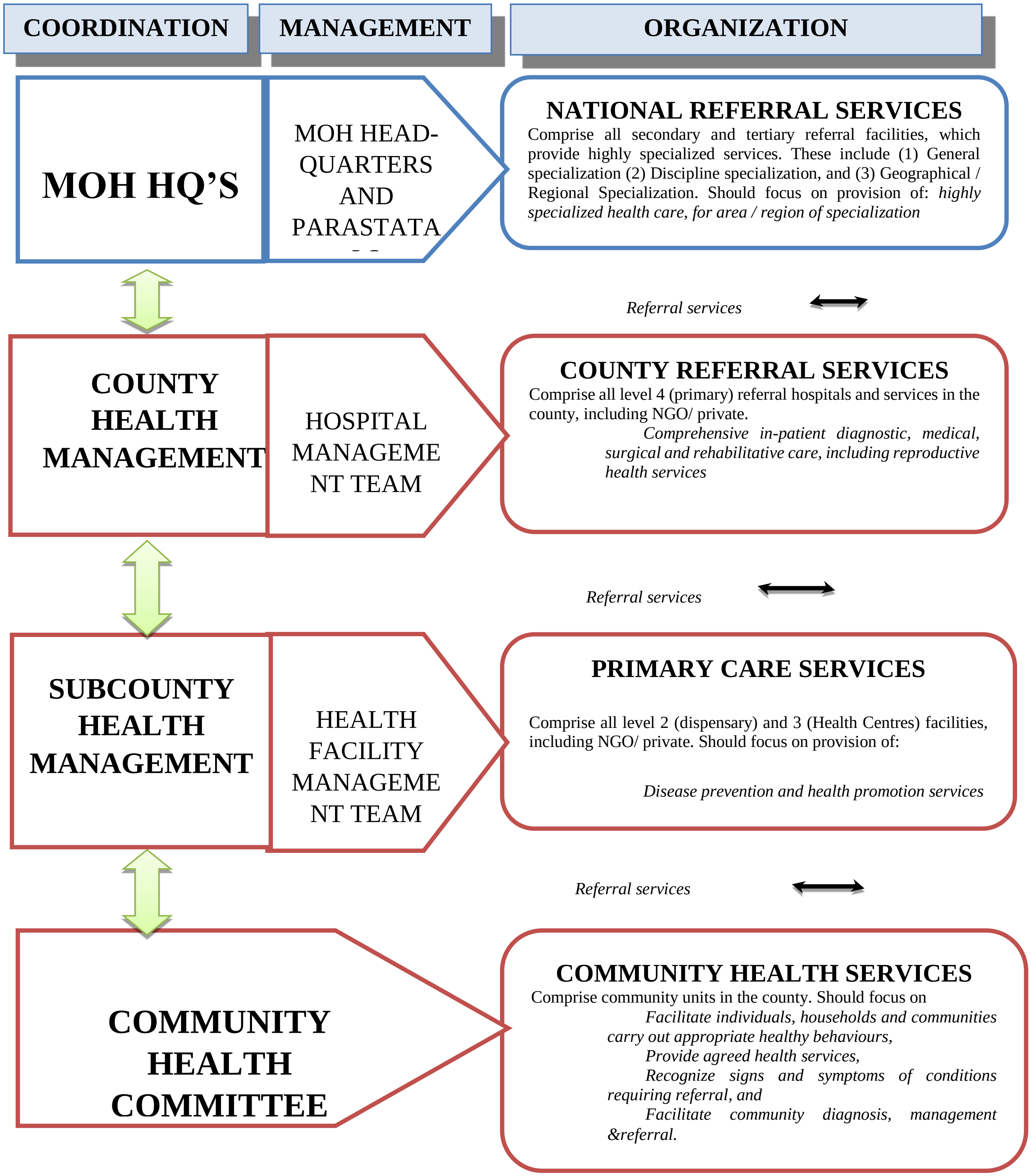

Figure 2.7: Organization of Health Services in Kenya

Source: (Implementation of Health Service in the New Constitution Year, 2011)

2.5.7 The Community Health Committee (CHC) Formation and Composition

The lowest health governance structure is the CHC, elected in such a way that all villages in the Community Unit (app. 1000 households) are represented. The CHC is elected at an Assistant Chief's ***baraza*** (Public Meeting) under the chairmanship of the Assistant Chief. The committee is chaired by a respectable member of the community. It is recommended that a CHV should be the Treasurer while the Community Health Extension Worker (CHEW) should be the Secretary. The CHC should have 9 members who may include representatives of: Youth, Faith groups, Gender, Women's group, NGOs, People Living with Aids (PLWA), People with Disability (PWD) and any others.

2.5.8 Role and Functions

The role and functions of the CHC include:

- Identification of community health priorities through regular dialogue.
- Planning for community health actions.
- Participating in community health actions.
- Monitoring and reporting on planned health actions.
- Mobilizing resources for health actions.
- Coordinating CHWs activities.
- Organization and implementation of Community Health Days.
- Reporting to Level 2 on priority diseases and other health conditions.
- Leading community outreach and campaign initiatives.
- Advocating health in the community.

2.5.9 The Roles, Activities and Challenges of Community Health Volunteers in Provision of Community Health Services

The engagement of the community health workers has been identified as one strategy to address the growing shortage of health workers, particularly in low-income countries where the community members engage to render certain basic health services to the communities. The concept has been around for at least 50 years. There have been innumerable experiences throughout the world with programmes ranging from large-scale, national programmes to small-scale, community-based initiatives (WHO, 2016). Reviewed literature by WHO 2016 revisited questions regarding the feasibility and effectiveness of community health worker programmes. The review is aimed at assessing the presently existing evidence. It constituted a desktop review, very broad in scope, which drew together and assessed the evidence as it could be found in the published and selected "grey" literature since the late 1970s. The umbrella term "community health worker" (CHW) embraces a variety of community health aides selected, trained and working in the communities from which they come. Generalizations about the profile of community health workers internationally are difficult. While there are some broad trends, CHWs can be men or women, young or old, literate or illiterate. More importantly is an acknowledgement that the definition of CHWs must respond to local societal and cultural norms and customs to ensure community acceptance and ownership (WHO, 2016). The roles and activities of community health workers are enormously diverse throughout their history, within and across countries and across programmes (WHO, 2016; 2024)

While in some cases CHWs perform a wide range of different tasks that can be preventive, curative and/or developmental, in other cases CHWs are appointed for very specific interventions (WHO, 2016). WHO recognizes that though it is difficult, given the extensiveness of the topic and the diversity of the literature informing the review, to make generalizations about experiences with CHW programmes or answer the question of what makes a good CHW programme, there is however consensus in the literature on a number of issues: First, CHWs can make a valuable contribution to community development and, more specifically, can improve access to and coverage of communities with basic health services. There is robust evidence that CHWs can undertake actions that lead to improved health outcomes, especially, but not exclusively, in the field of child health. However, although they can implement effective interventions, they do not consistently provide services likely to have substantial health impact, and the quality of services they provide is sometimes poor (WHO, 2016). Second, for CHWs to be able to make an effective contribution, they must be carefully selected, appropriately trained and – very important – adequately and continuously supported. Large-scale CHW systems require substantial increases in support for training, management, supervision and logistics (WHO, 2016).

Third, CHW programmes are therefore neither the panacea for weak health systems nor a cheap option to provide access to health care for underserved populations. Numerous programmes have failed in the past because of unrealistic expectations, poor planning and an underestimation of the effort and input required to make them work. This has unnecessarily undermined and damaged the credibility of the CHW concept.

Fourth, by their very nature CHW programmes are vulnerable unless they are driven, owned by and firmly embedded in communities themselves. Where this is not the case, they exist on the geographical and organizational periphery of the formal health system, exposed to the moods of policy swings without the wherewithal to lobby and advocate their cause, and thus are often fragile and unsustainable.

However, the concept of community ownership and participation is often ill-conceived and poorly understood as a byproduct of programmes initiated by the centre. Evidence suggests that CHW programmes thrive in mobilized communities but struggle where they are given the responsibility of galvanizing and mobilizing communities (WHO, 2024).

Examples of successful programmes can thus be found in the wake of community mobilization efforts, either as part of large-scale political transformation, such as in Brazil or China; or through local mobilization, often facilitated by nongovernmental, community-based or faith-based organizations. In many cases programmes last through the lifespan of the mobilization effort and wither or collapse entirely as the momentum of mobilization is lost. The rhythms and dynamics of community participation though lie outside the scope of the WHO review, it is crucial to better understanding and discussing the future of CHW programmes. A key challenge lies in institutionalizing and mainstreaming community participation. To date, the largest and most successful programme in this regard is the Brazilian Family Health Programme, which has integrated

CHWs into its health services and institutionalized community health committees as part of municipal health services to sustain social participation. This means that community participation does not become an alternative, but an integral part of the state's responsibility for health care delivery (Couttolenc and Dmytraczenko 2013; Medcalf *et al.*2015).

Fifth, the question of whether CHWs should be volunteers or remunerated in some form remains controversial. There exists virtually no evidence that volunteerism can be sustained for long periods: as a rule, community health workers are poor and expect and require an income.

Although in many programmes they are expected to spend only a small amount of time on their health-related duties, leaving time for other breadwinning activities, community demand often requires full-time performance. The reality is that CHWs as a rule and by their very nature provide services in environments where formal health services are inaccessible, and people are poor. This also complicates the issue of community financing, which is rarely successful unless institutionalized, as in China. Most of the evidence reflects failures of community financing schemes, leading to high drop-out rates and the ultimate collapse of programmes (WHO, 2024).

Given present pressures on health systems and their proven inability to respond adequately, the existing evidence overwhelmingly suggests that particularly in poor countries, CHW programmes are not cheap or easy, but remain a good investment, since the alternative in reality is no care at all for the poor living in geographically peripheral areas. While there is a lot to learn, there is a lot we do know about making programmes work better: appropriate selection, continuing education, involvement and reorientation of health service staff and curricula and improvement, supervision and support are non-negotiable requirements. These need political leadership and substantial and consistent provision of resources. We need to learn from examples of large-scale successful programmes in this regard, particularly providing longitudinal evidence of what works and what does not work. This presently constitutes the biggest knowledge gap (WHO, 2016).

CHW programmes have been revered as panacea and described as a delusion in the past. A sober view reveals today, as it did in the late 1980s, that “with political will, however, governments can adopt more flexible approaches by planning CHW programmes within the context of overall health sector activities, rather than as a separate activity.

Weaknesses in training, task allocation and supervision need to be addressed immediately. CHWs represent an important health resource whose potential in providing and extending a reasonable level of health care to underserved populations must be fully tapped” (Gilson *et al*., 1989),

The campaign to get community health workers paid and formally integrated into the health system has been rolled out across Africa. Dr. Githinji Gitahi, AMREF Health Africa Group CEO said considering that more than 50 per cent of Africans do not access the formal health system, Community Health Workers are a critical and necessary part of the continent’s health infrastructure. Advocating for the remuneration of community health workers and their inclusion into the formal health workforce is the main key campaign agenda for the SSA.

Currently in Kenya, community health workers are either paid KES 2000 (USD $ 20) in specific programmes or projects or not remunerated at all and rely on volunteerism. This is despite the critical role that they play in the health infrastructure, especially at the community level where many lack access to the formal health system. These are people who live in communities they serve, providing a critical link between those communities and the primary health care system. Much of the hesitation in incorporating them into the formal health system has been brought about by lack of data on what it would cost, even though the positive impact of their work has been recognized in many pilot programmes (MOH, 2014).

The campaign rolled out seeks to have the CHVs receive one year of training: three months in a classroom and nine months in the field under supervision. In addition, each CHW is expected to receive a monthly salary of between KES 7,000-Ksh10,000 (USD 70-100). This is the ideal approach for Kenya; given the huge role the community health workers play in bridging gaps in the formal health workforce.

The World Health Organization (WHO) voiced its support for a community-based health system, adding that this was where the health care need was most pressing. Community health workers need sustainable careers and stable income. Ethiopia is one such country whose strong political will has seen it become the benchmark for Africa's community health worker strategy. Through its health extension programme, Ethiopia has expanded disease prevention and primary care through service delivery to the communities at the grass-root level, with more than 35,000 community health workers currently on record (WHO, 2014, World Vision, 2015)

Although there are examples of CHWs having a wide range of roles, most CHW programs within the area of MCH and primary health care tend to focus on a few main areas that fall under three broad categories of health promotion, community mobilization, and treatment. Perhaps the most common role taken on by CHWs is that of health promoters, where the CHW primarily provides information and counseling with the aim of encouraging particular behaviors. CHWs in this role are typically used to promote breastfeeding and child nutrition, family planning, immunization, and other behaviors linked to mother and child health. In addition, CHWs are sometimes also used to promote awareness about social welfare issues, such as domestic violence or alcohol and drug abuse (WHO, 2014).

In a second role, the CHW provides preventive health care services by distributing commodities such as bed nets, iron folate supplements and other micronutrients, condoms, contraceptives, and certain vaccines, for example, to all pregnant women or children of a certain age. Although this role usually includes promotional activities, the provision of commodities has logistical implications, as well as implications for how the CHW is perceived by the community, making this role different from that of health promoter (WHO, 2014).

In a third role, CHWs act as community mobilizers, initiating activities such as the digging of latrines, the identification of clean water sources, and the organization of nutrition and sanitation days. Another role involves the provision of curative health care. Tasks for this role commonly include the diagnosis and management of common childhood illnesses, such as malnutrition, diarrhea, and pneumonia, as well as timely referral to health facilities, when needed. Another aspect of treatment is assistance to women during labor and birth. In some cases, this role may be limited to providing support to the mother in the presence of a skilled birth attendant. In other cases, CHWs are trained to manage uncomplicated labor and to detect high-risk pregnancies and labor complications so that timely referral can be made. This role is often taken on by traditional birth attendants (TBAs) who have received additional training and have been incorporated into a formal health care program.

Since Kenya's independence in the 1960s, the country has undergone a series of health care reforms aimed to decentralize fiscal and programmatic responsibilities to local authorities. In 2010, Kenya approved a new constitution devolving political, management, and financial responsibilities, including health, to local authorities. By that time, efforts to improve community health, including an updated package of essential health services, had improved child and maternal health indicators, including contraceptive use. Currently, the Kenya Health Policy provides an overall framework under which the community health system operates.

It sets Kenya's health goals over a 16-year period, outlines strategies to achieve those goals, and delineates responsibilities within the decentralized system, specifying the roles of the national and county levels. The policy also establishes guidelines for collaboration and partnership between stakeholders at all levels of the health system to ensure harmonized implementation (Egan *et al.*, 2017). The Kenya Health Sector Strategic and Investment Plan sets additional shorter-term goals for the community health system, and defines the services included in the Kenya Essential Package for Health (KEPH). The Strategy for Community Health guides the lowest level of health service provision, specifies the management and implementation structures of the community health system, and lays out strategic objectives with the ultimate goal of sustaining a community-led health system. The strategy also defines the roles and responsibilities of stakeholders at the national, county, sub-county, and community levels, including community health providers (Egan *et al.*, 2017).

CHEWs and CHVs implement KEPH services within a community unit, or geographic area covering approximately 5,000 people. CHEWs and CHVs serve as the link between community units and their corresponding health facility, extending services that have traditionally been based at facilities to the household level. Programs are implemented at the county level. Specific programs and the services that CHEWs and CHVs provide can therefore differ from county to county. There are a large number of programs operating in Kenya, and at the community level most use CHEWs and CHVs to provide services guided by the KEPH. While nongovernmental organizations (NGOs) implement some programs, they still operate under the guidance of the MOH and county officials. Civil society organizations (CSOs) and community groups are heavily involved in Kenya's community health system.

CSOs support health service delivery planning, policy development, and implementation through participation in national coordinating committees for community health, and in health management committees at the county and sub-county levels. Community health committees (CHCs) provide leadership, oversight, and coordination of community services and activities within the community unit. They work with CHEWs and CHVs to mobilize communities for health promotion and prevention activities (Egan *et al.,* 2017). In Kenya, a community Health Volunteer (CHV) is trained to provide the most essential lifesaving interventions such as emergency front-line care and can save children's lives from many if not most of the major preventable child mortality causes like diarrhoea, pneumonia and malaria. CHVs also equip families with knowledge and skills to prevent disease. They promote good nutrition, sanitation, and hygiene, and link families to essential services (Egan *et al.,* 2017).

CHVs have effectively taken roles in the health sector such as, Health Sector Referral System, Community Based Maternal and Newborn Care, Community Based Deworming (deliver deworming treatment to all community members in Kwale County in 2014-2016), Community Led Total Sanitation through campaigns of Open Defecation Free (ODF) in Rural Kenya, Community Based Tuberculosis Care, Care of Children Aged Under-Five Years in Western Kenya among others as well as Universal Health Care Programmes in the Counties. The success of ODF in rural Kenya is heavily embedded on issues around behaviour. Hardware facilities may be available in some instances but collective and individual buy in is a critical entry point towards communities appreciating the health benefits and correctly using toilet facilities." (MOH, 2014).

As a programme to facilitate Universal Health Care in Machakos County, The County Government established 250 Community Health Units (CHUs) and trained over 2,500 Community Health Volunteers (CHVs). While launching the programme of Universal Health Care, Dr. Alfred Mutua, Governor of Machakos said having such volunteers will ensure residents deep in the villages get good accessible health care and important lifestyle information that will help them curb diseases.

"***Having these volunteers will ensure that wananchi who are deep in the villages are kept abreast with new health information, know more about lifestyle diseases like hypertension, diabetes and understand the importance of hospital deliveries among other things,"*** Mutua said.

He spoke during the unveiling exercise of the community health volunteers at Kenyatta Stadium in Machakos town on Tuesday 15 January 2019. Accompanied by the national government's representatives from ministry of Health, the governor met the volunteers to elaborate on his vision for a healthy Machakos.

Mutua urged the volunteers to join his clarion on Universal Health Coverage registration in the villages

"***My people deserve an efficient health system and I will not condone any sabotage within my government concerning UHC***," Mutua said

He urged all Machakos residents to register and be part of the programme.

"Let's take our health seriously because we have one life to live and a heathy nation is a productive nation," he added.

In Western Kenya, Onyango (2017) found out that Community health volunteers' role in under-five care included health education, assessment, follow up of HIV exposed infants, ARV, and immunization defaulter tracing, dispensing of drugs and referral.

Onyango concluded that CHVs are a link between households, communities and health facilities and cannot be underestimated particularly in health education, health assessment, defaulter tracing, referral and community drug dispensing. She recommends that their roles should be strengthened through continuous training and close supervision by health care workers in the health facilities and under-five health programs where CHVs are attached.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Sites

Two counties with similar malaria endemicity, socio-economic characteristics, geographical features, climate/weather condition and demographic characteristics were compared before and after intervention. One county served as Control (Non-Intervention). The two counties are Migori county in the former Nyanza Province, (the Intervention area) and Kwale county in the former Coast Province (Non- Intervention/ Control area).

3.1.1 Migori County

Migori County is one of the 47 counties in Kenya, situated in the South-Western with area coverage of 2,596.5 square Km including approximately 478 square km of water surface. The Kenya National Census of 2019 indicated that Migori County had a population of 1,116,436 inhabitants.

Migori County borders Homabay to the South, Republic of Tanzania to the South and Southwest, Kisii to the Northeast, Narok to the East and Northeast and Lake Victoria to the West. The County is administratively divided into 8 sub-counties: Suna East, Suna West, Kuria East, Kuria West, Rongo, Nyatike, Awendo and Uriri. Migori is a multi-ethnic county with the dominant tribes being the Luo, Suba, Kuria, Luhya, Kisii and Somalis. The county has an inland equatorial climate modified by the effect of altitude, relief and the influence of Lake Victoria. Rainfall is generally continuous with little distinctions between short and long rains. Long rains come between March and May, while short rains are between September and November. Dry seasons are between December and February and June and September. Nyatike and Kuria East sub counties have comparatively harsher climatic conditions than other sub counties.

Generally, the county does not experience any extreme climatic conditions. Temperatures range between a minimum of 24 Celsius and maximum of 31 Celsius.

The presence of Lake Victoria, Migori and Kuja rivers and the relatively good weather patterns in Migori County have allowed the soils in the region to be well drained, making the county conducive for agriculture. Agricultural produce consists of tobacco, sugar cane, maize, beans, coffee, groundnuts and vegetables. Livestock farming is also undertaken on a small scale. Fishing is also a major activity in Lake Victoria. Due to mineral resources available in the county such as gold and copper, there is a growing mining industry, particularly gold mining.

In 2015 Migori county had 213 health facilities consisting of 126 Public, 17 NGO, 27 faith-based and 43 private.

3.1.2 Kwale County

Kwale country is one of the 47 counties in Kenya, located in the South Coast of Kenya, bordering the Republic of Tanzania to the Southwest, the Indian Ocean to the East and the following counties; Taita Taveta to the West, Kilifi to the North and Mombasa to the North East. The County has a total surface area of 8,270.2 square kilometres of which 62 is water surface and accounts for 1.42 per cent of Kenya's total surface area.

Administratively, Kwale County is divided into 4 sub-counties; Msambweni Sub-County; Matuga Sub-County; Kinango Sub-County and Lungalunga Sub-County. The Kenya National Census of 2019 indicated that Kwale County had a population of 866,820 inhabitants.

Main ethnic communities in the county include the Digo and Duruma clans of the larger Mijikenda tribe and a significant presence of the Kamba tribe.

The County has a tropical type of climate influenced by the monsoon seasons. The average temperature is about 23ºC with a maximum temperature of 25ºC being experienced in

March during the winter monsoon period and minimum temperature of 21ºC experienced in July a month after the start of the southwest monsoon (also known as *Kusi*). Rainfall is bimodal with short rains (*Mvua ya Vuli*) being experienced from October to December, while the long rains (*Mvua ya Masika*) are experienced from March/April to July.

