ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS MALARIA PREVENTION AND CONTROL AMONG PRIMARY SCHOOL CHILDREN IN BUSIA DISTRICT, KENYA

BY

THADEUS OBADHA ODENYO (B SC. HONS)

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH AND EPIDEMIOLOGY OF KENYATTA UNIVERSITY.

AUGUST, 2005
DECLARATION

I, Thadeus Obadha Odeny, declare that this thesis is my original work and has not been presented for a degree in any other university or any other award.

Signed ........................................ Date ........................................

SUPERVISORS APPROVAL

We confirm that the work reported in this thesis was carried out by the candidate under our supervision.

PROF. ALLOYS O. S. ORAGO
SIGNATURE .................................................. DATE ..............................

DEPARTMENT OF HEALTH SCIENCES
KENYATTA UNIVERSITY

DR. MICHAEL OTIENO
SIGNATURE .................................................. DATE ..............................

DEPARTMENT OF HEALTH SCIENCES
SCHOOL OF PURE AND APPLIED SCIENCES
KENYATTA UNIVERSITY

DR. SYPRINE A. OTIENO
SIGNATURE .................................................. DATE ..............................

DEPARTMENT OF BIOLOGICAL SCIENCES
SCHOOL OF PURE AND APPLIED SCIENCES
KENYATTA UNIVERSITY
DEDICATION

To my Grandmother whose life was an inspiration to me, to my parents who fought an endless battle with malaria throughout my under-five childhood and to all pupils in Busia District primary schools whose lives are perpetually threatened by malaria.
ACKNOWLEDGEMENTS

Most importantly, my thanks go to Doris Morgan Trust without whose support this study would not have been realized. I am greatly indebted to Dr. Otieno, Syprine; Professor Orago, Alloys; and Dr. Otieno, Michael for providing directions and their invaluable time throughout this study. My sincere gratitude also goes to Professor Okelo Romanus for thoroughly evaluating the statistical analyses used in this study.

Many thanks to the District Commissioner, Busia District. District Education Officers Busia and Kisumu, District Officers; Township Division, Butula Division and Budalang’i Division. Head teachers; Burumba Primary School, Bulanda Primary school, Bukhuma primary school, Longinus Atundo primary school and Port Victoria Mixed primary school for allowing this study in their schools.

I wish to extend my sincere thanks to the following groups and persons: The council of elders in Busia District, the Catholic church, the Legio Maria church of Africa. The Imam Jamia mosque Busia, The chief Township location, the District officer Mr. P. Ndambuki, the District Public Health officer- Mr. S. Makama, the District Education officer Mr. S. Kilonzo, Mrs. H. Lukalo, Mrs. J. Lutaba, Miss J. Odenyo, Mr. J. Ogoye, J. Akoth, Mr. P. Waithaka, and Mrs. N. Asango of Kenyatta University, education and to M. von Arx for assisting with invaluable information on statistics.

Last but not least, I wish to pay maximum tribute to all the people whose names I am unable to mention here.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iv</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF ACRONYMS USED IN THIS REPORT</td>
<td>xi</td>
</tr>
<tr>
<td>DEFINITION OF TERMS USED IN THIS REPORT</td>
<td>xii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>xiii</td>
</tr>
<tr>
<td>CHAPTER 1</td>
<td></td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td></td>
</tr>
<tr>
<td>1.1 Background information</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Rationale for study</td>
<td></td>
</tr>
<tr>
<td>1.2.1 Statement of problem</td>
<td>3</td>
</tr>
<tr>
<td>1.2.2 Justification for the study</td>
<td>3</td>
</tr>
<tr>
<td>1.2.3 Research questions</td>
<td>4</td>
</tr>
<tr>
<td>1.3 Null Hypotheses</td>
<td>5</td>
</tr>
<tr>
<td>1.4 Objectives of the study</td>
<td>5</td>
</tr>
<tr>
<td>1.4.1 General objective</td>
<td>5</td>
</tr>
<tr>
<td>1.4.2 Specific objectives</td>
<td>5</td>
</tr>
<tr>
<td>CHAPTER 2</td>
<td></td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>6</td>
</tr>
<tr>
<td>2.1 The changing face of human malaria</td>
<td></td>
</tr>
<tr>
<td>2.1.1 Malaria parasite life cycle</td>
<td>6</td>
</tr>
<tr>
<td>2.1.2 Malaria Diagnosis</td>
<td>7</td>
</tr>
<tr>
<td>2.1.3 Global Malaria Prevalence</td>
<td>7</td>
</tr>
<tr>
<td>2.1.4 Malaria prevalence in Africa</td>
<td>8</td>
</tr>
<tr>
<td>2.1.5 Malaria situation in Kenya</td>
<td>8</td>
</tr>
<tr>
<td>2.1.5.1 Malaria distribution in Kenya</td>
<td>8</td>
</tr>
<tr>
<td>2.1.5.2 Economic cost of malaria in Kenya</td>
<td>9</td>
</tr>
<tr>
<td>2.1.5.3 Malaria transmission in Kenya</td>
<td>9</td>
</tr>
</tbody>
</table>
2.2 Malaria control and management

2.2.1 Global control strategies

2.2.1.1 Roll Back Malaria (RBM)

2.2.2 Malaria control strategies in Kenya

2.2.2.1 Intervention measures

2.2.2.1.1 Improved case management

2.2.2.1.2 Antimalarial drugs used in Kenya

2.2.2.1.3 Chemoprophylaxis

2.2.2.1.4 Personal protection

2.2.2.1.5 Vector control

2.2.2.2 Epidemic preparedness

2.3 Failure of conventional approaches in malaria control

CHAPTER 3

MATERIALS AND METHODS

3.1 Study area

3.1.1 Disease incidence

3.1.2 Climate of Busia district

3.1.3 Health facilities

3.1.4 Education in the facilities

3.1.5 Economic activities

3.2 Study population

3.2.1 Inclusion Criteria

3.2.2 Exclusion criteria

3.3 Ethical considerations

3.4 Study design

3.5 Sample size determination

3.6 Sampling procedure

3.7 Data collection

3.7.1 Preparatory organization

3.7.2 Data collection techniques and procedure

3.7.2.1 Data Management and analysis

3.7.2.1.1 Quantitative data
### CHAPTER 4

#### RESULTS

4.1 Demographic characteristics of the study population

4.1.1 Place of residence of the respondent

4.1.2 Perceived proximity to the health facility

4.1.3 Type of house in which the respondent lives

4.1.4 Health facility visits by respondents

4.2 Knowledge on malaria

4.2.1 Causes of malaria as perceived by the respondents

4.2.2 Knowledge on Signs and symptoms of malaria as perceived by the respondents

4.2.3 Knowledge on Prevention and Control

4.2.4 Knowledge on various malaria variables

4.3 Practices towards prevention and control of malaria

4.3.1 Use of mosquito nets

4.3.2 Use of chemotherapy in malaria control

4.3.3 Use of Chemoprophylaxis

4.3.4 Visiting a health facility

4.4 Beliefs and Perceptions about malaria

4.4.1 Perceptions on visiting a health facility

4.5 Results for the teacher interviews

4.6 Focus Group Discussion (FGD)

### CHAPTER 5

#### DISCUSSION

5.1 Knowledge on malaria prevention and control

5.2 Beliefs and perceptions

5.3 Practices towards Prevention and Control of malaria

5.3.1 Use of mosquito nets

5.3.2 Visiting a health facility
5.3.3 Chemoprophylaxis 59
5.3.4 Chemotherapy 60

CHAPTER 6
CONCLUSIONS, OPERATIONAL RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE RESEARCH WORK 63
6.1 Conclusions 63
6.2 Recommendations 64
6.2.1 Operational recommendations 64
6.2.1.1 Information, Education and Communication 64
6.2.1.2 Policy Formulation 64
6.2.1.3 Evaluation and Monitoring 64
6.2.1.4 Coordination of Intersectoral collaboration 64
6.3 Suggestions for future work 65
6.4 General recommendation 65
REFERENCES 66
APPENDICES 70
LIST OF FIGURES

Figure 1: Map of Busia District with Kenya inset. .................................................. 18

Figure 2: Place of residence of the respondent (n = 649) ...................................... 28

Figure 3: Percentage of pupils living in different types of houses (n = 649) ............. 30

Figure 4: Frequency of malaria episodes in respondents (n = 649) ......................... 35
LIST OF TABLES

Table 1. Probability proportional to size sampling table .......................................................... 23
Table 2: Percentage of respondents by proximity to the health facility (n = 649) .................. 29
Table 3: Knowledge on etiology of malaria as perceived by the respondents (Guided interview results) .................................................................................................................. 31
Table 4: Signs and symptoms of malaria as perceived by the respondents (Guided interview results) .................................................................................................................. 32
Table 5: Methods of prevention of malaria as perceived by the respondents (Guided interview results) .................................................................................................................. 33
Table 6: Percentage respondents with Knowledge on various malaria variables (n = 649) ... 34
Table 7: Practices towards prevention and control of malaria (n = 649) ................................. 36
Table 8: Use of mosquito nets versus selected variables (n = 649) ....................................... 37
Table 9: Chemotherapy use versus selected variables (n = 649) .......................................... 38
Table 10: Chemoprophylaxis use versus selected variables (n = 649) ................................. 38
Table 11: Visiting a health facility versus selected variables (n = 649) ................................. 39
Table 12: Use of mosquito nets versus perceptions and beliefs on malaria (n = 649) ......... 42
Table 13: Perceptions on visiting a health facility versus selected variables (n = 649) ......... 42
Table 14: Responses from the teacher interviews .................................................................. 43
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>Artemisinin Based Combination Therapy</td>
</tr>
<tr>
<td>CHV</td>
<td>Community Health Worker</td>
</tr>
<tr>
<td>CHW</td>
<td>Community Health Volunteer</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>CRC</td>
<td>Convention on the Rights of the Child</td>
</tr>
<tr>
<td>DALYs</td>
<td>Disability Adjusted Life Years</td>
</tr>
<tr>
<td>DOMC</td>
<td>Division of Malaria Control</td>
</tr>
<tr>
<td>IPT</td>
<td>Intermittent Preventive Therapy</td>
</tr>
<tr>
<td>ITNs</td>
<td>Insecticide Treated bed Nets</td>
</tr>
<tr>
<td>MEWS</td>
<td>Malaria Early Warning Systems</td>
</tr>
<tr>
<td>MoH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>NMCC</td>
<td>National Malaria Coordinating Committee</td>
</tr>
<tr>
<td>OR</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>PHC</td>
<td>Primary Health Care</td>
</tr>
<tr>
<td>PHD</td>
<td>Public Health Department</td>
</tr>
<tr>
<td>PPSS</td>
<td>Probability Proportional to Size Sampling</td>
</tr>
<tr>
<td>RBM</td>
<td>Roll Back Malaria</td>
</tr>
<tr>
<td>RoK</td>
<td>Republic of Kenya</td>
</tr>
<tr>
<td>ROU</td>
<td>Republic of Uganda</td>
</tr>
<tr>
<td>SP</td>
<td>Sulfadoxine-Pyrimethamine and Sulfalene Pyrimethamine</td>
</tr>
<tr>
<td>SPSS</td>
<td>statistical Package for Social Sciences</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
## DEFINITION OF TERMS USED IN THIS REPORT

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belief and perceptions</td>
<td>Strongly held principles and respondents’ understanding of malaria related issues</td>
</tr>
<tr>
<td>Belief and perception level</td>
<td>Based on an interval scale ranging from 0 to 100. The scores are rated on a number of issues answered correctly as per arbitrary belief-perception scale</td>
</tr>
<tr>
<td>Desirable/good knowledge</td>
<td>Knowledge score over 40 %</td>
</tr>
<tr>
<td>Desirable Beliefs and perceptions</td>
<td>Belief and perception score over 40 %</td>
</tr>
<tr>
<td>Desirable practice</td>
<td>Practice scores over 40 %</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Respondent’s repertoire of information on causes, symptoms and cure for malaria as well as malaria prevention practices.</td>
</tr>
<tr>
<td>Knowledge level on malaria</td>
<td>Based on an interval scale ranging from 0 to 100</td>
</tr>
<tr>
<td>Malaria control</td>
<td>Practices mounted to combat malaria at secondary level by use of chemotherapy, analgesics and antipyretics to abate severe symptoms.</td>
</tr>
<tr>
<td>Malaria prevention</td>
<td>Practices that are used to combat malaria at the primary level by use of mosquito nets, insect repellants, environmental hygiene and insecticides.</td>
</tr>
<tr>
<td>Nets</td>
<td>Nets used regardless of treatment with insect repellants. Iron-sheet roofed houses (non-grass thatched houses)</td>
</tr>
<tr>
<td>Permanent house</td>
<td>Iron-sheet roofed houses (non-grass thatched houses)</td>
</tr>
<tr>
<td>Practices</td>
<td>Activities undertaken to prevent and control malaria.</td>
</tr>
<tr>
<td>Practice level</td>
<td>Based on an interval scale ranging from 0 to 100. The scores are rated on a number of facts answered correctly.</td>
</tr>
<tr>
<td>Village</td>
<td>Small residential areas with houses and shops</td>
</tr>
</tbody>
</table>
Malaria is endemic in Busia District in Western Province of Kenya. In the year 2003, malaria was incriminated for 50.0% all cause mortality in the district. Malaria is on the rise, in spite of available effective and proven control tools. Conventional malaria prevention and control efforts have hitherto failed to strike an epidemiological breakthrough. Involvement of children in malaria prevention and control has not yet been attempted in the district. The overwhelming need for innovative approaches to defeat malaria has increasingly become an overarching priority. This study used; structured questionnaires among 649 pupils, 16 guided interviews among pupils, in-depth interviews among science teachers and focus group discussions among stakeholders in the malaria sector to gather information on malaria.

The objective of this study was to assess the knowledge, attitudes and practices of the pupils in Busia District. Results show that 94.1% of the pupils had knowledge on malaria transmission. These findings were better than results from studies in other endemic areas. Use of mosquito nets (55.0%) and ownership (93.8%) had a significant statistical difference (p < 0.001). There was a significant statistical difference between chemotherapy use (99.7%) and compliance with prescribed dosage (45.0%, p < 0.001). Chemoprophylaxis use was dependent on age (p < 0.001), class of pupil (p < 0.001), having been taught about malaria in class (p < 0.001) number of malaria bouts (p < 0.001) and compliance with prescribed dosage (p < 0.001). Use of mosquito nets significantly improved with scaling-up of net coverage (p < 0.001). Radio ownership significantly influenced chemotherapy use (p < 0.001). Perceptions on visiting a health facility positively influenced health facility visits (p < 0.001). Perceptions on mosquito net use positively influenced net use (p < 0.001). The teacher interview results show that there is lack of malaria education in the primary school curriculum. Focus group discussions findings show that there is lack of collaboration among the malaria sector players.

