

**ADHERENCE TO ANTIMALARIAL COMBINATION THERAPY  
WITH ARTEMETHER- LUMEFANTRINE IN CHILDREN BELOW  
FIVE YEARS IN EMBU DISTRICT, KENYA**

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**DECLARATION**

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

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## **DEDICATION**

Dedicated to my wife Margaret, children: Joy, Dan and Steve for their patience and support during the entire research and thesis write up period.

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## DEFINITION OF TERMS

**Adherence** - Adherence to a medication regimen is generally defined as the extent to which patients take the medications as prescribed by their health care providers which includes dose taking (taking the prescribed number of pills each day) and the timing of doses (taking pills within a prescribed period).

**Adherence to dose timing** – Adherence by dose timing was taken as any case where the caregiver stated giving the tablets as recommended.

**Adherence to pill count** - as any case where the expected number of remaining tablets were physically counted during the follow up visit.

**Caregiver** - A person who is either a biological parent to a child below five years and providing care to the child or any other person who provides care and support to a child.

**Composite adherence** – Overall adherence. Cases where tablet count was as expected on the follow up day and the caregiver reported correct timing of doses were considered adherent.

**Definite follow up** – Requirement that a patient returns to a health worker after a specified time for review.

**Definitely adherent** – Cases where from the information available on drug taking and the pill count, it is evident that the drugs were taken in an adherent manner.

**Definitely non adherent** – Cases where it is evident from the patient report and or pill count that the drugs were not taken in an adherent manner.

**Fever** – Child with a temperature of 37.5<sup>0</sup>C or higher

**Probably adherent** – Cases where there is doubt about whether the drugs were taken  
in an adherent manner or not.

**Satisfactory rate of adherence:** Any adherence rate that is equal to or above 90%.

## **LIST OF ABBREVIATIONS/ ACRONYMS**

ACT –Artemisinin Combination Therapy

AL - Artemether Lumefantrine

CBS – Central Bureau of Statistics

DCAH –Division of Child and Adolescent Health

GoK – Government of Kenya

IMCI –Integrated Management of Childhood Illness

ITNs – Insecticide Treated Nets

KDHS – Kenya Demographic and Health Survey

KU – Kenyatta University

MCH – Maternal and Child Health

MDGs – Millennium Development Goals

MoST – Ministry of Science and Technology

MoH – Ministry of Health

NCAPD – National Coordinating Agency for Population and Development

PGH – Provincial General Hospital

SP - Sulfadoxine Pyrimethamine

SPSS – Statistical Package for Social Sciences

SSA – Sub Saharan Africa

WHO – World Health Organization

**ABSTRACT**

Malaria is a major public health challenge in Kenya especially among young children and pregnant women. It accounts for 30% of all outpatient attendances, 19% of all admissions and leads to 20% of all deaths in children aged below five years. Despite much effort to fight malaria, the efforts have been undermined by malaria parasites that develop resistance to the commonly available malaria drugs. Since a new antimalarial drug, Artemether - Lumefantrine (AL) was introduced in Kenya in the mid 2006, not much has been known about how this new drug has been used by patients. A descriptive cross sectional study was therefore carried out between April and May 2008 to assess adherence to AL in children below the age of five years in Embu District. Purposive and random sampling procedures were used to select the study site and subjects. Data was collected at the Embu Provincial General Hospital and in Gatunduri, Dallas and Itabua dispensaries where a total of 355 caregivers of children treated for malaria with AL were recruited, interviewed using a structured schedule and followed up on the third day of treatment. The results showed that though 73.5% of the caregivers had either good or very good knowledge on malaria, the knowledge on how to take AL had gaps and was inadequate. Whereas 97.5% and 88.2% could tell the correct amount of drug to give and correct schedule respectively, there were deficiencies and knowledge gaps in areas like preparation of AL for the children to take (78.7%), possible side effects (20.3%) and the dietary requirements that go along with AL use (63.9%). Further, the composite adherence was low (46.8%). There was a significant association between adherence and caregivers' knowledge on malaria ( $P < 0.001$ ), knowledge on the AL dispensing instructions ( $P = 0.001$ ), occupation of caregiver ( $P = 0.03$ ), age of caregiver ( $P = 0.02$ ), vomiting ( $P = 0.001$ ) and the time the first dose was given ( $P = 0.001$ ). The study concluded that adherence to AL was low in this setting and rejected the research hypothesis that adherence to AL was satisfactory among children aged below five years in Embu district. To address adherence, the study recommends education to the community to boost knowledge on malaria which was positively associated with adherence, re-training health workers on communication skills for effective counseling on disease and treatment issues and development of communication materials, reinforcing the requirement that all first doses of AL be administered at the health facility before the child left, the children under treatment for malaria with AL should be followed up after 2 days of treatment to monitor the response to treatment and sort out challenges that arose from treatment like replenishing the supply of AL if needed and that the health managers take up adherence to malaria treatment as an urgent challenge and address the factors that hamper adherence.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background information

Malaria is a highly communicable disease characterized by clinical symptoms which include fever, joint pains, headache, chills, sweating, vomiting, anaemia, loss of appetite, cough, diarrhoea and respiratory distress (Chin, 2000). If not treated or incompletely treated, malaria can lead to recurrence (Najera *et al.*, 2000). Malaria is caused by protozoa of genus *Plasmodium* with four species that cause malaria in humans namely: *Plasmodium falciparum*, *Plasmodium malariae*, *Plasmodium vivax* and *Plasmodium ovale* (Chin, 2000).

Malaria is and continues to be a major cause of death and disability the world over despite efforts by Governments and increased international support in combating the disease (WHO, 2000a; Snow *et al.*, 2005). Globally, malaria accounts for between 300 and 500 million new infections with an associated high mortality predominantly among young African children (Bloland, 2001; WHO, 2001). According to WHO, malaria alone accounts for 29% of all deaths among children under five years which translates to about 1 million children annually. Majority (80%) of these deaths occur in the low resource developing countries particularly in Sub Saharan Africa (SSA) which makes malaria a priority disease in this region (WHO, 2001; UNICEF, 2008).

In Kenya, over 25 million people live under the threat of malaria. It accounts for 30% of all outpatient attendances, 19% of admissions and leads to about 20% of all deaths in children under the age of five years (MOH, 2006). In addition, the effects of malaria on the national economy are enormous as a result of associated costs of treatment and loss of productive working hours when one is bed ridden with malaria or attending to a sick person. The Kenya Demographic and Health Survey (KDHS) of

2003 estimated that an average of 170 million man hours are lost in Kenya annually as a result of malaria (CBS *et al.*, 2004). Malaria therefore will need to be addressed in order to achieve Millennium Development Goals (MDGs) and especially number 4 (Reducing child mortality) and number 6 (combating HIV/AIDS, malaria and other diseases). To address this grave public health burden in Kenya, the National Malaria Strategy (NMS) (2001 – 2010) was formulated with an objective of reducing the level of malaria infection and consequent deaths in Kenya by 30% by year 2006 and sustain this improved level of control up to the year 2010 (MoH- DoMC, 2001). This a level that was not achieved by 2006 (MoH, 2006). Other measures included provision of free anti-malarial treatment, the changes in the malaria treatment policy and guidelines to accommodate the emerging malaria treatment issues and issuance of Insecticide Treated Nets (ITNs) etcetera. These efforts are however incapacitated by the malaria parasites, especially the *Plasmodium falciparum* which frequently develops resistance to the commonly available antimalarial drugs (MOH-DOMC, 2005).