Kwale is mainly an inland County, but it has a coastline south of Mombasa. Kwale County forms a part of the larger Kenyan South Coast well known for its rich tourist attraction sites such as, Diani Beach, globally renowned beach hotels, Shimba Hills National Reserve (the home of Sable antelope), Mwaluganje Sanctuary, marine reserves and parks, indigenous coastal forests and mangroves, coral and swathes of sandy beaches.

In 2019, there were a total of 99 health facilities in Kwale County, 98 were public health facilities categorized as follows; 1 referral hospitals, 3 sub county hospital, 9 health centres and 86 dispensaries distributed in the four sub counties.

Table 3.1: Comparison of the Two Study Sites

Stratification	Migori County (Intervention)	Kwale County (Control)
Geographic (land size, Altitude, physical features, vegetation)	2597 km^2 and 592 km^2 of this is permanently under water. Altitudes: 1,500 meters above sea level.	8270 km^2 and 62 km^2 of this is under water. Altitudes: 400 meters above sea level.
Climate/Weather (Temperature, rainfall)	Two rain seasons Rainfall average 1369 mm per annum Average temperature of 25^0C with maximum mean of 35^0C	Rainfall 400- 1,680mm per annum. Average temperature is 24.2°C
Demographic (population size, growth rate, IMR, U5MR, Life expectancy, TFR, Average size of Household, Population density, poverty levels, Age Dependency Ratio).	917,170 consisting of 476,928 females and 440,242 males, 147931 households 3.05 % growth rate, 50.8-year life expectancy TFR of 6.0 Average size of Households is 6.2 Population density is 353 per square km, Poverty Level 43%: Infant Mortality Rates: 95/1000, Under Five Mortality Rates: 149/1000 Age Dependency Ratio**:** 100:107	649,931 consisting of 333,934 females and 315, 997 males, 122,047 household 2.6 % growth rate, 51.2-year life expectancy. TFR of 5.7 Average size of Households is 5.33. Population density is 79 per square km. Poverty Level: 74.9 % Infant Mortality Rates: 70/1000.

Stratification	Migori County	Kwale County
		Under Five Mortality Rates: 118/1000. Age Dependency Ratio: 100:103
International boundary	Republic of Tanzania Boarder post in Isebania town	Republic of Tanzania Boarder post in Horohoro town
Malaria prevalence Prevalent disease	Malaria **40 %**, HIV/AIDS (Measure Evaluation, 2012)	Malaria 30-40%. (Measure Evaluation, 2012)
	Diarrhoea, and UTI (Urinary Tract Infections)	skin diseases and diseases of respiratory tract system.
Resources	Natural Gold, Water, river Migori,	Wildlife, Livestock, Water, Pasture, Forests
Tourist Attractions	Muhuru bay	Tsavo National Park, Shimba Hills National Reserve, Mwaluganje Elephant Sanctuary, Sheldrick Falls, Maji Moto Springs
Financial Services	Banks, Micro-Finance Institutions, Decentralized funds (CDF & LATF)	4 Commercial Banks, 2 Micro-Finance
Main Economic Activities/industries	Agriculture, mining, Fishing, and manufacturing	Fruits, Livestock, Mixed farming, Fishing, Mining, Commercial Businesses
Agricultural products	Livestock Products, sugarcane, sorghum groundnuts, Maize, Cassava, Millet, Sweet Potatoes, Beans, Rice, Sukuma wiki, sweet potatoes, sweet bananas	Oranges, Maize, Pawpaw, Mangoes, Livestock Products, Fish, Coconuts
Study sites	Itongo CHU and Getongoroma CHU in Kuria East Sub County. Nyamagagana CHU and Gosebe CHU in Kuria West Sub County	Eshu CHU and Mafisini CHU in Msambweni Sub County and Mamba CHU and Kikoneni CHU in Lungalunga Sub County

Migori County (Intervention) **Kwale County (Control)**

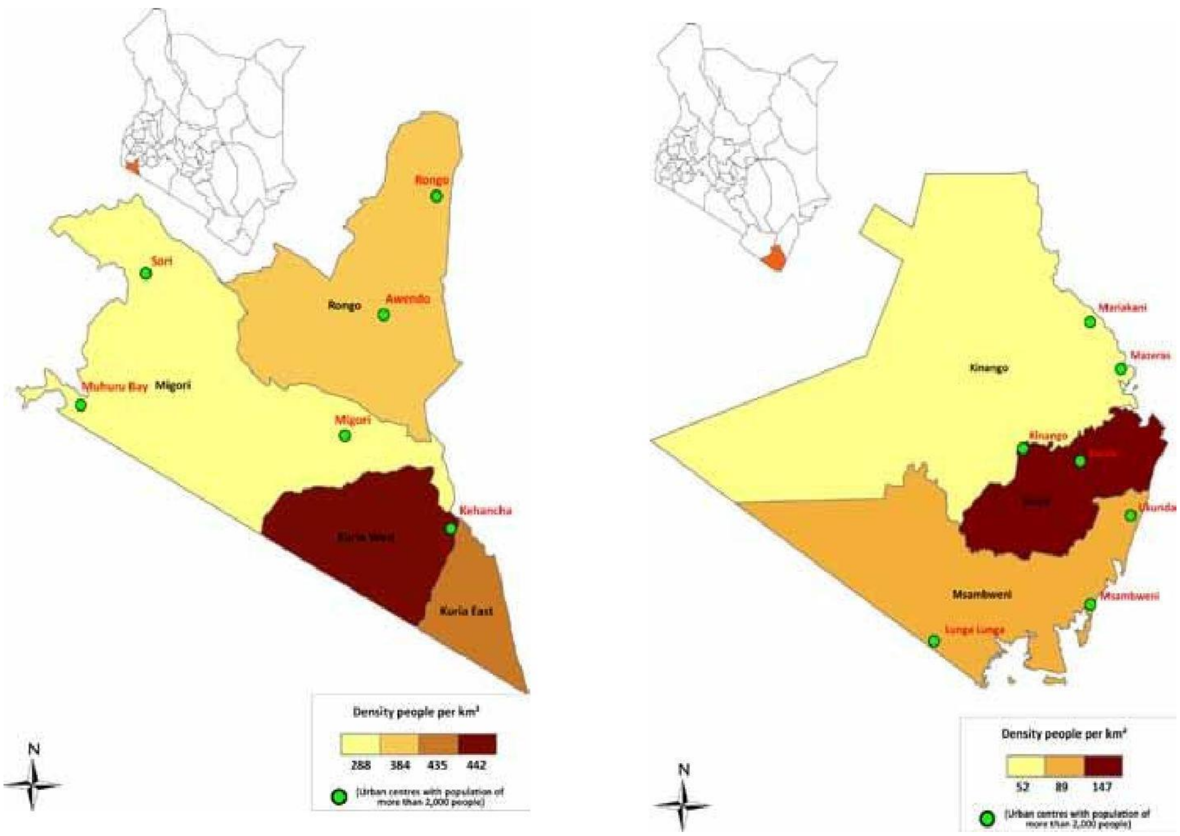

Figure 3.1: Maps of the Study Sites in Migori and Kwale Counties

Source: (Kenya County Maps, 2012)

3.1.3 Study Design

The study design was a quasi-experimental. The primary unit of analysis was the household. Data was collected at two time points: pre-intervention (baseline) and post-intervention. This design allows for comparison between the two counties over time, helping us isolate the effect of the intervention by controlling for other temporal changes that might affect malaria prevalence.

In Migori, the intervention constituted training of Community Health Volunteers (CHVs) by strengthening community health services through establishment of four (4) new community health units (CHUs) in Kuria East and West sub counties of Migori County (Intervention area). An agreement was reached for 2 new CHUs to be established in each of the Sub counties. Kuria west Sub County identified Nyamagagana and Gosebe as the two new units to be established. Kuria East Sub County identified Itongo and Getongoroma as the two new units to be established. In each CHU, the first body constituted for the operationalization of the CHS in a Community Health Unit was the CHC which consisted of 11 members drawn from the various segments in the community. This was followed by the selection of 10 CHVs in each CHU, fourty four (44) CHC member and fourty (40) CHVs were trained on the community health strategy module for three weeks. These were trained by the KeNAAM project officer, Community focal strategy persons and public health officers from the two sub counties. All the 40 targeted CHVs were then trained on community case management of malaria (CCMM, Prevention and Control using the MOH training guidelines for CCMM for three days. The objectives of the training were scaling up of community malaria services and creating, awareness and access to ACTs, LLINs, IPTp, IRS at the community level for the newly formed units, carried out in year one and two of the four years of the project implementation period, comprising the following topics: case management of patients at community level; including immediate testing, treatment and referral of cases. carried out by KeNAAM Project Officers, sub county malaria focal point persons and public health officers from the two sub counties.

The measure of main outcome was assessed by establishing whether the intervention worked or not and the level of uptake of malaria prevention and control interventions by community members especially children <5 years', pregnant women and household members. In summary at baseline in 2012, the implementation of community health strategy in both Migori and Kwale counties had not taken place. At the Control (Kwale County), no training of CHVs took place during the intervention period.

At Kwale (Control) there was no training of CHVs on community strategy, malaria prevention and control including community case management of malaria (CCMM) as well as health behaviour and communication.

By conducting surveys at the household level, we captured a wide range of information on perceived malaria prevalence, control practices, and other health-related behaviors that could have informed the evaluation of the intervention.

3.1.4 Study Population

3.1.4.1 Population Description

The study population included household members, key informant, Focus Group discussants from men, Women and youth groups who live within the four identified CHUs in the study area.

3.1.4.2 Inclusion Criteria

i. Any head of household, key informants and Focus Group discussants from men, Women and youth groups living within the four identified CHUS in the study area in Migori County who gave written or verbal consent.
ii. Adult (above 18 years) household residents within the four identified CHUS in the study area in Migori County.
iii. Adult head of household members who agreed to give a written or verbal informed consent to participate in the study voluntarily.

3.1.4.3 Exclusion Criteria

i. Adult head of household resident who refused to give written or verbal informed consent to participate in the study voluntarily.
ii. Absent adult household residents at the time of the study.

3.1.4.4 Sampling Frame

The sampling frame for this study consisted of all households within the defined geographical boundaries of both Migori and Kwale counties. The most recent census data, provided by the Kenya National Bureau of Statistics (KNBS), served as the foundation for creating the sampling frame. This data includes the number of households in each administrative unit (e.g., sub-counties or wards) in both counties. By using this official data, we ensured that our sampling frame was comprehensive and up-to-date, accounting for any recent population changes. This enabled us to ensure that the sample is representative of the population within each county, taking into account the diversity in household structures, demographics, and geographic locations.

3.1.4.5 Sample Size Calculation

The sample size for this study was calculated to ensure sufficient power to detect the effect of the intervention on perceived malaria prevalence in the two counties, Migori (intervention county) and Kwale (control county).

To estimate the required sample size, we considered the following parameters:

- **Significance Level (α)**: A 95% confidence interval was chosen, corresponding to a significance level of 0.05, which translates to a Z-value of 1.96.
- **Power (1−β)**: The desired power of the study was set at 80%, corresponding to a Z-value of 0.84.
- **Standard Deviation of Outcome Measure**: Based on prior studies, we assumed the standard deviation of perceived malaria prevalence to be 25% (0.25).
- **Minimum Detectable Effect (MDE)**: We aim to detect a 10% change in malaria prevalence, set as the minimum detectable effect (Δ=0.10).

Using these parameters, the required sample size for each group (Migori and Kwale counties) was calculated using the following formula by Clifton *et al.*, (2019)

$$n = \frac{r+1}{r} \times \frac{(Z_{\propto/2} + Z_{\beta})^2 \times \sigma^2}{\Delta^2}$$

Where:

- n is the required sample size per group.
- r sample allocation ratio between groups (this calculation assumes 1:1 between Migori and Kwale)
- $Z_{\propto/2}$ is the Z-value for the significance level, which is 1.96.
- Z_{β} is the Z-value for the power, which is 80%.
- σ^2 is the variance of the outcome measure, which is 0.0625.
- Δ is the minimum detectable effect, which is 0.10.

Based on the calculation, the required sample size for each county (Migori and Kwale) is approximately 384 households per county for both the pre-intervention and post-intervention periods.

This means that at baseline, a total of 768 households (384 from Migori and 384 from Kwale) were to be interviewed. The same number of households were to be interviewed at the endline.

This sample size ensures that the study will have sufficient statistical power to detect a 10% change in malaria prevalence between the two counties, accounting for both temporal and county-level differences.

3.1.4.6 Stratified Random Sampling

To account for heterogeneity within both Migori and Kwale counties, we used a stratified random sampling approach. Stratification divides the population into subgroups (or strata) based on characteristics that are expected to influence the outcome variable, such as geographical location, urban vs. rural settings, and socio-economic factors.

By stratifying the population, we ensured that different subgroups were proportionately represented in the sample, which improved the precision of the estimates and made the results more generalizable to the entire population.

In both counties, the primary stratification was based on administrative units, such as sub-counties, wards, villages/Community Health Units (CHUs), to capture potential differences in malaria prevalence across regions. Stratification by urban and rural areas further refined the sampling process, as malaria transmission and prevention strategies may differ significantly between urban and rural populations. In urban areas, access to healthcare and malaria prevention programs might be more widespread, whereas rural areas might face different challenges, such as limited healthcare access or higher malaria transmission rates.

Once the strata are defined, the next step was to randomly select administrative units from each stratum. Within each selected administrative unit, households were randomly selected to participate in the study. This method ensured that every household had an equal chance of being selected, and that the sample was representative of the county's overall population in terms of key stratification variables.

3.1.4.7 Statistical Analysis

Quantitative data was entered into Epi-Info version 7.2.1.0 and analyzed using Stata version 11.2, hypothesis tested and finally presented in tables, graphs and text. To conduct an exploratory Difference-in-Differences (DiD) analysis for malaria control and prevention outcomes in Migori (the intervention county) and Kwale (the control county), the primary focus is on quantifying the changes in malaria-related indicators, such as malaria prevalence and the use of preventive measures, in percentage terms. The DiD approach, in this context, does not involve fitting a formal statistical model, but instead compares the percentage changes in the selected outcomes over time (from baseline to endline) for both counties. This method allowed us to evaluate the effect of the intervention in Migori, while Kwale serves as a control.

The first step was to collect data at two time points: baseline (before the intervention) and endline (after the intervention) for both counties. The key indicators, such as malaria prevalence, bed net usage, and other prevention practices, were measured at both time points. The percentage change in each indicator for both counties from baseline to endline was then calculated. For example, if malaria prevalence in Migori decreases from 30% at baseline to 20% at endline, the percentage change is a reduction of 10%. Similarly, the percentage change for Kwale is calculated, and these changes are compared. The Difference-in-Differences (DiD) approach was used to quantify the differential changes in malaria outcomes between the two counties. This was done by calculating the difference in percentage changes between the two counties. For instance, if Migori shows a 10% reduction in malaria prevalence and Kwale shows only a 5% reduction, the DiD difference is 5%. This value represents the additional change in the malaria outcome in the intervention county (Migori) compared to the control county (Kwale). If the difference is large and statistically significant, it suggests that the intervention in Migori had a greater impact than the changes observed in Kwale. The DiD method, while relying on percentage differences, provided a straightforward way to assess the relative effectiveness of the intervention without the need for complex statistical models. To assess the significance of the DiD, we examine the confidence intervals of the computed difference between Migori and Kwale, measured as Odds Ratios for both baseline and endline separately. If the confidence intervals do not overlap, it indicates a statistically significant difference between the two counties.

In the second step, to carry out tests of significance we employed the Regression methodology on selected household data. The study examined the impact of an intervention on various factors, including Net Ownership, Net Use by Household, Net Use by Children, Net Use by Pregnant Women, Malaria Testing, Tests by Community Health Volunteers (CHVs), Malaria Positivity, ACT (Artemisinin-based Combination Therapy) within 24 hours, and ACT Received. The analysis compared data from Migori and Kwale, using baseline and endline data to assess the intervention's effects. To evaluate the impact, we fitted a logistic regression model that analyzed the difference-in-difference, adjusting for the intervention (Migori vs. Kwale), time point (Endline vs. Baseline), and the interaction between the intervention area and time point. We also adjusted for potential confounders, including household size and the sex of the household head. The results focus on the effect of the interaction term, which captures the difference-in-difference, representing the impact of the intervention. We also report 95% CIs and p – values associated with this impact. For malaria morbidity data we used a Paired t-test to test for Malaria Rates for Under 5 years and above Five years in the (Intervention Group) as well as the (Control group) to get The mean difference in malaria rates per 1000 population between 2013 and 2016.

Qualitative data were sorted, aggregated from the 8 FGDs and responses of each FGD Participants. Recorded interviews were transcribed and interview field notes typed using Microsoft word document. The information was read through severally, patterns identified, with similar content being aggregated into thematic categories. A thematic framework was followed to analyze the transcribed data. The findings are presented as distinctive verbatim quotes and summary tables and presented in the results section (chapter 4) to corroborate and triangulate the quantitative data.

3.2 Study Tools

Focus group and in-depth interview guides were used to generate qualitative data. Questionnaires, Rapid Diagnostic Tests (RDT) and ACTs consumption data tools were used to generate quantitative data. All research tools were pre-tested in a local area and adjusted subsequently.

3.3 Data Collection Methods

3.3.1 Quantitative Data

Health facility data on malaria morbidity was gathered on monthly basis by trained two KeNAAM project staff and aggregated annually from the four CHUs in both intervention and non-intervention areas from January 2013 to December 2016.

A structured questionnaire to collect quantitative data was developed to gather and collate information on access and utilization of malaria control interventions (ACTs, LLINS, IRS and IPTp) by household respondents. Research Assistants were trained on the data collection procedures at the household and were supervised by the researcher. The household respondent, who as either head of the household or an adult representative gave response to questions from the structured questionnaire. Questionnaires were filled manually and entered into an excel sheets. After filling the questionnaires were handed over to the supervisor for archiving.

A total of 384 households were to be interviewed, each at baseline and endline in both intervention and control study sites. However, a total of 1206 and 578 households were involved in the research in the baseline and endline survey respectively at the intervention area. The difference in the reduction of samples is because the project had 40 trained CHVs, each covering 100 households and therefore was each randomly allocated 30 households to obtain the baseline data to give a total of 1206. At endline the sample reduced to 578 due to logistic challenges but fell within the determined sample size of 384. The assumption was that the greater the sample taken the better the representation of the bigger population. While in the Control area a total of 878 and 430 households were involved in the research in the baseline and endline surveys respectively. The difference in the reduction of sample take is for the same reason as explained above.

3.3.2 Qualitative Data

Guides on Focus Group Discussions (FGDs) and In-depth Interviews (IDIs) to collect qualitative data were developed to gather and collate information on access and utilization of malaria control interventions (ACTs, LLINS, IRS and IPTp) by participants.

The researcher and two trained degree holder research assistants participated in the FGDs and IDIs with heads of households and key informants. The researcher was on site for all interviews/FGDs and was able to address any concerns that the trained research assistants raised. To comprehensively answer the research questions and overcome errors implicit in each type of study methods of data collection, triangulation was applied. Triangulation was carried by collecting information on access and utilization of malaria control interventions (ACTS, LLINs, IRS, IPTp) and malaria morbidity using both qualitative methods such as FGDs, KIIs as well as quantitative method using structured questionnaires and routine data from health facility and project activities.

3.3.3 Focus Group Discussions (FGDs)

The FGDs were used to explore participants' knowledge, attitudes, access and utilization of malaria control interventions (ACTs, LLINS, IRS and IPTp). Eight (8) FGDs were conducted at each of the study sites (Intervention and Control). Each FGD consisted of between 10 -12 participants. FGDs were conducted with CHVs, Women group members, Youth groups members and Men group members.

3.3.4 In-Depth Interviews (IDIs)

IDIs were used to provide individual accounts of access and utilization of malaria control interventions (ACTs, LLINS, IRS and IPTp). IDI were conducted with women, youth and men.

3.3.5 Key Informant Interviews (KIIs)

Key informants were interviews to understand their attitudes and utilization of malaria control interventions (ACTs, LLINS, IRS and IPTp). KIIs were conducted with facility in charges, Sub County community strategy focal point persons, Sub County public health officers, Community health assistants, Chiefs, assistant chiefs, and village Elders.

3.4 Data Management

Various quality control measures were placed to ensure the quality of information collected was guided. The measures included involvement of suitable fieldworkers'/research assistants and training them on the study protocol, pre-testing of study tools and supervision during data collection.

Quantitative data captured in questionnaires were coded after collection and double entered in Ms Access. Any inconsistencies were dealt with immediately. To ensure consistency and completeness in qualitative data, clear requirements for the tools were continually expressed to the data collectors. At the end of each FGD and in-depth interview, there was debriefing about the salient issues arising out of the process, anomalies that occurred and what their overall opinions of the discussion/interview were.

3.5 Ethical Considerations

The study was approved by the Maseno University Ethical Review Committee (MUERC), protocol number MSU/DRPO/MUERC/0038/17. The baseline survey was approved by KENAAM and the SCHMTS of Kuria east and West sub counties (appendices 9 and 11).

Prior to the start of the study, permission was sought from the local community leadership and other relevant authorities in the selected areas in which the study was conducted. The study informants were fully informed about the aims and objectives of the survey before being included in the study. Written consent was sought from each informant, and they were fully informed about their right to decline or withdraw at any time from participating in the study without feeling constrained. Confidentiality was assured to each informant and ensured during the data collection and analysis processes. The study lasted four (4) years. Study participants gained in this study in the form of advocacy for the utilization of malaria control intervention. The information collected from participants was for research purposes only and strictly private and confidential. No information about the participants or provided by the participants during the research was disclosed to others without their written permission, except to protect the rights or welfare, or if required by law. Names were not used at any point and is of no purpose for this study and no information was included that would reveal the identity on publications or in conferences. In case officials from the authorized institutions were needed to review the records for the study, they protected participant’s privacy.