In conclusion, many respondents had knowledge on malaria etiology, consequently, concomitantly fewer bouts of malaria were reported. However varied and dynamic environmental factors hampered diametrical gains from practices. It is recommended that policy formulation on malaria be directed towards information, education, and communication; monitoring and evaluation and intersectoral collaboration.
CHAPTER 1
INTRODUCTION

1.1 Background information

Malaria is a parasitic disease caused by a haemoprotozoan known as *Plasmodium* (WHO, 1998). The four species of Plasmodia are: *Plasmodium falciparum, P. malariae, P. ovale* and *P. vivax*. The main cause of malaria in Africa is *P. falciparum* (RBM/WHO, 2000). Malaria causes between 1.1—1.5 million deaths in sub-Saharan Africa annually, mainly among under-fives (WHO, 1998; RBM/WHO, 2000). It is estimated that malaria causes 44 million Disability Adjusted Life Years (DALYs) and accounts for 1.3 % economic penalty on the malaria endemic countries (WHO/UNICEF, 2003). The overall impact on African economies is a negative economic growth rate (Sachs and Malaney, 2002).

One of the most efficacious control tools is insecticide treated bed nets (ITNs) (WHO/UNICEF, 2003; RBM/WHO, 2000; Mutero *et al.*, 1998; Aikins *et al.*, 1994). However, recent studies have shown that the rate of ITN uptake is still low (Vulule and Mharakurwa, 1996; Ongore *et al.*, 1989). Unprecedented challenges continue to emerge as conventional chemotherapy use is fast becoming less efficacious due to mounting parasite resistance to first-line drugs such as Sulfadoxine-Pyrimethamine, Amodiaquine and Sulfalene Pyrimethamine (SP). Currently the use of Artemisinin-Based Combination Therapy (ACTs) is recommended to back-up the losing SP drugs (WHO/UNICEF, 2003).

In spite of the availability of these new drugs, the community still suffers from malaria attack (WHO/UNICEF, 2003). Malaria control tools must take into account subtle socio-economic and socio-cultural factors that engender the current scenario (Sachs and Malaney, 2002; Portero *et al.*, 2002) The integration of knowledge, attitudes and practice intervention measures in the
control programme is necessary (Govere et al., 2000; Quick et al., 1996). Low knowledge levels affect the attitudes and practices towards any control strategy (Sharp et al., 2002; Helman, 2000; Zaim et al., 1997); at the same time the availability of malaria control tools does not guarantee a gain in the war against malaria (Onwujekwe et al., 2000; Stephens et al., 1995; Ongore et al., 1989).

The prevailing attitudes and practices in a community determine the success of any control initiative (Klein et al., 1995). Moreover, modes of intervention that are perceived incorrectly by the people may have a low public efficacy as the community may be reluctant to embrace them (Dossou-yovo et al., 2001; ROU, 2000; Ettling et al., 1994). The context in which KAP abounds is never homogeneous and demands for a broad-based approach in the implementation of control initiatives (ROU, 2000). It is with the above views borne in mind that knowledge is considered as a fundamental component in attitude and practice improvement (Uza et al., 2002; Vulule and Mharakurwa, 1996; Stephens et al., 1995).

In Kenya, children and women constitute 70.0% of the population (RoK/UNICEF, 1998). As members of the wider community their knowledge, attitudes and practices are determined by the prevailing community KAP. If the knowledge, beliefs and perceptions as well as practices of the pupils are predisposing them to malaria, then it calls for aggressive efforts to purge the pathogenic KAP (Dossou-Yovo, 2001; Zaim et al., 1994).
1.2 Rationale for study

1.2.1 Statement of problem

Malaria in Busia has seen an upward trend recently, in spite of integrated management approaches including use of mosquito nets, education and chemotherapy (RBM/WHO, 2000). Today, malaria prevention and control tools are available to combat the disease (RBM/WHO, 2000). Insecticide treated bed nets (ITNs), Artemisinin based Combination Therapy (ACTs) and Intermittent preventive therapy are proven tools for malaria prevention and control. In spite of the availability of ITNs, Intermittent Preventive Therapy (IPT) and ACTs, malaria prevention and control is yet to attain a breakthrough status. Generally these tools have failed to attain the desired efficacy due to lack of coordination and direction on the part of the government. Specifically, ITNs failure is attributable to exclusive marketing of nets, poverty and lack of compatible infrastructure for ITNs use. Sulfadoxine/Sulfalene Pyrimethamine drugs are facing overwhelming parasite resistance in Eastern and Southern Africa.

In light of the prevailing socio-cultural and socio-economic scenario, novel interventions and innovative approaches are needed to combat malaria. There is need to design a framework for ensuring that the ITNs are implemented with provision for compatible infrastructure. There is need to undertake capacity building activities to empower the community with expertise to use tools. Education is needed amongst the primary school children and expectant women to ensure that information is not equivocal. It is through the use of scientific innovations that target locally available infrastructure and resources that the community shall relegate the indigenous malaria prevention and control methods that appear to supplant the proven prevention and control tools such as ITNs, IPT and ACTs. Consequently by studying malaria among the pupils, use of malaria prevention and control tools may be initiated at a formative age among the pupils.
1.2.2 Justification for the study

In Busia District, malaria accounts for 50.0% of all mortalities and morbidity reported (Republic of Kenya, 1997). To date, Insecticide Treated bed Nets (ITNs), Artemisinin Based Combination Therapy (ACT) and Intermittent Preventive Therapy (IPT) are considered fundamental malaria prevention and control tools. With malaria incidence and mortality on the rise in Busia District (District Health management team report, 2003 unpublished) Novel innovations are needed to defeat the disease (RMB/WHO, 2000). In spite of their availability, proven and cost-effective control tools have failed to attain epidemiologic breakthrough (RBM/WHO, 2000). Children have not been fully involved in malaria prevention and control, in spite of Kenya signature of the convention on the rights of the child (RoK/UNICEF, 1998). Since school pupils carry the burden of 10-20 % all cause mortality due to malaria, school age children ought to be engaged in anti-malaria campaigns (Brooker et al., 2000). Investigating knowledge, attitudes and practices among the pupils will generate crucial information for planning, implementation, monitoring and evaluation of malaria control activities. Additionally, the knowledge generated will be invaluable in understanding malaria and designing new studies.

1.2.3 Research questions

a) What is the knowledge level of the pupils on the causes and the symptoms as well as the methods for preventing malaria?

b) What are the beliefs and perceptions of the pupils on the causes and the methods used for prevention and control of malaria?

c) What are the pupils’ practices towards prevention and treatment of malaria?
1.3 Null Hypotheses

a) There is lack of knowledge on malaria among pupils in Busia District.
b) Knowledge has no effect on the beliefs and perceptions towards malaria among pupils in Busia District.
c) Knowledge has no effect on practices among pupils in Busia District.

1.4 Objectives of the study

1.4.1 General objective

To assess the level of knowledge, attitudes and practices of primary school children in Busia District towards malaria prevention and control.

1.4.2 Specific objectives

a) To establish the knowledge levels of school pupils in Busia District on malaria.
b) To investigate the effect of knowledge level on the perceptions and beliefs of school children towards prevention and control of malaria.
c) To investigate the practices of school pupils towards malaria prevention and control.
CHAPTER 2
LITERATURE REVIEW

2.1 The changing face of human malaria

2.1.1 Malaria parasite life cycle

Infected female *Anopheles* mosquitoes transmit malaria when they draw a blood meal in order to produce fertile eggs (WHO, 1998). The malaria parasite life cycle involves two hosts. During a blood meal, a malaria-infected female *Anopheles* mosquito inoculates sporozoites into the human host. Once in the system sporozoites infect liver cells and mature into schizonts, which rupture and release merozoites (WHO, 2002). In *P. vivax* and *P. ovale* a dormant stage known as hypnozoites can persist in the liver and cause relapses by invading the bloodstream weeks, or even years later. After this initial replication in the liver (exo-erythrocytic schizogony) the parasites undergo asexual multiplication in the erythrocytes (erythrocytic schizogony) (WHO, 2002). At this stage the parasites undergo further differentiation to become ring stage trophozoites which mature into schizonts, which rupture releasing merozoites. Some parasites differentiate into sexual erythrocytic stages (gametocytes). Blood stage parasites are responsible for the clinical manifestations of the disease (WHO, 2002). The gametocytes, male (microgametocytes) and female (macrogametocytes), are ingested by an *Anopheles* mosquito during a blood meal. The parasites’ multiplication in the mosquito is known as the sporogonic cycle. While in the mosquito’s stomach, the microgametes penetrate the macrogametes generating zygotes (WHO, 2002). The zygotes in turn become motile and elongated (ookinetes) and invade the midgut wall of the mosquito where they develop into oocysts. The oocysts grow, rupture, and release sporozoites, which make their way to the mosquito’s salivary glands. Inoculation of the sporozoites into a new human host perpetuates the malaria life cycle.
2.1.2 Malaria Diagnosis

The parasites are transmitted from an infected to a susceptible host (WHO, 2002). In the host, the parasite attacks red blood corpuscles resulting in low red blood cell count, and in severe malaria physio-pathological involvement of the viscera, which can be fatal (WHO/UNICEF, 2003). The symptoms of the malaria include; periodic fever (Hamel et al., 2001) shivering (Tumwesigire and Watson, 2002), headache, pain in the joints, repeated vomiting (Olaf et al., 2004; Kaona and Tuba, 2003), various degrees of anemia, splenomegaly and other syndromes resulting from the physio-pathological involvement of certain organs such as the brain, liver and kidney (WHO, 2002; WHO, 2000; WHO, 1998).

Malaria diagnosis involves microscopic screening of a blood smear for parasites (WHO, 2002). A simple diagnostic test involves the use of Giemsa stain (parasite fraught red blood cells have a higher affinity for the stain) as a gold standard in differential staining for Plasmodium parasites in the victim’s blood (WHO, 2002).

2.1.3 Global Malaria Prevalence

Malaria is a public health problem in over 90 third world countries (WHO/UNICEF, 2003; WHO, 2000; WHO, 1998). It is estimated that the endemic countries host about 2.4 billion people and accordingly, 40.0 % of the world’s people reside in malaria zones (WHO/UNICEF, 2003). The degree of their exposure ranges from holo-endemic, hyper- to hypo-endemic (WHO, 1998). The hyper-endemic zones experience stable malaria transmission throughout the year whereas hypo-endemic areas experience unstable transmission and hence are prone to epidemics (Lindblade et al., 1999; Snow et al., 1997).
2.1.4 Malaria prevalence in Africa

In Africa, 75.0% of the population lives in areas of unstable malaria transmission and 18.0% in epidemic prone zones (WHO, 2002). While *P. vivax* accounts for 80 million cases per year, *P. falciparum* cause 300-500 million infections each year (WHO, 2002; WHO, 2000). In Africa, 1.1-1.5 million deaths are caused by *P. falciparum* (WHO/UNICEF, 2003; WHO, 2002). It is estimated that African children under five years of age bear 75.0% of the malaria burden (WHO/UNICEF, 2003; RBM/WHO, 2000). In fact an African child dies of malaria every thirty seconds (WHO/UNICEF, 2003; WHO, 2002), with 2.4% of the deaths occurring among Kenyan children (RoK, 2001). The economic implications of malaria are grave with an overall negative growth rate in the malaria endemic countries (Sachs and Malaney, 2002).

2.1.5 Malaria situation in Kenya

2.1.5.1 Malaria distribution in Kenya

Distribution and occurrence of malaria in Kenya varies from one region to another. The level of endemicity ranges from hyper-holo-endemic areas of coastal and lake regions to relatively "malaria-free" regions in the highlands of the Aberdare ranges and around Mt. Kenya. The altitude along the coast and Lake Victoria favors stable malaria transmission throughout the year (RoK, 1998). Unstable malaria occurs in many areas in Kenya. In Kenya, over 20 million people are regularly affected by the most deadly of human malaria parasites, *P. falciparum*. Malaria is the leading cause of clinic attendance and admission to hospitals across the country (RoK, 2001).
2.1.5.2 Economic cost of malaria in Kenya

Precise demographic data on numbers of death from malaria in Kenya each year are not available (RoK, 2001). However, informed evidence suggests that each year 26,000 children below the age of five die from direct consequences of malaria infection or 72 children every day (RoK, 2001) as compared to the African scenario. Kenya accounts for 2.4% of the malaria mortality in sub-Saharan Africa. For pregnant women, infection with malaria parasite can cause severe anaemia, increasing their risk of morbidity, mortality and the chances of a low-birth weight baby (RoK, 2001).

The untold suffering caused by the clinical consequences of malaria affect almost every Kenyan household, costing families hundreds of shilling each month to manage. Overall national economic output is hampered by a continued burden of malaria on the workforce and their families (RoK, 2001). An estimated 170 million working days are lost each year due to malaria. Kenya is a popular tourist destination and the threat of drug resistant malaria is likely to impact upon the KSh 6.6 billion of foreign exchange earned from this industry (RoK, 2001).

2.1.5.3 Malaria transmission in Kenya

The parasite is principally transmitted by the mosquito vector complex *Anopheles gambiae s.l* and in some areas by *A. funestus*. Kenya’s diverse ecology supports a wide range of transmission conditions (RoK, 2001). These range from sporadic out-breaks associated with unusual rainfall in the arid areas of north eastern Kenya, to acute seasonal transmission prone to epidemics in the Kenyan highlands and the intense transmission along Kenya’s coast and around lake Victoria. In areas where infection is frequent the disease is most common and severe in children and
pregnant women (RoK, 2001). At least 8 million Kenyans live in high intensity agricultural areas of Kenya, where epidemics of malaria are increasing in frequency. In areas at risk of epidemics the entire population can be at risk of disease and death.