In Kenya, the ever increasing resistance of malaria parasites to chloroquine led to a change in the malaria treatment policy in 1998 with the adoption of Sulfadoxine-Pyrimethamine (SP) which was fully employed nationally in the year 2000. In just under four years, another policy change became necessary as the efficacy of SP had already started dwindling. The new policy embraced Artemisinin Combination Therapy (ACT) with a combination of Artemether and Lumefantrine (AL) recommended as the first line drug (MOH-DOMC, 2005). The new drug reached national usage and was available in all public health facilities by the middle of the year 2006 (Amin *et al.*, 2007).

When chloroquine was efficacious, studies carried out in some countries showed that its use was far from ideal. Its use was characterized by little attention paid to appropriate dosage and completion of the dose which resulted to poor adherence and this may have led to the reported resistance (WHO, 1986; McCombie, 1996; Basco, 2004).

For successful use of ACTs in Kenya, it is important to revisit the experiences with monotherapies such as chloroquine and carefully consider how the new treatment could be used judiciously. In view of this, several issues need to be addressed, among them being the patients' adherence to treatment (Bloland, 2000). The consequences of non-adherence are serious and include lower cure rates, development of resistance to the drugs and mis-use of left over drugs (Berkow, 1992; White, 1999).

## **1.2 Problem statement**

Not much quantitative information on adherence to antimalarial treatment is available in Kenya. In some of the countries where studies have been done, adherence has been reported to be poor (Nshakira, 2002; Kachur *et al.*, 2004; Depoortere *et al.*, 2004a,b;). According to McDonnell *et al* (2002), little attention is paid to the appropriate dosage and completion of the prescribed doses. A number of studies have linked the poor or non adherence to the increased malaria related morbidity and mortality, therapeutic failure, drug resistance and mis-use of the left over drugs (WHO, 1986; Okeke *et al.*, 1999; WHO, 1999; Homedes *et al.*, 2001; Senst *et al.*, 2001). Similarly, non adherence has been associated with increased health care costs (Senst *et al.*, 2001; McDonnell *et al.*, 2002).

In Kenya, despite the much effort put in place to fight malaria including the formulation of Malaria treatment policies, provision of free malaria treatment and subsidized or free Insecticide Treated Bed nets (ITNs), malaria is still a major public health challenge particularly to pregnant women and the children under the age of five years (Snow *et al.*, 1999; WHO, 2000b; Snow *et al.*, 2005; MoH, 2006).

Effective treatment is key to the success in fighting malaria. However, it is noteworthy that the full benefits of the treatment can only be achieved if patients adhere to the prescribed regimen reasonably well (Osterberg *et al.*, 2005). The new malaria treatment with AL is envisaged to have a long therapeutic life of up to 8 years if well used (DoMC-MoH, 2005). The drug is however much dependent on adherence and so the efficacy of the drug could be ruined if not well used (Nosten and Brasseur, 2002). Achieving full adherence in children presents unique challenges. It requires not only the co-operation of the child but also a devoted persistent caregiver (Simpson, 2006).

Despite the importance of adherence, not much quantitative data is available on adherence to the malarial treatment at the study area (Embu district). This is true for both the recently introduced AL and the earlier used malaria drugs (Chloroquine and Sulfadoxine Pyrimethamine). There is therefore a glaring information gap on how AL is used. The current study aimed at measuring the rate of adherence to AL and identifying factors that influenced it. This is important in guiding the rational use of Artemether Lumefantrine with the benefit of helping to ensure correct drug use which will result to better and longer lasting therapeutic value. This study also addressed the existing information gap on adherence in the use of Artemether Lumefantrine.

### **1.3 Justification of the study**

This study assessed adherence to the newly introduced antimalarial treatment with Artemether Lumefantrine in the study area. It aimed at getting information on how the drug is used and the factors that determine adherence to its regimen. Since no adherence studies have been carried out in the study area on malaria treatment, this study is imperatively handy in generating important information that will help in safeguarding the new drug against inappropriate use. The findings of this study will also draw the attention of the health managers and other stakeholders on adherence and help put in place appropriate measures to curb non adherence.

### **1.4 Research Questions**

1. Do caregivers of children below age five years in Embu district have knowledge on malaria and its severity?
2. Do caregivers of children treated for malaria with AL in Embu district know how to give the drug to their children appropriately?
3. What is the level of adherence to AL in children under five years in Embu district?
4. What are the factors that influence adherence to malaria treatment with AL in Embu district?

### **1.5 Research Hypothesis**

Adherence to *Artemether - lumefantrine* in the treatment of malaria is satisfactory among children under the age of five years in Embu district.

## **1.6 Main Objective**

Assess the level of adherence to *Artemether – lumefantrine* in the treatment of malaria and the factors that influence it among children under the age of five years in Embu district.

### **1.6.1 Specific objectives**

1. Assess if caregivers of children below age five years have knowledge on malaria and its severity.
2. Assess if the caregivers know how to correctly give AL to their under five years children.
3. Determine the level of adherence to AL among children under five years who are on malaria treatment in Embu district
4. Identify factors that influence adherence to malaria treatment with AL in children below age five years in Embu district.

## **1.7 Significance and expected output of the study**

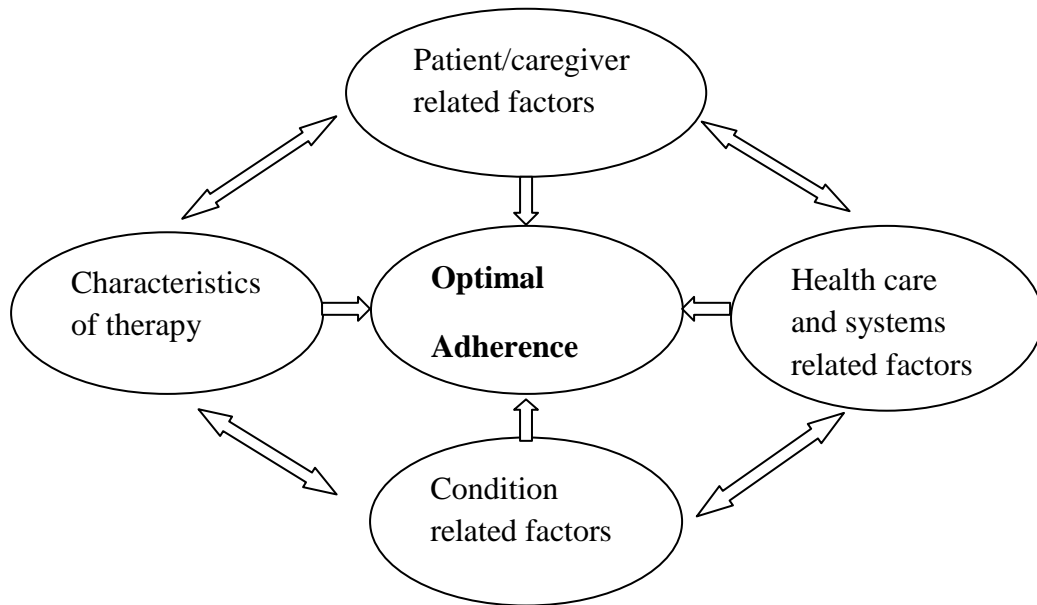
The findings and recommendations of this study will help health managers at the district to make crucial decisions on AL use. The study sought to explore arising adherence issues with a possibility of replication in other parts of the country.