CHAPTER FOUR

RESULTS

4.1 Sample Size Achievements and Response Rate

The sample size of 768 was calculated to detect a 10% change in malaria prevalence between the two counties with 80% power. However, extra interviews were conducted beyond the initially planned number at both baseline and endline in each of the 2 sites (Table 4.1)

Table 4.1: Sample Size Achievements

County	Targeted sample size	Achievement at Baseline	Achievement at Endline	Total
Migori	384	1206	578	1784
Kwale	384	878	430	1308
Total		**2084**	**1008**	**3092**

Reasons for exceeding the targeted sample size are that each of the CHP was allocated 30 households for the 3 days of the data collection exercise, and there was no mechanism for controlling how many interviews they were going to conduct. Hence, exceeding the targeted sample size.

4.2 Socio-Economic and Demographic Profile of households in Migori and Kwale

In Migori, a total of 1206 and 578 households were involved in research in the baseline and endline survey respectively. The average family size was 5.8 and 6 during baseline and endline survey respectively. Gender balance was good in the research, 49.6% were males and 50.4% were females while 49.7% were males and 50.3 were female during baseline and endline surveys respectively. The main source of income among households was farming 85.7% at baseline and 77.6%) at endline.

In Kwale, a total of 878 and 430 households were involved in the research in the baseline and endline survey respectively. Gender balance was good in the research, 49.63% were males and 50.37% were females while 49.81% were males and 50.19% were female at baseline and endline surveys respectively (Table 4.2).

Table 4.2: Socio- Economic and Demographic Profile of Households in Migori and Kwale

	MIGORI		**KWALE**	
	Baseline	**Endline**	**Baseline**	**Endline**
Households visited	1206	578	878	430
Gender				
Male	598 (49.6%)	285 (49.3%)	436 (49.63%)	214 (49.81%)
Female	608 (50.4%)	293 (50.3%)	442 (50.37%)	216 (50.19%)
Average size of Household	5.9	6.0	5.9	6.0
Minimum	1.0	1.0	2.0	2.0
Maximum	11.0	10.0	10.0	11.0
Average size of land (acres)	4.5	6.8	5.0	7.0
Minimum	0.0	2.0	3.0	4.0
Maximum	35.0	24.0	30.5	50.0
Source of income				
Farming	1034 (85.7%)	449 (77.68%)	790 (90%)	387 (91%)
Self-Employment	71 (5.9%)	47 (8.20%)	26 (2.9%)	15(3.5%)
Formal Employment	25 (2.1%)	17 (3.0%)	40(4.6%)	18(4.1%)
Business	52 (4.3%)	57 (9.9%)	22(2.5%)	4(0.93%)
None	24 (2.0%)	8 (1.4%)	0 (0%)	6(1.37%)
% HH in Possession				
A watch	345 (28.6%)	282 (48.8%)	187(21.6%)	200 (46.5%)
A bicycle	247 (20.5%)	169 (29.2%)	203 (23.1%)	130 (30.2%)
A motorcycle or motor scooter	91 (7.5%)	98 (17.0%)	89 (10.1%)	65 (15.10%)
A car or truck	72 (6.0%)	57 (9.9%)	65 (7.4%)	53 (11.1%)
A bank account	362 (20.0%)	152 (26.3%)	255 (29.0%)	153 (35.6. %)
Mpesa Account	611 (50.66%)	462 (79.9%)	445(50.66%)	332 (77.2%)
Mobile Phone	749 (62.1%)	477 (82.5%)	664 (75.6.1%)	350 (81.4%)

4.3 The Influence of the Use of Trained CHVs on Utilization of Malaria Prevention and Control Intervention in Migori County

4.2.1 Net Ownership and Utilization by Households in Migori and Kwale

Households with at least one Mosquito net (LLIN) in Migori increased more significantly compared to Kwale while nets in use the night before Survey by household members in Migori increased more compared to Kwale.

There was a significant increase in Nets use the night before Survey by children <5 years in Migori compared to Kwale. However, more pregnant women in Migori used nets the night before compared to those in Kwale.

There was a higher proportion of households' representative who attended a net hanging demo in Migori compared to Kwale, suggesting an increased proportion of nets hanging properly in Migori.

Table **4.3** shows that Nets in use the night before survey by children <5 years increased more significantly in Migori compared to Kwale. While net in use the night before survey by pregnant women increased more in Migori compared to Kwale.

Table 4.3: Net Ownership and Utilization by Households in Migori and Kwale

	MIGORI		**KWALE**	
	Baseline	**Endline**	**Baseline**	**Endline**
Households visited	1206	578	878	430
Household Nets Ownership (Household owning at least one 1 net)	794 (65.8%)	532 (92.0%)	816 (92.9%)	396 (92.0%)
Nets in use the night before Survey by household members	474 (39.3%)	560 (96.8%)	265 (21.9%)	310 (72.0%)
Nets in use the night before Survey by children <5 years	496 (36.77%)	608 (80.4%)	294 (68.0%)	150 (72.0%)
Net in use the night before Survey by pregnant women	234 (38.6%)	72 (60.2%)	16 (28.5%)	10 (36.0%)
Proportion of households Representative who attends a net hanging demo	271 (22.5%)	427 (73.8%)	290 (33.0%)	237 (55.0%)
Proportion of nets hanging Properly	416 (34.5%)	414 (71.6%)	686 (78.1%)	331 (77.0%)

Impact of the use of trained CHVs on utilization of malaria prevention and control intervention in Migori County.

Table 4.4 below shows the difference –in differences for comaparing the changes in outcome at baseline and endline between Migori and Kwale

Table 4.4: Test of Difference in Differences (DiDs) between Intervention and Control

Variable	DiD	Odds Ratio	Lower 95% CI	Upper 95% CI	P-value
Household Nets Ownership	27.10 %	8.29	4.82	14.28	<0.0001
Net use by household	2.60%	7.92	4.33	14.49	<0.0001
Net use by children < years	39.63%	6.05	4.27	8.57	<0.0001
Net use by pregnant women	14.10%	1.53	1.11	2.10	0.0094
Proportion of HH who attended net hanging demo Campaign	29.3%	9.07	5.12	15.15	<0.0001
Proportion of net Observed hanging properly	38.2%	5.98	4.10	8.37	<0.0001

At baseline, a higher percentage of households in control areas (92.9%) owned nets compared to intervention areas (65.8%), resulting in a difference of -27.1%. This disparity suggests that, prior to the intervention, net ownership was already higher in the control areas, potentially due to pre-existing health initiatives or infrastructure that facilitated net distribution in these regions. By endline, however, net ownership was equalized across both groups at 92.0%, indicating the intervention's success in bridging this gap. The difference-in-differences (DiD) of 27.1% with an Odds Ratio (OR) of 8.29 (95% CI: 4.82 to 14.28, $p < 0.001$). This suggests that individuals who own a mosquito net are more than eight times more likely to benefit from the malaria prevention intervention compared to those who do not own a net. This suggests that the intervention contributed to a substantial relative increase in net ownership in intervention areas compared to control areas, aligning with findings from other studies that have shown the effectiveness of targeted interventions in promoting equitable access to preventive health commodities like bed nets. The statistical significance (OR of 8.29 (95% CI: 4.82 to 14.28, $p < 0.001$) of this change provides robust evidence of the intervention's effectiveness in improving net ownership, a crucial step toward malaria prevention.

For net use at the household level, baseline data revealed that a higher percentage of households in intervention areas (39.3%) used nets compared to control areas (21.9%), with a difference of 17.4%. By endline, net use had increased to 96.8% in intervention areas and 72.0% in control areas, resulting in a difference of 14.8%. The DiD calculation of 2.6% indicates a modest, yet statistically significant (OR of 7.92 (95% CI: 4.33 to 14.49,

$p < 0.001$), increase in net use in the intervention areas relative to the control areas. This suggests that the intervention was effective in sustaining net use behavior, but the relatively smaller effect size may be indicative of barriers to continued behavior change that persist even after the intervention, such as cultural factors or lack of reinforcement. Similar findings have been reported in other studies where while net ownership improved, consistent use was more challenging to achieve. Despite this, the intervention appears to have contributed to a lasting change in behavior, a critical factor in long-term malaria prevention efforts.

Among children under five, baseline net use was significantly higher in control areas (68.0%) than in intervention areas (36.8%), resulting in a difference of -31.2%, with an OR of 6.05 (95% CI: 4.27 to 8.57, $p < 0.001$). Children who use mosquito nets are more than six times more likely to benefit from the intervention compared to those who do not use nets (appendix1). This suggests that, at baseline, control areas may have had stronger maternal and child health programs or more widespread awareness of the importance of net use for young children. However, by endline, the intervention had a profound impact on increasing net use in intervention areas (80.4%) relative to control areas (72.0%), resulting in a difference of 8.4%. The DiD calculation of 39.6% highlights a substantial improvement in the net use among children under five in intervention areas, indicating that the intervention specifically benefited this vulnerable group. This aligns with other studies that have found targeted interventions for young children to be effective in improving net use. The significant change observed in the intervention areas points to the potential for focused interventions to reduce childhood morbidity and mortality associated with malaria.

For pregnant women, the baseline net use was already higher in intervention areas (38.6%) compared to control areas (28.5%), yielding a difference of 10.1%. By endline, the intervention areas saw a considerable increase in net use to 60.2%, while control areas saw a smaller increase to 36.0%, producing a difference of 24.2%. The DiD of 14.1% with an OR of 1.53 (95% CI: 1.11 to 2.10, $p = 0.0094$). While statistically significant, the smaller effect size compared to other groups suggests that while net use during pregnancy does provide some protective benefit, it may not be as strong as the effect observed in children or households. However, it suggests that the intervention was particularly effective in increasing net use among pregnant women, a group that is at heightened risk for malaria. Studies have consistently highlighted the importance of protecting pregnant women from malaria, as they are more vulnerable to the adverse effects of infection, including maternal anemia, low birth weight, and even death. The intervention's success in improving net use among pregnant women is consistent with the literature emphasizing the need for focused interventions to protect this high-risk group.

In terms of attendance at net hanging demonstrations, baseline participation was higher in control areas (33.0%) compared to intervention areas (22.0%), with a difference of -10.5%. By endline, however, participation increased significantly in both areas, reaching 73.8% in intervention areas and 55.0% in control areas, resulting in a difference of 18.8%. The DiD calculation of 29.3% demonstrates that the intervention was highly effective in promoting engagement with net hanging demonstrations, which are crucial for ensuring proper net use and maintenance. This outcome is consistent with previous research showing that education and skill-building interventions, such as net hanging demonstrations, can improve both the correct use and longevity of malaria prevention tools. The significant increase in attendance in intervention areas suggests that the intervention successfully increased community participation and awareness, which are vital for the sustainability of malaria prevention efforts.

Finally, regarding the proper hanging of nets, baseline observations revealed that control areas (78.1%) had a higher percentage of properly hung nets compared to intervention areas (34.5%), with a difference of -43.6%. By endline, the rates of properly hung nets in intervention areas improved to 71.6%, though control areas remained higher at 77.0%, resulting in a difference of -5.4%. The DiD calculation of 38.2% indicates a marked improvement in the proper hanging of nets in intervention areas, suggesting that the intervention not only increased net ownership and use but also had a positive effect on the quality of net use. This aligns with findings from other studies that emphasize the importance of not just distributing nets but also ensuring that they are used correctly for maximum effectiveness in preventing malaria transmission. The significant improvement in proper net hanging in intervention areas highlights the intervention's broader impact on malaria prevention, reinforcing the importance of integrating both behavior change and technical training into malaria control programs.

Collectively, these findings provide compelling evidence that the intervention had a meaningful and statistically significant impact on net ownership, use, and the proper hanging of nets across multiple target groups. This evidence supports the growing body of literature that underscores the importance of integrated malaria prevention strategies that combine both access to tools and behavior change interventions, particularly for vulnerable populations such as children and pregnant women.

4.2.2 Results from the Focus Group Discussions

This section presents findings of the Focus Group Discussions (FGDs) with CHVs, men, women and youth groups from the study area. The information is from the 8 FGDs and responses of each FGD Participants shown in table 4.5 below.

Table 4.5: FGD Findings on the Net Ownership and Utilization by Respondents. in Migori and Kwale Counties

	Migori (Intervention)		Kwale (Control)	
Net ownership and utilization	**Baseline findings (reasons)**	**Endline findings (reasons)**	**Baseline findings (reasons)**	**Endline findings (reasons)**
What Motivate household members to sleep under a net	Fear of mosquito bites and nuisance, To avoid getting or contracting malaria High cost of treating malaria. After receiving health talks.	Prevention of malaria. Avoid mosquito's nuisance and noise at night. To avoid the cost of treating malaria.	Keeping us way from mosquitoes.	To avoid mosquito bites. To keep us off from getting malaria.
What makes a household member not to sleep under a net	Feels like one is suffocating or lacking fresh air under the net, Feels hot when under the net Allergic to the net e.g. itchiness Have no time to tie the net or just laziness/ carelessness Forgetting to tie the net at night Lack of a bed.	Lack of space to hang the nets in the house. Stuffiness when covered under the net. Allergic Reaction such as itchiness. Torn mosquito nets which make no sense to hang them.	They make the bed to be hot at night We feel very uncomfortable sleeping under a net.	Stuffiness when covered under a bed net. When the weather is hot it becomes unbearable to sleep under the net.

Generally, most household owned nets during baseline survey but some were either torn or completely worn out for effective malaria prevention,

"***I have two mosquito*** **nets*****; they are all torn and even worn out. I no longer hung them on my beds*** FGD with women at Baseline, Kuria West Sub-County.

All respondents of FGD owned and used mosquito nets for the prevention of malaria during the endline survey. The average number of people who slept under bed nets the previous night before the survey at baseline in Migori improved from four (4) to five (5) at baseline and endline respectively.

"In our routine household visits, we realized that some community members never aired their new mosquito nets before hanging. They complained of getting itchiness and some allergic reactions. This made them not to sleep under the mosquito net". CHVs FGD at Endline, Kuria West Sub County.

During mass net distribution communities were not informed about airing of nets before hanging. CHVs had to provide information on the airing of new nets before hanging during routine household visits after the mass net distribution.

4.3 The Proportion of Malaria Cases Seen at Health Facilities That Receive Prompt and Effective Malaria Treatment in Migori county

4.3.1 Access to Diagnosis, Treatment and Utilization of Case Management by Households in Migori and Kwale Counties

There was an increase in malaria testing by CHVs, an increased uptake of ACT within 24 by those with fever and a decrease in malaria case incidence in Migori compared to Kwale (Table 4.6), with Table 4.7 showing the difference in differences between intervention and control.

Table 4.6: Access to Diagnosis, Treatment and utilization of Case Management by Households in Migori and Kwale Counties

Households visited	MIGORI Baseline 1206	Endline 578	KWALE Baseline 878	Endline 430
Households with at least one				
Malaria case incidence	443 (36.73%)	171 (29.58%)	560 (63.7%)	262 (61.0%)
Number tested for malaria	546 (45.5%)	540 (93.5%)	351 (40.0	232
Tests performed by CHVs			%)	(54.0%)
Malaria tests results positive	0 (0.0%)	252 (43.6%)	0 (0.0%)	23 (5.4%)
Malaria tests results negative	1105(96.6%)	494 (85.4%)		
How Long after fever started was	101 (8.4%)	84 (14.6%)	717 (81.6%)	206 (48.0%)
ACT taken within 24 hours	397 (32.9%)	300 (51.9%)	162 (18.4%)	206 (48.0%)
Positive cases that Received ACT				
Those that Received ACT from	1172	574 (99.3%)	70 (8%)	43 (10.0%)
Public health facilities	(97.2%)	293 (50.69%)	878 (100%)	430(100%)
Those who received ACT from	548 (45.4%)	231 (40.0%)	685(78.0%)	344 (80.0%)
CHV	0 (0.0%)		0 (0/0%)	22 (5%)

Table 4.7: Test of Difference in Differences (DiDs) Between Intervention and Control

Variable	DiD value	Odds Ratio	Lower 95% CI	Upper 95% CI	p - value
Malaria Tests	34.0%	7.87	5.27	11.74	<0.0001
Tests by CHV	38.23%	11.5	-	-	0.9975
Malaria positive	22.4%	0.82	0.50	1.34	0.4274
ACT taken Within 24hrs	17.0%	1.92	1.24	2.98	0.0035
ACT Received from Public	4.09%	3.52	-	-	0.9994

At baseline, 63.7% of households in control areas reported at least one malaria case, compared to 36.73% in intervention areas, reflecting a 26.79% difference. By endline, 61.0% of households in control areas reported malaria cases, compared to 29.58% in intervention areas, showing a 31.42% difference.

The difference-in-difference calculation revealed a 4.45% higher malaria incidence in the control areas compared to the intervention areas. This decrease in malaria incidence in the intervention areas is supported by findings from a study such as the KMIS 2010 and KMIS 2015, which showed that community-level interventions, including educational campaigns and insecticide-treated nets, reduced malaria transmission significantly. The statistical significance of this difference underlines the robustness of the intervention's impact.

In terms of malaria testing, the intervention areas showed a higher percentage of individuals tested at baseline (45.50%) compared to the control areas (40.0%), a difference of 5.5%. By endline, 93.50% of individuals in the intervention areas were tested, compared to 54.0% in the control areas, reflecting a 39.5% difference. The difference-in-difference calculation revealed a 34.0% greater increase in testing rates in the intervention areas with an OR of 7.87 (95% CI: 5.27 to 11.74, $p < 0.0001$), aligning with similar findings in studies which demonstrated that increased testing coverage through community-based initiatives led to higher detection rates of malaria. The statistical significance (OR of 7.87 (95% CI: 5.27 to 11.74, $p < 0.0001$) of this difference emphasizes the success of the intervention in improving testing accessibility and coverage.

The involvement of Community Health Volunteers (CHVs) in malaria testing also showed marked improvements. Initially, no tests were performed by CHVs in either group, but by endline, 43.63% of individuals in the intervention areas had malaria tests performed by CHVs, compared to 5.4% in the control areas, yielding a 38.23% difference. This 38.23% increase is similar to the findings of other studies which highlighted that CHVs, as trusted members of the community, are effective at increasing access to malaria testing, particularly in remote and underserved areas. The statistical significance further suggests the intervention's effectiveness in leveraging local health resources.

Regarding malaria test results, 96.60% of tests in the intervention areas were positive at baseline, compared to 81.60% in the control areas, reflecting a 15.0% difference. By endline, the intervention areas had 85.40% positive test results, compared to 48.0% in the control areas, showing a 37.40% difference. The difference-in-difference calculation indicated a 22.40% higher rate of positive results in the intervention areas, which is in line with studies that found that improved diagnostic practices through community-based interventions led to more accurate identification of malaria cases, contributing to timely treatment.

In contrast, malaria test negatives were more prevalent in control areas. At baseline, 18.40% of tests in the control areas were negative, compared to 8.40% in the intervention areas, reflecting a 10.0% difference. By endline, 48.0% of individuals in the control areas tested negative, compared to 14.60% in the intervention areas, yielding a 33.40% difference with an OR of 7.87 (95% CI: 5.27 to 11.74, $p < 0.001$. This suggests that individuals who have been tested for malaria are nearly eight times more likely to benefit from the intervention compared to those who were not tested. The significant association between malaria testing and intervention underscores the importance of diagnostic services in malaria control efforts. Testing plays a critical role in identifying individuals with malaria infection, facilitating early treatment, and preventing the spread of the disease. The ability to detect malaria infections early, combined with appropriate treatment, can dramatically improve health outcomes and reduce the incidence of severe malaria. This result emphasizes the need for strengthened diagnostic infrastructure in malaria-endemic areas, ensuring that individuals have access to timely and accurate malaria testing as part of comprehensive prevention and treatment strategies. The difference-in-difference calculation showed a 23.40% higher rate of negative results in control areas, which suggests that, in the intervention areas, the intervention had a more focused impact on the detection and management of malaria cases, as seen in similar research.

The timing of ACT administration also showed improvements in the intervention areas. Initially, 32.90% of individuals in the intervention areas received ACT within 24 hours of fever onset, compared to 8.0% in the control areas, a 24.9% difference. By endline, 51.90% of individuals in the intervention areas and 10.0% in the control areas received ACT within 24 hours, resulting in a 41.90% difference. The difference-in-difference calculation revealed a 17.0% greater proportion of individuals receiving timely ACT in the intervention areas with an OR of 1.92 (95% CI: 1.24 to 2.98, $p < 0.0035$), echoing findings from studies which highlighted the importance of timely treatment in reducing malaria morbidity and mortality. The statistical significance (OR of 1.92 (95% CI: 1.24 to

2.98, $p < 0.0035$) of this result underscores the effectiveness of the intervention in ensuring timely access to treatment.

In terms of ACT administration for positive malaria cases, the intervention areas initially had 97.20% of positive cases receiving ACT, compared to 100% in the control areas, reflecting a 2.80% difference. By endline, 99.30% of positive cases in the intervention areas received ACT, compared to 100% in the control areas, showing a 0.70% difference. The difference-in-difference calculation indicated a 2.1% higher rate of ACT administration in the intervention areas, suggesting that the intervention successfully enhanced ACT accessibility. This finding is supported by other studies, which found that increasing ACT availability and uptake in community-based settings leads to improved treatment outcomes.

Regarding the administration of ACT from public health facilities, control areas initially had 78.80% of individuals receiving ACT, compared to 45.40% in the intervention areas, a 33.40% difference. By endline, 50.69% of individuals in the intervention areas received ACT from public health facilities, compared to 80.0% in the control areas, showing a 29.31% difference.