2.2 Malaria control and management

In some parts of the world such as Western Europe and the United States of America, malaria has been successfully wiped out. However, due to global climate change the disease is re-emerging in areas that were recently regarded as “malaria free zones”. Malaria is a problem in South East Asia, South America and sub-Saharan Africa (WHO, 1998). Malaria management efforts have been directed at vector control as well as chemotherapy. Recently novel advances were made in climatological and environmental epidemiology to boost the epidemic preparedness of the global public health institutions (Snow et al., 1997). At the same time, the use of insecticide treated bed nets has had the greatest impact on malaria prevention (RBM/WHO, 2000). The use of intermittent preventive treatment (IPT) among pregnant women may also help to abate malaria related anaemia as well as improve on the maternal health and child survival (WHO/UNICEF, 2003; RBM/WHO, 2000). The use of IPT holds great hope in the fight against malaria since over 30 million pregnancies occur in malaria endemic areas (WHO/UNICEF, 2003). Given that the malaria parasite in eastern and southern Africa is fast developing resistance to Sulfadoxine Pyrimethamine (SP), the use of Artemisinin based combination therapy (ACTs) is now recommended for onslaught on malaria (RBM/WHO, 2000; WHO/UNICEF, 2003).
2.2.1 Global control strategies

The Global malaria control strategy was endorsed by a ministerial conference in Amsterdam in October 1992. In the conference, endemic countries agreed to initiate and strengthen malaria control efforts in order to reduce the burden of disease at all levels (Louis et al., 1997). The overall global malaria control goal is the prevention of mortality and reduction in morbidity as well as social and economic loss due to malaria through the progressive improvement and strengthening of local national capabilities for malaria control at national, district and community level. Within these two goals, two main objectives were set: that by the year 1997 at least 90% of the countries affected by malaria implement appropriate malaria control programmes; that by the year 2000, malaria morbidity be reduced by at least 20% compared to 1995 in at least 75% of the affected countries.

Some of the objectives have been met by several countries south of Sahara, where 90.0% malaria mortalities occur (WHO, 1993). In most countries Health management and information system is underdeveloped. Among the strategies for malaria control in Africa is prevention through personal protection against mosquito bites. Many methods are available for personal protection and currently insecticide treated fabrics are mostly considered (bed nets, curtains and eave strips). Barriers include repellants in the form of sprays, coils, lotions and creams. Currently, Kenya is among 35 countries involved in ITN campaigns (RoK, 2001).

2.2.1.1 Roll Back Malaria (RBM)

Roll Back Malaria is a global movement mobilizing support for local initiatives. It is a WHO
initiative and intends to reduce by 50.0 % the burden of malaria by the year 2010 through the use of multiple strategies to meet local malaria control needs (RoK. 2001). Principles of RBM include early detection, rapid treatment and multiple interventions which include the use of insecticide treated bed nets (ITNs) (WHO/AFRO, 1999).

2.2.2 Malaria control strategies in Kenya

The Kenya National Policy Guidelines for malaria control and the guidelines on diagnosis, treatment and prevention were developed in 1997 (RoK. 2001). The policy covers intervention measures (Improved case management and antimalarial drug policy), referral, quality assurance, drug procurement, supply and distribution, vector control, epidemic preparedness and other intervention measures such as personal protection, among others (RoK. 2001).

To implement the RBM initiative in Kenya, there are eight divisions within the MoH, which are central to policy formulation, strategy and implementation of malaria control. The National malaria coordinating committee (NMCC) has been established to address coordination of malaria control activities, which will facilitate the realization of RBM in Kenya.

2.2.2.1 Intervention measures

2.2.2.1.1 Improved case management

Malaria cases are managed as stipulated in the National guidelines on malaria diagnosis, treatment and control (RoK. 2001). With widespread resistance to chloroquine, there has been need to review the chemotherapy policy on first line drug for malaria treatment (RoK. 2001). Currently, ACTs have been endorsed by the world health organization for malaria management
in Kenya. The guidelines give essential directions that ensure that drug resistance is curbed and discourage unsupervised use of accessible antimalarial drugs (RoK. 2001).

2.2.2.1.2 Antimalarial drugs used in Kenya

The selection of anti-malarial drugs is based on the benchmarks set by World Health Expert Committee on malaria as well as the extent of resistant malaria found from efficacy studies in various parts of Kenya (RoK. 2001). Research has revealed that there is *P. falciparum* resistance to chloroquine in the coastal and lake regions where malaria is holo-endemic and the distribution of resistance is not homogeneous (WHO/UNICEF. 2003). Kenya is a critical hotspot for chloroquine resistance, given that chloroquine is not effective for the management of 60.0% of clinical episodes across the country. It has been replaced by Sulfadoxine Pyrimethamine or Sulfalene/Pyrimethamine combination (Fansidar or Metakelfin) as first line drugs which shows evidence of reduced sensitivity in several parts of the country (RoK. 2001).

Amodiaquine is the alternative drug for the treatment of uncomplicated malaria in health facilities with trained health workers. Quinine administered orally is reserved for treatment of uncomplicated malaria cases that have failed to respond to therapeutic doses of Fansidar or Metakelfin. Parenteral quinine is reserved for complicated malaria in health facilities (RoK. 2001). Suppository Artesunate is the drug proposed for severe and complicated malaria cases at peripheral health facilities with trained health workers (RoK. 2001).

2.2.2.1.3 Chemoprophylaxis

Chemoprophylaxis improvement in high risk groups has been undertaken. Such groups include pregnant women, travellers, settlers and workers in endemic areas, tourists and those with health conditions. Social marketing of chemoprophylaxis has been done through increasing public
awareness of malarial risks including prophylaxis in clinic regimens for high-risk persons (RoK, 2001). Health providers are also trained to inform patients/visitors about correct therapy (RoK, 2001).

2.2.2.1.4 Personal protection

Personal protection to safeguard high-risk groups such as pregnant women, children infants and travellers is the primary intervention of infection and disease (RoK, 2001). The plan recommended utilization of insecticide treated material for persons at risk and appropriate chemoprophylaxis for expectant women and travellers. Pyrethroids are preferred for net impregnation (RoK, 2001).

2.2.2.1.5 Vector control

This is done through community participation in order to reduce mosquito-breeding sites. Chemical control is limited to specific situations, and target habitats such as irrigation schemes, urban centers and selected regions in epidemic prone areas (RoK, 2001). Environmental management is enhanced through community participation (RoK, 2001). The policy also encourages the use of biological control agents (RoK, 2001). Biological control measures have been used to a limited extent due to limited expertise. Such measures have been directed at immature stages through the use of predators such as Gambusia affinis affinis, G.a. holbrooki, Sarotherodon spp and Panchax spp.

2.2.2.2 Epidemic preparedness

Malaria Early Warning Systems (MEWS) are intended to facilitate the timely responses that will prevent and contain epidemics (WHO/UNICEF, 2003). MEWS comprise forecasting, early warning and early detection. Forecasting refers to seasonal climate forecasts, early warning
refers to monitoring of meteorological conditions such as rainfall and temperature, while early
detection is based on routine clinical surveillance (WHO/UNICEF, 2003)

Epidemic preparedness approach is to minimize death and illness in all epidemic prone areas.
Training is conducted at district level on early warning signs in order to detect impending epidemics (RoK, 2001). Early warning based on district-level rainfall estimates has high potential for detecting epidemics in highland districts in southwestern Kenya (WHO/UNICEF, 2003). The district specific warnings can give four weeks’ notice of possible emergency conditions, as identified in retrospective analysis (WHO/UNICEF, 2003). The rainfall estimates are freely available and their use requires minimal training and technical facilities (WHO/UNICEF, 2003). In this setting, seasonal forecasts have proved to be less specific and less accurate.

### 2.3 Failure of conventional approaches in malaria control

In spite of the availability of proven control tools malaria continues to threaten life in Africa (WHO/UNICEF 2003; WHO, 2002; RBM/WHO 2000). While the parasite and vector versatility have been incriminated for the low success rate, failure in social marketing is largely responsible for the low acceptance rate of the malaria control tools in Africa (WHO/UNICEF, 2003).

If any success is desired in the war against malaria, community participation must be encouraged (Munguti, 1998). Additionally, community-wide malaria management programmes require high knowledge levels, positive attitudes and good practices (Sharp et al., 2002; Uza et al., 2002; Stephens et al., 1995). Knowledge, attitudes and practice studies among adults have shown that lack of knowledge may lead to poor disease management and consequently increase disease
incidence (Rodriguez et al., 2003; Sharp et al., 2002; Karanja et al., 1999). Low knowledge levels have been reported among households and families (ROU, 2000). While such studies have shown the relationships between KAP variables, pupils have not been engaged in similar studies.

Knowledge on malaria should be based on prevention, treatment and control (ROU, 2000). In the event that low knowledge levels abound, the resulting attitudes and practices may act as a drawback on use of malaria control tools (Ongore et al., 1989; Lukwa et al. 1999; Sharp et al., 2002). If the attitudes among the family are shared, it is likely that negative attitudes may be transmitted down the family lineage (Helman, 2000; Munguti, 1998). Consequently if these attitudes are passed on, the malaria control tools may fail to achieve the desired effectiveness. It is therefore crucial that attitude change be effected in the formative days of life. At the same time, with the implementation of the free primary education and the convention on the rights of the child (RoK/UNICEF, 1998), the large number of pupils enrolled may offer a high potential group for the war on malaria.
CHAPTER 3:
MATERIALS AND METHODS

3.1 Study area

This study was carried out in Busia District between September 2003 and May, 2004. The town is situated approximately 118 kilometers west of Kisumu City (Figure 1). The Ministry of Planning and Development describes the District as bordering Kakamega District to the East, Teso District to the North, Siaya District to the Southeast and the Republic of Uganda to the West. It lies between latitude 0° and 0° 25’ North and longitude 33° 54’ East. The District covers an area of 1262 sq. km. This includes 137 sq. km, which is under permanent water surface (RoK. 1997). The Divisions in Busia include: Nambale, Butula, Funyula, Budalangi, Busia Municipality and Matayos.

3.1.1 Disease incidence

Major diseases in the district are malaria, acute respiratory infections, anaemia and intestinal worms. Malaria alone contributes about 50.0 % of the total morbidity in the district. In the year 2003, malaria caused 248 deaths in the District. This accounted for 33.3 %. anaemia was incriminated for 20.5 %. Additionally, malaria caused 52.9 % of the cases followed by Upper Respiratory tract Infection (URTI) with 22.2 % cases.

3.1.2 Climate of Busia district

There are two rainy seasons in the district, the long rains and the short rains. The mean annual rainfall for the district is 1500mm with most parts of the district receiving rainfall of between 1270-1790mm. The driest parts of the district receives between 760-1015mm of rainfall annually.
and is found along the lakeshore. The annual mean maximum temperature ranges from 26°-30° C. while the mean minimum temperature varies between 14° and 18° C.
3.1.3 Health facilities

The total number of health facilities in the district is 28 out of which 2 are government hospitals, 5 private nursing homes, 17 dispensaries and health centres manned by the government and the remaining 4 are private mission hospitals. In terms of their distribution, Township/Matayos division has 6, Butula division 4, Budalangi 4, Funyula 8, and Nambale 6.

3.1.4 Education in the facilities

The district has 27 secondary schools, 225 primary schools, 241 pre-primary schools, 8 youth polytechnics, 1 farmer training center and 1 family life training centres. In reference to primary schools in the district, Township/Matayos division has 38, Butula division 60, Budalangi 31, Funyula 61, and Nambale 35 (RoK, 1997). There are 118,337 primary school pupils in Busia district (Education office, Busia District, 2003).

3.1.5 Economic activities

The few processing factories include bakeries located in Busia town and in Funyula division. Small businesses in Busia district are found within the small market centres such as Mundika, Bar Ong’eche, Matayos and Korinda. The enterprises are small both in terms of employees and start up capital. Retail and wholesale trade are scattered all over the district with high concentration in market and urban centres like Bumala and Lake Victoria. The informal sector in the district includes carpentry, tailoring, bicycle repair, brick making, steel and metal fabrication, welding, building and construction electronics, plumbing and food stalls all on a small scale. The sale of second hand clothes is spreading throughout the district and it is employing a substantial number of people (RoK, 1997).
3.2 Study population

The study was undertaken among Day Mixed Primary school children and science teachers.

3.2.1 Inclusion Criteria

The study included the following:

a) Pupils in class 2, 3, 6 and 7 (class 2 and 3 represented lower primary while class 6 and 7 represented upper primary).

b) Science teachers for classes 2, 3, 6 and 7.

c) Religious leaders, education heads, provincial administrators, youth leaders, women group leaders, NGO heads, and village elders.

3.2.2 Exclusion criteria

The study excluded the following:

a) All pupils in class one, four, five and eight and all pupils in class two, three, six and seven not consenting.

b) All non-science teachers and all science teachers for class two, three, six and seven not consenting.

3.3 Ethical considerations

Permission to undertake research was granted by the Department of Zoology, School of Pure and Applied Sciences (SPAS) and the Board of Postgraduate Studies (BPS) of Kenyatta University. Further permission was granted by the Ministry of Education Science and Technology. The District Commissioner, District Medical officer and the District Education Officer. The pupils were assured that their responses would not be divulged to any one. Each questionnaire was
completed anonymously. Pupils who were interested in learning more about malaria were taught
by the investigator after all the data had been collected. Schools will be informed of the study
findings and recommendations will be made available to the District Health Management Team
for consideration when the final report is out.

3.4 Study design
This is a descriptive cross-sectional study. Four schools were sampled during the same period
starting with the urban zone followed by the periurban and rural parts of Busia district. Sampling
in the schools was carried out during third school term.

3.5 Sample size determination
Sample size determination for populations over 10,000 can be performed by use of sample size
determination formula as used by fisher et al. (1998). In this study the total population of pupils
in district at the time of the study was 118,337. Consequently, the Sample size was determined
by using the formula as previously used by Fisher et al., (1998)

\[ n = \frac{Z^2pqD}{d^2} \]

Where: \( Z = 1.96 \) at 95% confidence interval (CI)
\( p = \) Proportion of target population
\( q = 1 - p \)
\( d = \) degree of accuracy, usually 0.05, and \( D = \)

Therefore: Where \( p = 0.513 \)

The sample size was:

\[ n = \frac{1.96^2 \times 0.513 \times 0.487 \times 1}{0.05^2} = 384 \]
From the Fisher's formula computed on the previous page, the sample size was doubled to 768 to cater for non-response and questionnaire redundancy. This was due to lack of response from some of the children involved in the questionnaire pre-testing. Some of the children enrolled in the study were shy to give any answers to the investigator consequently prompting the need to double the number of pupils to meet the foreseen shortfall. However, due to resource constraints and some pupils failing to respond to some of the questions, only 649 questionnaires were completed in this study. For a population of 118,337, the sample size of 649 was sufficient to represent the entire population of pupils in Busia district (Fisher et al. 1998).