## **1.8 Limitations of the study**

Follow up on the caregivers was done on the third day of treatment at the health facility. At follow up time, one dose was meant to be remaining and was assumed that it was going to be given.

Since adherence to dose timing was based on the caregiver reports, though proved reliable, there is a likely recall difficulty particularly on time AL was given. Financial resources needed for the study were another constraint.

## 1.9 Conceptual framework



**Patient/caregiver factors** - These include knowledge of the health problem and therapy instructions, personality issues like self efficacy, memory, perceptions on the drug and socio demographic characteristics like age, education, occupation, and marital status.

**Characteristics of therapy** – These include the physical size of the drug, taste, complexity of the dosage schedule, side effects or perceived harm resulting from the treatment, the requirement that the drug be given with fatty foods.

**Condition related factors** – This refers to the condition of the child. For instance whether the condition improves or appears to be worsening or if the child has problems in tolerating the drug.

**Health care and systems related factors** – These include instructions given to the caregiver on taking the drug, prescribing the right dosages, availability of the drug.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 Definition of adherence

Adherence to a medication regimen is generally defined as the extent to which patients take the medications as prescribed by their health care providers

(Chisolm, 2007). It seeks to define medication taking behaviour as it is clear that full benefits of the many effective medications that are available will be achieved only if patients follow prescribed treatment regimens reasonably closely. Adherence can further be defined to include data on dose taking (taking the prescribed number of pills each day) and the timing of doses (Yepez *et al.*, 2000; Ansah *et al.*, 2001; Osterberg *et al.*, 2005). Rates of adherence for individual patients are usually reported as the percentage of the prescribed doses of the medication actually taken by the patient over a specified period.

### 2.2 Prevalence of adherence

The home is an important component of management of acute clinical episodes of malaria and influences the prevalence of adherence. Every effort must therefore be employed to improve this important component by making it easier for the caregiver to adhere to the prescribed treatment (Hill *et al.*, 2004). Success in reducing childhood mortality requires more than just availability of adequate health services with well trained health personnel, as the families also have a major responsibility in caring for their children including taking them to the health facilities when sick and following the advice given by their health care providers to ensure the children recover quickly and fully. This involves giving the children the full course of prescribed medications, in the right quantities, manner, right timing as well as honouring the appointments for follow up care (Hill *et al.*, 2004).

Although ACTs are recommended to confront the notorious drug resisting *Plasmodium falciparum* malaria, it is true that their dosing schedule especially for AL is complex; consisting of six doses to be taken over three days. This raises critical questions as to whether this complex multidose treatment will be practical and to what extent patients will complete the recommended doses (Kremsner, 2005). It is noteworthy that achieving full adherence in children requires not only the child's co-operation but also a devoted, persistent and adherent caregiver (Simpson, 2006).

Studies across the world demonstrate low adherence rates for both acute and chronic illnesses with most studies recording a median rate of 58% and a range of 40 to 93%). In a study carried out in Uganda to determine adherence in children dispensed with the right dosage of chloroquine, only 38% were found to be completely adherent (Nshakira, 2002). In another study carried out in rural Tanzania to determine adherence to antimalarial treatment with ACTs; Sulfadoxine-Pyrimethamine and Artesunate, adherence was reported at 75% (Kachur *et al.*, 2004). Similarly, Depoortere *et al.* (2004a) reported an adherence of 39.4% in a Zambian refugee settlement. A study carried out to determine adherence to AL among children in Sudan showed that 18.3% of the children were considered certainly non-adherent, 22.6% were probably non-adherent and 59.1% were probably adherent (Depoortere *et al.*, 2004b). Fogg *et al.* (2004) reported high adherence to a combination of Artemether and Lumefantrine in Uganda in which 90% of the children were documented as being probably adherent, 7.1% being definitely non-adherent and 2.9% probably non-adherent. Though there is no definite standard as to what constitutes adequate adherence, rates greater than 95% are mandatory particularly for serious diseases (Spilker, 1991).

### 2.3 Determinants of adherence

Key determinants of adherence include knowledge, attitudes, support and therapy characteristics, all grouped into proximate and distant determinants (Hill *et al.*, 2004). To achieve adequate adherence, caregivers need to have adequate knowledge and understand the treatment regimen well. They also need to have knowledge on the health problem the child has. Knowledge is crucial for the caregiver to be able to give the treatment as required and deal with the tendency to stop treatment when symptoms dissipate (McCombie, 1996; Hill *et al.*, 2004). In addition, good communication with the caregivers not only ensures that the client has adequate knowledge on the treatment but also provides a chance for clarifications on other aspects of care that are crucial for adequate adherence to be achieved. Homedes *et al.* (1993) in a study carried out in Costa Rica observed that patients were rarely active in asking for clarification in interactions during a consultation with a clinician. Indeed, 27-83% of patients left the consultation room with incomplete knowledge of how to take the medication. Strengthening communication between a health worker and patient is a key effective strategy in boosting the patient's ability to follow treatment regimen (Haynes, 2002).

Adherence patterns are also dictated by the complexity of the dosing schedules. Simple schedules (One pill a day) help maximize adherence. Studies have shown that adherence is inversely proportional to the frequency of treatment schedules with patients on a four times daily schedule achieving the lowest average adherence (Peas *et al.*, 1997; Claxton *et al.*, 2001; Abuaku *et al.*, 2004; Depoortere *et al.*, 2004b; Osterberg *et al.*, 2005).

Malaria management guidelines in Kenya indicate that treatment of malaria in children below the age of five years be made on IMCI algorithm which indicates that

the first dose of AL be given at the health facility and the remaining doses be given according to a six dose schedule which has to be followed precisely (MOH, 2006; MoH-DCAH, 2007). Admittedly, the six dose schedule of AL is complex (Kremsner, 2005), especially noting that it was introduced to replace the then first line treatment with Sulfadoxine- Pyrimethamine (SP) which was a much easier regimen to follow; being a single dose that was often taken as Directly Observed Treatment (DOT) in the clinic. For the AL to be effective, it has to be taken in a very particular way with the first dose usually taken in the clinic, the second is taken precisely 8 hours after the first one and the remaining doses are taken 12 hours apart. In addition, the drug needs to be taken with fatty food to enhance the absorption of Lumefantrine, the component which is responsible for a sustained maximum level of the drug in the blood for effective action. This requirement is admittedly difficult for a child with malaria who often has nausea and poor appetite. Though WHO introduced a blister package for the drug with the dose adjusted to the weight of children, this dosing schedule poses a real challenge in other aspects as described above.