The difference-in-difference calculation showed a 4.09% higher rate of ACT administration from public health facilities in the intervention areas, suggesting that the intervention may have helped to reduce dependency on public health facilities for treatment, in line with other studies which demonstrated that improving access to community-based health services can reduce reliance on formal healthcare facilities for malaria treatment.

Finally, the proportion of individuals receiving ACT from CHVs was 0% in both areas at baseline. By endline, 40.0% of individuals in the intervention areas received ACT from CHVs, compared to 5.0% in the control areas, yielding a 35.0% difference. This 35.0% difference is consistent with the findings of other studies which showed that CHVs were instrumental in improving access to ACT in malaria-endemic regions. The statistical significance of this finding further underscores the success of the intervention in integrating CHVs into the malaria treatment framework. In summary, the intervention led to significant improvements across multiple malaria-related outcomes, including case incidence, testing, treatment timing, and treatment accessibility. These findings are consistent with previous research demonstrating the effectiveness of community-based malaria interventions in improving diagnosis, treatment, and overall disease control. The statistical significance of these results highlights the intervention's potential as a model for malaria control in similar settings.

4.3.2 Confirmed Annual Malaria Cases per 1000 in Migori County CHUs 2013 to 2016

Figure 4.1 shows the annual malaria cases per 1000 population at risk in under and above five years old for all facilities between 2013 and 2016. Overall, the annual malaria cases per 1000 population at risk decreased from **703/1000** in 2013 to **351/1000** in 2016 for above five years of age, while in under five years of age it decreased from 4204/1000 in 2013 to 1413/1000 in 2016.

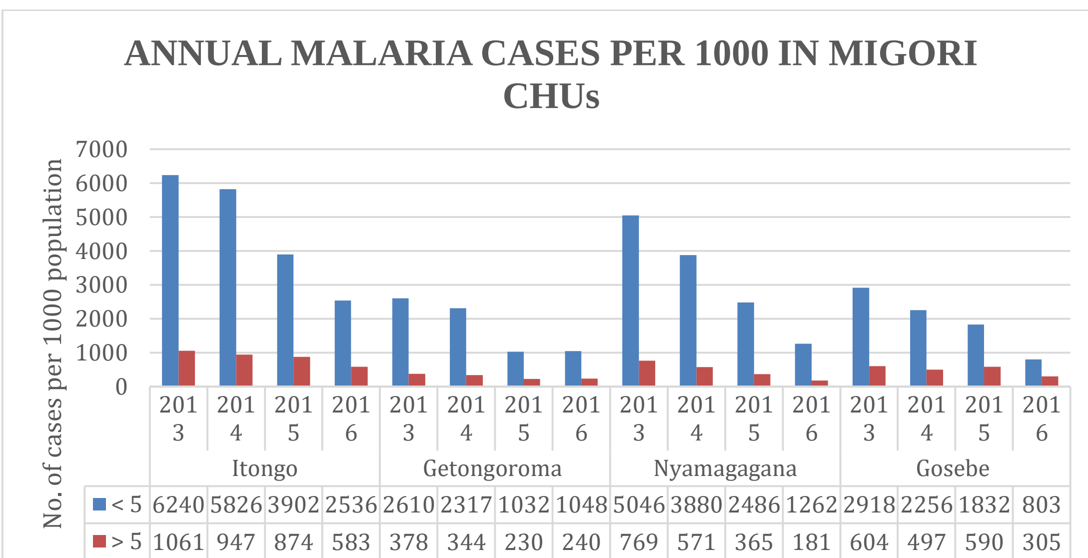

Figure 4.1: Confirmed Annual Malaria Cases per 1000 in Migori County CHUs 2013 to 2016

4.3.3 Confirmed Annual Malaria Cases per 1000 in Kwale County CHUs 2013 to 2016

Figure 4.2 shows the annual malaria cases per 1000 population at risk in under and above five years old for all facilities between 2013 and 2016. Overall, the annual malaria cases per 1000 population at risk increased from **345/1000** in 2013 to **517/1000** in 2016 for above five years of age, while in under five years of age it increased from **998/1000** in 2013 to **1228/1000** in 2016.

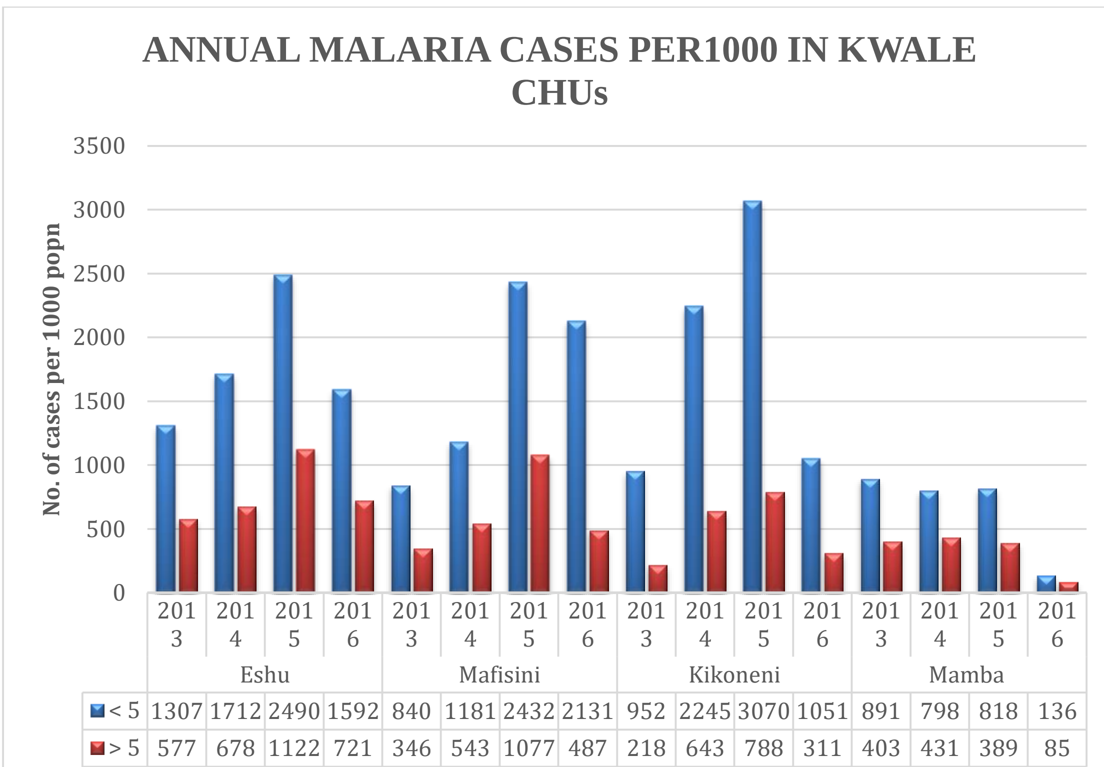

Figure 4.2: Confirmed Annual Malaria Cases per 1000 in Kwale County CHUs 2013 to 2016

4.3.3.1 Summary of Findings Migori (Intervention)

Above 5 Years Group: There was a reduction in malaria rates (mean difference = 85.03 cases per 1000 population), but the reduction was not statistically significant (p = 0.06767) and 95% Confidence Interval (CI) of (-11.49975, 181.55689). The intervention's impact on this group is inconclusive and may require further investigation or a larger sample size (appendix 1).

Under 5 Years Group: There was a significant reduction in malaria rates (mean difference = 697.8 cases per 1000 population, p = 0.01566) and 95% Confidence Interval (CI) of (250.8067, 1144.7933).

The intervention had a strong and statistically significant impact on this group, highlighting its effectiveness for younger children (appendix 1).

4.3.3.2 Summary of Findings Kwale (Control)

Above 5 Years Group (Control): There was a slight increase in malaria rates (mean difference = -42.88571 cases per 1000 population), but the change was not statistically significant (p = 0.3912).

The Control group showed no meaningful change in malaria rates over time.

Under 5 Years Group (Control): There was a slight increase in malaria rates (mean difference = -57.5 cases per 1000 population), but the change was not statistically significant (p = 0.6221).

The Control group showed no meaningful change in malaria rates over time.

4.3.3.3 Comparison between Intervention and Control Groups

Above 5 Years Group:

Intervention Group: A reduction of 85.03 cases per 1000 population (marginally significant, p = 0.06767).

Control Group: A slight increase of 42.89 cases per 1000 population (not significant, $p = 0.3912$).

The intervention group showed a **trend toward improvement**, while the control group showed no meaningful change.

Under 5 Years Group:

Intervention Group: A significant reduction of 697.8 cases per 1000 population ($p = 0.01566$).

Control Group: A slight increase of 57.5 cases per 1000 population (not significant, $p = 0.6221$).

The intervention group showed a **strong and significant improvement**, while the control group showed no meaningful change.

4.3.4 Findings from the FGDs on the Access to Diagnosis, Treatment and Utilization of Case Management by Respondents in Migori and Kwale Counties

In Migori, at baseline survey all respondents received ACTs from public health facilities while at endline most of the respondents received ACTs from CHVs.

While in Kwale at baseline survey all respondents received ACTs from public health facilities while at endline most of the respondents received ACTs from CHVs.

At both baseline and endline surveys in Migori there were no Negative cases that received ACT

Households with at least one malaria case incidence in Migori decreased from majority at baseline to few at endline. While in Kwale County, households with at least one malaria case incidence in Migori increased from average at baseline to about three quarters at endline.

Fever cases that took ACT within 24 hours after its onset in Migori increased from average to three quarters at baseline and endline respectively.

Expressions by FGD participants:

"We rarely get malaria these days unlike before. We feel the CHVs are giving us good health information on how to prevent ourselves from malaria especially when they insist to use mosquito nets every night at all the seasons". women group respondents in Migori during FGD at endline survey.

Majority of the respondents in Kwale mentioned malaria case are more often in the household than previous in 2013 (Table 4.6). ***"These days we experience more malaria cases at our house than previously".*** women group responds in Kwale during FGD at endline.

Majority of the respondents mentioned children as the ones that suffered from malaria in their household (baseline survey) in the past one week.

Most of the respondents mentioned community health volunteers (CHVs) as the best placed to provide malaria medicine at the community level.

"*CHVs are with us in the community. They visit us regularly. So if they have malaria medicine in their drug kits they can be of great assistance to us".* A man respondent from men group in Kuria West Sub County during the baseline survey.

At endline survey in Migori, most of the malaria tests were done by CHVs. Households with at least one malaria case incidence in Migori reduced from high values to a quarter at baseline and endline surveys respectively. While in Kwale, a few were done by CHVs. Households with at least one malaria case incidence in Kwale increased from most to about three quarters at baseline and end line surveys respectively.

"***All of us CHVs have been trained and are able to test, treat and track malaria cases in our respective CHUs".*** A CHV respondent at Getongoroma CHU in Kuria East during FGD at endline survey.

4.3.5 Access and Utilization of Malaria Prevention in Pregnancy by Households in Migori and Kwale Counties

Pregnant women currently attending ANC in Migori increased from 60% to 91.9% at baseline and end line respectively while in Kwale it increased from 31.4% to 54.4% in the period.

ANC attending women who had received IPTp3 in Migori increased from 20% to 35.3% at baseline and end line respectively Kwale it decreased from 18.2% to 0%) in the same period.

ANC attending women who had received IPTp2 in Migori increased from 29.12% to 47.1% at baseline and end line respectively (Figure 4.3).

Pregnant women currently attending ANC in Kwale increased from 31.4% to 54.5%% at baseline and end line respectively. ANC attending women who had received IPTp2 in Kwale increased from 31.4% to 54.5% at baseline and end line respectively. ANC attending women who had received IPTp3 in Kwale decreased from 18.2% to 0% at baseline and end line surveys respectively (Figure 4.3)

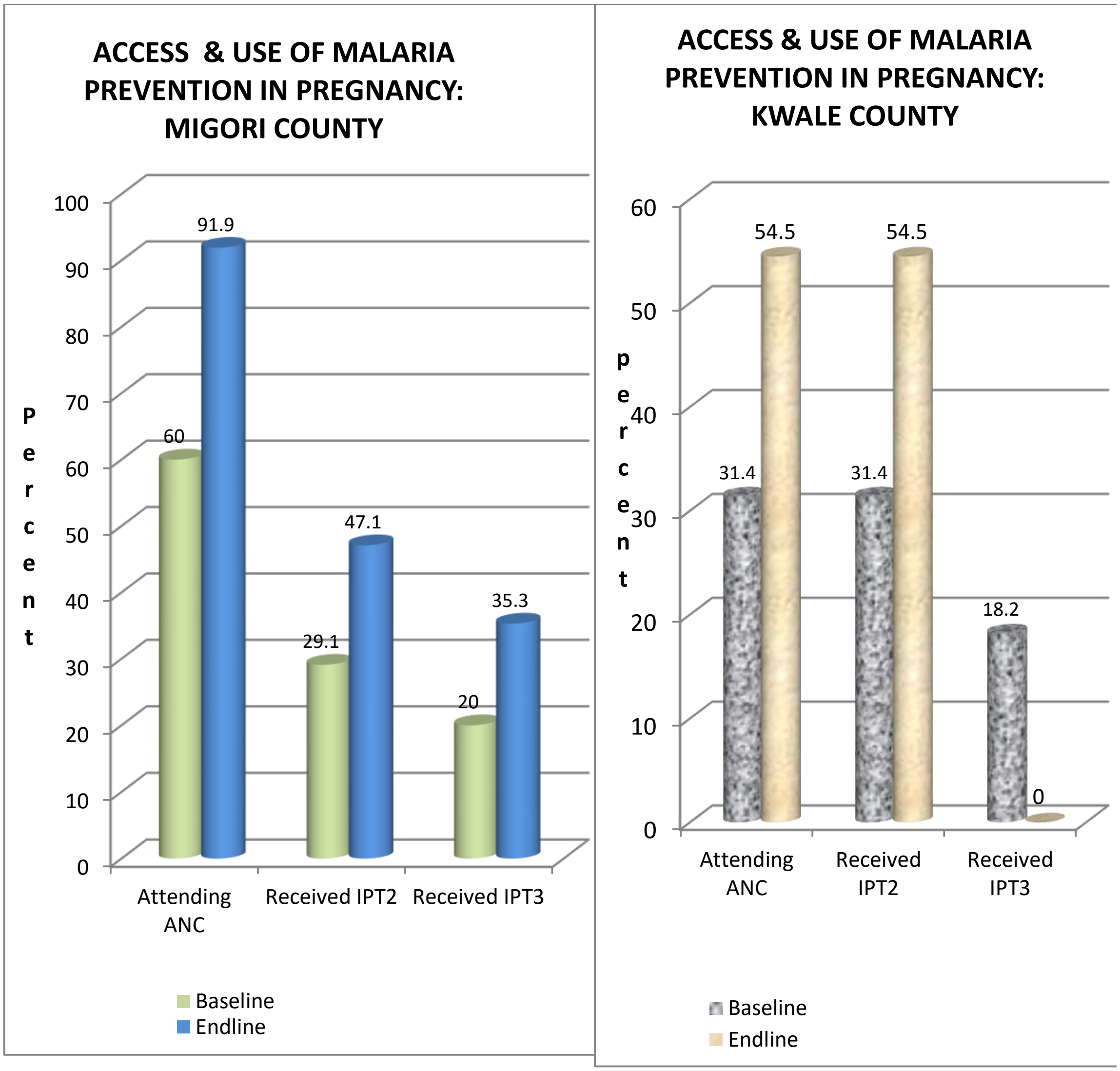

Figure 4.3: Access and Utilization of Malaria Prevention in Pregnancy by Households in Migori and Kwale Counties.

At baseline, 31.4%% of pregnant women attended ANC visits in control areas, compared to 60.0% in intervention areas, reflecting a 28.6% difference. By endline, 54.4.0% of pregnant mothers attended ANC visit in control areas compared to 91.9%% in intervention areas, showing a 37.5% difference. The difference-in-difference calculation revealed a 2.92% greater increase in ANC attendance among pregnant women in the intervention areas, aligning with similar findings in studies like that of KMIS 2010 and KMIS 2015, which demonstrated that increased awareness for ANC attendance among pregnant women due to action by the trained CHVs. The statistical significance of this finding further underscores the success of the intervention in mobilization of pregnant women by CHVs into the promotion of ANC attendance which is a platform for uptake of IPTp.

In terms of pregnant receiving IPTp 2, the control areas showed a higher percentage of pregnant women receiving IPTp2 at baseline (31.40%) compared to the intervention areas (29.12%), a difference of 2.28%. By endline, 54.4% of pregnant women in the control areas received IPTp2, compared to 47.15% in the control areas, reflecting a 7.25% difference. The difference-in-difference calculation showed a 0.96% higher rate IPTp2 uptake in the intervention areas, which suggests that, in the intervention areas slight increase of pregnant women taking IPTp2.

Regarding pregnant women receiving IPTP3, the intervention area showed a higher percentage of pregnant women receiving IPTp3 at baseline (20.0%) compared to the control areas (18.2%), a difference of 1.8%. However, by endline 35.1% of pregnant women in the intervention areas received IPTp3, compared to 0% in the control areas, reflecting a 35.1% difference. The difference-in-difference calculation showed a 14.89% higher rate of IPTp3 uptake in the intervention areas compared to the control area. In summary, the intervention led to a high significant improvement in IPTp3 uptake among pregnant. These findings are consistent with previous research in malaria prevention in pregnancy. The statistical significance of these results highlights the intervention's potential as a model for malaria control in similar settings.

Less than a quarter of the respondents mentioned that they had a woman of childbearing age in their household who was pregnant during FGD at baseline. About one out of ten received medicine for malaria prevention (IPTp). Most of the respondents during FGD mentioned they were not aware about malaria prevention using IPTp. Majority of the respondents did not know how many times a pregnant woman must take medicine for malaria prevention (IPTp) at baseline survey in Migori

*"**I am not aware that pregnant women get malaria medicine for prevention. I even do not how many times they are supposed to take**".* A woman respondent from women group in Kuria East Sub County during FGD at the baseline survey.

During FGD at end line survey in Migori a quarter of the respondents mentioned they had a woman of childbearing age in the households who was pregnant**.** All respondents during FGD at end line survey mentioned that they were aware of malaria prevention using IPTp.

"We are all aware that pregnant should take IPTp. This is because every time the CHV visits our house they remind every pregnant woman to attend ANC so that they get IPTp". Women group respondents from in Kuria west Sub County during FGD at end line survey.

4.3.6 Access and Utilization of Indoor Residual Spraying by Households

During FGDs at baseline and end line in Migori, all the respondents mentioned their households have never been sprayed over the past one year. 43% of the respondents mentioned government as the best placed to support IRS, followed by NGOs (38%). Majority of the respondents (76.16%) mentioned the government should pay for IRS followed by NGOs (23%).

"IRS activities are very expensive. Household are poor and cannot afford payment for this. The Government should provide free IRS services to communities the way they provide malaria **medicine".** A Youth respondent from Youth group in Kuria East Sub County during the baseline survey.

*"**We are all aware of IRS being conducted in 6 other sub counties of Migori County namely Awendo, Rongo, Suna East, Suna West, Uriri and Nyatike with exception of Kuria East and Kuria West Sub County. We think the selection was entirely political. Despite us being neighbours to Nyatike Sub County and Migori County having been supported to conduct IRS by the Government through partners in 2016, we were left out.***

This is perhaps due to the fact that Kuria East and West is affiliated to a political party that is not popular with the rest of Migori County." Men's group respondents in Kuria west Sub County during end line survey.

During FGDs at both baseline and end line in Kwale all the respondents mentioned their households had never been sprayed over the past one year. All respondents at both baseline and end line survey mentioned Government as the entity to pay and support IRS.

Table 4.8: Access and Utilization of Indoor Residual Spraying by Households

Households visited	**MIGORI Baseline** 1206	**Endline** 578	**KWALE Baseline** 878	**Endline** 430
Household that have experienced IRS over the last 1 year	47 (3.9%)	1 (0.2%)	0(0.0%)	0(0.0%)
Household that paid for IRS	17(36.2%)	1(100.0%)	.0 (0.0%)	0 (0.0%)

4.4 Influence of the Use of Trained CHVs on the Awareness and Demand of Malaria Prevention and Control Interventions by Communities in Migori County

Table 4.9: Awareness and Demand of Malaria Prevention and Control Interventions by Communities in Migori County

	Migori (Intervention)		**Kwale (Control)**	
Respondents' opinion on who is best placed at the household to promote and Influence net use.	Man, of the house Woman of the house Everyone Children	CHVs are responsible to make sure that nets are hanged properly in the households and influence net use. Mothers, women or wives are the most responsible to hang nets in the households.	The man in the house who is the head of the household.	Community health volunteers who visit the households.
Respondents' opinion on who is best placed to create awareness and demand at community level to promote malaria prevention and control interventions	Youth groups, CHVs, Government Respondents themselves, Village elders, Health workers Chiefs Mothers	CHVs are supposed to advocate for awareness creation and demand for malaria prevention and control intervention at the households. Followed by Village elders and Chiefs	The Village elders and chiefs	The CHVs and village elders. The man in the house.

During all the focus group discussions, CHVs were mentioned as the main agents who create awareness and demand for malaria prevention and control intervention in Migori County (Table 4.9).

4.5 The Challenges of Community Health Volunteers in Delivering Community Health Services

The study conducted in-depth interviews with Key Informants such as CHEWs, KeNAAM, Sub county MOH, PHOs as well as FGD with CHVs, Men, Women and Youth groups. The objective was to assess in Migori the challenges Community health volunteers faced in discharging their duties.