3.6 Sampling procedure
Multistage sampling was used. At first the District was conveniently divided into three zones: Urban, Peri-urban and Rural. Urban in this study is defined as the densely populated commercial-central business division of Busia District. Peri-Urban is defined as the transition zone sharing both urban and rural features. Rural is defined as the sparsely populated and mainly subsistence farming-dependent community with limited social amenities such as lack of hospitals, drugs, telephone and electricity, tap water and characterized by low income. From a list of schools in each zone of the district, random numbers were assigned to schools in each zone. Only one school was picked in the urban and peri-urban zones. 2 schools represented the rural zone. This was because the two schools were less than 1km apart. Children from the same homesteads attended the two schools. Moreover, the schoolteachers lived in the same locality. Probability Proportional to Size Sampling (PPSS) was used to sample respondents per school (Table 1). Simple random sampling was used to sample respondents in each class. Focus Group
Discussions (FGD) were conducted with the un-interviewed group of respondents. Science teachers were conveniently chosen for each participating class.

Table 1. Probability proportional to size sampling table

<table>
<thead>
<tr>
<th>School</th>
<th>No. of Boys</th>
<th>No. of Girls</th>
<th>Proportions</th>
<th>Class 2,3, 6 and 7</th>
<th>Proportion sampled</th>
<th>Sample</th>
<th>boys</th>
<th>girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>girls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burumba primary</td>
<td>240</td>
<td>146</td>
<td>0.6</td>
<td>0.4</td>
<td>386</td>
<td>0.4</td>
<td>165</td>
<td>103</td>
</tr>
<tr>
<td>Bulanda primary</td>
<td>180</td>
<td>186</td>
<td>0.7</td>
<td>0.3</td>
<td>248</td>
<td>0.3</td>
<td>106</td>
<td>77</td>
</tr>
<tr>
<td>L. Atundo primary</td>
<td>140</td>
<td>44</td>
<td>0.8</td>
<td>0.2</td>
<td>184</td>
<td>0.2</td>
<td>79</td>
<td>60</td>
</tr>
<tr>
<td>Bukhuma primary</td>
<td>18</td>
<td>60</td>
<td>0.2</td>
<td>0.8</td>
<td>78</td>
<td>0.1</td>
<td>34</td>
<td>8</td>
</tr>
<tr>
<td>Grand total</td>
<td>578</td>
<td>436</td>
<td>0.645</td>
<td>0.355</td>
<td>896</td>
<td>1</td>
<td>384</td>
<td>248</td>
</tr>
</tbody>
</table>

3.7 Data collection

3.7.1 Preparatory organization

The pilot study was conducted in Township Division, which is an urban setting in Busia District. Thirty respondents were interviewed from Burumba and Bulanda primary schools. Twenty pupils in Burumba primary school were involved in a FGD. Necessary corrections and clarifications to the questionnaire and FGD schedule were made. All inquiries were undertaken by the investigator.

3.7.2 Data collection techniques and procedure

Data collection started on 16th October 2003 and was completed in 17th May 2004. Data was collected by using a pre-tested semi-structured questionnaire, guided interviews and by way of focus group discussions. The semi-structured questionnaire was designed in English. The pre-testing was conducted in consultation with the primary school teachers to ensure language used
was understandable to pupils. The questionnaires were explained in English and Swahili whenever necessary. Completed questionnaires were double-checked for completeness, consistency and reliability after each day. All questionnaires were completed using indelible ink to safeguard against data deterioration. Guided interviews were conducted per class in each school. Uninterviewed pupils were recruited randomly to participate in the discussion. Simple random sampling technique was used to give all pupils equal chance of participating in the interview. All discussions were restricted to 35 minutes equivalent to the duration of a standard class lesson. Participants were 30 on average per session. The principle investigator facilitated each interview session, while the class teacher acted as a rapporteur and enforced order. Guided interviews were conducted in English, Swahili and vernacular (Luhya).

A focus group discussion was conducted with representatives of the Provincial administration, Religious groups, Civil Society, Youth groups, Ministry of information and tourism, ministry of education, ministry of health and non-Governmental organizations. Focus Group Discussion guide was administered by the investigator with the assistance of a trained research assistant. Each item in the FGD guide was posed before the discussion group. Each participant was given time to respond in discussion fashion. Anecdotes and specific policy references were noted. Responses from participants were recorded using a 2AA battery tape recorder. Back-up notes were taken by the research assistant and the principal investigator.

3.7.2.1 Data Management and analysis

3.7.2.1.1 Quantitative data

A semi-structured questionnaire was used in this study. All answers were coded before data entry. Analysis of quantitative data was by the use of SPSS version 10.0 and version 11.5
(version 10, 11.5 MS office 2002 SPSS). The results are presented in descriptive form using tables and line graphs. Analysis was conducted using Measures of central tendency (frequency mean, mode and median) for the knowledge scores attained by the children. Comparison and differences of variables (Chi square) statistical tests of association and significance were computed for knowledge, beliefs and perceptions and practices. All analyses were set at 5% confidence level (p = 0.05)

3.7.2.1.1 Structured questionnaire
Piloting of semi-structured questionnaires was undertaken amongst 30 pupils from Busia District. The information generated from the guided interviews and semi-structured questionnaire was used to design the final semi-structured questionnaire. The questionnaire was pre-tested in Busia District, which is the study District. The questionnaire was administered to class two, three, six and seven pupils. Questionnaire administration was one-to-one to forestall confounding differences in levels of understanding among the pupils.

3.7.2.1.2 Qualitative data
Analysis of data was conducted systematically and manually as per the objectives in this study. Qualitative inferences have been used to explain the quantitative data. Whenever necessary, similarities and differences have been expounded in this thesis.
3.7.2.1.2.1 In-depth interviews

Sixteen science teachers were interviewed from four schools involved in the study, to gather information on curriculum and the extent to which malaria is covered by the curriculum. The interview started with a general question on malaria in the 8.4.4 curriculum. The teachers were asked about the number of pupils they supervised and whether they thought the language of instruction regarding malaria was an impediment to effective articulation of malaria related health information. They were also asked if MoH workers ever visited their schools for Health Education, and if any of the visiting health worker complemented what was taught during science lessons. Other questions included the role of curriculum in malaria control whether passive or active; whether the time allocated to science lessons was adequate, the frequency of health parades conducted and the school policy on malaria among pupils from case reporting until presentation for treatment at a health facility. They were asked about the need to create the position of a health teacher, the role of parents in health education on malaria and the need to have malaria taught in other non-science subjects.

3.7.2.1.2.2 Guided interviews

Sixteen Guided interviews were used to check responses of individual pupils among un-interviewed members of each participating class. The guided interviews covered the issues generated from one to one interviews administered to randomly selected pupils. The guided interview participants were randomly selected using random numbers. Participants were involved in discussions based on class mainly lower and upper primary; class 2 and 3 pupils representing lower primary school while class 6 and 7 pupils represented upper primary. This was done to facilitate free discussion particularly for lower primary. Children in lower primary
would be shy to speak before their upper primary schoolmates. Besides, there was need to capture diverse responses from different groups without interference from other groups.
4.1 Demographic characteristics of the study population

4.1.1 Place of residence of the respondent

Out of all the pupils, 37.4 % (243/649) lived in the village (Figure 2). While Burumba and Atundo primary schools had over 60.0 % (389/649) of their pupils living in the village, all the children who attended Bukhuma primary school did not live in the village (Figure 2). Similarly, 84.1 % of the children who attended Bulanda primary school lived away from the village (Figure 2). Overall, 62.6 % (404/649) of the children did not live in the village.

Figure 2: Place of residence of respondent (n = 649)
4.1.2 Perceived proximity to the health facility

Pupils who perceived health facilities to be far from their homes were 39.3% (255/649). Of the children attending Bukhuma primary school 83.3% (541/649) thought they lived far away from the hospital. Atundo primary school had the lowest proportion of children that perceived health facilities as far from their residence. Generally, about 61% (396/649) of the children thought that the nearest health facility was far from their homes (Table 2).

Table 2: Percentage of respondents by proximity to the health facility (n = 649)

<table>
<thead>
<tr>
<th>Name of primary school</th>
<th>Respondent lives near a health facility</th>
<th>Respondent does not live near a health facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burumba</td>
<td>46.8%</td>
<td>53.2%</td>
</tr>
<tr>
<td>Atundo</td>
<td>59.2%</td>
<td>40.8%</td>
</tr>
<tr>
<td>Bulanda</td>
<td>27.3%</td>
<td>72.7%</td>
</tr>
<tr>
<td>Bukhuma</td>
<td>16.7%</td>
<td>83.3%</td>
</tr>
<tr>
<td>Total</td>
<td>39.3% (255.0)</td>
<td>60.7% (394)</td>
</tr>
</tbody>
</table>

4.1.3 Type of house in which the respondent lives

Overall, children who lived in grass-thatched houses were 31.4% (204/649). Among the pupils attending Bukhuma primary school 60.0% (389/649) lived in grass-thatched houses. Burumba primary school had the least number of children living in grass-thatched houses. Overall, 68.5% (444/649) of the children lived in permanent houses (Figure 3).
Figure 3: Proportion (%) of pupils living in different types of houses
4.1.4 Health facility visits by respondents

There was a significant difference ($\chi^2 = 95.268, \ p < 0.001$) between the respondents who visited a health facility 97.8% (635) and those that did not 2.2% (14).

4.2 Knowledge on malaria

4.2.1 Causes of malaria as perceived by the respondents

Children perceived malaria to be caused by factors other than *Plasmodium*. They perceived malaria to be caused by food that is contaminated and eating foods such as bananas in cold weather. Generally, children incriminated dirty hands, dirty water and sharing food with malaria patients for malaria causation (Table 3).

Table 3: Knowledge on etiology of malaria as perceived by the respondents (Guided interview results)

<table>
<thead>
<tr>
<th>Causes of malaria</th>
<th>Associated Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosquitoes*</td>
<td>Animal</td>
</tr>
<tr>
<td>Stagnant water, long grass</td>
<td>Environmental</td>
</tr>
<tr>
<td>Drinking dirty water, contaminated food and eating bananas in cold weather</td>
<td>Food</td>
</tr>
<tr>
<td>Playing in rain, taking a cold bath</td>
<td>Personal /Self</td>
</tr>
<tr>
<td>Long nails, dirty hands</td>
<td>Other people</td>
</tr>
<tr>
<td>Sharing food with malaria patients</td>
<td>Supernatural</td>
</tr>
<tr>
<td>Punishment from God</td>
<td></td>
</tr>
</tbody>
</table>

*only mosquitoes transmit malaria

4.2.2 Knowledge on Signs and symptoms of malaria as perceived by the respondents

While some of the children mentioned the known signs and symptoms of malaria, there was evidence that most of children associated malaria with symptoms other than malaria signs and symptoms. Signs and symptoms such as vomiting, chills, headache, joint pain, fever, sadness, running stomach ("kuharisha" Swahili), stomach ache, sleep, general body pain, dizziness.
diarrhoea, mass wasting, rashes on the skin, back pain, earache, eye pains, neck pain, crying, basking in the sun, red eyes, running nose and colored urine were perceived as malaria signs and symptoms by the children (Table 4). Some of the symptoms are for other ailments. Some of the children were unable to distinguish malaria signs and symptoms from other ailments sharing signs and symptoms with malaria.

Table 4: Signs and symptoms of malaria as perceived by the respondents (Guided interview results)

<table>
<thead>
<tr>
<th>Signs and symptoms perceived as malaria</th>
<th>Signs</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs</td>
<td>Vomiting</td>
<td>Chills, headache, joint pain, fever</td>
</tr>
<tr>
<td></td>
<td>Sadness</td>
<td>Running stomach (&quot;kuharisha&quot; in Swahili), stomach ache.</td>
</tr>
<tr>
<td></td>
<td>Sleep</td>
<td>General body pain, dizziness, diarrhoea, mass wasting, rashes on the skin.</td>
</tr>
<tr>
<td></td>
<td>Colored urine, basking in the sun</td>
<td>Back pain, ear ache, eye pains, neck pain, crying, red eyes and running nose.</td>
</tr>
</tbody>
</table>

4.2.3 Knowledge on Prevention and Control

Children had varied knowledge levels on the methods that were used for malaria prevention in Busia district. However, they were unable to comprehend the differences between antimalarials and painkillers (Table 5). Conventional and indigenous methods of malaria prevention such as insecticides, mosquito nets and herbal repellants were used by the children.
Table 5: Methods of prevention of malaria as perceived by the respondents (Guided interview results)

<table>
<thead>
<tr>
<th>Prevention methods</th>
<th>Specific classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosquito nets</td>
<td>Insecticide treated nets</td>
</tr>
<tr>
<td>Insecticides, mosquito coils, burn cypress (<em>Pinus</em> spp.) burning leaves</td>
<td>Insecticides</td>
</tr>
<tr>
<td>(smelly leaves, &quot;Bwari&quot; leaves (Luhya)), burning dry cow dung. Also perceived insecticides as a control measure for pests.</td>
<td></td>
</tr>
<tr>
<td>Vaseline repellent jelly, Night rose plant.</td>
<td>Use of repellants</td>
</tr>
<tr>
<td>Taking paracetamol when travelling and antimalarials such as Chloroquine</td>
<td>Chemoprophylaxis</td>
</tr>
<tr>
<td>Closing doors and windows early enough</td>
<td>Protective behavior</td>
</tr>
<tr>
<td>Wearing clothes covering most body parts</td>
<td></td>
</tr>
<tr>
<td>Use Kerosene on exposed water bodies, drainage of stagnant water, clearing of bushes, cleaning the house, disposal of old pots and tins. Also perceived environmental sanitation as a control measure for rodents and snakes.</td>
<td>Environmental management/Hygiene</td>
</tr>
</tbody>
</table>

4.2.4 Knowledge on various malaria variables

Knowledge on malaria etiology was recorded among 94.1% (611/649) of the respondents. Insecticides treated bed nets 67.0% (435/649) and 41.0% (266/649) on personal net treatment among the respondents (Table 6). There was variability in knowledge among the respondents on treated and untreated nets indicating that most of the nets used by the respondents were unlikely to be treated (knowledge on net treatment was 67.0% (435/649), personal net treatment status was 41.0% (266/649) whereas net ownership was 93.8% (609/649).

Knowledge scores based on percentage of correct answers from the questionnaire ranged from 20-93 on a zero to a hundred interval scale. In general, based on a cut-off mark of 40 with 13.0% (84/649) of the respondents had less than 40 marks and hence were classified as exhibiting low knowledge level. The overall knowledge levels on malaria were consistent with the findings on knowledge of etiology. These results show that 87.1% (565/649) of the
respondents had knowledge scores above 40.0% (Table 6). The mean knowledge score was 61.0±0.6 SE (95% CI).