Though malaria treatment in all Government of Kenya (GoK) health facilities is free, there are instances where patients are required to buy drugs particularly when stocks are exhausted. Artemether Lumefantrine has been estimated to cost 10 – 20 times more than the other common antimalarial drugs previously used such as SP (Mutabingwa *et al.*, 2005; Piola *et al.*, 2005). In addition, malaria treatment is provided in other health facilities like the private sector at a fee which makes the cost of AL an important factor to consider. High drug costs often lead to patients buying drugs equivalent to the amount of money available and this may lead to patients taking under doses which can compromise the efficacy of *Artemether -lumefantrine* (Molyreux, 2002).

## 2.4 Measuring adherence

Adherence to medication regimens has been monitored since the time of Hippocrates when effects of various drugs were recorded in a bid to find out whether the patient took the medication or not (Osterberg *et al.*, 2005). According to these authors, the methods available for measuring adherence can be grouped into two; direct and indirect. Direct methods include the Direct Observed Therapy (DOT), measurement of the level of medicine or metabolite in blood and measurement of the biological markers in blood. These methods are objective and accurate but have a limitation of being expensive and some require expensive equipment. Indirect methods on the other hand include questionnaires for patients, patients' self reports, pill counts and questionnaires for caregivers/teachers where the patient is a child. These methods are simple, objective, often easy to perform, quantifiable, inexpensive and are most widely used to measure adherence. A combination of the direct and indirect methods could also be employed. While each method has its own merits and demerits, no method can be considered as definite standard (Wagner, 2001; Osterberg *et al.*, 2005).

Caregiver reports have been documented as reliable in several studies in which the caregiver reports were compared with blood serum levels and a high degree of agreement was documented (Qingjun *et al.*, 1998; Marsh *et al.*, 1999; Kofoed *et al.*, 2003; Fogg *et al.*, 2004; Marsh *et al.*, 2004; Depoortere *et al.*, 2004b). The studies above demonstrate that caregiver reports and pill count are reliable methods of assessing adherence in sick children and prove that caretaker interviews could be relied on to measure adherence. Further, these two methods of measuring adherence (pill count and patient/caretaker reports) have been tested and shown to have very good agreement (Fogg *et al.*, 2004).

Though data on adherence is often dichotomous (Adherence versus Non-adherence), adherence can vary along a continuum of 0 to more than 100% as sometimes patients can take more than the prescribed amounts of medication (Osterberg *et al.*, 2005).

## **2.5 Consequences of poor adherence**

Non adherence can lead to preventable morbidity and mortality as it leads to therapy failure, drug resistance and misuse of left over medicine (Homedes *et al.*, 2001). In 2001, poor adherence to medication accounted for sustained worsening of disease, death and increased health care costs in the United States of America (Senst *et al.*, 2001; McDonnel *et al.*, 2002). In addition, these authors documented that of all medication related admissions in the USA, 33-69% were as a result of non-adherence. Similarly a study in Nigeria found out that 84% of children diagnosed with malaria who did not get better when treated with chloroquine were actually non-adherers (Okonkwo *et al.*, 2001). Further, non adherence is linked to resistance because sub-inhibitory regimens predispose the selection of resistant pathogen strains (Okeke *et al.*, 1999; WHO, 1999). In Senegal, an increase in the risks of malaria deaths in children was linked to the emergence of chloroquine resistance (Trape *et al.*, 1998). Consequently, resistance to drugs lead to a long, laborious and expensive process of identifying a new drug.

## CHAPTER THREE: MATERIALS AND METHODS

### 3.1 The study area

This study was carried out in the Central Division, Embu District, at four health facilities namely; Embu Provincial General Hospital and Dallas, Itabua and Gatunduri dispensaries.

Embu District makes up one of the districts of Eastern Province, bordering Mbeere District to the East and to the southeast, Kirinyaga to the west and Meru South to the North. The district lies approximately between latitude  $0^{\circ} 8''$  and  $0^{\circ} 35''$  south, and longitude  $37^{\circ} 19''$  and  $37^{\circ} 42''$  East and occupies a total area of 708 square kilometers. Administratively, the district is sub-divided into five divisions namely Manyatta, Central, Nembure, Runyenjes and Kyeni (Figure 3.1). These are further divided into 15 Locations and 52 Sub Locations. The district lies at an altitude between 1,200 and 4,500 metres above sea level. Majority of the people in the district (86%) live in the rural areas and engage in dairy, cash crop (tea and coffee) and subsistence farming while 14% live in the two main urban centres (Embu and Runyenjes). Civil servants and the business community are concentrated in the two urban centres. The district experiences a bimodal rainfall pattern (two rainy seasons), with long rains occurring between March and June and short rains between October and December. This rainfall pattern has a major influence on the use of land in the district (Embu – MoH, 2006, 2007).

The Central division which was the area of study covers an area of 64 square kilometers and has a projected population of 57,989 (CBS, 1999). The division also houses the Eastern Provincial and the Embu District headquarters and has both urban and rural set ups ((Embu – MOH, 2006, 2007).

Embu district was chosen for study because it was one of the three earliest districts in Kenya to implement the Integrated Management of Childhood Illness (IMCI), a strategy which emphasizes improved management of childhood illnesses. The other districts are Kajiado and Vihiga. This strategy was embraced by the Ministry of Health as key to achieving the Millennium Development Goals number 4 and 6 (Appendix 1). As a result, the district is presumed to offer considerably better quality of health care to children. In addition, malaria is a priority disease in the district, being among the top causes of admissions to hospital among children below the age of five years. Among the top ten causes of both morbidity and mortality, malaria is ranked second after respiratory diseases and accounts for 21% and 22% of morbidity and mortality respectively (Embu – MoH district annual reports, 2006 and 2007). Besides, Embu district had higher malaria cases in 2007 (189,509) when compared to the two other districts, Kajiado (148,856) and Vihiga (139,830) as reported in the Health Management Information System 2008 (MoH, 2008). In addition, a study on adherence to AL had not been carried out in the district and hence a need to undertake such a study.

### **3.2 Sample population**

The sample population was children below the age of five years in Embu district who were diagnosed to have malaria and treated with the new drug; Artemether Lumefantrine. The caregivers of these children who met the eligibility criteria were interviewed using a structured interview schedule both at the clinic and later during a follow up visit on the third day of treatment.