Results from KII and FGS in Migori illustrates that CHVs equip families with the knowledge and skills to prevent diseases. They promote good nutrition, sanitation, and hygiene, and link families to essential services including referral services to their clients for services they do not offer at the community level and give antimalarial medicine especially AL after testing with mRDTs as well as paracetamol and Albendazole. Specifically, the study found out that CHVs roles and activities included, Community Case Management of Malaria (CCMM), prevention and Control; Home visits and referrals; Defaulter tracing; Growth monitoring; Condom distribution; Advocacy on behavior change; provision of Outreach services such as immunization and treatment of minor ailments; Disease prevention messages; Health education; WASH sensitization; Conducting community dialogues and participating in health action days and Conducting household registration.

In the delivery of integrated health services, CHVs face several challenges. Key among them is the inadequacy and sometimes, lack of the monthly stipend offered to them. From the CHVs discussions, it revealed dissatisfaction with the stipend received monthly. They claimed that the stipend is **"*very minimal pay, against lots of hours spent in the community*"** (FGD participant from Kuria West – Migori County). A delay in paying CHV stipend sometimes demotivates them disrupting their work and referrals.

Most CHVs in Kwale mentioned lack of stipend for those noted supported. It was also felt that KES. 2000 was not enough remuneration. This affected their motivation to work. When asked what remuneration they would prefer, All CHVs in Migori and Kwale said **"*We would wish to get a monthly salary of between KES. 7,000 -10,000 same as our Support staff colleagues employed by the Ministry of Health in the County. We support services such as immunization; dispensing drugs at the facilities as well do growth monitoring and outreach services in addition to our normal duties*".**

Further, the additional support given to them in terms of transportation i.e. the provision of a bicycle is also thought to be inadequate because they lacked maintenance facilitation in Migori county.

The working tools such as service delivery logbook MOH 514 are sometimes too complicated for the CHVs level of understanding and are on occasion inadequate in supply. There have been instances where medical supplies are not enough. Some CHVs lack badges causing challenges in their identification. This may be one of the reasons why some are rejected by the communities within which they are stationed. Illiteracy of community members also poses a challenge to the uptake of health messages passed to them by the CHVs.

During FGDs respondents were asked about the challenges faced by the CHVs in delivering their work. Most respondents said that rejection from the community is one of the challenges faced by CHVs. Perhaps one of the reason is that community lack confidence on the CHV as they consider them not well educated to provide medicine. CHVs offer antimalarial medicine especially AL after testing with mRDTs as well as paracetamol and Albendazole.

Another challenge is their scarce numbers hence some have to travel long distances to cover all community members within their jurisdictions. This is exacerbated by the little or lack of support to them in terms of transport and poor remuneration altogether.

Shortage of supplies is another aspect that curtails their work. This challenge came out mostly in Kwale County compared to Migori.

One common challenge was the erratic supply of commodities for the CHVs. Key informant interviews with health care managers indicated that in Migori, commodities for the three diseases are procured separately and delivered to the link facilities every quarter before distribution to the CHVs on a need basis.

Poor documentation and reporting were cited as a challenge**.** The findings from CHV's FGD's and Health Care Workers (HCWs**)** KII's show that there is poor documentation and reporting on the project activities. Some of the issues contributing to this include; erratic supply of reporting tools which led to some CHVs using their own money to make copies, inaccuracy and incomplete data due to illegibility of writings when submitting the hand written reports or technical know-how when uploading into the DHIS2, Key informant interviews with facility managers pointed out challenges on poor documentation of work that has been done in the community by CHVs, incomplete uploading of data to the DHIS, erroneous data entry, and poor linkages between the field and facility CHEWs and other staff at the health facility, minimal understanding of the data flow, biased reporting by CHVs on specific interventions, inadequate laptops/computers and airtime for bundles to upload data onto the DHIS2, inadequate capacity of CHEWS to enter data into the DHIS2, untimely reporting by CHVs and lack of understanding of reporting by CHCs as cited below

In Migori findings from key informant interviews with facility managers show that despite the good linkages between the community and facility, some challenges still persist. Top among those identified were inadequate human resources at the facilities. Lean staffing level affected average time patient spend at the facilities.

"Yeah, they are seen like the other patients. How I wish we had enough number of staff so that we could give them first priority.'' (KII Facility in charge, Migori County).

The other challenge is that of human resource where sometimes the CHVs have already made referrals but sometimes the tests cannot be done due to absence of the health care workers or unwillingness.

Findings from the study clearly showed that some of the patients referred to facilities for services come with different expectations. Most common is the expectation for express treatment at the facility even without going through the triage. The other challenges presented by patients referred to for service are those who delay presenting themselves to the facility for treatment. These cases are common among those who are not accompanied by services at the facility by CHVs. This is particularly felt when there are many referrals to the facility who expect to be served without delays.

Sometimes referred patients do not submit referral forms to facilities or submit to the wrong health workers at the facility making follow up a challenge.

With regards to transport support, all CHVs should be provided with a bicycle since some do not have. It would also be helpful if the CHVs were supported further in servicing and maintenance of the bicycles.

The community should be sensitized about the existence of CHVs and their roles in the community through avenues such as chief's barazas, community dialogue and open days. They should be given uniforms and badges for ease of identification by community members. They should also be supported by providing them with a cell phone and airtime for them to communicate with ease. Regular capacity building is necessary for the CHVs for them to perform as required. This should go hand in hand with proper supervision from CHEWS. Inter – personal skills were deemed necessary for the CHVs to have for them to be able to relate well with the community. Respondents suggested improving the Community Health Volunteers work such as; providing them with umbrellas, gumboots and raincoats to wear during the rainy season. The study came out with various suggestions on how to overcome some of these challenges. For instance, initiation of IGAs can render livelihood to CHVs. These can be in farming, rearing dairy cattle etc. Registration of CHVs to social services may also provide an avenue to access funds as a group. Exchange visits for well performing CHVs and CHEWs would also foster learning and consequently efficiency in undertaking their duties. Recruitment of more PHOs is necessary to reduce the PHO: CHV ratio. A community strategy policy for the county would help to streamline the activities of CHUs in the county.

They said those given bicycles should get the requisite maintenance fee to be able to cover their households. Regular trainings should be organized for the CHVs. The CHVs would be better motivated if their stipends were increased and paid in a timely way. With regards to transport support, all CHVs should be provided with a bicycle since some do not have. It would also be helpful if the CHVs were supported further in servicing the bicycles. Timely provision of working tools and medical supplies would improve the work of the

CHVs. To have the tools in both English and Swahili translations is deemed necessary as well as the provision of regular refresher trainings for the CHVs on how to use them.

Conducting community/village introductory meetings to the CHVs would be helpful in increasing their acceptance. Their identification is also important hence the provision of badges and/or uniforms would help them to be better identified. Findings from FGDs with CHVs show that they felt well supported by the CHEWs. Most notable support was planning and execution of the community dialogue and action days where the CHEWs ensured that the required persons such as doctor(s), chief, or partners would be available during the dialogues and action days depending on the topic or activity being undertaken.

The CHEWs were also hailed for their capacity building role in areas such as reporting; the CHEWs took through the CHVs how to fill in their registers and compile their reports. The CHEWs also acted as the liaison between the facility in-charge and the CHVs and thus sensitized the doctors about the importance of receiving and filling referral forms.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Influence of the Use of trained CHVs on Utilization of Malaria Intervention in Migori County

The ultimate goal of malaria control is to reduce morbidity and prevent mortality due to malaria thereby mitigating the socio-economic burden of the diseases in Kenya (MOH, 2018). One of the key strategic interventions is to provide early parasitological diagnosis and prompt treatment using effective medicines (MOH, 2018). ACTs are at present the best treatment for uncomplicated malaria and the efficacy of the treatment recommended in the current guidelines for the diagnosis, treatment and prevention of malaria in Kenya (MOH, 2018). In this study, these findings suggest that establishing community health units and making them operational has positive health impacts especially on reduction of malaria morbidity among the general population and even greater among children under five. Perhaps the main reason is access and utilization of malaria control interventions triggered by the activities of CHVs during regular household visits. These findings are consistent with Perry & Freeman (2009) where they found increasing evidence demonstrating that community and women's empowerment can have a remarkable impact on the health of children. LeBan *et al.*, (2011) also demonstrated that high-impact health prevention and promotion activities, such as exclusive breastfeeding, infant and young child feeding, birth delivery planning, use of an insecticide-treated net for malaria prevention, essential newborn care can be realized in a community setting. This is particularly of high importance in community settings where behavior change approaches are essential, than in facility settings where more complex medical procedures are promoted for maximum impact. The CHVs activities have demonstrated behaviour change at households on utilization of malaria control interventions. For instance, ACTs taken within 24 hours after onset of fever increased significantly from 32.9% to 51.9% at baseline and endline surveys in Migori, while in Kwale a slight increase from 8.0% to 10.0% over the same period with an OR of 1.92 (95% CI: 1.24 to 2.98, $p < 0.0035$). These findings are further supported by FGD findings whereby participants mentioned fever cases that took ACT within 24 hours after its onset in Migori increased from just a half (1/2) to three quarters (3/4) at baseline and endline surveys respectively.

On recorded confirmed malaria cases shows a reduction between 2015 and 2016 in Kwale County with a greater reduction being exhibited in Mamba and Kikoneni CHUs. This could be because of the adoption of the community health strategy in Kwale in 2015.

5.1.2 Proportion of Malaria Cases Seen at Health Facilities That Receive Prompt and Effective Treatment in Migori (Intervention) and Kwale (Control) Counties

In this study, at baseline, 63.7% of households in control areas reported at least one malaria case, compared to 36.73% in intervention areas, reflecting a 26.79% difference. By endline, 61.0% of households in control areas reported malaria cases, compared to 29.58% in intervention areas, showing a 31.42% difference. The difference-in-differences calculation revealed a 4.45% higher malaria incidence in the control areas compared to the intervention areas with an OR of 7.87 (95% CI: 5.27 to 11.74, $p < 0.001$). This suggests that individuals who have been tested for malaria are nearly eight times more likely to benefit from the intervention compared to those who were not tested. The significant association between malaria testing and intervention underscores the importance of diagnostic services in malaria control efforts. Testing plays a critical role in identifying individuals with malaria infection, facilitating early treatment, and preventing the spread of the disease. The ability to detect malaria infections early, combined with appropriate treatment, can dramatically improve health outcomes and reduce the incidence of severe malaria. This result emphasizes the need for strengthened diagnostic infrastructure in malaria-endemic areas, ensuring that individuals have access to timely and accurate malaria testing as part of comprehensive prevention and treatment strategies. This decrease in malaria incidence in the intervention areas is supported by findings from the world malaria report 2019, where the incidence rate of malaria declined globally between

2010 and 2018, from 71 to 57 cases per 1000 population at risk (WHO, 2019). which showed that community-level interventions, including educational campaigns and insecticide-treated nets, reduced malaria transmission significantly. The statistical significance of this difference underlines the robustness of the intervention's impact. Perhaps the main reason is the improvement of access and utilization of malaria diagnosis and treatment services in Migori compared to Kwale due to the activities of trained CHVs in the later.

In terms of malaria testing, the intervention areas showed a higher percentage of individuals tested at baseline (45.50%) compared to the control areas (40.0%), a difference of 5.5%. By endline, 93.50% of individuals in the intervention areas were tested, compared to 54.0% in the control areas, reflecting a 39.5% difference. The association between malaria testing and the intervention area is also striking, with an OR of 7.87 (95% CI: 5.27 to 11.74, $p < 0.001$).

This suggests that individuals who have been tested for malaria are nearly eight times more likely to benefit from the intervention compared to those who were not tested. The significant association between malaria testing and intervention underscores the importance of diagnostic services in malaria control efforts. Testing plays a critical role in identifying individuals with malaria infection, facilitating early treatment, and preventing the spread of the disease. The ability to detect malaria infections early, combined with appropriate treatment, can dramatically improve health outcomes and reduce the incidence of severe malaria. This result emphasizes the need for strengthened diagnostic infrastructure in malaria-endemic areas, ensuring that individuals have access to timely and accurate malaria testing as part of comprehensive prevention and treatment strategies.

The difference-in-difference calculation revealed a 34.0% greater increase in testing rates in the intervention areas, aligning with similar findings in studies like that of F. Sakari ***et al., 2024,*** which demonstrated that increased testing coverage through community-based initiatives led to higher detection rates of malaria.

The statistical significance of this difference emphasizes the success of the intervention in improving testing accessibility and coverage.

The involvement of Community Health Volunteers (CHVs) in malaria testing also showed marked improvements. Initially, no tests were performed by CHVs in either group, but by endline, 43.63% of individuals in the intervention areas had malaria tests performed by CHVs, compared to 5.4% in the control areas, yielding a 38.23% difference. This 38.23% increase is like the findings of a study by F. Sakari *et al.,* 2024) which highlighted that CHVs, as trusted members of the community, are effective at increasing access to malaria testing, particularly in remote and underserved areas. The statistical significance further suggests the intervention's effectiveness in leveraging local health resources.

Regarding malaria test results, 96.60% of tests in the intervention areas were positive at baseline, compared to 81.60% in the control areas, reflecting a 15.0% difference. By endline, the intervention areas had 85.40% positive test results, compared to 48.0% in the control areas, showing a 37.40% difference. The difference-in-difference calculation indicated a 22.40% higher rate of positive results in the intervention areas, which is in line with studies such as those by F. Sakari *et al.,* 2024, who found that improved diagnostic practices through community-based interventions led to more accurate identification of malaria cases, contributing to timely treatment.

In contrast, malaria test negatives were more prevalent in control areas. At baseline, 18.40% of tests in the control areas were negative, compared to 8.40% in the intervention areas, reflecting a 10.0% difference. By endline, 48.0% of individuals in the control areas tested negative, compared to 14.60% in the intervention areas, yielding a 33.40% difference. The difference-in-differences calculation showed a 23.40% higher rate of negative results in control areas, which suggests that, in the intervention areas, the intervention had a more focused impact on the detection and management of malaria cases, as seen in similar research by F. Sakari *et al.,* 2024

The timing of ACT administration also showed improvements in the intervention areas. Initially, 32.90% of individuals in the intervention areas received ACT within 24 hours of fever onset, compared to 8.0% in the control areas, a 24.9% difference. By endline, 51.90% of individuals in the intervention areas and 10.0% in the control areas received ACT within 24 hours, resulting in a 41.90% difference. The difference-in-difference calculation revealed a 17.0% greater proportion of individuals receiving timely ACT in the intervention areas, echoing findings from studies like that of F. Sakari *et al.,* 2024 which highlighted the importance of timely treatment in reducing malaria morbidity and mortality. The statistical significance of this result underscores the effectiveness of the intervention in ensuring timely access to treatment.

In terms of ACT administration for positive malaria cases, the intervention areas initially had 97.20% of positive cases receiving ACT, compared to 100% in the control areas, reflecting a 2.80% difference. By endline, 99.30% of positive cases in the intervention areas received ACT, compared to 100% in the control areas, showing a 0.70% difference. The difference-in-difference calculation indicated a 2.1% higher rate of ACT administration in the intervention areas, suggesting that the intervention successfully enhanced ACT accessibility, like other studies which indicate increasing ACT availability and uptake in community-based settings leads to improved treatment outcomes.

Regarding the administration of ACT from public health facilities, control areas initially had 78.80% of individuals receiving ACT, compared to 45.40% in the intervention areas, a 33.40% difference. By endline, 50.69% of individuals in the intervention areas received ACT from public health facilities, compared to 80.0% in the control areas, showing a 29.31% difference. The difference-in-difference calculation showed a 4.09% higher rate of ACT administration from public health facilities in the intervention areas, suggesting that the intervention may have helped to reduce dependency on public health facilities for treatment, in line with studies like that of F. Sakari *et al.,* 2024 which demonstrated that improving access to community-based health services can reduce reliance on formal healthcare facilities for malaria treatment.

Finally, the proportion of individuals receiving ACT from CHVs was 0% in both areas at baseline. By endline, 40.0% of individuals in the intervention areas received ACT from CHVs, compared to 5.0% in the control areas, yielding a 35.0% difference. This 35.0% difference is consistent with the findings of other studies, such as the one by F. Sakari *et al.*, 2024 which showed that CHVs were instrumental in improving access to ACT in malaria-endemic regions. The statistical significance of this finding further underscores the success of the intervention in integrating CHVs into the malaria treatment framework.

In summary, the intervention led to significant improvements across multiple malaria-related outcomes, including case incidence, testing, treatment timing, and treatment accessibility. These findings are consistent with previous research demonstrating the effectiveness of community-based malaria interventions in improving diagnosis, treatment, and overall disease control. The statistical significance of these results highlights the intervention's potential as a model for malaria control in similar settings.

In addition, while carrying statistical analysis using paired t-test for the mean difference in malaria rates per 1000 population between 2013 and 2016 for Migori for above 5 years old, there was a reduction in malaria rates (mean difference = 85.03/1000 population), but not statistically significant ($p = 0.06767$), CI (-11.49975, 181.55689). For under 5 years old, there was a significant reduction in malaria rates (mean difference = 697.8 /1000, $p = 0.01566$), CI (250.8067, 1144.7933). While in Kwale over the same period, for above 5 years old, there was a slight increase in malaria rates (mean difference = -42.88571/1000, but the change was not statistically significant ($p = 0.3912$) CI (-179.43945 to 93.66802). For under 5 years, there was a slight increase in malaria rates (mean difference = -57.5/1000, but the change was not statistically significant ($p = 0.6221$), CI (-391.6629 to 276.6629). It therefore means that the Intervention group demonstrated a significant reduction in malaria rates for the under 5 years' group and a trend toward improvement for the above 5 years' group. While in the Control group, it showed no significant changes in malaria rates for either age group, as expected. These results suggest that the intervention was effective, particularly for the under 5 years group, which is often more vulnerable to malaria.

These findings are supported by the FGDs where the majority of the respondents from both focus group discussions and key informant interview in Migori County mentioned that there has been a reduction in malaria morbidity among the general population and children under five in 2016 endline survey compared to 2012 baseline survey. While in Kwale County over the same period a sizeable majority of the respondents of Focus Group Discussion and key informant interview mentioned there was a slight increase in malaria morbidity in 2016 compared to 2013. These findings are further supported by FGD findings whereby majority of the people who took ACTs within 24hrs of developing a fever mentioned an increased between baseline and endline in Migori (intervention) compared to Kwale (Control) where there wasn't. These findings are consistent with the findings of the Kenya malaria indicator surveys conducted in 2010 and 2015 showing a reduction in morbidity from 38% to 27% in the lake endemic region while coast endemic region showed a slight reduction from 11% to 8 % over the same period (KMIS 2010 and KMIS 2015). These findings are consistent with the world malaria report 2019, where the incidence rate of malaria declined globally between 2010 and 2018, from 71 to 57 cases per 1000 population at risk. However, from 2014 to 2018, the rate of change slowed dramatically, reducing to 57 in 2014 and remaining at similar levels through to 2018 (WHO, 2019). According to a report from the department health services of Kwale County malaria had increased from a prevalence of 8% in 2015 to 12% in 2017 (Annual work plan 2018-9).

5.1.3 The Awareness and Demand of Malaria Prevention and Control Intervention by Communities in Migori County

5.1.3.1 Net Ownership and Utilization

The study found out that CHVs were the main agents that created awareness and demand for malaria prevention and control interventions in Migori County. Further, the study found out that the proportion of households owning at least one net increased significantly (OR of 8.29 (95% CI: 4.82 to 14.28, $p < 0.001$) in Migori (Intervention) compared to Kwale. This suggests that individuals who own a mosquito net are more than eight times more likely to benefit from the malaria prevention intervention compared to those who do not own a net. The narrow confidence interval and statistically significant p-value confirm the robustness of this finding, which emphasizes the critical importance of net ownership as a fundamental aspect of malaria prevention. Ownership represents the first step in gaining access to protective measures, and the high OR suggests that this intervention is highly effective at reducing the risk of malaria-related health outcomes. This finding underscores the need to ensure that vulnerable populations have access to mosquito nets, with ownership serving as a key entry point to wider malaria prevention efforts. Thus, at baseline, a higher percentage of households in control areas (92.9%) owned nets compared to intervention areas (65.8%), resulting in a difference of -27.1%. This disparity suggests that, prior to the intervention, net ownership was already higher in the control areas, potentially due to pre-existing health initiatives or infrastructure that facilitated net distribution in these regions.

The statistical significance of this change with an odds ratio (OR) of 8.29 (95% CI: 4.82 to 14.28, $p < 0.001$), provides robust evidence of the intervention's effectiveness in improving net ownership, a crucial step toward malaria prevention. This suggests that individuals who own a mosquito net are more than eight times more likely to benefit from the malaria prevention intervention compared to those who do not own a net. These findings compare favourable with those of LLIN ownership in the 2011 and in the 2015 KMIS surveys. Nationally, ownership of at least one LLIN increased by 19 percentage points since 2010, from 44 percent to 63 percent. These findings are consistent with global figures. Globally, across sub-Saharan Africa, household ownership of at least one ITN increased from 50% in 2010 to 80% in 2016 (WHO, 2017). However, the proportion of households with sufficient nets (i.e., one net for every two people) remains inadequate, at 43% in 2016 (WHO, 2017).

For net use at the household level, baseline data revealed that a higher percentage of households in intervention areas (39.3%) used nets compared to control areas (21.9%), with a difference of 17.4%. By endline, net use had increased to 96.8% in intervention areas and 72.0% in control areas, resulting in a difference of 14.8%. The association between net use at the household level and the intervention area is also significant, with an OR of 7.92 (95% CI: 4.33 to 14.49, $p < 0.001$). This indicates that households that use mosquito nets are almost eight times more likely to experience the benefits of the intervention compared to households that do not use nets. This result highlights the importance of household-wide interventions in ensuring malaria prevention is practiced consistently within communities. The wide-reaching effect of net use at the household level suggests that when all members of a household are protected by mosquito nets, the risk of malaria transmission is substantially reduced. This reinforces the importance of community-based approaches to malaria prevention, where the focus is not only on individual use but also on ensuring that nets are distributed and used effectively within households.