Knowledge on visiting a health facility on the first day was 66.0% (428/649) among the respondents, 23.0% (149/649) on the second day and 11% (71/649) respondents would visit a health facility on any other day (Table 6).

Table 6: Percentage respondents with Knowledge on various malaria variables (n = 649)

<table>
<thead>
<tr>
<th>Knowledge variable</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria etiology</td>
<td>94.1</td>
</tr>
<tr>
<td>Insecticide treated nets</td>
<td>67.0</td>
</tr>
<tr>
<td>Personal net treatment status</td>
<td>41.0</td>
</tr>
<tr>
<td>Knowledge levels above 40%</td>
<td>87.1</td>
</tr>
<tr>
<td>Visiting health facility on day one</td>
<td>66.0</td>
</tr>
<tr>
<td>Visiting hospital on day two</td>
<td>23.0</td>
</tr>
<tr>
<td>Visit hospital on any other day</td>
<td>11.0</td>
</tr>
</tbody>
</table>

4.3 Practices towards prevention and control of malaria

Malaria communication at the family level was 69.0% (448/649) among the respondents. Out of all respondents, 50.0% (324/649) were aware of the school policy regarding malaria. The school policy on malaria was unequivocal and recommendation to seek health care was based on signs and symptoms presented. Children were obligated to seek medical care upon reporting malaria cases nevertheless, 1.0% (6/649) of the respondents would fail to act upon experiencing a bout of malaria. Consequently, 61.0% (396/649) of the respondents had experienced more than two bouts of malaria during the year of study whereas 39.0% (253/649) had experienced two or less bouts of malaria (Figure 4). Chemotherapy use was 99.7% (647/649) among the respondents.
Compliance with prescribed dosage was 45.0% (292/649), while 55.0% did not comply (357/649) (Table 7).

Figure 4: Frequency of malaria episodes in respondents (n = 649)
Mosquito net usage was 54.7% (357/649) among the study population. 13.6% (88/649) respondents used repellant jelly while 58.6% (380/649) respondents used insecticides (Table 7). The use of nets, repellants and insecticides were mutually inclusive.

### Table 7: Practices towards prevention and control of malaria (n = 649)

<table>
<thead>
<tr>
<th>Practice</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria communication at home</td>
<td>69.0</td>
</tr>
<tr>
<td>Awareness and practice of school policy on malaria</td>
<td>50.0</td>
</tr>
<tr>
<td>Take no action on malaria symptoms</td>
<td>1.0</td>
</tr>
<tr>
<td>Use chemotherapy</td>
<td>99.7</td>
</tr>
<tr>
<td>Complied with prescribed dosage</td>
<td>45.0</td>
</tr>
<tr>
<td>Used mosquito net at night</td>
<td>54.7</td>
</tr>
<tr>
<td>Used repellant jelly</td>
<td>13.6</td>
</tr>
<tr>
<td>Used insecticide</td>
<td>58.6</td>
</tr>
</tbody>
</table>

#### 4.3.1 Use of mosquito nets

Age did not have a significant statistical relationship to use of mosquito nets among the respondents ($\chi^2 = 0.225, p = 0.635$) (Table 8). However, having a radio (access to media) was significantly related to use of mosquito nets ($\chi^2 = 21.7, p = 0.000$), with respondents being 4 times more likely to use nets. It was observed that mosquito net use was independent of house-type ($\chi^2 = 0.76, p = 0.856$). Net ownership among the respondents and use appeared to be positively related. In fact, respondents who had nets were 36 times more likely to use them ($\text{OR} = 36, \chi^2 = 330.8, p = 0.000$).

There was a significant relationship between use of mosquito nets and chemotherapy use ($\chi^2 = 7.31, p = 0.003$). This was further corroborated by the positive relationship between use of nets and visiting a health facility when experiencing malaria episodes ($\chi^2 = 3.94, p = 0.04$). Similarly,
compliance with prescribed dosage for malaria ($\chi^2 = 9.44, p = 0.002$) and insecticide use ($\chi^2 = 23.28, p = 0.000$) appeared to be significantly related to mosquito net usage (Table 8).

**Table 8: Use of mosquito nets versus selected variables (n = 649)**

<table>
<thead>
<tr>
<th>Cross tabulation</th>
<th>Proportion (%)</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>54.7</td>
<td>0.225</td>
<td>0.635</td>
</tr>
<tr>
<td>Having a radio</td>
<td>-53.0</td>
<td>21.70</td>
<td>0.000**</td>
</tr>
<tr>
<td>Respondent’s type of house</td>
<td>54.6</td>
<td>0.76</td>
<td>0.856</td>
</tr>
<tr>
<td>Net ownership</td>
<td>54.7</td>
<td>330.80</td>
<td>0.000**</td>
</tr>
<tr>
<td>Chemotherapy use</td>
<td>54.6</td>
<td>7.31</td>
<td>0.003**</td>
</tr>
<tr>
<td>Visiting health facility</td>
<td>53.9</td>
<td>3.94</td>
<td>0.040*</td>
</tr>
<tr>
<td>Compliance with prescribed dosage</td>
<td>27.4</td>
<td>9.44</td>
<td>0.002**</td>
</tr>
<tr>
<td>Insecticide use</td>
<td>36.5</td>
<td>23.28</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

* p value is significant at 0.05. ** p value is significant at 0.01

**4.3.2 Use of chemotherapy in malaria control**

Chemotherapy usage was positively related to age ($\chi^2 = 6.13, p = 0.043$), having been taught about malaria ($\chi^2 = 2.8, p = 0.022$), knowledge on malaria transmission ($\chi^2 = 32.25, p = 0.000$) and having a radio ($\chi^2 = 26.3, p = 0.000$) (Table 9). Conversely, class of the respondent ($\chi^2 = 2.03, p = 0.421$), perceptions on chemotherapy usage ($\chi^2 = 0.27, p = 0.363$), perceptions on visiting a health facility ($\chi^2 = 2.1, p = 0.496$) and visiting a health facility ($\chi^2 = 0.04, p = 0.715$) did not have any significant relationship with chemotherapy use (Table 9).
Table 9: Chemotherapy use versus selected variables (n = 649)

<table>
<thead>
<tr>
<th>Cross tabulation</th>
<th>Proportion (%)</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have been taught about malaria</td>
<td>99.7</td>
<td>6.13</td>
<td>0.043</td>
</tr>
<tr>
<td>Have knowledge on malaria transmission</td>
<td>57.6</td>
<td>2.80</td>
<td>0.022</td>
</tr>
<tr>
<td>Have a radio at home</td>
<td>93.1</td>
<td>32.25</td>
<td>0.000**</td>
</tr>
<tr>
<td>Class of respondent</td>
<td>53.0</td>
<td>26.30</td>
<td>0.000**</td>
</tr>
<tr>
<td>Perception on chemotherapy use</td>
<td>86.9</td>
<td>0.27</td>
<td>0.363</td>
</tr>
<tr>
<td>Visiting a health facility</td>
<td>96.8</td>
<td>0.04</td>
<td>0.715</td>
</tr>
</tbody>
</table>

* p value is significant at 0.05. ** p value is significant at 0.01

4.3.3 Use of Chemoprophylaxis

Respondents who were over ten years of age were more likely to take chemoprophylaxis ($\chi^2 = 44.52$, $p = 0.000$) (Table 10). This was further corroborated by the observation that respondents in upper primary schools were equally likely to use chemoprophylaxis ($\chi^2 = 94.51$, $p = 0.000$). Respondents who had been taught about malaria were 2.7 times more likely to use chemoprophylaxis ($\chi^2 = 34.44$, $p = 0.000$) this is consistent with the observation that respondents who had been taught about malaria in class had fewer bouts of malaria ($\chi^2 = 8.0$, $p = 0.002$) (Table 10). Respondents who used mosquito nets were less likely to use chemoprophylaxis ($\chi^2 = 0.74$, $p = 0.674$). Respondents taking chemoprophylaxis for malaria prevention were more likely to comply with prescribed malaria dosage ($\chi^2 = 45.9$, $p = 0.000$) (Table 10).

Table 10: Chemoprophylaxis use versus selected variables (n = 649)

<table>
<thead>
<tr>
<th>Cross tabulation</th>
<th>Proportion (%)</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>44.52</td>
<td>0.000**</td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>94.51</td>
<td>0.000**</td>
<td></td>
</tr>
<tr>
<td>Have been taught about malaria</td>
<td>34.44</td>
<td>0.000**</td>
<td></td>
</tr>
<tr>
<td>Bouts of malaria</td>
<td>8.00</td>
<td>0.002**</td>
<td></td>
</tr>
<tr>
<td>Net use</td>
<td>0.74</td>
<td>0.674</td>
<td></td>
</tr>
<tr>
<td>Compliance</td>
<td>45.9</td>
<td>0.000**</td>
<td></td>
</tr>
</tbody>
</table>

* p value is significant at 0.05. ** p value is significant at 0.01
4.3.4 Visiting a health facility

Visiting a health facility did not significantly influence the perception that mosquito nets can prevent malaria ($\chi^2 = 2.7, p = 0.098$) (Table 11). At the same time perception that treated nets are better than untreated nets appeared to be independent of visiting a health facility ($\chi^2 = 0.6, p = 0.55$). Respondents who visited a health facility were not likely to undertake environmental sanitation as a way of controlling malaria ($\chi^2 = 1.04, p = 0.31$) and were less likely to perceive insecticides as a control tool for malaria ($\chi^2 = 0.9, p = 0.349$). Overall, 92.0% (597/649) respondents perceived a health facility as center for managing clinical malaria and consequently visited ($\chi^2 = 54.4, p = 0.000$). Perception that chemoprophylaxis can prevent malaria was not significantly related to visiting a health facility ($\chi^2 = 0.37, p = 0.549$).

Table 11: Visiting a health facility versus selected variables (n = 649)

<table>
<thead>
<tr>
<th>Cross tabulation</th>
<th>Proportion (%)</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions on use of nets</td>
<td>81.7</td>
<td>2.70</td>
<td>0.098</td>
</tr>
<tr>
<td>Perceptions on treated nets</td>
<td>77.4</td>
<td>0.60</td>
<td>0.55</td>
</tr>
<tr>
<td>Environmental sanitation</td>
<td>80.1</td>
<td>1.04</td>
<td>0.310</td>
</tr>
<tr>
<td>Perceptions on insecticide use</td>
<td>73.0</td>
<td>0.90</td>
<td>0.349</td>
</tr>
<tr>
<td>Perceptions on visiting a health facility</td>
<td>91.8</td>
<td>54.4</td>
<td>0.000**</td>
</tr>
<tr>
<td>Age</td>
<td>97.8</td>
<td>2.60</td>
<td>0.111</td>
</tr>
<tr>
<td>Class</td>
<td>97.8</td>
<td>0.26</td>
<td>0.605</td>
</tr>
<tr>
<td>Number of malaria bouts</td>
<td>99.8</td>
<td>0.10</td>
<td>0.759</td>
</tr>
<tr>
<td>Radio ownership</td>
<td>92.9</td>
<td>1.10</td>
<td>0.296</td>
</tr>
<tr>
<td>Television set ownership</td>
<td>36.6</td>
<td>2.58</td>
<td>0.106</td>
</tr>
<tr>
<td>Perceived distance from the nearest health facility</td>
<td>39.2</td>
<td>0.68</td>
<td>0.41</td>
</tr>
<tr>
<td>Perception on use of chemoprophylaxis</td>
<td>38.5</td>
<td>0.37</td>
<td>0.549</td>
</tr>
<tr>
<td>Compliance with prescribed dosage</td>
<td>44.1</td>
<td>0.04</td>
<td>0.22</td>
</tr>
<tr>
<td>Use of chemoprophylaxis</td>
<td>41.1</td>
<td>1.50</td>
<td>0.221</td>
</tr>
</tbody>
</table>

* p value is significant at 0.05. ** p value is significant at 0.01

Visiting a health facility when one had malaria was not significantly dependent on age ($\chi^2 = 2.6, p = 0.111$) or class of respondent ($\chi^2 = 0.260, p = 0.605$). The number of malaria bouts
experienced by the respondents did not have a significant influence on visiting a health facility ($\chi^2 = 0.100, p = 0.759$). However, respondents who had more than two bouts of malaria were 1.2 times more likely to visit a health facility. Having a radio or a television set did not significantly impact on visiting a health facility ($\chi^2 = 1.1, p = 0.296$ and $\chi^2 = 2.58, p = 0.106$). Also, perceived distance from a health facility did not significantly relate to visits ($\chi^2 = 0.68, p = 0.41$) (Table 11). However, respondents who lived near a health facility were 1.6 times more likely to visit. Respondents having malaria in the village were less likely to visit a health facility ($\chi^2 = 0.18, p = 0.666$) (Table 11).

Perception on use of chemoprophylaxis was not significantly related to visiting a health facility, ($\chi^2 = 0.37, p = 0.549$) as compliance with prescribed dosage was not dependent on visiting a health facility ($\chi^2 = 1.5, p = 0.22$) (Table 11). Use of chemoprophylaxis to prevent malaria was not significantly dependent on visiting a health facility ($\chi^2 = 1.5, p = 0.221$) (Table 11).