THE STUDY SITE

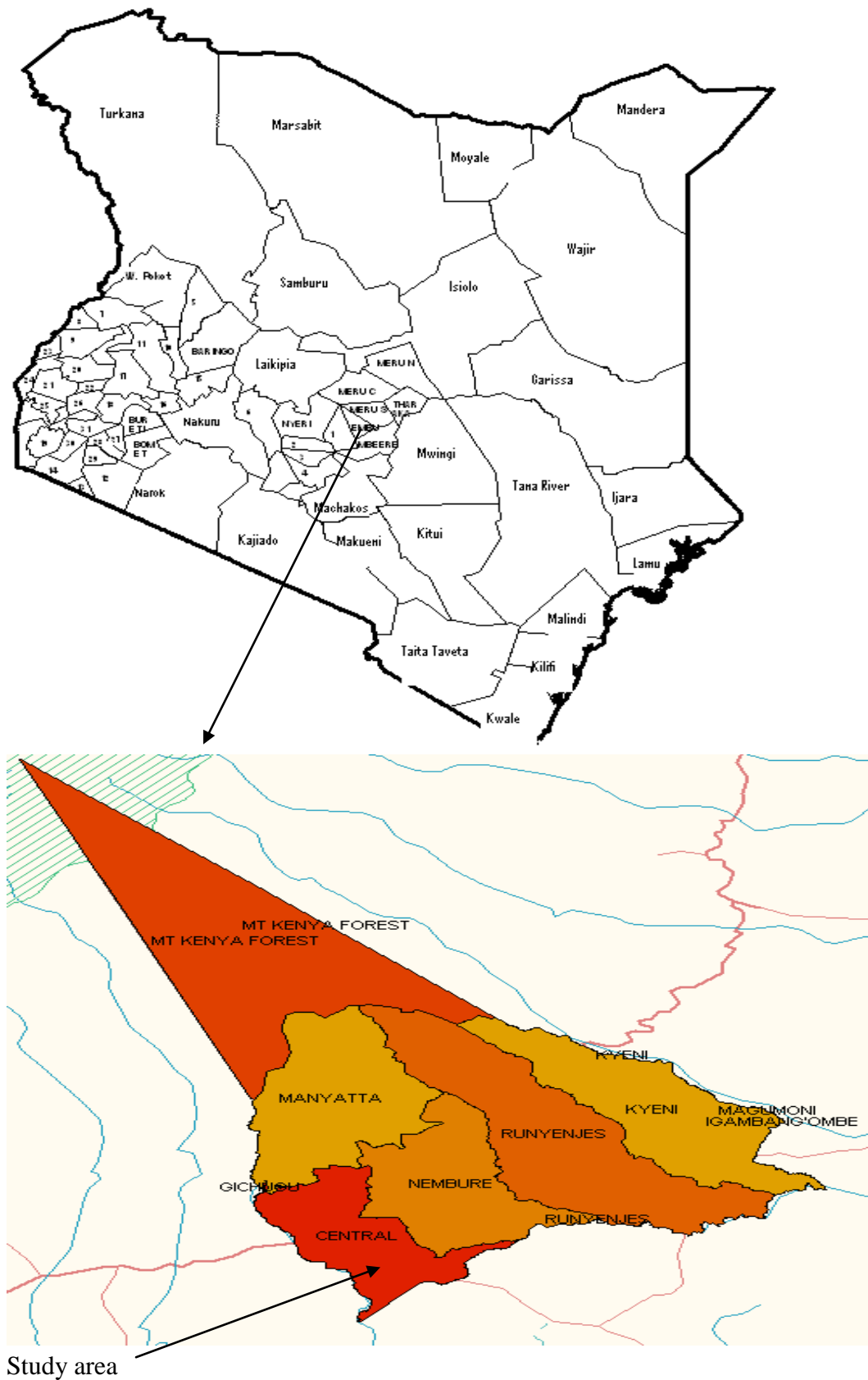


Figure 3.1. Location of Embu District and the study area

### 3.3 Inclusion criteria

All children under the age of five years diagnosed with malaria and treated with Artemether Lumefantrine and whose respective caregivers gave consent to participate in the study.

### 3.4 Exclusion criteria

All children above the age of five years were excluded as their age was above the target. Children diagnosed to have severe malaria, who are normally treated with quinine, were also excluded from this study as well as those hospitalized because there would be no chance to follow them up. A child whose sibling was already participating in the study was also excluded to avoid interviewing one caregiver more than once. Similarly, the children whose caregivers did not consent to take part in the study were also excluded.

### 3.5 Research design

This was a descriptive cross sectional study to assess the rate of adherence to AL, the drug taking instructions given to the caregivers of children and the factors that influence adherence among children below the age of five years in Embu district.

### 3.6 Sample size determination

Sample size was determined using the formula as used by Fisher and colleagues (Fisher *et al.*, 1983):

$$n = \frac{z^2 pq}{d^2}$$

where

n = the desired sample size when population is > 10,000

z = Standard normal deviate set at 1.96 at 95% confidence level

$p$  = the proportion of the population estimated to have a particular characteristic being measured.

For this study,  $p$  was estimated at 0.265 (proportion of children treated for malaria (CBS *et al.*, 2004).

$$q = 1-p (1-0.265 = 0.735).$$

$$\text{Thus } n = \frac{1.96^2 \times 0.265 \times 0.735}{0.05^2} = 299$$

An additional 10% was included to cushion against loss to follow up and thus 329 was the minimum sample size required.

### 3.7 Sampling methods

Embu district was purposively selected from among the three districts in the country in which Integrated Management of Childhood Illness (IMCI) strategy was first implemented on basis of higher malaria case load. Further, the Central division was purposively selected from among the five divisions of Embu district because it has the highest malaria cases and houses the Eastern Provincial General Hospital.

In the central division, there are six public health facilities namely Embu Provincial General Hospital and Dallas, Kangaru, Itabua, GK prisons and Gatunduri dispensaries. These facilities provide malaria treatment free of charge hence accessibility to AL is largely uniform. Embu Provincial General Hospital was selected for inclusion as it is the only hospital and referral facility in the area. A simple random sampling procedure was employed to select among the remaining health facilities whereby the names GoK Prisons, Dallas, Itabua, Gatunduri and Kangaru dispensaries were written on pieces of paper, folded to conceal identity and mixed. Dallas, Itabua and Gatunduri dispensaries were picked and as such were included in the study. The number of subjects to be sampled in each of the health

facilities was calculated proportionately to the number of children treated for malaria in each of the health facilities. This was obtained by dividing the number of malaria cases treated in each facility with the total number treated in the four facilities in a month (3095) and multiplying by the required sample (329). Using this method, 141 caregivers from Embu Hospital, 76 from Dallas, 52 from Itabua and 60 from Gatunduri dispensaries were obtained hence included in the study. To achieve this sample size, all caregivers bringing their under five year old children to each of the participating health facilities, who met the eligibility criteria and consented to participate in the study, were recruited till the desired sample was achieved.

### **3.8 Pre-testing, reliability and validity**

The data collection tools (interview schedule) were pre-tested at Kangaru dispensary which is within the study area but not included in the study. Research assistants participated in this exercise which was part of the training to ascertain that they fully understood the interview schedule. The necessary corrections were made on the interview schedule to improve on its reliability and validity.

### **3.9 Data collection**

Pre-tested structured interview schedules (Appendix 2) were used to collect data. This process was started before the caregiver left the hospital but after being issued with drugs. The interview at this point collected data on the socio-demographic characteristics, the treatment received and the instructions given to the caregiver about how to use the dispensed drugs. Further data on how the drug was actually taken, the pill count and any challenges encountered in the course of treatment was collected during a follow up visit at the health facility on the third day of treatment.

To ensure that authentic data was collected, research assistants were trained on the use of the interview schedule and also involved in the pre-testing of the instrument. After data collection, the interview schedules were checked for accuracy of information while still in the field and stored well for subsequent coding and analysis.

### **3.10 Ethical considerations**

Authority to carry out this study was obtained from the School of Health Sciences through the Department of Public Health, Kenyatta University, the Ministry of Science and Technology, local provincial administration and the Ministry of Health in the study area. Informed consent was obtained from the caregivers prior to interview. Confidentiality of the information provided by the respondents was guaranteed and ensured.