This suggests that the intervention was effective in sustaining net use behavior, but the relatively smaller effect size may be indicative of barriers to continued behavior change that persist even after the intervention, such as cultural factors or lack of reinforcement. Similar findings have been reported in other studies where while net ownership improved, consistent use was more challenging to achieve (Augustincic *et al*., 2015, WHO, 2019). Despite this, the intervention appears to have contributed to a lasting change in behavior, a critical factor in long-term malaria prevention efforts.

Among children under five, baseline net use was significantly higher in control areas (68.0%) than in intervention areas (36.8%), resulting in a difference of -31.2%. This suggests that, at baseline, control areas may have had stronger maternal and child health programs or more widespread awareness of the importance of net use for young children. However, by endline, the intervention had a profound impact on increasing net use in intervention areas (80.4%) relative to control areas (72.0%), resulting in a difference of 8.4%. The study also found a significant association between net use among children and the intervention area, with an OR of 6.05 (95% CI: 4.27 to 8.57, $p < 0.001$). Children who use mosquito nets are more than six times more likely to benefit from the intervention compared to those who do not use nets. This finding is particularly important as children are one of the most vulnerable groups to malaria infection due to their developing immune systems. The strong protective effect of mosquito nets for children underscores the necessity of targeting this group in malaria prevention efforts. Ensuring that children are provided with and consistently use mosquito nets could have a significant impact on reducing the burden of malaria-related morbidity and mortality in this age group. This also highlights a substantial improvement in the net use among children under five in intervention areas, indicating that the intervention specifically benefited this vulnerable group. This aligns with other studies that have found targeted interventions for young children to be effective in improving net use (WHO, 2019) The significant change observed in the intervention areas points to the potential for focused interventions to reduce childhood morbidity and mortality associated with malaria.

For pregnant women, the baseline net use was already higher in intervention areas (38.6%) compared to control areas (28.5%), yielding a difference of 10.1%. By endline, the intervention areas saw a considerable increase in net use to 60.2%, while control areas saw a smaller increase to 36.0%, producing a difference of 24.2%. Net use during pregnancy shows a positive association with the intervention area, although the effect size is more modest, with an OR of 1.53 (95% CI: 1.11 to 2.10, $p = 0.0094$). While statistically significant, the smaller effect size compared to other groups suggests that while net use during pregnancy does provide some protective benefit, it may not be as strong as the effect observed in children or households. Pregnant women are particularly vulnerable to malaria, which can lead to adverse outcomes such as maternal anaemia, low birth weight, and foetal death. The protective benefit of mosquito nets for pregnant women, though important, is likely enhanced by additional interventions such as intermittent preventive treatment in pregnancy (IPTp) and other targeted measures. This finding highlights the need for multi-faceted strategies to protect pregnant women, ensuring that they not only have access to mosquito nets but also receive other malaria prevention measures that can provide more comprehensive protection during pregnancy. Further, it suggests that the intervention was particularly effective in increasing net use among pregnant women, a group that is at heightened risk for malaria. Studies have consistently highlighted the importance of protecting pregnant women from malaria, as they are more vulnerable to the adverse effects of infection, including maternal anemia, low birth weight, and even death (MOH, 2018). The intervention's success in improving net use among pregnant women is consistent with the literature emphasizing the need for focused interventions to protect this high-risk group.

In terms of attendance at net hanging demonstrations, baseline participation was higher in control areas (33.0%) compared to intervention areas (22.0%), with a difference of -10.5%. By endline, however, participation increased significantly in both areas, reaching 73.8% in intervention areas and 55.0% in control areas, resulting in a difference of 18.8%. The DiD calculation of 29.3% demonstrates that the intervention was highly effective in promoting engagement with net hanging demonstrations, which are crucial for ensuring proper net use and maintenance. This outcome is consistent with previous research showing that education and skill-building interventions, such as net hanging demonstrations, can improve both the correct use and longevity of malaria prevention tools (Augustincic Polec *et al.*, 2015).

The significant increase in attendance in intervention areas suggests that the intervention successfully increased community participation and awareness, which are vital for the sustainability of malaria prevention efforts.

Finally, regarding the proper hanging of nets, baseline observations revealed that control areas (78.1%) had a higher percentage of properly hung nets compared to intervention areas (34.5%), with a difference of -43.6%. By endline, the rates of properly hung nets in intervention areas improved to 71.6%, though control areas remained higher at 77.0%, resulting in a difference of -5.4%. The DiD calculation of 38.2% indicates a marked improvement in the proper hanging of nets in intervention areas, suggesting that the intervention not only increased net ownership and use but also had a positive effect on the quality of net use. This aligns with findings from other studies that emphasize the importance of not just distributing nets but also ensuring that they are used correctly for maximum effectiveness in preventing malaria transmission (WHO, 2017). The significant improvement in proper net hanging in intervention areas highlights the intervention's broader impact on malaria prevention, reinforcing the importance of integrating both behavior change and technical training into malaria control programs.

Perhaps the regular training, motivation and support of the CHV in Migori contributed to this outcome. CHVs who are the main drivers of the community health services (foot soldiers) received three trainings in Migori County during the study period. One training on the community health strategy module for CHVs in year one, a training on community malaria case management training module in year one and refresher training on the same in year 3 of the intervention study. They received a monthly stipend of KES 2,000/= throughout the study period. They received a bicycle each, a drug kit which they kept replenishing at the referral health facility as well as got uniforms and badges. They participated in most of the community health activities such health promotion, net distributions, net hanging campaigns, national immunization services (measles and polio), growth monitoring, family planning and other health promotion activities. The Ministry of Health through the National Malaria Control Program's Strategy for universal mass net distribution every three years has not only increased net ownership in households but also increased net utilization by household members, children under five and pregnant women.

During the four-year period of the study, free net distribution took place twice in Migori County in September 2014 under FY 2014/15 and in November 2016 under FY 2016/17 compared to Kwale that took place only once in August 2015 under FY 2014/2015 (appendix 9). Trained CHVs in Migori were pivotal in LLINs distribution campaigns at the household as well as in the actual net distribution for universal coverage. Perhaps this activity increased their recognition, motivation, visibility, as well as acceptance at the household level in their area of jurisdiction to promote demand and use of malaria control interventions and health promotion.

Insecticide-treated bed nets (ITNs) form a protective barrier around persons using them. They have been shown to reduce severe disease and mortality due to malaria in endemic regions. Several studies have also demonstrated the efficacy of ITNs with an overall reduction in all-cause mortality by 19% (Phillip-Howard et al., 2003). A 25% reduction in all-cause mortality for children one to nine years of age was detected during the first year of the Gambian National Bed Net Program (D'Alessandro *et al.,* 1995). In Kilifi District, Kenya, a 33% reduction in mortality and a 44% reduction in hospital admissions for severe malaria were also found (Neville *et al.*, 1996).

Long Lasting Insecticide Treated Nets (LLINs) are one of today's most effective malaria prevention interventions. They have been shown to reduce severe disease and mortality due to malaria in endemic regions among the vulnerable groups (pregnant women, children below five years). They are mainly recommended for pregnant women, children below five years and HIV positive people. LLIN use is encouraged early and consistently throughout pregnancy and after delivery (WHO, 2006). They retain lethal concentrations of insecticide for at least 3 years.

Collectively, these findings provide compelling evidence that the intervention had a meaningful and statistically significant impact on net ownership, use, and the proper hanging of nets across multiple target groups. This evidence supports the growing body of literature that underscores the importance of integrated malaria prevention strategies that combine both access to tools and behavior change interventions, particularly for vulnerable populations such as children and pregnant women.

5.1.3.2 Access and Utilization of Malaria Prevention in Pregnancy

The study found at baseline, 31.4%% of pregnant women attended ANC visits in control areas, compared to 60.0% in intervention areas, reflecting a 28.6% difference. By endline, 54.4.0% of pregnant mothers attended ANC visit in control areas compared to 91.9%% in intervention areas, showing a 37.5% difference. The difference-in-difference calculation revealed a 2.92% greater increase in ANC attendance among pregnant women in the intervention areas, aligning with similar findings of KMIS 2010 and KMIS, 2015 which demonstrated that increased awareness for ANC attendance among pregnant women. Thus, pregnant women in Migori are more likely to attend ANC compared to those of Kwale. Nationally, ANC services are universally promoted in the country. The disparity between Migori and Kwale in terms of utilization of ANC services by pregnant women over the same period is perhaps because of the pregnant women motivations by trained CHVs in the former than the later. Respondents from Focus Group Discussions in Migori mentioned that CHVs promoted the use of IPTp which is administered at ANC clinics during the endline survey. However, in Kwale CHVs promoted the use of IPTp mainly in Mamba and Kikoneni CHUs that were established by WOFAK.

In this study, ANC attending women receiving IPTp 2, in the control areas showed a higher percentage of pregnant women receiving IPTp2 at baseline (31.40%) compared to the intervention areas (29.12%), a difference of 2.28%. By endline, 54.4% of pregnant women in the control areas received IPTp2, compared to 47.15% in the control areas, reflecting a 7.25% difference. The difference-in-difference calculation showed a 0.96% higher rate IPTp2 uptake in the intervention areas, which suggests that, in the intervention areas slight increase of pregnant women taking IPTp2.

Regarding ANC attending women receiving IPTP3, the study found that the intervention area showed a higher percentage at baseline (20.0%) compared to the control areas (18.2%), a difference of 1.8%. However, by endline 35.1% of pregnant women in the intervention areas received IPTp3, compared to 0% in the control areas, reflecting a 35.1% difference. The difference-in-difference calculation showed a 14.89% higher rate of IPTp3 uptake in the intervention areas compared to the control area. In summary, the intervention led to a high significant improvement in IPTp3 uptake among pregnant. These findings are consistent with previous research, especially those of KMIS of 2010 and 2015. The statistical significance of these results highlights the intervention's potential as a model for malaria prevention and control in pregnancy for similar settings.

In Kenya, there has-been increased IPTp uptake over the years but has not reached the national target of 80% (MOH, 2016). IPTp 1: 56-79% between 2015 and 2017. Analysis of data reported by country programmes and data available through household surveys shows relatively high levels of ANC attendance (88%, IQR 68%–95%) but much lower proportions of women attending ANC receiving IPTp3 (44%, IQR 30%–57%) (WHO, 2012). These findings are further supported by the FGDs during baseline and endline surveys in Migori. Thus, a few of the respondents mentioned that they had a woman of child-bearing age in their household who was pregnant during FGD at baseline. About 0ne out of ten received medicine for malaria prevention (IPTp). Most of the respondents did not know how many times a pregnant woman must take medicine for malaria prevention (IPTp).

Thus, at baseline survey, the study found that the awareness of the community about malaria prevention using IPTp was very low. Most of the respondents during FGDs at baseline survey mentioned they were not aware of malaria prevention using IPTp.

However, at endline survey because of the activities of health promotion by the CHVs in the Intervention area, awareness on the use of IPTp at the household level increased. All respondents during FGD at endline survey mentioned they were aware about malaria prevention using IPTp.

The overall antenatal care (ANC) package for maternal health in Kenya provides access to IPTp using SP in all health facilities that provide ANC services. All respondents during FGDs mentioned that SP was available at the ANC clinics whenever they attended. **"***When a pregnant woman visits an ANC clinic they always receive IPTp-SP".* A woman respondent from Glory women group in Kuria East Sub County during the endline survey FGDs. Thus, access may not be the real issue but perhaps utilization is inhibited by other factors such as contraindications for SP which is a Sulphur based medicine or other cultural beliefs and practices that were not explored by this study**.**

Malaria infection during pregnancy is a major public health problem, with substantial risks to the mother, her foetus and the newborn (MOH, 2016). During pregnancy there is altered/ suppressed immune response to malaria especially in primi and secundi gravidae as well as HIV infected. Malaria infection in pregnancy can cause maternal complications, morbidity including anaemia and mortality (MOH, 2016). The goal of preventing malaria in pregnancy is to reduce maternal and perinatal morbidity and mortality associated with malaria (MOH, 2018). The strategies in prevention of malaria in pregnancy are integrated in the overall antenatal care (ANC) package for maternal health. (MOH, 2018). To prevent the irreversible, negative consequences of malaria during pregnancy, it is critical to encourage pregnant women to sleep under LLINs and start IPTp-SP regimen as early as possible in the second trimester.

WHO and partners recommend initiating malaria prevention efforts beginning at 13 weeks to achieve major benefits. The period between 13 and 20 weeks is critical because this is the time when the placenta is forming, and the parasite densities are highest (MOH, 2016). IPTp is an anti-malarial given in treatment doses at defined intervals. It assumes every woman in a malaria endemic area has malaria parasites in blood or placenta. IPTp prevents placental malaria infection, low birth weight associated with early infant mortality (MOH, 2016).

5.1.3.3 Access and Utilization of Indoor Residual Spraying

The study found out that no household had access and used Indoor Residual Spraying over the past one year at both baseline and endline surveys in Migori and Kwale Counties.

During FGDs at baseline and endline in Migori, all the respondents mentioned their households had never been sprayed over the past one year. Less than half of the respondents mentioned government as the best placed to support IRS, followed by NGOs. Majority of the respondents mentioned the government should pay for IRS followed by less than a quarter who mentioned NGOs.

During FGDs at both baseline and endline in Kwale all the respondents mentioned their households had never been sprayed over the past one year. All respondents at both baseline and endline survey mentioned Government as the entity to pay and support IRS.

Many malaria vectors are endophilic, resting inside the house after taking a blood meal. These mosquitoes are particularly susceptible to control through indoor residual spraying (Curtis *et al.*, 1990). Both IRS and insecticide treated mosquito nets are effective tools for reducing malaria burden and when implemented in an area of moderate to high transmission with moderate ITN coverage, there may be an added benefit of IRS (Griming JE *et al*, 2016).

In collaboration with the Kenya National Malaria Control Program, the Ministry of Health and local authorities, the PMI AIRS Project developed an implementation plan to spray all sleeping structures in six sub-counties in Migori County, which include Rongo, Awendo, Uriri, Suna East, Suna West and Nyatike. Kuria East and Kuria West in Migori County (study intervention site) were excluded from Indoor Residual Spraying.

5.1.3.4 The Challenges of Community Health Volunteers in Community Health Services Provision

The use of community health workers/volunteers has been identified as one strategy to address the growing shortage of health workers, particularly in low-income countries. Using community members to render certain basic health services to the communities they come from is a concept that has been around for at least 50 years (WHO, 2016). There have been innumerable experiences throughout the world with programmes ranging from large-scale, national programmes to small-scale, community-based initiatives. The roles and activities of community health workers are enormously diverse throughout their history, within and across countries and across programmes. While in some cases CHWs perform a wide range of different tasks that can be preventive, curative and/or developmental, in other cases CHWs are appointed for very specific interventions (WHO, 2016).

CHW programmes have been revered as panacea and described as a delusion in the past. A sober view reveals today, as it did in the late 1980s, that "with political will, however, governments can adopt more flexible approaches by planning CHW programmes within the context of overall health sector activities, rather than as a separate activity. Weaknesses in training, task allocation and supervision need to be addressed immediately. CHWs represent an important health resource whose potential in providing and extending a reasonable level of health care to underserved populations must be fully tapped" (Gilson *et al*., 1989),

In Kenya, a community Health Volunteer (CHV) is trained to provide the most essential lifesaving interventions such as emergency frontline care and can save children's lives from many if not most of the major preventable child mortality causes like diarrhoea, pneumonia and malaria. CHVs also equip families with knowledge and skills to prevent disease. They promote good nutrition, sanitation, and hygiene, and link families to essential services.

In Kenya, CHVs have effectively taken roles in the health sector such as, Health Sector Referral System (MOH, 2014), Community Based Maternal and Newborn Care (MOH, 2012), Community Based Deworming (deliver deworming treatment to all community members in Kwale County in 2014-2016) (MOH/MOEST, 2014), Community Led Total Sanitation through campaigns of Open Defecation Free (ODF) in Rural Kenya (MOH , 2014), Community Based Tuberculosis Care (Sichangi, 2017), Care of Children Aged Under-Five Years in Western Kenya (Onyango, 2017) among others as well as Universal Health Care Programmes in the Counties (MOH, 2018).

In this study, findings from KII and FGS in Migori illustrate that CHVs equip families with the knowledge and skills to prevent diseases. They promote good nutrition, sanitation, and hygiene, and link families to essential services including referral services to their clients for services they do not offer at the community level and give antimalarial medicine especially AL after testing with mRDTs as well as paracetamol and Albendazole. Factors contributing to their acceptability in the communities included: recognition as members of the community; selection through community participatory processes; willingness to help through volunteerism; and provision of good community services. Personal attribute such as good character and ease of interaction with community members were also cited.

In the delivery of integrated health services, CHVs face several challenges. Key among them is the inadequacy and sometimes, lack of the monthly stipend offered to them. From the CHVs discussions, it revealed dissatisfaction with the stipend received monthly. They claimed that the stipend is *very minimal pay, against lots of hours spent in the community (*FGD participant from Kuria West – Migori County). A delay in paying CHV stipend sometimes demotivates them by disrupting their work and referrals. Most CHVs mentioned inconsistent payment of monthly stipend. It was felt that KES. 2000 was not enough remuneration. This affected their motivation to work.

The study agrees with the Voice of WHO (2014) in its support for a community-based health system, adding that this was where the health care need was most pressing.

"Community health workers need sustainable careers and stable income," said Dr. Matshidiso Moeti, Regional Director, WHO Africa Regional Office, underscoring the timeliness of the campaign for remuneration of CHVs. Ethiopia is one such country whose strong political will has seen it become the benchmark for Africa's community health worker strategy. Through its health extension programme, Ethiopia has expanded disease prevention and primary care through service delivery to the communities at the grass-root level, with more than 35,000 community health workers currently on record.

The campaign to get community health workers paid and formally integrated into the health system has been rolled out across Africa by AMREF Health Africa in all its country programmes. Dr. Githinji Gitahi, AMREF Health Africa Group CEO said considering that more than 50 per cent of Africans do not access the formal health system, Community Health Workers are a critical and necessary part of the continent's health infrastructure. **"*In this campaign, we are advocating for the remuneration of community health workers and their inclusion into the formal health workforce*,"** said Dr. Gitahi. The campaign roll-out seeks to have CHWs receive one year of training: three months in a classroom and nine months in the field under supervision. In addition, each CHW is expected to receive a monthly salary equivalent to KES.7, 000-10, 000.

Dr. Gitahi added that this was the ideal approach for Kenya; given the huge role the community health workers play in bridging gaps in the formal health workforce. During FGD with CHVs in both Migori and Kwale, they gave similar figures as those proposed by AMREF Africa.

When asked how much they would wish to be remunerated, the study agrees with these sentiments as this is the only way to address the challenge of CHV's remuneration. In 2010, Kenya approved a new constitution devolving political, management, and financial responsibilities, including health, to local authorities.

The study sees this as a great opportunity where strong political will from Governors in the Counties can help strengthen community and primary health care services through adequate budgetary allocation for its implementation. A good Example is the experience of Machakos County. As a programme to facilitate Universal health Care in Machakos County, The County Government established 250 Community Health Units (CHUs) and trained over 2,500 Community Health Volunteers (CHVs). While launching the programme of Universal Health Care, Dr. Alfred Mutua, Governor of Machakos said having such volunteers will ensure residents deep in the villages get good accessible health care and important lifestyle information that will help them curb diseases**. "*Having these volunteers will ensure that wananchi who are deep in the villages are kept abreast with new health information, know more about lifestyle diseases like hypertension, diabetes and understand the importance of hospital deliveries among other things,"*** Mutua said.

One of the challenges CHVs faced is the referral of clients to health facilities. The Kenya referral system has four levels of service: Community, Primary Care, County Referral Services, and National Referral Services. The health service delivery system in Kenya is organized across six levels of care, beginning at the community level and continuing through primary care services, which include dispensaries (level 2) and health centres (level 3), and County Referral Health Services (level 4 & 5) all the way to the national referral health services (level 6).

The strengthening of referral linkages across service delivery units is one of the elements in the health policy strategy to achieve an efficient health service delivery system that maximizes health outcomes. A comprehensive referral system in Kenya with effective linkages will ensure continuity of care across all levels (MOH, 2014).

To strengthen the referral system, the Ministry of Health (MOH) developed the Kenya Health Sector Referral Strategy 2014–2018. This strategy defines referral as a mechanism to comprehensively manage clients' health needs by using resources beyond those available where they access care. The scope of referral services defined in this strategy includes movement of clients, specimens, services and experts, and client parameters (MOH, 2014).

The rationale for a Well-Functioning Referral System is that most of the population of Kenya is rural and poor. An effective referral system will ensure health services to all people in Kenya in the following ways: Coordination and standardization of referral services; Continuity of care across the different levels of care; Cost-effectiveness of health services provided to Kenyan citizens; Promotion of universal coverage and equity in provision of health services and Health care planning through performance monitoring of the referral system (MOH, 2014).

The benefits of a well-functioning referral system are as follows: Maximize efficiency of the health system by ensuring appropriate use of health services; Strengthen lower-level facilities and improve capacity for decision-making by health workers at all levels; Create opportunities for balanced distribution of funds, services, and human resources; Promote linkages across the different levels of care and between public and private entities and ensure that care is provided at the lowest possible cost (MOH, 2014).

The study found out that the referral process was noted to have a few challenges, with some patients seeking services without accompanying referral forms and some not seeking referrals at all

Majority of the CHVs noted that referrals increased the patient's confidence in accessing services, while in some cases the referrals facilitated direct services (without queuing) especially in emergency cases.

The data collection tools i.e., service delivery logbook MOH 514 and the patient referral form are sometimes too complicated for the CHVs level of understanding and are occasionally inadequate in supply. There have also been instances where medical supplies are not enough. Some CHVs lack badges causing challenges in their identification. This may be one of the reasons why some are rejected by the communities within which they are stationed. Illiteracy of community members also poses a challenge to the uptake of health messages passed to them by the CHVs.