4.4 Beliefs and Perceptions about malaria.

Respondents who perceived nets as a tool for malaria prevention were 1.8 times more likely to use them compared to those who had negative perceptions ($\chi^2 = 7.7, p = 0.002$) (Table 12). Perception on chemotherapy use for malaria control was not significantly related to net use ($\chi^2 = 0.42, p = 0.527$). Perception that repellants can prevent malaria was not significantly related to use of mosquito nets ($\chi^2 = 0.07, p = 0.046$). Respondents who used mosquito nets perceived insecticides as an important mosquito control tool ($\chi^2 = 7.1, p = 0.003$).
Respondents using mosquito nets were 1.2 times likely to believe that treated nets were better than untreated nets ($\chi^2 = 0.87, p = 0.16$) (Table 12). Overall, 49.8% (323/649) respondents who perceived a health facility as an important referral center for clinical malaria used mosquito nets ($\chi^2 = 4.41, p = 0.045$). There was a significant relationship between perceptions on environmental sanitation and the use of nets ($\chi^2 = 3.74, p = 0.044$). Use of mosquito nets was not significantly related to the perception that chemoprophylaxis can be used to prevent malaria ($\chi^2 = 0.05, p = 0.841$) (Table 12).
Table 12: Use of mosquito nets versus perceptions and beliefs on malaria (n = 649)

<table>
<thead>
<tr>
<th>Cross tabulation</th>
<th>Proportion (%)</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptions on use of nets</td>
<td>47.8</td>
<td>7.70</td>
<td>0.002**</td>
</tr>
<tr>
<td>Perceptions on use of Chemotherapy</td>
<td>48.4</td>
<td>0.42</td>
<td>0.527</td>
</tr>
<tr>
<td>Perceptions on use of repellants</td>
<td>15.3</td>
<td>0.07</td>
<td>0.046</td>
</tr>
<tr>
<td>Perceptions on use of insecticides</td>
<td>43.1</td>
<td>7.10</td>
<td>0.0034**</td>
</tr>
<tr>
<td>Perceptions on treated nets</td>
<td>42.8</td>
<td>0.87</td>
<td>0.160</td>
</tr>
<tr>
<td>Perceptions on visiting a health facility</td>
<td>49.6</td>
<td>4.41</td>
<td>0.045</td>
</tr>
<tr>
<td>Perceptions on environmental sanitation</td>
<td>43.1</td>
<td>3.74</td>
<td>0.044</td>
</tr>
<tr>
<td>Perception that chemoprophylaxis can be used to prevent malaria</td>
<td>50.8</td>
<td>0.05</td>
<td>0.841</td>
</tr>
</tbody>
</table>

* p value is significant at 0.05. ** p value is significant at 0.01

4.4.1 Perceptions on visiting a health facility

The findings show that the class of respondent ($\chi^2 = 7.3$, $p = 0.002$) and knowledge on malaria etiology were related to perceptions on visiting a health facility ($\chi^2 = 11.95$, $p = 0.000$) (Table 13). Nevertheless, having been taught about malaria in class ($\chi^2 = 0.04$, $p = 0.558$), number of bouts experienced by a respondent ($\chi^2 = 0.34$, $p = 0.553$), and perceived distance from a health facility ($\chi^2 = 1.63$, $p = 0.532$) failed to have any significant relationship to health facility visits (Table 13).

Table 13: Perceptions on visiting a health facility versus selected variables (n = 649)

<table>
<thead>
<tr>
<th>Cross tabulation</th>
<th>Proportion (%)</th>
<th>Chi-square</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class of respondent</td>
<td>91.8</td>
<td>7.30</td>
<td>0.002**</td>
</tr>
<tr>
<td>Knowledge on malaria transmission</td>
<td>88.1</td>
<td>11.95</td>
<td>0.000**</td>
</tr>
<tr>
<td>Having been taught about malaria in class</td>
<td>53.9</td>
<td>0.04</td>
<td>0.558</td>
</tr>
<tr>
<td>Bouts of malaria</td>
<td>91.8</td>
<td>0.34</td>
<td>0.553</td>
</tr>
<tr>
<td>Perception on distance from the health facility</td>
<td>37.0</td>
<td>1.63</td>
<td>0.532</td>
</tr>
</tbody>
</table>

* p value is significant at 0.05. ** p value is significant at 0.01
4.5 Results for the teacher interviews

Teachers were interviewed on the various parameters that are related to malaria. The interview focused on malaria among the pupils and their understanding on curriculum and malaria, population of pupils supervised, language of instruction used in passing information about malaria, attitudes of pupils towards malaria, examination on knowledge of malaria, MoH role and health visits, science teachers' tenure in science, time and health parades, school policy on malaria, school and community harmony as well as the health teacher's position and the role of the parents in malaria prevention and control (Table 14).

Table 14: Responses from the teacher interviews

<table>
<thead>
<tr>
<th>Interview item</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum and malaria</td>
<td>There was need to teach malaria through demonstrations and activities such as drama, games and songs.</td>
</tr>
<tr>
<td>Language of instruction used in passing information about malaria</td>
<td>Language (English) used in giving malaria instructions was perceived as an impediment to effective teaching of malaria lessons.</td>
</tr>
<tr>
<td>Attitudes of pupils towards malaria</td>
<td>Pupils had negative attitude towards malaria-related health information passed to them through the school.</td>
</tr>
<tr>
<td>Examination</td>
<td>There was need to examine malaria lessons during the mid-term and end-term examinations.</td>
</tr>
<tr>
<td>MoH role and health visits</td>
<td>Health education visits were lacking and as such a vacuum was created.</td>
</tr>
<tr>
<td>School policy on malaria</td>
<td>The school policy on malaria was unequivocal and recommendation to seek health care was based on signs and symptoms presented. Children were obligated to seek medical care upon reporting malaria cases.</td>
</tr>
<tr>
<td>School and community harmony and health teacher's position</td>
<td>Schools were perceived by the community as a source of information and enlightenment to the children. However, in some communities there were incidents of acrimony towards the teachers and the school staff. This was contingent on the teacher-parent relationship.</td>
</tr>
<tr>
<td>Parents role in malaria prevention and control</td>
<td>Some parents sought treatment from magicians and village sorcerers, however, parents were expected to join in the campaign on malaria prevention and control. They were also expected to provide tools and equipment for undertaking healthy practices at school.</td>
</tr>
</tbody>
</table>
4.6 Focus Group Discussion (FGD)

This was conducted with representatives of the Provincial administration, Religious groups, Civil Society, Youth groups, Ministry of information and tourism, Ministry of education, Ministry of health and non-Governmental organizations. The role of PHD is to ensure that the public health policies are implemented. It was evident that the position taken by the PHD was not congruent with the position of the Religious groups, Civil Society, Youth groups, Ministry of Information and Tourism, Ministry of Education Science and Technology and non-Governmental organizations.

The stakeholders have fully undertaken prevention and control programmes in collaboration with the MoH. The Church has undertaken health promotion activities through a network of community based health workers and volunteers (CHW and CHVs). The stakeholders have been involved in addressing malaria at Primary Health Care level (PHC). The Social challenges facing malaria include non-compliance with tools. The control tools fail due to poor social marketing.

Cultural practices could not be changed without clear information. The government has authority and expertise in community management and provision of essential infrastructure at the same time NGOs rely on the government for policy direction and coordination. Information management and dissemination is sensationalistic and aimed at hitting maximum sales. There is no clear policy on collaboration amongst departments and institutions working on malaria in the community.
CHAPTER 5
DISCUSSION

5.1 Knowledge on malaria prevention and control

This study evaluated knowledge, beliefs and perceptions as well as practices on malaria among pupils in Busia District, Kenya. Guided interview results revealed that pupils associated mosquitoes with malaria transmission and were also aware of the symptoms and therapy for malaria, in spite of misconceptions similar to findings in past studies (Olaf et al., 2004; Kaona and Tuba, 2003; Tumwesigire and Watson, 2002; Hamel et al., 2001). Overall, 94.1% (611/649) of respondents had knowledge on malaria transmission. This was higher than the findings of a study undertaken using same method used in Mpumalanga Province, South Africa (Govere et al., 2000). Similarly, these knowledge levels were higher than levels reported in Ghana, Guinea Bissau and Sierra Leone (Aikins et al., 1994) and in Southern Mexico where 48.0% knowledge on malaria etiology was reported (Rodriguez et al., 2003). Nevertheless, some of the children associated malaria with other causes such as supernatural beings and environmental factors as well as food. These findings were similar to findings by Aikins et al. (2000), which reported that in Gambia malaria causation was attributed to an act of supernatural beings and consumption of certain foods.

Knowledge on personal net treatment was 41.0% (266/649), indicating that over 50.0% (325/649) of the pupils were likely to be in possession of untreated nets or none. It is postulated that consciousness of respondents’ net treatment with insect repellant would improve the sustenance of net re-treatment culture. Respondents who scored 40.0% on malaria knowledge were more likely to use the recommended malaria prevention practices. Since there was a
significant relationship between scoring 40 and above and use of mosquito nets among the respondents.

Good knowledge was measured at 40.0 % awareness with 80.0 % of the respondents (519/649), having 40.0 % and above in knowledge on malaria. Use of nets had significant relationship to scoring over 40.0 % (p <0.001).

Timely health seeking was 66.0% (428/649) among the respondents. this was nearly similar to findings from studies in Mpumalanga Province in South Africa which had 66.9 % timely health visit (Govere et al., 2000). Some of the respondents (34.0 % (221/649)) exhibited health seeking, either delaying until the next day or over the weekend when they thought it would least interfere with going to school. While the overall population of students seeking health was 98.0 % (636/649), the profile was highly varied across the study population, suggesting that health seeking ought to be understood in the context of timeliness. Knowledge on malaria transmission was related to respondents having been taught about malaria at school. Teachers envisioned that language of instruction would be a barrier if the children did not conceive the gist of lessons taught on malaria. The language used in giving instructions about malaria was perceived as an impediment to effective teaching of malaria lessons albeit to a limited extent. Consequently there was need to instruct pupils in lower primary in vernacular (Luhya) and Swahili. From the teacher interviews it was recommended that language barriers be surmounted through compulsory teaching of lessons in lower primary school in vernacular. Moreover, knowledge on transmission of malaria appeared to influence health seeking. If the knowledge on malaria is unequivocally imparted on children the quality of health seeking behaviour in the context of timeliness is likely to improve beyond the current rate. There was need to teach malaria through demonstrations and
activities such as drama, games and songs. This view emanated from the observation that pupils learnt faster and practiced lessons taught through demonstration as compared to the use of instructions in teaching. While it appears that children ought to be the target group for the war on malaria to be won, teachers have a pivotal role to play. Teachers argued that this is due to the trust that pupils have in teachers as a fountain of knowledge.

It was further suggested that parents were expected to get out of inactivity and enlist the campaign on malaria prevention and control, since children spent more time at home than at school. Parents were expected to provide tools and equipment for undertaking healthy practices at school. It was evident that children could only espouse what they experienced in practice. Children found it difficult to tell their parents about malaria especially in rural schools, mainly due to cultural demands requiring children to be obedient and submissive to parents. Children saw their parents consulting magicians and sorcerers indicating that disease causation and explanatory models were extrapolated from lay perspectives. In the urban setting, children were at liberty to undertake discourse in malaria issues. These findings show that respondents who sought treatment for merely malaria signs and symptoms were potentially non-compliant to prescribed chemotherapeutic dosage, since chemotherapy use (99.7% (643/649)) is significantly different from compliance (55.0% (357/649)), (p < 0.001). It was evident that respondents failed to conceive signs and symptoms in the context of malaria and consequently viewed each sign and symptom as a separate disease warranting separate intervention.

Teaching of malaria related well with prevention by use of chemoprophylaxis (p < 0.001). However, respondents failed to undertake the recommended prevention and control practices and
this was attributed to respondents associating malaria causation with multiple etiologies. Relating malaria to multiple etiologies is incriminated for the poor coordination of malaria prevention and control tools among respondents. Use of insecticides, insect repellants, chemotherapy and mosquito nets was poorly conceived by the respondents. Similarly, environmental management was not perceived positively for malaria prevention. Guided interviews showed that most pupils perceived insecticides as a tool for vermin control and environmental management as a practice to keep snakes and rodents out of homes. Considering the above scenario, underutilization of tools would fail to confer complete benefit leading to rejection of tools and apathy. The implications of underutilization of tools caused a disadvantageous ratchet effect. It is surmised that utilization of one tool would encourage users to seek other tools. However, if one tool was underutilized it was bound to confer less protection consequently culminating with less confidence in the given tool for protection against malaria.

Teaching about malaria in schools related well with perceptions on use of nets. Additionally, there was need to teach malaria lessons in all subjects, implying that malaria would be taught in subjects like English, Swahili, Fine Arts, Music and other languages taught at school. There was also need to design messages on malaria that appeal to the learners and examine malaria at the end of each school term and in the final examination. Perceptions on net use and insect repellants may be positively changed through aggressive teaching of well-designed malaria package in primary schools. On a broader context, beliefs and perceptions may be changed through education of the wider community. By teaching the wider community, poor beliefs and perceptions will be fought from multiple perspectives. Consequently, iteration of malaria related
health messages is inevitable if the messages are intended to bring about desirable belief and perception change.

Respondents failed to perceive treated nets as better than untreated in spite of having been taught about malaria at school. This observation is indicative of the low insecticide treated net usage among the respondents. This was supported by the disparity in knowledge levels among respondents on treated nets and importantly, about the treatment status of their nets. This is in view of the disparities between use of nets (54.7 % (357/649)), knowledge on personal net treatment status (41.0 % (266/649)) and the percentage of insecticide treated nets in possession of the respondents (67.0% (435/649)).

Sources of information for pupils on malaria were varied, consequently causing diversity and disparity in levels of comprehension among members of the same class. Some respondents accessed information through the radio (92.9% (603/649)) and others through television sets (36.7% (238/649)) among several other sources. making the spectrum of information broad and heterogeneous. This was much better than findings from a study in Uganda which estimated that access to information via the radio was 77.9 % whereas access to television set was rated at 15.2 % (ROU, 2000). The diverse sources of information for pupils accounts for the heterogeneity in knowledge.

Respondents having little knowledge on malaria were more prone to bouts of malaria as compared to their knowledgeable counterparts, indicating that the significant difference in malaria incidence between those with good knowledge and those with poor knowledge may be a
fundamental basis for advocating high knowledge on malaria. Radio as a medium for transmitting malaria messages appears to be a potentially effective information, education and communication tool since respondents who had radios at home exhibited higher knowledge levels. This was consistent with findings from a study on malaria in Uganda (ROU, 2000). Respondents with good knowledge on malaria transmission were more likely to own nets. Accordingly, we surmise that increased knowledge on malaria may improve demand for mosquito nets, and at the same time strengthen the respondent’s association of mosquitoes to malaria transmission.

It was evident in this study that knowledge on malaria health related issues needed iteration, creating the need for a comprehensive curriculum encompassing lessons on malaria and consistent teaching throughout primary schools in malaria endemic zones. It also appeared that malaria related messages were given discretely over the radio and television programs. This led to dis-association of malaria related issues leading to poor articulation of knowledge and practices among respondents.

There is need to identify various malaria prevention and control related messages and develop a malaria package for primary schools in endemic zones. Knowledge on malaria transmission had significant influence on mosquito net treatment. It is evident that an increase in knowledge on malaria transmission directly increases the awareness on use of insecticide treated nets. While only 69.0% (448/649) of the children shared knowledge on malaria at home, this is a positive indicator that children’s involvement might benefit the wider community. By involving children as community health volunteers, messages about malaria may be conveyed to the wider
community at a greater propensity. In view of the fact that schools were perceived by the community as a source of information and enlightenment to the children, there was need to cultivate concord between teachers and the school staff, this was contingent on the teacher-parent relationship. There was need to cultivate concord between the school and the community to ensure that potential health benefits were eventually realized.