### **3.11 Data management**

The completed interview schedules were received from the research assistants on a daily basis and safely stored awaiting processing. Data was checked for completeness and accuracy before being keyed into the Statistical Package for Social Sciences (SPSS version 12.0) which was used for analysis. Qualitative data was transcribed, coded and translated before being analyzed. The results were presented using frequency tables, percentages, bar and pie charts. Chi square test for association was used to determine associations of categorical variables e.g. age, occupation, education, marital status, knowledge on the treatment with the resultant adherence. Analysis Of Variance (ANOVA) was used to compare mean scores of knowledge in the participating health facilities and where significant, tukey test was applied for multiple comparisons of the means. Pearson's Product- Moment correlation was used

to determine the relationship between variables. For all statistical tests applied, a p value less than 0.05 ( $P < 0.05$ ) was considered statistically significant.

### **3.12 Decision making criteria**

- i) Adherence by dose timing was taken as any case where the caregiver stated giving the tablets as recommended (caregiver reported to have followed the correct dosing schedule).
- ii) Adherence based on tablet (pill) count was defined as any case where the expected number of remaining tablets were physically counted during the follow up visit.
- iii) A composite (overall) adherence assessment was judged based on the remaining tablet count and the information obtained from caregivers on timing of the doses. Cases where tablet count was as expected on the follow up day and the caregiver reported correct timing of doses were considered adherent.  
  
All cases where the remaining tablet count on the follow up day were as expected but the timing of doses incorrect or where correct timing was reported by the caregiver but the remaining not as expected on the day of follow up day were considered non adherent.
- iv) A difference of one hour between the time a dose should have been taken and the actual time it was taken was considered acceptable.
- v) Adherence rate below 90% was considered unsatisfactory.

## **CHAPTER FOUR: RESULTS AND DISCUSSION**

### **4.0 Introduction**

Although the minimum sample required for the study was 329, a total of 355 caregivers were interviewed during the study period to further reduce the sampling error and enhance validity. They were recruited at one provincial hospital and three dispensaries as follows: Embu Provincial General Hospital - 153(43.1%), Dallas dispensary - 82(23.1%), Gatunduri dispensary - 65(18.3%) and Itabua dispensary - 55(15.5%). The results are presented in four areas as per the study objectives: Knowledge of malaria and its severity, Caregivers' knowledge on how to administer AL to their children, adherence to Artemether Lumefantrine and factors influencing adherence.

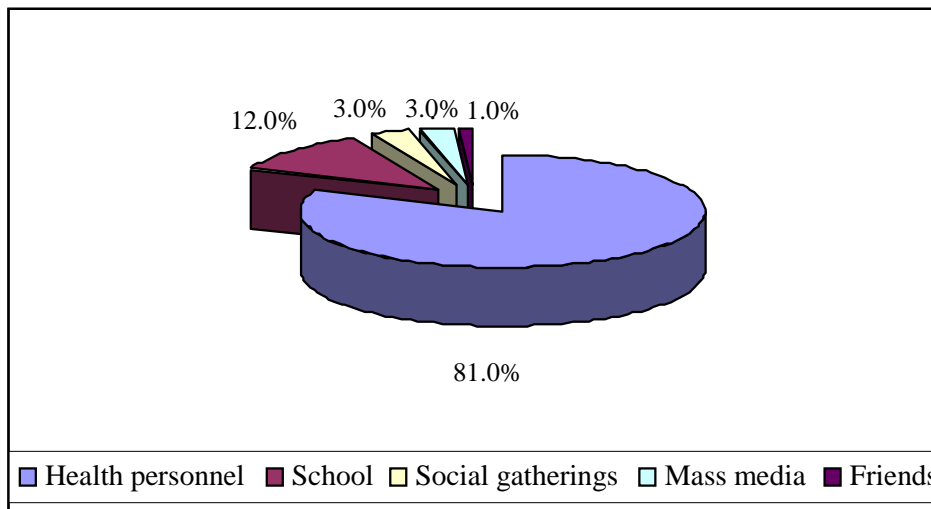
### **4.1. Knowledge on malaria and its severity**

Knowledge on malaria is important and is key in planning or taking appropriate interventions. In addition, knowledge on severity of a disease influences the health seeking behaviour by caregivers. In this study, knowledge was assessed based on whether the caregivers knew of malaria as a disease, source of the knowledge, knowledge on the most vulnerable groups to contracting malaria, mode of malaria transmission, severity (fatality) of malaria, prevention measures and the action taken when malaria is suspected in a child. These were considered as key areas of knowledge in relation to malaria.

#### **4.1.1 Source of knowledge on malaria**

All the caregivers knew malaria as a disease. The sources of knowledge on malaria varied with most caregivers (81.0%) stating that they learned about malaria from

health workers, 12.0% from school, 3.0% from social gatherings, 3.0% from the mass media while 1.0% learned about malaria from friends. Figure 4.1 shows the sources of knowledge on malaria (n=355).



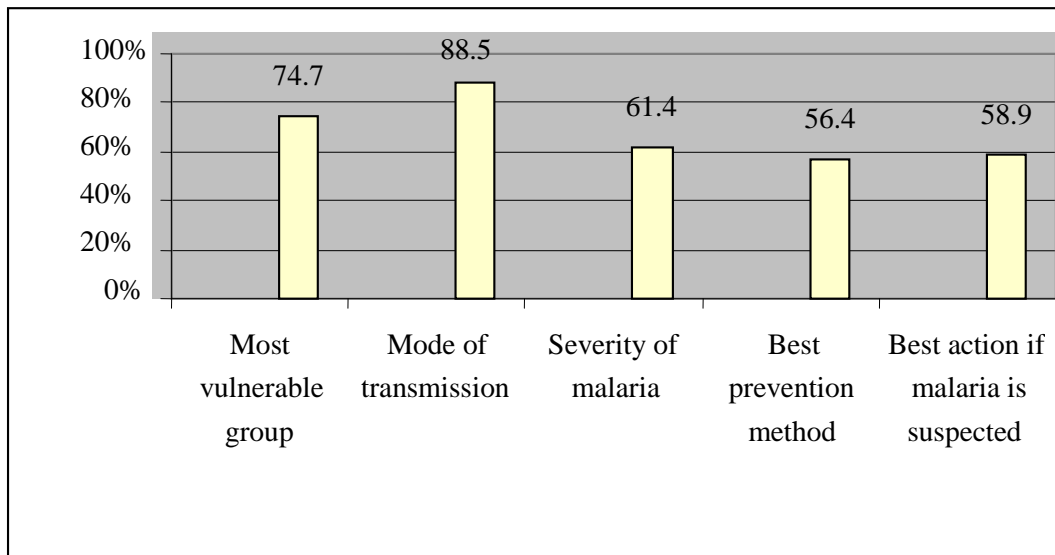
**Figure 4.1 Source of knowledge on malaria**

Since health workers are the main source of knowledge on malaria, it is important for them to create opportunities to share this knowledge and also strengthen the schools, the media and leaders of various social groupings to be able to reach more people.