During FGDs respondents were asked what challenges are faced by the CHVs in delivering their work. Most respondents mentioned rejection by the community as one of the challenges faced by CHVs. Some community members are hostile towards them and refuse to take the drugs they offer especially in Kwale County compared to Migori.

CHVs offer antimalarial medicine, especially AL after testing with mRDTs as well as paracetamol and Albendazole. This rejection is partly attributed to poor interpersonal skills in some instances. In other cases, their inadequate knowledge in some health issues makes community members to look down upon them and their work. Another challenge is their scarce numbers hence some must travel long distances to cover all community members within their jurisdictions. This is exacerbated by little or lack of support to them in terms of transport and poor remuneration altogether. Shortage of supplies is another aspect that curtails their work.

One common challenge was the erratic supply of commodities for the CHVs. Key informant interview with health care managers indicated that in both Counties, commodities for the three diseases are procured separately and delivered to the link facilities every quarter before distribution to the CHVs on a need basis.

Poor documentation and reporting were cited as a challenge**.** The qualitative findings from CHVs FGDs and the HCWs KIIs showed that there is poor documentation and reporting on the project activities. Some of the issues contributing to this include; erratic supply of reporting tools which led to some CHVs using their own money to make copies, inaccuracy and incomplete data due to illegibility of writings when submitting the hand written reports or technical know-how when uploading into the DHIS2, Key informant interviews with facility managers pointed out challenges on poor documentation of work that has been done in the community by CHVs, incomplete uploading the data to the DHIS, erroneous data entry, and poor linkages between the field and facility CHEWs and other staff at the health facility, minimal understanding of the data flow, biased reporting by CHVs on specific interventions, inadequate laptops/computers and airtime for bundles to upload data onto the DHIS2, inadequate capacity of CHEWS to enter data into the

DHIS2, untimely reporting by CHVs and lack of understanding of reporting by CHCs as cited below**.** In Kwale some community members refused water treatment for fear of being laced with contraceptives for fertility control. In some communities, HIV related stigma made it difficult to trace treatment defaulters for assistance. The findings allude to existing misconception among CHV as relates TB and HIV testing.

Qualitative findings from key informant interviews with facility managers show that despite the good linkages between the community and facility, some challenges persist. The top among those identified were inadequate human resources at the facilities. Lean staffing level affected average time patient spend at the facilities.

Findings from the study clearly showed that some of the patients referred to facilities for services come with different expectations. Most common is the expectation for express treatment at the facility even without going through the triage. The other challenge presented by patients referred for service is delays in presenting themselves to facilities for treatment. These cases are common among those who are not accompanied for services at the facility by CHVs.

This is particularly felt when there are many referrals to the facility who expect to be served without delays. Sometimes referred patients do not submit referral forms to facilities or submit to the wrong health workers at the facility making follow ups a challenge.

The null hypothesis (Ho:) for this study postulated that strengthening level 1 health services has no impact on community access and utilization of malaria control interventions, while the alternative hypothesis (H_1), stated that Strengthening level 1 health services had an impact on community access and utilization of malaria control interventions: In this study, we reject the null hypothesis since there is enough statistical evidence to infer that strengthening community health services (level 1) has an impact on community access and utilization of malaria control services as demonstrated by these key variables with p values of less than 0.05. and resulting in a reduction of malaria morbidity more significantly in Migori compared to Kwale.

5.2 Conclusions

1. The study has demonstrated that, strengthening community health services at (level one) leads to great improvement in community utilization of malaria control interventions such as ***Net ownership and utilization, Access and utilization of malaria prevention in pregnancy (IPTp3)*** as well as ***Access to diagnosis and treatment utilization*** of malaria case management, this has a great effect in reducing malaria morbidity and mortality as desired in the country's national malaria control strategy.
2. The proportion of malaria cases seen at health facilities that receive prompt and effective malaria treatment improved significantly in Migori County compared to Kwale County. Malaria cases tested in Migori increased significantly compared to Kwale. During Focus group discussions participants mentioned that malaria case incidence within the household in Migori had decreased significantly compared to Kwale. The study concludes that the approach of strengthening community health services (level one) by using trained CHVs is feasible and has demonstrated a faster and perhaps sustainable means of achieving this objective.
3. In this study, net ownership improved significantly in reference to the national coverage (54%). Thus, households with at least one Mosquito net (LLIN) in Migori increased significantly to 92% compared to Kwale. Perhaps one reason could be that Migori County received two rounds of free LLINs distribution in 2014 and 2016 while Kwale County had received only one round of free LLINs distribution in early 2015 (see circular on free nets distribution appendix 9). In this study, households' representatives who attend a net hanging demo in Migori increased significantly compared to Kwale. At the same time, the proportion of nets hanging properly in Migori increased significantly compared to Kwale. In this study, net in use the night before the survey by households' members, children under 5 years and pregnant women in Migori increased significantly compared to Kwale.

4. The study found out that main challenges faced by CHVs were inadequate remuneration, lack of working tools, supplies, transport, motivation as well as poor referral processes while delivering community health services.

5. The strategy for universal free net distribution every three years by the National Malaria Control Program has not only increased net ownership by households but also increased nets utilization by household members, children under five and pregnant women.
6. The study concludes that CHVs have various roles and activities that facilitate the access and utilization of malaria prevention and control interventions. Thus, CHVs can bridge the gap of inadequate human resource for health and can effectively be deployed to support primary health care Services at low cost.
7. The study demonstrated that the information disseminated by community health volunteers to members of the community has changed the communities' perception, knowledge, behaviour and utilization of health services positively. The community health system linkage through CHEWs in Kenya is feasible and has taken root in areas where this study was conducted.
8. In conclusion, involving, engaging and training of CHVs greatly contributes to community access and utilization of malaria control interventions in a community setting where behaviour approaches for change are essential, as well as supportive supervision and provision of adequate medical commodities, supplies and tools. Bearing in mind that health services are not readily available in most developing and third world countries where malaria is endemic, the establishment of community health auxiliaries like the community health volunteers as first line responders to health issues is a sure way of ensuring that community health issues including malaria are taken care off at the community level. Also it ensures management of complicated issues receives due referrals. Further, documentation and reporting of activities improves monitoring and collecting of indicators that give pointers to malaria situations

5.3 Recommendations

Strengthening level one health services has a positive health outcome.

1. This study recommends that to achieve universal health coverage, counties should establish community health units and develop policies to strengthen community health services. County Government Departments' of Health Services should provide adequate budget allocation to enhance CHVs stipend as well as budgetary allocation for Community health activities.
2. For social and economic development, counties should earmark resources for establishment and operationalization of the Community Health Units as they are avenues to strengthen community development.
3. Health services have been devolved to the counties. The ministry of health at national level has the mandate to set health standards for health services in the County. Therefore, they should advocate for strong political will and commitment from Governors at the county level for establishment of community and primary health care services with the requisite budget allocation as a way of achieving universal health care in the County. The advocacy mechanisms should go through established National forum such as the CECM Health Services Council Forum and the Council of Governors.
4. In counties where community health units are already established, transport in the form of bicycles should be provided to all CHVs for ease of mobility within the CHUs. Mechanisms should be put in place for repair and maintenance of the bicycles.
5. CHVs represent an important human resource for health whose potential in providing and extending a reasonable level of health care to underserved populations must be fully tapped. CHVs have been given the responsibility of galvanizing and mobilizing communities for health actions. Community health volunteers need sustainable careers and a stable income. Counties should provide an adequate remuneration package for the CHVs. We propose a monthly

salary/stipend of between KES 7,000-Ksh10,000 commensurate with that of support staff employed by the health departments in the county.

6. A positive attitude among health workers should be created to enhance positive health seeking behavior from community members to improve utilization of malaria control and prevention services. At the same time the community health system using CHVs should be strengthened to empower households to take appropriate positive health behavior in response to services offered for malaria control and prevention interventions at the community and health facilities levels.
7. Infrastructure and skills performance by health workers should be strengthened so as to improve the quality of malaria case management and to mitigate against irrational drug use. CHVs should continue playing the pivotal role of promotive and preventive activities carried out at the household level.
8. Service delivery by CHVs can be improved by equipping them with enough supplies and tools to carry out their work. They also require comprehensive support through supervision from the CHUs and linked facilities. Their continuous training is also paramount to curb the gap of drop outs. This should go hand in hand with proper supervision from and collaboration with CHEWs.
9. A reward system for the best performing CHVs would contribute towards motivating them to perform better. They would also need umbrellas, gumboots and raincoats to wear during the rainy season. The community should be sensitized about the existence of CHVs and their roles in the community.

5.4 Future Research

Finally, this study recommends further research to be conducted on the economic evaluation of the community health services as well as cost benefit analysis on the remuneration of community health volunteers.

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APPENDICES

Appendix I: Analysis of Health Facility Data

Table 7.1: Above 5-Years Malaria Cases between Baseline and Endline in Migori by CHUs

Name of CHU	Malaria cases in 2013 (Baseline)	Malaria cases in 2016 (Endline
Itongo	4641	2550
Getongoroma	1654	1469
Nyamagagana	3364	793
Gosebe	2441	1336
Total	**12300**	**6148**

Total malaria cases at Baseline= 12,300

Above five years Population at risk = 17,500

Malaria Cases per 1000 population at risk = 12300/17500 x 1000 = **703/1000**

Total cases at Endline= 6148

Above five years Population at risk = 17,500

Malaria cases per 1000 population at risk = 6148/17500 x 1000 = **351/1000**

Table 7.2: Under 5-Years Malaria Cases between Baseline and Endline in Migori by CHUs

Name of CHU	Malaria cases in 2013 (Baseline)	Malaria cases in 2016 (Endline
Itongo	3900	1585
Getongoroma	1631	655
Nyamagagana	3154	789
Gosebe	1824	502
Total cases	**10509**	**3531**

Total malaria cases at Baseline= 10,509

Under five years Population at risk = 2,500

Malaria Cases per 1000 population at risk = 10509/2500 x 1000 = **4204/1000**

Total cases at Endline= 3531

Under five years Population at risk = 2,500

Malaria cases per 1000 population at risk = 3531/2500 x 1000 = **<u>1413/1000</u>**

Table 7.3: Over 5-Years Malaria Cases between Baseline and Endline in Kwale by CHUs

Name of CHU	**Malaria cases in 2013 (Baseline)**	**Malaria cases in 2016 (Endline**
Eshu	2524	3154
Mafisini	1515	4248
Kikoneni	802	1359
Mamba	1204	286
Total	**6045**	**9047**

Total malaria cases at Baseline = 6045

Above five years Population at risk = 17,500

Malaria Cases per 1000 population at risk = 6045/17500 x 1000 = **<u>345/1000</u>**

Total cases at Endline= 9047

Above five years Population at risk = 17,500

Malaria cases per 1000 population at risk = 9047/17500 x 1000 = **<u>517/1000</u>**

Table 7.4: Under 5-Years Malaria Cases between Baseline and Endline in Kwale by CHUs

Name of CHU	**Malaria cases in 2013 (Baseline)**	**Malaria cases in 2016 (Endline**
Eshu	817	995
Mafisini	525	1332
Kikoneni	595	657
Mamba	557	85
Total	**2494**	**3069**

Total malaria cases at Baseline= 2494

Under five years Population at risk = 2,500

Malaria cases per 1000 population at risk = 2494/2500 x 1000 = **<u>998/1000</u>**

Total cases at Endline= 3069

Under five years Population at risk = 2,500

Malaria cases per 1000 population at risk = 3069/2500 x 1000 = **<u>1228/1000</u>**

Appendix II: Questionnaire

Module 1: Household Listing

Now we would like some information about the people who usually live in your household or who are staying with you now.

LINE NO.	USUAL RESIDENT AND VISITORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX	RESIDENCE		AGE	ELIGIBLE WOMEN	CURRENTLY PREGNANT?
	please give me the name of the person who usually live in your household and guests of the household who stayed here last night, starting with the head of the household	What is the relationship of (NAME) to the head of the household?	Is (NAME) male or female?	Does (NAME) usually live here?	Did (NAME) stay here last Night?	How old is (NAME)?	Circle line number of all women age (15-49)	For eligible women ask is (NAME) currently pregnant
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
01			M F 1 2	YES ….1 NO….. 2	YES…. 1 NO …..2	IN YRS	01	YES 1 NO/DK 2
02			M F 1 2	YES… 1 NO…. 2	YES… 1 NO …..2	IN YRS	02	YES 1 NO/DK 2
03			M F 1 2	YES… 1 NO…. 2	YES… 1 NO ….2	IN YRS	03	YES 1 NO/DK 2
04			M F 1 2	YES… 1 NO…..2	YES… 1 NO… 2	IN YRS	04	YES 1 NO/DK 2
05			M F 1 2	YES…. 1 NO….. 2	YES… 1 NO ….2	IN YRS	05	YES 1 NO/DK 2
06			M F 1 2	YES…. 1 NO……2	YES… 1 NO….2	IN YRS	06	YES 1 NO/DK 2
07			M F 1 2	YES… 1 NO…..2	YES… 1 NO ….2	IN YRS	07	YES 1 NO/DK 2

LINE NO.	USUAL RESIDENT AND VISITORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX	RESIDENCE		AGE	ELIGIBLE WOMEN	CURRENTLY PREGNANT?
08			M F 1 2	YES… 1 NO…. 2	YES….1 NO….2	IN YRS	08	YES 1 NO/DK 2
09			M F 1 2	YES… 1 NO…. 2	YES… 1 NO… 2	IN YRS	09	YES 1 NO/DK 2
10			M F 1 2	YES… 1 NO ….2	YES… 1 NO… 2	IN YRS	10	YES 1 NO/DK 2

*CODES FOR Q3: RELATIONSHIP TO THE HEAD OF HOUSEHOLD

01=HEAD **06= PARENT** **10 = ADOPTED/FOSTER/STEPCHILD**
02= WIFE/HUSBAND **07 = PARENT IN LAW**
03= SON/DOUGHTER **08 = BROTHER/SISTER**
04 = SON/DAUGHTER IN LAW **09 = OTHER RELATIVE**
05 = GRANDCHILD **11 = NON RELATED** **98 = DON'T KNOW**

Module 2: Net ownership and use

11	Does your household have any mosquito nets that can be used while sleeping? **IF NO SKIP TO 14**	YES .... 1 NO 2
12	How many mosquito nets does your household have?	Number of nets ……………………
13	Among your HH member, who slept under a mosquito net last night?	Insert the Number/name from the HH list…………
14	How many separate sleeping spaces are there in your household?	Number of sleeping spaces
15	Have you attended a net hanging demonstration in the last one year?	Yes……………………………………1 No……………………………………2

Module 3: Access to diagnosis and treatment use

16	Has anyone in your household suffered from malaria over the last two weeks? **IF NO SKIP TO 25**	Yes...1 No 2
17	If yes, who suffered from malaria in your HH?	Insert the Number from the HH list…………
18	Was he/she tested for malaria?	Yes...1 No ....2 .
19	Who performed the test	Laboratory tech...........................1 Health Worker (facility) ....2 Community Health Worker ....3 Do not Know 4
20	If tested, what were the results?	Positive ....1 Negative......................................2 .
21	If Positive, did name receive ACT	Yes……………………………………..1 No……………………………………...2
23	If Negative, did name receive ACT	Yes……………………………………..1 No……………………………………...2
22	How long after fever started did name take ACT	Same day ....1 Next day ....2 After two days ....3 After three days 4
24	Where did name receive the antimalarial drugs (source)?	Already present in the house ....1 Public health facility....................2 Drug shop ....3 Pharmacy ....4 Community Health Worker 5

Module 4: Access and use of malaria prevention in pregnancy

25	Is there a woman of child bearing age who is currently pregnant in your household? **IF NO SKIP TO 29**	YES ....1 NO 2

26	Is she attending ANC	Yes……………………………………..1 No……………………………………2
27	If yes, has she received any medicines for keeping her from getting malaria (IPT)?	YES ....1 NO ....2 .
28	If yes, how many times has she taken the medicines (IPT)?	IPT1..1 IPT2..2 IPT3..3

Module 5: ***Access*** **and use of Indoor residual spraying**

29	Has your house been sprayed with insecticide over the last one year? **IF NO SKIP TO 31**	YES ....1 NO 2
30	If yes, did you pay for the IRS?	Yes……………………………………..1 No……………………………………2

Module 6: Socio-economic status

31	What is the source of income for the household?	Farming ....1 Self employment ....2 Formal employment.............3 Business ....4 None.......................................5		
32	Does any member of your household own or have: **YES NO** a) A watch? b) A bicycle? c) A motorcycle or motor scooter? d) An animal-drawn cart? e) A car or truck? f) A boat with a motor? g) A boat without a motor? e) A bank account?	 WATCH .... BICYCLE .... MOTORCYCLE/SCOOTER....... ANIMAL-DRAWN CART . ...; CAR/TRUCK .... BOAT WITH MOTOR .... BOAT WITH NO MOTOR .... BANK ACCOUNT	**YES** 1 1 1 1 1 1 1 1	**NO** 2 2 2 2 2 2 2 2
33	How many of the following animals/birds does this household own? a) Local Cattle? b) Exotic/Cross Cattle? c) Goats? d) Sheep? e) Pigs? f) Chickens?	LOCAL CATTLE . . . . EXOTIC/CROSS CATTLE . . . . GOATS . . . . SHEEP . . . . PIGS . . . . CHICKENS		
34	How many acres of agricultural land do members of this Household own?	Acres…………………………………………		

Module 7: CHECKLIST

35. Observe the net to see if

1. In use ☐ 2. Not in use ☐

36. Asses condition of ITN

2. Smaller than sleeping area ☐ 3 Dirty ☐

1. Damaged ☐

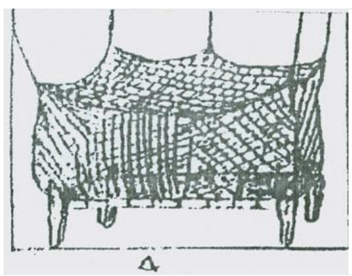
.

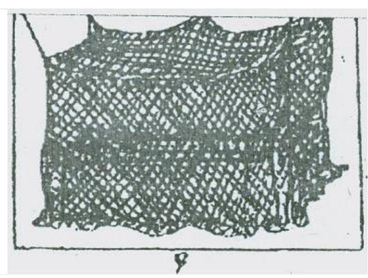
. 4. Larger than sleeping area ☐

37. Assess how mothers hang the ITN at night?

Tick appropriately

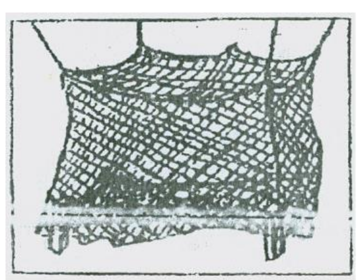
A ☐





'B ☐

C ☐



Appendix III: Focused Group Discussion Guide

EVALUATION OF THE IMPACT OF STRENGTHENING COMMUNITY HEALTH SERVICES ON UTILIZATION OF MALARIA CONTROL INTERVENTIONS IN MIGORI COUNTY

Introduction

Please identify a private setting for the FGDs. Ask/assist each of the participants to complete the background information form.

I would like to thank each of you for agreeing to be a part of this focus group discussion.

My name is ………………. . I will be leading the discussion session.

My colleague (s) here is/are called …………………; will help by taking notes about the discussion.

We also request you to allow the session to be audio-taped so that we do not miss writing down any of the ideas. The purpose of conducting this discussion is ways of how to of strengthen community health services for community utilization of malaria control interventions in Migori county.

There are no wrong or right answers. Please be assured that your personal details or what you say as a person will not be used at any time. What you say is therefore confidential and anonymous. We shall tape-record the discussion. This will help us in ensuring that we captured all the important information discussed. We will ensure confidentiality with regard to all the information discussed and in particular, the information in the tapes will be destroyed after analysis. This discussion will also be anonymous – your names will not be recorded in the notes; rather we shall assign codes to the names. You are therefore encouraged to participate actively and to feel free during the discussion.

Do you have questions at this point about this discussion? *Ask each participant to introduce him or herself in turn. After the introductions, open up the discussion by asking the questions below.*

Demographic profile of the participants

Bio data form for FDGs

Code	**Age in years**	**Gender**	**Occupation**	**Religion** ***(Christian, Muslims, African Traditional)***	**Education level** ***(None, primary, secondary, higher)***	**Other key observations**
1						
2						
3						
4						
5						

Net ownership and utilization

Does your household have any mosquito nets that can be used while sleeping?

How many mosquito nets does your household have?

How many separate sleeping spaces are there in your household? Among your HH member, who slept under a mosquito net last night? What motivates a HH member to sleep under a mosquito net?

What makes a HH member not to sleep under a mosquito ne?

In your opinion, who is best paced to promote mosquito net use at your house hold? In your own view, who are best placed within your community to advocate for mosquito net use at your house hold?

Access to diagnosis, treatment and utilization of case management

Has anyone in your household suffered from malaria over the last two weeks?

Who suffered from malaria in your HH?

Was he/she tested for malaria? What were the results of the test?
How long after fever started did he/she take ACT?
Where did he/she receive the antimalarial drugs (source)?
In your own view, who are best placed within your community to antimalarial drugs (source)?

Access and utilization of malaria prevention in pregnancy

Is there a woman of child bearing age who is currently pregnant in your household?

Has she received any medicines for keeping her from getting malaria (IPT)? How many times has she taken the medicines (IPT)?

Access and utilization of Indoor residual spraying

Has your house been sprayed with insecticide over the last one year?

In your own view, who are best placed within your community to support indoor residual spraying?

Who should pay for indoor residual spraying for your houses?