Knowledge on malaria transmission appeared to have a desirable influence on health seeking tendencies especially through visiting a health facility this was in concord with findings from a study in Zimbabwe (Lukwa et al., 1999) which reported a relationship between malaria control measures and knowledge. However, respondents with knowledge on malaria transmission failed to use chemoprophylaxis. It is likely that by associating malaria with multiple etiologies, the use of recommended modes of intervention might appear irrelevant and ineffective. In a study in Baringo District (Munguti, 1998) respondents who attributed malaria causation to multiple etiologies were likely to seek remedy from sources other than in a health facility. Accordingly, it is surmised that malaria should be included in primary school and teacher training curricula with components covering lessons on diagnosis, treatment, domestic management as well as prevention and control.

Knowledge on transmission appeared to have a good influence on compliance with prescribed dosage ($p < 0.001$). It is suggested in this study that good knowledge on transmission improves on adherence to recommended dosage of chemotherapy. At the same time, it is inferred that use of nets was not influenced by good knowledge on malaria transmission, since an insignificant number of respondents used mosquito nets at night.
It was evident that respondents with good knowledge on malaria transmission still preferred non-allopathic modes of intervention. Knowledge on malaria transmission did not improve on the perception that chemotherapy cures malaria. It is thus suggested that beliefs associating malaria with multiple etiology and multi-therapy should be considered when designing an onslaught on malaria. Perception that malaria patients should visit a health facility related well with knowledge on malaria transmission ($p < 0.001$). It is suggested that knowledge on malaria transmission strongly influenced visiting a health facility. Perceptions on chemoprophylaxis related poorly with knowledge on transmission, while knowledge on malaria transmission did not improve on perceptions related to treatment of nets.

5.2 Beliefs and perceptions

Class of respondents did not significantly improve perceptions and beliefs on mosquito net use ($p < 0.002$) suggesting in this study that beliefs and perception on nets are influenced by other factors. At the same time perception that nets prevent malaria was not positively related to use of nets ($p < 0.05$), making it evident in this study that net users did not necessarily perceive nets as a tool for malaria prevention. Messages transmitted over the radio had a positive influence on perceptions and beliefs surrounding net use among respondents ($p < 0.05$). Respondents having desirable beliefs and perceptions on malaria prevention methods such as use of chemoprophylaxis, use of insecticides, and perception that patients should visit a health facility and practices such as visiting a health facility, perceived nets as a tool for malaria prevention. Nevertheless, respondents who perceived treated nets as better did not perceive nets to prevent
malaria, implying that respondents who perceived nets positively failed to perceive treated nets as better.

Respondents in upper primary school had good perceptions on visiting a health facility (p < 0.01). However, the perceptions and beliefs were not related to having been taught about malaria at school (p > 0.5). This was consistent with the observation that respondents who had poor perceptions about visiting a health facility suffered many bouts of malaria. Additionally, respondents who had positive perceptions on malaria were not hindered by distance to believe that it is good to visit a health facility (p > 0.5). This was confirmed by the positive relationship between perceptions on visiting a health facility and residing in the village (p > 0.05). Perceptions on visiting a health facility related poorly with perceptions on use of mosquito nets, revealing how the beliefs and perceptions on malaria are discrete. Perceptions on visiting a health facility related well with beliefs and perceptions on the efficacy of chemotherapy: at the same time respondents perceived medicine prescribed at a health facility as effective for malaria treatment. Most respondents who perceived visiting a health facility positively consequently visited one (p < 0.001). It is suggested in this study that factors that positively affect perceptions on visiting a health facility would result in malaria patients visiting such a facility. It is surmised that perceptions on seeking of health care were determined by class of respondents, with more children in lower primary seeking healthcare as compared to their counterparts in upper primary school who elect self-medication (teacher interview). This was consistent with a study in Kenya on management of fever among children and adults which revealed that most drugs are consumed by the adult population (Guyatt and Snow, 2004). Consequently, this indicates that adulthood comes with autonomy of health practices. Tacit in this scenario is the use of
54

painkillers instead of antimalarials for the management of malaria episodes, this is in view of the
mention of panadol which is a painkiller, for malaria prevention among the pupils.

5.3 Practices towards Prevention and Control of malaria

Health facility visit in the event of a malaria episode was recorded among 98.0 % (636/649) of respondents. These findings were better than those by Schulpen and Swinkel (1980) who reported a health seeking behaviour rate of 37.0 % (240/649). It appears that health seeking among the pupils in Busia District was fairly high. Case reporting of malaria to school authorities was recorded among 51.0 % (331/649) of the respondents, implying that 49.0 % (319/649) of the respondents were at risk of experiencing complicated malaria due to untimely case reporting. This was consistent with the observation by science teachers that some of the children failed to conceive the morbidity and mortality caused by malaria. These findings were corroborated by focus group discussions in which participants confirmed that cases of complicated malaria had been reported in their schools albeit at a fairly low prevalence rate. It appeared that there was need to educate respondents on the varied forms of malaria. Of all the respondents, 99.7% (647/649) of respondents used chemotherapy when having malaria. This was much better than findings by Geissler et al (2000). In spite of this assuring level of chemotherapy use, compliance with recommended dosage was still poor hence jeopardizing the sustenance of gains made in chemotherapy use. The utilization of chemotherapy was contingent on prevalent signs and symptoms. Respondents abandoned regimens when the signs and symptoms subsided. Teacher interviews reported that pupils had negative attitude towards malaria-related health information passed to them through the school. One teacher said, "some pupils take malaria so lightly and use painkillers such as panadol to combat malaria"
It was important for teachers to practice what they expected the pupils to emulate. Additionally, it is suggested that the number of bouts experienced by pupils remained high due to non-compliance with prescribed dosage. It is further suggested that the pockets of resistance existing among the study population may be attributed to the high non-compliance rate (55.3 %, 359/649). To increase compliance, education on malaria should be tailored on aspects that deal with compliance in chemotherapy use. This is mainly due to the desirable perceptions on chemotherapy use.

Nets were used by 55.0% (357/649) of respondents, which was low when compared to 93.8% (609/649) of respondents having mosquito nets. These findings are similar to those of Rodriguez et al. (2000) and by Ongore et al. (1989) which revealed that net user rates were lower than ownership rates. Poor perceptions on use of mosquito nets is to a great extent inerminated for this shortfall. These findings show that mosquito nets were the most popular method of personal protection against mosquitoes. Among the respondents, 13.6% (88/649) used mosquito repellants, implying that narrowing of campaigns to limited, inaccessible and unaffordable or poorly perceived tools may undermine the synergy accruing from integrated use of various tools to prevent and control malaria. Even though mosquito nets have a great potential in abating malaria, the role of other tools should be equally acknowledged and respondents encouraged to use the tools. In this study the use of integrated malaria prevention and control methods among pupils is advocated. These findings were not in accord with Mutero et al. (1998) whose study in Suba District reported that mosquito net was the most frequently used malaria control tool, at the same time these findings were higher than those of 44.0 % in Gambia, but lower than 86.0 % in Ghana (Aikins et al., 1994).
5.3.1 Use of mosquito nets

Respondents in upper primary school were two times more likely to use nets in comparison to their counterparts in lower primary ($p > 0.01$). According to the civil society and the youth group in Busia District, social marketing of nets should target the lower and upper primary school as units of project implementation and upper primary pupils should be encouraged to pass on their knowledge on use of nets. The village elders argued that the availability of proven prevention tools such as ITNs has not provided a solution. At the same time the public health department argues that the provision of effective chemotherapeutic regimen has failed to achieve a status that would be considered an epidemiologic success. While there is a considerable achievement in malaria prevention and control efforts, the magnitude of failure is overwhelming. The Church argues that the successes and failures are attributable to stakeholders undertaking malaria prevention and control programmes.

Teaching of lessons on malaria at school increases the net-user-rates. This study suggests that broad based and comprehensive teaching of malaria lessons at school might create a greater demand for and use of mosquito nets. It was also evident that users of mosquito nets experienced fewer bouts of malaria. Ownership of radio and television sets appeared to associate well with mosquito net use ($p < 0.001$). Given that knowledge on malaria causation was high among respondents having radios at home, it is evident that mosquito net ownership and use can be improved through radio education programmes. This was consistent with a study in Uganda which showed that families that had access to radio and television were more likely to use mosquito nets as compared to those families that did not have access to radio and television.
(ROU, 2000). Consequently, increasing mosquito net coverage might significantly reduce malaria since net ownership positively increased user rates. This was consistent with past studies that strongly underscored the need to buttress net coverage (RBM/WHO, 2000). It appeared that mosquito net use significantly resulted in an improved understanding of malaria causes and prevention resulting in increased use of malaria prevention and control tools. It is also evident that increasing the number of mosquito net users might significantly result in better practices related to prevention and control of malaria since the chemotherapy use \( p < 0.01 \), health seeking \( p < 0.05 \), compliance with prescribed dosage \( p < 0.01 \) and use of insecticides \( p < 0.001 \) all had a significant relationship to use of mosquito nets.

A comparison of net use with various perceptions revealed that there was a poor interaction between them. These results are in accord with results emanating from Lukwa et al. (1999), which reported that there was marked disparity between awareness on morbidity and malaria prevention in Zimbabwe. It is likely that respondents did not visualize the link between malaria, *Plasmodia* and mosquitoes. This study suggests that the poor understanding of malaria related variables coupled with complex and inaccurate perceptions on malaria conspire to exacerbate the spread of malaria. Accordingly, it is surmised that exclusive marketing of nets has relegated competing indigenous prevention and control tools to disuse, in the view of which we recommend innovative and integrated use of tools among economically disadvantaged communities. Studies conducted in Guatemala showed that communities lack knowledge on the transmission of malaria by mosquitoes consequently dampening their resolution to institute integrated malaria prevention and control measures (Klein et al., 1995) Importantly, this study concurs with antecedent revelations that communities should use plants and other indigenous
methods to repel mosquitoes as an keystone measures towards achieving integrated malaria
prevention and control (Lukwa et al., 1999).

5.3.2 Visiting a health facility

Of all respondents, 97.8% (635/649) visited a health facility, this was much higher when
compared to findings from studies in Southern Mexico in which the health seeking behaviour
was prevalent at 51.0% (Rodriguez et al., 2000). Results for teacher interviews showed that high
health seeking rate was attributable to school policy on malaria. It was evident that teaching of
malaria at school did not have a significant influence on visiting a health facility when
respondents had malaria. This implies that expanding lessons on malaria may not significantly
improve health seeking behaviour among respondents. Given that class did not show any
significant relationship, it is inferred that there is no difference in knowledge on malaria between
lower and upper primary school pupils. It is likely that the mode of instruction and the time
allocated malaria makes the lessons taught in lower primary have similar ramifications to what is
taught in upper primary school. It is recommended that the curriculum should be tailored to
harness the potential of pupils to learn more about malaria and translate to better health seeking
behaviour. While in this study, class of respondents did not have a significant relationship to
knowledge on malaria health seeking, studies in Mpumalanga Province of South Africa and
Bouake in Ivory Coast (Dossou-yovo et al., 1997), have shown that education and health seeking
are related. At the same time, it is argued in the study that scaling-up health education campaigns
can improve awareness on importance of early diagnosis and prompt treatment, improving the
community understanding of the function of indoor residual spraying and awareness in the
community of malaria transmission (Govere et al., 2000). Respondents who visited a health
facility failed to comply with prescribed dosage (p > 0.05). While the schools obligated the pupils
to seek health care, the curriculum has little on compliance with prescribed dosage for malaria treatment. It is also evident that messages on visiting a health facility are transmitted discretely rather than integratively.

5.3.3 Chemoprophylaxis

Respondents who took chemoprophylaxis for malaria were 41.0% (266/649). Contrary to what would be expected in an ideal situation the rate of chemoprophylaxis usage is less than 50.0 (325/649) indicating that respondents failed to conceive the relationships between malaria prevention and control factors. Improving on chemoprophylaxis requires that integrated innovative approaches be put to use. Class of respondent had a positive influence on chemoprophylaxis (p < 0.001). Likewise having been taught about malaria appeared to have a similar positive influence (p < 0.001). Consequently, we surmise that teaching takes precedence over other determinants of knowledge and practices on prevention and control of malaria. Knowledge on malaria transmission did not improve respondents’ understanding of chemoprophylaxis in regard to mosquitoes transmitting malaria. The users of chemoprophylaxis were therefore open to the consequences of poor usage of malaria prevention and control tools. Since the respondents associated malaria causation with multiple etiologies, it undermined the use of chemoprophylaxis among respondents. Respondents who used chemoprophylaxis benefited and were encouraged to use it continually. Respondents who used nets were less likely to use chemoprophylaxis (p > 0.05), indicating that there was a misconception on the extent to which nets confer protection against malaria. It is argued here that respondents may have viewed the use of nets and chemoprophylaxis as mutually exclusive. Respondents using chemoprophylaxis were also more likely to use chemotherapy (p < 0.001). At the same time
positive perceptions on use of chemoprophylaxis positively influenced use of chemoprophylaxis as a mode of prevention. Respondents using chemoprophylaxis had poor perceptions on seeking health through visiting a health facility. It is likely that respondents who used chemoprophylaxis perceived it as a treatment instead of a preventive tool.

5.3.4 Chemotherapy

Chemotherapy use was independent of the respondents’ class (p < 0.05). This was contrary to what was expected since upper primary school curriculum was expected to be more advanced than lower primary school. It may therefore be inferred that messages on malaria are tailored for passing examination. Moreover, if children’s involvement is needed in the war on malaria, then curriculum developers should integrate mechanisms for translating scholarly rhetoric to action. To realize this, lessons on malaria should come out as pragmatic activities especially in malaria endemic zones. This may be achieved through curriculum appraisal. Given that respondents who had good knowledge on malaria appeared to be better users of chemotherapy (p < 0.01), curriculum appraisal in regard to malaria may have a greater impact on its control through chemotherapy use. It is suggested that parent-child malaria communication may be enhanced through activities executed as homework.