#### **4.1.2 Level of knowledge on malaria**

Five key variables were used to assess knowledge. The results showed that the level of knowledge was average with 74.7% of the caregivers identifying the most vulnerable population to malaria infection (children and pregnant mothers), 88.5% knew the mode of malaria transmission (mosquitoes) while 61.4% expressed malaria to be a very fatal disease. Only 55.5% knew how best to prevent malaria (use of

insecticide treated bed nets) while 58.9% knew of the best action to take if a child was suspected to be suffering from malaria (taking the child to a health worker at either public or private health facility). Figure 4.2 shows the results on the level of knowledge on malaria.



**Figure 4.2 Proportion of caregivers having correct knowledge on malaria**

Majority of caregivers (88.5%) were aware that malaria was transmitted by mosquitoes which was similar to results of a study conducted in Nyamira, Kenya which showed that 91.8% of respondents associated malaria with mosquitoes. Association of malaria with mosquitoes can greatly contribute towards its prevention and control (Osero *et al.*, 2005). Further, some caregivers, though few (11.5%) had wrong perceptions on the transmission of malaria and linked it to cold or rain and eating mangoes. This is consistent with findings by Espino (1997) who reported that people from different communities held various beliefs about malaria which were often contradictory. This underscores the importance of intensifying health education to correct these wrong perceptions.

This study also revealed that 74.7% of the caregivers correctly knew that children and pregnant mothers were the most vulnerable groups to contract malaria just as was reported by Snow *et al* (1999) and WHO (2000b). On malaria prevention, only 56.4% of the caregivers knew of the best malaria prevention measures and correctly singled out use of Insecticide Treated Nets as one of the best prevention method which agrees with studies reported by Lengeler (2000), Hanson *et al* (2004) and Lindblade *et al* (2004) which showed that ITNs were the most cost effective malaria prevention measure. Without proper knowledge on malaria prevention, caregivers cannot be proactive in malaria prevention activities. This calls for intense education of the community members in this area to create awareness on malaria prevention.

#### **4.1.3 Action taken when malaria was suspected in a child**

The most popular action taken by caregivers of sick children suspected to have malaria was to seek treatment from a nearby public health facility (56.9%). The other actions included purchasing drugs from a shop and giving drugs at home (40.3%), visiting private clinics (2.0%) and resorting to herbal medicine (0.8%). Table 4.1 shows action taken by caregivers when malaria was suspected in their children.

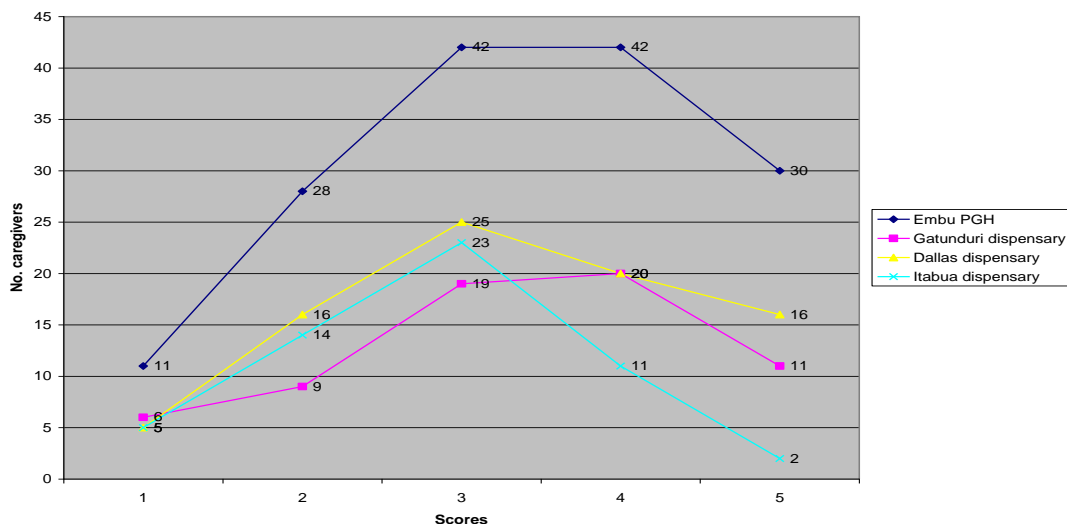
**Table 4.1 Action taken by caregiver when malaria is suspected in a child**

<b>Action</b>	<b>Frequency</b>	<b>Percentage</b>
Visit public health facility	202	56.9
Purchase drugs from shop (self prescription)	143	40.3
Visit private clinic	7	2.0
Give herbal medicine	3	0.8
Total	355	100.0

Information on the best action one would take if malaria was suspected was meant to tease out health care seeking behaviour among the caregivers since success in malaria treatment depends much on early initiation of correct treatment. The results showed that 58.9% knew of the correct measures to take in case of malaria and visited a health facility. It was worrying that 40.3% of the caregivers would result to self prescription because drugs bought from the shops for the treatment of fevers have been documented to be often incorrect, the wrong doses are taken and the treatment being overall sub optimal (Mwenesi *et al.*, 1995; Marsh *et al.*, 1999). The use of herbal medicine is of great concern particularly in children under 5 years of age since their use is not well regulated.

#### 4.1.4 Malaria knowledge scores by health facility

Each of the variables measuring knowledge on malaria (most vulnerable group, mode of transmission, severity of malaria, best prevention method and best action when malaria was suspected) were assigned a score of 1 if the response to the question assessing it was answered correctly hence a possible minimum and maximum of 0 and 5 points (scores) respectively. Most caregivers attained scores between 3 and 4 in all the health facilities as shown in Figure 4.3 (n = 355).



**Figure 4.3 Ungrouped malaria knowledge scores per health facility**

When malaria knowledge scores were grouped, they were categorized into: score 2 and below (poor score), scores 3 and 4 (good scores) and score 5 (very good score). About 74% of caregivers (73.5%) had scores ranging between 3 and 5 while 26.5% had a score of 2 and below. Table 4.2 shows grouped malaria knowledge scores.

**Table 4.2 Grouped malaria knowledge scores per Health facility**

Knowledge scores	Embu PGH n=153		Gatunduri disp. (n=65)		Dallas disp. (n=82)		Itabua disp. (n=55)		Total (n=355)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Poor knowledge (Score 2 & below)	39	25.5	15	23.0	21	25.6	19	34.5	94	26.5
Good knowledge (Scores 3 & 4)	84	54.9	39	60.0	45	54.9	34	61.8	202	56.9
Very good knowledge (Score 5)	30	19.6	11	16.9	16	19.5	2	3.60	59	16.6
Statistic	$\chi^2 = 9.042, P = 0.17$									

The level of knowledge on malaria compared favourably in all the participating health facilities with no significant difference in the knowledge scores (P=0.17). Majority of the caregivers (73.5%) had good or very good knowledge on malaria which is adequate for appropriate action on malaria. This could be explained by the fact that the health workers attending to children in these health facilities were trained in the Integrated Management of Childhood Illness (IMCI). It is worthy noting that

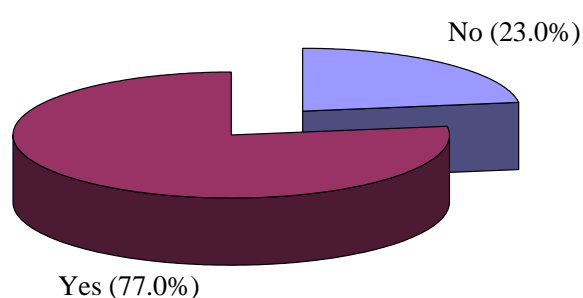
though the knowledge on malaria appeared adequate as was evident in this study, there were gaps that required to be bridged particularly in the area of malaria prevention and health seeking behavior.