Socio-economic status

What are the sources of income for your households? Does any member of your household own

a) A watch?
b) A bicycle?
c) A motorcycle or motor scooter?
d) An animal-drawn cart?
e) A car or truck?

f) A boat with a motor?

How many of the following animals/birds do your households own?

a) Local Cattle?
b) Exotic/Cross Cattle?
c) Goats?
d) Sheep?
e) Pigs?
f) Chickens?

How many acres of agricultural land do members of your household own? In your own view, who in this community is considered very rich?

In your own view, who in this community is considered poor of the poorest? In your own view, who in this community is considered middle class?

Appendix IV: Focus Group Discussion Guide

Focus Group Discussion Guide (Man, Women, Youth groups and Community Health Volunteers (CHVs))

INSTRUCTIONS TO THE INTERVIEWER

Please identify a private setting for the FGDs. Ask/assist each of the participants to complete the background information form.

A. CONSENT SECTION

I would like to thank each of you for agreeing to be a part of this focus group discussion. My name is ………………. I will be leading the discussion session.

My colleague (s) here is/are called …………………; will help by taking notes about the discussion.

We also request you to allow the session to be audio-taped so that we do not miss writing down any of the ideas. The purpose of conducting this discussion is ways of how to of strengthen community health services for community utilization of health services in Kwale County.

There are no wrong or right answers. Please be assured that your personal details or what you say as a person will not be used at any time. What you say is therefore confidential and anonymous. We shall tape-record the discussion. This will help us in ensuring that we captured all the important information discussed. We will ensure confidentiality with regard to all the information discussed and in particular, the information in the tapes will be destroyed after analysis. This discussion will also be anonymous – your names will not be recorded in the notes; rather we shall assign codes to the names. You are therefore encouraged to participate actively and to feel free during the discussion.

Do you have questions at this point about this discussion?

Ask each participant to introduce him or herself in turn. After the introductions, open up the discussion by asking the questions below.

SOCIO-DEMOGRAPHIC CHARACTERISTICS

Sub county:	**Moderator:**
CHU:	**Note taker:**
Date of FGD:	**Time start:**
Type of FGD	**Time stop:**
Participants at start: **Participants at stop:**	**Debrief notes**

Demographic Profile of the Participants

Bio data form for FDGs

Code	**Age in yrs**	**Gender**	**Occupation**	**Religion*(Christian, Muslims, African Traditional)***	**Education level*(None, primary, secondary, higher)***	**Other key observations**
1						
2						
3						
4						
5						
6						

B. Assessment of the roles of and support to, activities and challenges experienced by Community Health Volunteers (CHVs) in delivering malaria control interventions and other health related activities.

1. What role do community health volunteers (CHCs) play in interventions to control malaria and other health related activities?
2. What support do Community Health Volunteers (CHVs) receive as they undertake interventions to control malaria and other health related activities?

3. What specific activities do community health volunteers (CHCs) play in interventions to control malaria and other health related activities?
4. What challenges do community health volunteers (CHVs) encounter in the delivery of malaria control interventions and other health services?

Appendix V: Key Informant Interview Guide

Key Informant Interview Guide (SCMOH, SCHRIO, PHO, KeNAAM Project Officer and CHEW, CHU Chairman, Chiefs and Assistant Chiefs)

INSTRUCTIONS TO THE INTERVIEWER

Please identify a private setting for the FGDs. Ask/assist each of the participants to complete the background information form.

C. CONSENT SECTION

I would like to thank each of you for agreeing to be a part of this focus group discussion. My name is ………………. . I will be leading the discussion session.

My colleague (s) here is/are called …………………; will help by taking notes about the discussion.

We also request you to allow the session to be audio-taped so that we do not miss writing down any of the ideas. The purpose of conducting this discussion is ways of how to of strengthen community health services for community utilization of health services in Kwale County.

There are no wrong or right answers. Please be assured that your personal details or what you say as a person will not be used at any time. What you say is therefore confidential and anonymous. We shall tape-record the discussion. This will help us in ensuring that we captured all the important information discussed. We will ensure confidentiality with regard to all the information discussed and in particular, the information in the tapes will be destroyed after analysis. This discussion will also be anonymous – your names will not be recorded in the notes; rather we shall assign codes to the names. You are therefore encouraged to participate actively and to feel free during the interview.

Do you have questions at this point about this discussion?

D. Bio Data Form for KII

Code	**Age in years**	**Gender**	**Designation**	**Religion*(Christian, Muslims, African Traditional)***	**Level training**	**Type of Health Facility**

E. Assessment of the roles of and support to, activities and challenges experienced by Community Health Volunteers (CHVs) in delivering malaria control interventions and other health related activities.

1. What role do community health volunteers (CHCs) play in interventions to control malaria and other health related activities?

2. What support do Community Health Volunteers (CHVs) receive as they undertake interventions to control malaria and other health related activities?
3. What specific activities do community health volunteers (CHCs) play in interventions to control malaria and other health related activities?
4. What challenges do community health volunteers (CHVs) encounter in the delivery of malaria control interventions and other health services?

Appendix VI: Informed Consent

Title of Research: EVALUATION OF THE IMPACT OF STRENGTHENING COMMUNITY HEALTH SERVICES ON COMMUNITY UTILIZATION OF MALARIA CONTROL INTERVENTIONS IN MIGORI AND KWALE COUNTIES

Investigators:

Investigators	Expertise role
Athuman Nyae Chiguzo (Principal)	PhD in Public Health, Jomo Kenyatta University of Agriculture and Technology /ITROMID
Dr. Evan Mathenge	Principal Researcher KEMRI/(ESACIPAC) and a co-investigator
Professor Helen Lydiah Kutima	Associate Professor, JKUAT and a co-investigator
Professor Charles N.M. Mbogo	Chief Research Officer KEMRI/ Wellcome Trust Research Programme and a co-investigator

Introduction

My name is Athuman Chiguzo a student from the Institute of Tropical Medicine and Infectious Diseases department at JKUAT conducting the above-named study. You are asked to participate in the above research study because you meet the inclusion criteria. Your participation is entirely voluntarily. If you do not want to participate, there will be no penalty. You may stop your participation any time. You should read the information below and ask questions about anything you do not understand before deciding whether or not to participate.

Purpose

The main objective of this study is to evaluate the impact of strengthening the community level health services on utilization of malaria control intervention in Migori and Kwale Counties.

Procedures

Either my research assistant or I will identify himself to you after which you will be required to fill a detailed questionnaire through an interview. This is supposed to be a private and confidential exercise done in an enclosed area. You are supposed to fill the questionnaire only after you have accepted and signed a consent form. You will then be asked questions or given statement which you are expected to respond to afterwards. The questions will probe you on issues relating to the participation on the utilization of malaria prevention and control intervention and related operational research in this area. This will take about 25-30 minutes.

Benefits

There are no direct benefits to you from participating in this study. However, the information gathered from this study will be useful in improving planning for prevention and control programmes and operational research on malaria.

Risks

There are no known harmful effects associated with your participation in this study. However, to protect you from the risk of disclosure of information, all information you will give will be kept confidential within the research team. If you accept to participate in focus group discussions interview you are requested not to disclose personal information about yourselves or others. Confidentiality of the information discussed by all participants and researchers during focus group discussions will be maintained, and you are not required to answer any question that you do not wish to answer. Everything you say in this discussion will be kept private and no names will be used in my report. Your responses will be kept with lots of confidentiality and analyzed anonymously.

Confidentiality and Privacy

Information collected from you will be for research purposes only and strictly private and confidential. No information about you or provided by you during the research will be disclosed to others without your written permission, except to protect your rights or welfare, or if required by law. Names will not be used at any point and is of no purpose for this study and no information will be included that would reveal your identity on publications or in conferences.

In case officials from the authorized institutions will need to review your records for the study, they will protect your privacy.

Contact Information

If you have any questions regarding this study, please contact Athuman Chiguzo, on phone number 0722756962 or email athuman.chiguzo@gmail.com of P.0 BOX 41142- 80100 Mombasa. Department of Medical Services & Public Health. Plot no. MN/1948/Mtwapa, Zagota Hotel Building.

For any questions pertaining to rights to conduct this study please contact the Secretary Maseno University Ethics Review Committee (MUERC) Directorate of Research, Publications and Innovations (DRPI) Maseno University Main Campus along Kisumu-Busia road, Private Bag Maseno, Kenya.

Compensation: There will be no any reimbursement to be made for your participation in the study.

Consent and signature options

I confirm that I understand the information provided to me for the above study and that I have had the opportunity to ask questions. I have known the risks and they have been explained to my satisfaction. I understand that my participation is voluntary and that I am free to withdraw from the study at any time without any consequences**.**

Name of participant…………………………………………………

Signature………………....or Thumb print…………Date……………….

My signature as witness certifies that the subject signed this consent form in my presence as his or her voluntary act.

If participant illiterate **(witness**)………………. Signature…………. Date………………

I certify that I have followed all the study specific procedures in the SOP for obtaining informed consent.

Name of investigator……………….........Signature…………………….....Date………

☐ Participant received a copy

Appendix VII: Expected Outputs

Table 7.5: Expected Results to be Recorded at both Baseline and Post Interventions for Comparison as Well as Advocacy for Policy Change

NO.	Specific Objective	Indicator	Operational Definition
1	Determine the influence of the use of trained CHVs on utilization of malaria prevention and control intervention in Migori County	Households with LLINs proportion of household members sleeping under LLINs Proportion of houses covered by IRS Proportion of pregnant women that receive IPTp2	Number of households with LLINs. Number of household members sleeping under LLINs. Number of houses covered by IRS. Number of pregnant women that receive IPTp3.
2	To establish the proportion of malaria cases seen at health facility that receive prompt and effective malaria treatment in Migori County	Proportion of fever cases sourcing for a malaria test Malaria test positivity rate Proportion of confirmed malaria cases that receive ACT treatment within24 hours of onset of symptoms Proportion of malaria cases adhering to treatment regimen. Proportion of malaria negative tested not treated with ACTs.	Number of patients with fever who are tested for malaria. Number of fever cases that test positive for malaria Number of malaria test positive who are treated with ACTs within24 hours of onset of symptoms. Number of malaria cases that are adhering to treatment regimen. Number of patients with fever who have negative malaria test not treated with ACTs.
3	Determine the influence of use of trained CHVs on the awareness and demand of malaria Prevention and control interventions by communities in Migori county.	Proportion of household aware of malaria control interventions. Proportion of Households demanding for Malaria control interventions.	Number of household aware of malaria control interventions. Number of households demanding for malaria control interventions.

NO.	Specific Objective	Indicator	Operational Definition
4	Identify the challenges CHVs experience during the provision of Community Health Services in Migori county	The challenges of CHVs in Community Health Services provision	Number of challenges of CHVs in Community health services provision identified

Table 7.6: Baseline and Post Intervention Target Indicators

No.	Baseline indicators	Post intervention indicators
1	% of CUs established	% change proportion of CUs established
2	% of households with LLINs	% change of households with LLINs
3	% of household members sleeping under LLINs	% change of household members sleeping under LLINs
4	% of houses covered by IRS	% change of houses covered by IRS
5	% of pregnant women that receive IPTp3	% change of pregnant women that receive IPTp3
6	% of fever cases sourcing for a malaria test	% change of fever cases sourcing for a malaria test
7	% of Malaria test positive	% change of Malaria test positive
8	% of confirmed malaria cases that receive ACT treatment within 24 hours from the onset of symptoms	% change of confirmed malaria cases that receive ACT treatment within 24 hours from the onset of symptoms
9	% of malaria cases adhering to treatment regimen	% change of malaria cases adhering to treatment regimen
10	% of malaria negative tested not treated with ACTs	% change malaria negative tested not treated with ACTs
11	% of household aware of malaria control interventions	% change of household aware of malaria control interventions
12	% of households demanding malaria control interventions	% change of households demanding malaria control interventions

Appendix VIII: Indicators to be Measured

Access and Utilization of ACTs

The proportion of children under five with fever in the past 2 weeks who received antimalarial treatment within 24 and 48 hours of fever onset

The proportion of children under five with fever in the past 2 weeks receiving antimalarial treatment by type of drug within 24 and 48 hours of fever onset

- WHO/UNICEF registered ACT
- Nationally registered ACT
- Non-Artemisinin monotherapy
- Artemisinin monotherapy

The proportion of children under five with fever in the past 2 weeks who sought treatment by source

- Public health facility
- Pharmacy
- Drug Shop
- Community Health Worker
- Others (specify)

The proportion of caregivers of children under five with fever in the past 2 weeks who chose treatment source by reason

- Proximity
- Good reputation
- Inexpensive treatment
- Qualification of staff
- Availability of drugs

- Provides credit for purchases

The proportion of children under five with fever in the past 2 weeks who received antimalarial drugs by source

- Already present in house
- Public Health Facility
- Pharmacy
- Drug Shop
- Community Health Worker

Access and Utilization of LLIN

- The proportion of households with at least one LLIN Average number of LLINs per person
- The proportion of household residents who slept under LLIN the previous night of the survey
- The proportion of children under five who slept under LLIN the previous night of the survey

Access and utilization of malaria prevention in pregnancy

- The proportion of pregnant women who slept under LLIN the previous night of the survey
- The proportion of pregnant women who received IPTp1
- The proportion of pregnant women who received IPTp2
- The proportion of pregnant women who received IPTp3
- The proportion of pregnant women who received two or more doses of IPTp

Access and Utilization of IRS

- Percentage of targeted structures in IRS-targeted areas sprayed in the last 12 months.

Appendix IX: KeNAAM Baseline Research Approval Letter

KeNAAM
Kenya NGO's Alliance Against Malaria

AMREF Kenya Country Office Building
P.O Box 788-00100,
Nairobi, Kenya
Tel: +254 (0) 20 6994000
Email:info@kenaam.org
Website: www.kenaam.org

To: Athuman N .Chiguzo
Principal investigator

15th October, 2012

Dear Sir,

RE: BASELINE SURVEY: EVALUATION OF THE IMPACT OF STRENGHTHING COMMUNITY HEALTH SERVICES ON COMMUNITY UTILIZATION OF MALARIA CONTROL INTERVENTION IN MIGORI AND KWALE COUNTY.

Reference is made to your letter dated 5th October, 2012 to KeNAAM to conduct baseline survey for the global fund round 10 malaria project which was awarded to KeNAAM to be implemented in Kuria East and Kuria West districts.

The KeNAAM board in its board meeting held on 10th October, 2012 has granted you permission to conduct the baseline survey in collaboration with the DHMTs of Kuria East and West Districts.

Consequently, the baseline is granted approval by KeNAAM with effects from 15th October 2012 for a period of six (6) months.

The implementation of the baseline should be brought to the attention of KeNAAM and DHMTs of Kuria east and Kuria west and you should advice when the baseline is completed or discontinued.

You may proceed on the baseline survey

Yours faithfully,

Edward Mwangi
CEO
KENAAM

A Malaria-free Kenya

Appendix X: Ministry of Health Circulars on Free Nets Distribution

MINISTRY OF HEALTH RECEIVED 06 FEB 2015 OFFICE OF THE CABINET SECRETARY P. O. Box 30016-00100

CHIEF EXECUTIVE OFFICER COUNCIL OF GOVERNORS 10 FEB 2015 RECEIVED P. O. Box 40401 - 00100, NAIROBI

MINISTRY OF HEALTH

Directorate of Preventive and Promotive Health Services

National Malaria Control Program

Memo

To:	Cabinet Secretary
Thro':	Principal Secretary
Thro':	Director of Medical Services
Thro':	Head, Directorate of Preventive & Promotive Health Services
Thro':	Head, Division of Communicable Disease Prevention & Control
From:	Head, National Malaria Control Program
Date:	30th January 2015

RE: 2014/2015 Mass Distribution of Long Lasting Insecticide Nets (LLINs) in Coast and Western Region Counties

The Ministry of Health through National Malaria Control Program (NMCP) plans to distribute **13,406,539 nets** in 2014/2015 to populations living in the malaria endemic (Lakeside and Coast) and the Western highland epidemic prone Counties. The mass LLINs distribution campaign will be carried out at household level with the objective of achieving universal coverage. The campaign was officially launched by H.E the President of the Republic of Kenya in September 2014 in Migori County and has so far successfully distributed in six counties 3,294,439 LLINs between September and October 2014 as phase 1 & 2 of the campaign with a total protected population of 6,004,738 persons.

Currently, the NMCP plans to distribute **10,048,014 LLINs** in the remaining 17 target counties (former Coast, Western and Rift Valley regions) and in 3 irrigation area Counties. This activity is scheduled to take place from February 2015 to 31st August 2015.

The purpose of this memo is to request your office to inform the Governors for these 17 target Counties (annexed) of the planned mass LLINs distribution campaign that will be carried out in their Counties. We shall be in contact with the County Health Management Teams for preparation, effective planning and smooth implementation of this exercise.

Enclosed please find a letter addressed to the Governors for your perusal and signature.

Thank you.

Dr. Waqo Ejersa
Head – National Malaria Control Program
Encl.

DIRECTORATE OF PREVENTIVE AND PROMOTIVE HEALTH SERVICES RECEIVED 02 FEB 2015

MINISTRY OF HEALTH
OFFICE OF THE CABINET SECRETARY

Telegraphic Address
Telephone: Nairobi 254-2-2717077
Fax: 254-20-2719008
Email: cabsecretary@health.go.ke
When replying please quote

AFYA HOUSE
CATHEDRAL ROAD
P O Box 30016 00100
NAIROBI

CHIEF EXECUTIVE OFFICER
COUNCIL OF GOVERNORS
10 FEB 2015
RECEIVED
P. O. Box 40401 - 00100, NAIROBI

Ref. No.: MOH/ADM/1/1

6th February 2015

The County Governors,
Kilifi, Kwale, Lamu, Mombasa,
Taita Taveta, Tana River,
Busia, Kisii, Nyamira, Kakamega,
Bungoma, Trans Nzoia,
Kericho, Narok, Bomet,
Uasin Gishu and Nandi Counties

Thro'
Chairman, Council of Governors

RE: 2014/2015 Mass Distribution of Long Lasting Insecticide Nets (LLINs) in Coast and Western Region Counties

The Ministry of Health through National Malaria Control Program (NMCP) plans to distribute **13,406,539 nets** in 2014/2015 to populations living in the malaria endemic (Lakeside and Coast) and the Western highland epidemic prone Counties. The mass LLINs distribution campaign will be carried out at household level with the objective of achieving universal coverage. The campaign was officially launched by H.E the President of the Republic of Kenya in September 2014 in Migori County and has so far successfully distributed in six counties 3,294,439 LLINs between September and October 2014 as phase 1 & 2 of the campaign with a total protected population of 6,004,738 persons.

Currently, the NMCP plans to distribute **10,048,014 LLINs** in the remaining 17 target counties (former Coast, Western and Rift Valley regions) and in 3 irrigation area Counties. This activity is scheduled to take place from February 2015 to 31st August 2015.

The purpose of this letter is to inform your esteemed office about the planned mass net distribution campaign that will be carried out in your counties. NMCP will be in contact with the County Health Management Teams for preparation, effective planning and smooth implementation of this exercise.

Thank you for your continued support to malaria control activities.

James W. Macharia
Cabinet Secretary

Copy to: Cabinet Secretary, Ministry of Devolution and Planning
Chairman, Transition Authority

Appendix XI: Maseno University Ethical Review Committee Ethical Approval Letter

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 19th May, 2017

TO: Athuman Nyae Chiguzo
Jomo Kenyatta University of Agriculture and Technology
(Institute of Tropical and Infectious Diseases (ITROMID)
P.O Box 62000-0200, Nairobi, Kenya

REF: MSU/DRPI/MUERC/00384/17

RE: Evaluation of the Impact of Strengthening Community Health Services on Community Utilization of Malaria Control Interventions in Migori County. Proposal Reference Number MSU/DRPI/MUERC/00384/17

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 19th day of May, 2017 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 18th May, 2018. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 19th April, 2018.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 19th April, 2018.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

Thank you.

DIRECTORATE OF RESEARCH PUBLICATION & CONSULTANCIES
19 MAY 2017
MASENO UNIVERSITY

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee.

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

Appendix XII: List of and Links to Publications on the Study

1. The Roles, Activities and Challenges of Community Health Volunteers in Delivering Community–Based Malaria Control Interventions in Migori and Kwale Counties, Kenya **Authors**: Athuman Nyae Chiguzo, Helen Lydiah Kutima, Evan Murimi Mathenge, Charles N. M. Mbogo

   Link:https://www.noveltyjournals.com/upload/paper/The%20Roles%20Activities-14022022-4.pdf

2. A Comparative Study on Strengthened Community Health Services for Utilization of Malaria Control Intervention in Migori and Kwale Counties of Kenya

   Authors: Athuman Nyae Chiguzo, Helen Lydiah Kutima, Evan Murimi Mathenge, Charles Mwaniki Mbogo

   Link: https://www.irjms.com/journal/a-comparative-study-on-strengthened-community-health-services-for-utilization-of-malaria-control-intervention-in-migori-and-kwale-counties-of-kenya/

3. The Impact Of Strengthening Community Health Services On Malaria Cases That Receives Prompt And Effective Treatment In Migori And Kwale Counties

   Authors: Athuman Nyae Chiguzo, Helen Lydiah Kutima, Evan Murimi Mathenge, Charles Mwaniki Mbogo

   Link: https://ijiset.com/articlesv8/articlesv8s7.html

4. The Impact of Strengthening Community Health Services on Community Utilization of Malaria Control Interventions in Migori and Kwale Counties (A Baseline Survey Study)

   Authors: Athuman Nyae Chiguzo, Helen Lydiah Kutima, Evan Murimi Mathenge, Charles Mwaniki Mbogo

   Link: https://www.irjms.com/journal/the-impact-of-strengthening-community-health-services-on-community-utilization-of-malaria-control-interventions-in-migori-and-kwale-counties-a-baseline-survey-study