Access to information through the radio appeared to positively influence chemotherapy use (p < 0.001). It is deduced that children’s health radio programs on malaria may be used to reinforce regular lessons taught at school. Perception on chemotherapy use related poorly with perception on other control methods. Paradoxically, patients would get medicine from a health facility yet fail to comply with recommended dosage (p > 0.05). These findings are in accord with findings
by Dossou-yovo et al. (1997), whose study in Ivory Coast, reported disparity in access to chemotherapy and compliance to recommended dosage for malaria treatment. In this study it appeared that economic factors were responsible for this relationship between health seeking behaviour and compliance with health prescriptions. Studies on self-medication among children in Siaya had highlighted the impacts of economic statuses of individuals on their compliance with recommended chemotherapeutic dosage (Geissler et al., 2000). Even though knowledge on correct dosage was not tested, studies in Siaya District, Kenya (Geissler et al., 2000) showed that malaria practices of children carry a number of hazards. From an epidemiologic standpoint, non-compliance with prescribed dosage due to insufficient knowledge can lead to misuse of antimalarials. The health benefits of having good malaria practices appeared to translate to fewer bouts of malaria among the respondents.

Considering the multi-sectoral approach to malaria prevention and control many initiatives have failed to realize due to poor coordination and lack of strong leadership (Orago A., personal communication, 2004). The stakeholders have fully undertaken prevention and control programmes in collaboration with the MoH. The Church has undertaken health promotion activities through a network of community based health workers and volunteers (CHW and CHVs). The stakeholders have been involved in addressing malaria at Primary Health Care level (PHC). Fundamentally, enlightenment of the community is undertaken as an integral component of capacity building aimed at empowering the natives to surmount health challenges. Through the education system the stakeholders are tacitly involved in health promotion through the schools within the project zones. Despite the well-developed infrastructure under the management of the church and the other institutions and their concomitant involvement in health
programmes channeled through the church, malaria still remains a formidable challenge to the entire community.

The social challenges facing malaria include non-compliance with tools. It was evident that the control tools fail due to poor social marketing, which exacerbates disease leading to deeper poverty (Makama S., personal communication, 2004). While at the level of the implementers the objectives are achieved, at the level of the community malaria prevention tools are not affordable.
CHAPTER 6
CONCLUSIONS, OPERATIONAL RECOMMENDATIONS AND SUGGESTIONS FOR FUTURE RESEARCH WORK

6.1 Conclusions

1. Sources of information on malaria prevention and control for pupils were varied. consequently causing diversity and disparity in levels of comprehension among members of the same class.

2. Knowledge on malaria transmission appeared to relate well with practice of pupils. Those who had knowledge on malaria suffered fewer bouts.

3. Even though knowledge had a positive influence on beliefs and practice the implementation of the practices occurred on uneven milieu hence reducing the potential benefit of such practices. This requires that knowledge level be significantly built to defeat the negative effects caused by competing socioeconomic factors.

4. Knowledge on malaria positively influenced health seeking behaviour among respondents. However, the school curriculum lacked specific components aimed at abating the disease. Additionally, in spite of its real threat, malaria is not addressed as a serious problem in primary school curriculum.

5. Beliefs and perceptions appeared to be related well to practice and it was evident that desirable beliefs were positively related to low malaria incidence.
6.2 Recommendations

6.2.1 Operational recommendations

6.2.1.1 Information, Education and Communication

There is need to tailor a malaria package for use in malaria endemic zones of the country. The package may be transmitted through the school radio program since pupils seem to regard information coming over the radio positively.

6.2.1.2 Policy Formulation

Education programs aimed at increasing awareness among the pupils on malaria transmission might promote the use of personal protection against mosquitoes.

6.2.1.3 Evaluation and Monitoring

The role of the government in coordination, monitoring and evaluation of malaria prevention and control activities in the context of stakeholder involvement should be strengthened. It is recommended that capacity building should be undertaken among government officials charged with the management of malaria matters. Such training should be undertaken regularly to ensure that extant capacities can cope with emerging malaria challenges.

6.2.1.4 Coordination of Intersectoral collaboration

Paramount of all, the ministry of health should be at the frontier of malaria prevention and control. By mobilising the community through the school as a fundamental unit of the framework, children will appreciate the impacts of malaria on them and consequently conceive the advances that target malaria.
6.3 Suggestions for future work

i) There is need to carry out research to determine the socio-cultural determinants causing the disparity between ownership and net use among pupils in the District.

ii) There is need to investigate the determinants culminating into non-compliance to prescribed dosage on malaria among pupils in Busia district.

iii) There is need to follow-up knowledge evaluation on malaria with practices instituted by respondents to prevent malaria.

iv) It is imperative to investigate the relationship between respondents buying nets and their use as compared to recipients of nets as donations.

6.4 General recommendation

Parents, teachers and children must be sensitized on malaria prevention and control and children charged with the obligation to undertake practices that will protect them and the wider community from malaria.
REFERENCES


APPENDICES

APPENDIX I: QUESTIONNAIRE

Questionnaire for the study on the Knowledge, perceptions and beliefs as well as practices among school children towards Malaria in Busia District.

Age Code # Date
Class Family Size
Gender

Hello, my name is Obadha Thadeus from Kenyatta University. I am a Public Health student carrying out a survey on the knowledge of pupils in Primary schools in Busia District of which your school is one. Your answers will remain confidential and I will not take down your name or address so that no one will know you gave me these answers. There are no correct answers, each of your answers will depend on your views and your situation.

General

1. Have you been taught about malaria at school?

<table>
<thead>
<tr>
<th>A</th>
<th>Yes</th>
<th>B</th>
<th>No</th>
<th>Tick below</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2)</td>
</tr>
</tbody>
</table>

2. What is malaria?

<table>
<thead>
<tr>
<th>a</th>
<th>Disease caused by mosquitoes</th>
<th>(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>A disease that people get when they are bewitched</td>
<td>(2)</td>
</tr>
<tr>
<td>c</td>
<td>A disease that people get when they get rained on</td>
<td>(3)</td>
</tr>
<tr>
<td>d</td>
<td>A disease that people get when they eat mangoes</td>
<td>(4)</td>
</tr>
<tr>
<td>e</td>
<td>A disease that people get when they do not pray</td>
<td>(5)</td>
</tr>
<tr>
<td>f</td>
<td>A disease that people get when they have little food to eat</td>
<td>(6)</td>
</tr>
<tr>
<td>g</td>
<td>A disease that people get when they drink dirty water</td>
<td>(7)</td>
</tr>
<tr>
<td>h</td>
<td>A disease that people get when they breath bad air</td>
<td>(8)</td>
</tr>
<tr>
<td>i</td>
<td>Others</td>
<td>(9)</td>
</tr>
<tr>
<td>j</td>
<td>I do not know</td>
<td>(10)</td>
</tr>
</tbody>
</table>

3. How many times have you had malaria this year (2003)

<table>
<thead>
<tr>
<th>a</th>
<th>Once</th>
<th>b</th>
<th>Two times</th>
<th>c</th>
<th>Three times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Housing
In what type of a house do you live?
- Grass-thatched house...
- Iron sheet roof...

5. Do you have a radio at home? No (1) Yes (2)
6. Do you have a TV at home? No (1) Yes (2)
7. Do you think that you live near a health facility? No (1) Yes (2)
   (perception question)
8. How many meals do you take in a day
   a) Breakfast (1)
   b) Lunch (2)
   c) Dinner (3)

9. Do you live in town? No (1) Yes (2)
10. Do you live in the village? No (1) Yes (2)

Knowledge on prevention

1. Give some of the ways that may be used to prevent mosquito bites
   - By using mosquito nets (1)
   - By using Vaseline repellant jelly (2)
   - By using doom spray to kill the mosquitoes (3)
   - Using mosquito coils to drive mosquitoes away (4)
   - By clearing bushes around our houses (5)
   - By wearing clothes that cover all our body parts (6)
   - By burning leaves whose smoke drives mosquitoes away (7)
   - By burning cow dung to drive away mosquitoes (8)
   - Sweeping our homes clean (9)
   - By smearing all the cracks in the walls (10)
   - I do not know (11)
   - Other (please write which other) (12)

2. Do you have a mosquito net
   - Yes (1)
   - No (2)

3. If yes, is it treated?
   - Yes (1) No (2)

4. Where do you sleep?
   - Mat (1) mattress on the floor (2) bed (3)

5. Do you tell your brother/sister/mother/father about malaria lessons learnt at school?
### Knowledge on treatment and case management

1. **What do you do when you have malaria?**
   - a. To a health facility  
   - b. To the village medicine man  
   - c. Visit my grandparents for medicine  
   - d. Go to the church for prayers  
   - e. Go to the shop for medicine

2. **After how long should people having malaria see a doctor?**
   - a. On the same day I have malaria  
   - b. On the next day /after 2 days  
   - c. On Saturday or Sunday when I am not going to school  
   - d. Others

3. **How do you feel when you have malaria? (tick all your feelings)**
   - a. Feeling hot  
   - b. Feel cold  
   - c. Feel headache  
   - d. Feel stomach pain  
   - e. Feel pain in the joints  
   - f. Visit the toilet many times  
   - g. Have pain when urinating  
   - h. Feel tired and want to sleep all the time

### Treatment and control practices

1. **What is the first thing you normally do when you have malaria?**
   - a. Sleep  
   - b. Tell the teacher  
   - c. Tell my friend or any body next to me  
   - d. Cry  
   - e. Look unhappy and talk to nobody

2. **Do you continue taking medicine even when you have felt better?**
   - a. Yes  
   - b. No
Please tick Yes or No

1. Do you take medicine when traveling to malaria areas? Yes (1) No (2)

2. Do you use mosquito nets at night? Yes (1) No (2)

3. Do you use Vaseline repellent jelly? Yes (1) No (2) N/A (3)

4. Do you use doom insecticide spray to kill mosquitoes? Yes (1) No (2) N/A (3)

5. Do you take medicine when you have malaria? Yes (1) No (2)

6. Do you take food (eat) when you have malaria? Yes (1) No (2)

Beliefs and perceptions

1. Mosquito nets keep mosquitoes away yes (1) / No (2)

2. Vaseline repellant jelly keeps mosquitoes away? Yes (1) / No (2) / N/A (3)

3. Treated mosquito nets are better than untreated mosquito nets? Yes (1) / No (2)

4. Cutting grass reduces the number of mosquitoes near our houses Yes (1) / No (2)

5. Doom insecticide spray kills mosquitoes? Yes (1) No (2)

6. People with malaria get better when they take medicine? Yes (1) No (2)

7. People taking medicine for malaria should eat well? Yes (1) No (2)

8. It is good to visit a health facility when one has malaria? Yes (1) No (2)

9. It is good to take medicine before traveling to malaria areas? Yes (1) No (2)

10. People should visit a health facility as soon as they have the feeling of malaria? Yes (1) No (2)

Thank you for participating in this study.
APPENDIX II: GUIDED INTERVIEW SCHEDULE

1. Management of malaria (The management of malaria at home, use of available medicines and instruments to abate severe malaria outcomes)

2. Treatment of malaria (The methods used by the respondents to treat malaria at home such as use of chemotherapy and use of herbs.

3. Prevention of malaria (personal protections, family protections and environmental approaches).

4. Diagnosis and case identification are respondents able to identify
APPENDIX III: TEACHER INTERVIEW SCHEDULE

1. Curriculum and malaria
2. Language of instruction used in teaching science and malaria
3. Attitudes of pupils towards malaria
4. Examination and malaria
5. MoH role and health visits
6. School health parades
7. School policy on malaria
8. School and community harmony
9. Health teachers position
10. Parents role in malaria prevention and control
APPENDIX IV: FOCUS GROUP DISCUSSION GUIDE

My name is Obadha Thadeus Odenyo. I am a Public Health student from Kenyatta University investigating malaria in Busia District. I would like to get your views on various issues regarding malaria in the District. Please note that your views will be important in developing my Thesis and Policy matters on malaria in Kenya. Please comment on the issues featured in this interview guide. Thanks for your time.

1. Prevention – do you think that malaria prevention and control methods are failing.
2. Control – Diagnosis attitudes and beliefs on use of blood samples.
4. Causes – consider – environmental (plants, animals, dust, forest, mountains, lakes, mosquitoes), personal (misbehavior), extra personal (heavenly bodies such as stars and planets- the moon), spiritual (curses and evil spells), friends and neighbors (evil eye).
5. Tools used in the prevention (comment on the disadvantages of the tools in your view).
6. Treatment of malaria (comment on the various methods such as herbs such as spiritual, sacrifices, exorcism and chemotherapy).
7. Multi-sectoral approaches in malaria control.
APPENDIX V: A COPY OF RESEARCH AUTHORIZATION LETTER

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

ROST 1/001/3C 256/2

Thadens Obadha Odemy
Kenavata University
P.O. BOX 43844
Nairobi

Dear Sir,

RE: RESEARCH AUTHORIZATION

Please refer to your application for authority to conduct research on 'Malaria prevention and control'. Knowledge, Attitudes and practices among primary School Children in Busia District, Kenya. I am pleased to inform you that you have been authorised to conduct research in Busia District for a period ending 30th October, 1985.

You are advised to report to the District Commissioner, the District Education Officer, and the District Medical Officer of Health Busia District before commencing your research project.

You are further expected to deposit two copies of your research findings to this Office upon completion of your research project.

Yours faithfully,

A: G. KAMBA
FOR: PERMANENT SECRETARY/EDUCATION

CC
The District Commissioner
Busia District

The District Education Officer
Busia District

The District Medical Officer of Health
Busia District
MALARIA PREVENTION AND CONTROL AMONG PRIMARY SCHOOL CHILDREN IN BUSIA DISTRICT, KENYA

Speaker: Thadeus Obadha Odenyo
Supervisors: Dr. S. A. Otieno, Dr. M. Otieno, Prof. A.S.S. Orago

Abstract
Among the leading causes of morbidity in Busia District, malaria accounts for approximately 50% of all the cases. In the year 2003, malaria caused 248 deaths in the District. This accounted for 33.3%, anaemia was incriminated for 20.45%. Additionally, malaria caused 52.9% of the cases followed by upper respiratory tract infection with 22.2% cases. The study was undertaken in the District between October 2003 and May 2004. The study sought empirical evidence of socio-economic and socio-cultural dynamics of malaria transmission. Results show that in spite of good knowledge among school children, there was a disproportionate balance between knowledge and practice While pupils sought treatment from health facilities when having clinical malaria, compliance with prescribed dosage was low. At the same time there was disparity between net ownership (93.83%, n = 649) and net use (54.69%, n = 649). Net ownership and use appeared to be positively related. In fact, respondents who had nets were 36 times more likely to use them ($\chi^2 = 330.8, p < 0.001$). We conclude that knowledge, beliefs and perceptions as well as practices form a labyrinth interdependent body. Ingeniously coordinated approaches are needed to overcome the negative impacts of this interdependence.