#### **4.2 Caregivers' knowledge on administering AL to their children**

Whether caregivers know how to correctly administer drugs to children determines the success of treatment. Knowledge on administering drugs is much dependent on the quality of instructions given by the health care workers particularly, those who dispense the drugs at health facilities. To reinforce the instructions, the first doses of the dispensed drugs are supposed to be given at the clinic before the child leaves. Since the caregivers administer the treatment according to their understanding on the dispensing instructions, this aspect was assessed as the caregivers exited from the health facilities after receiving the drugs.

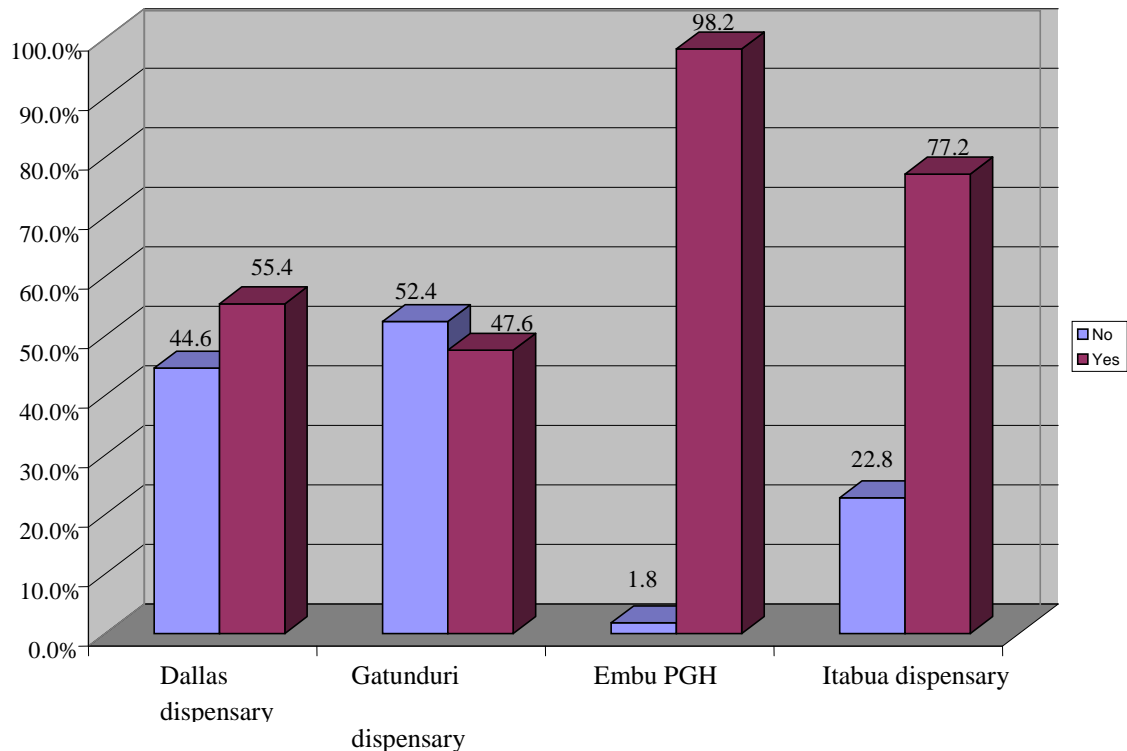
##### **4.2.1. First dose of AL taken at the health facility**

Integrated Management of Childhood Illness (IMCI) guidelines recommend that children take the first dose of every prescribed drug in the health facility which gives the caregiver an opportunity to see how the drug is prepared, measured, given and allows the caregiver to have a chance to practice the same. Figure 4.4 shows that in 77.0% of the children, the first dose of AL was taken at the health facility while it was not taken in 23.0% of the cases.



**Figure 4.4. Whether the first dose of AL was taken at the health facility**

The best performance of this practice was noted at Embu PGH (98.2%) and Itabua Dispensary (77.2%) and the practice was sub-optimally performed at Gatunduri (47.6%) and Dallas dispensaries (56.4%) as shown in Figure 4.5 (n=355).



**Figure 4.5 First dose administered at the health facility**

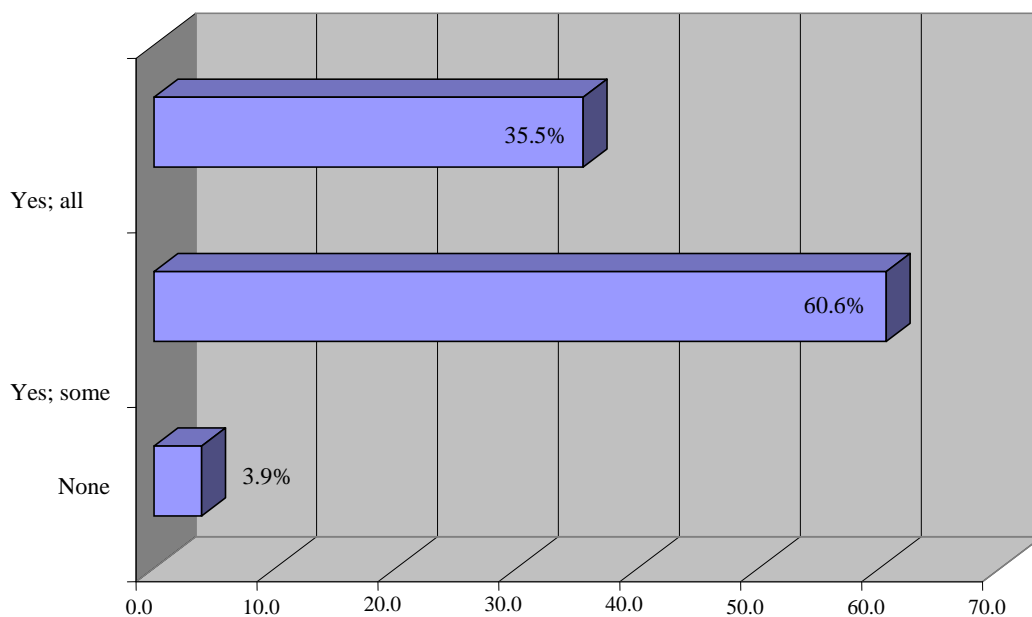
Counseling on how to give medication starts with the prescriber and then is reinforced by the health personnel dispensing the drugs. Giving the first dose at the clinic provides a good opportunity to reinforce on the dispensing instructions. In this study, 77.0% of children had their first dose given at the clinic which differs with the findings of studies done in Zambia and Sudan (Depoortere *et al.*, 2004a, b) and in Uganda (Fogg *et al.*, 2004) in which all the children were given the first doses at the clinic. The better performance noted at Embu provincial hospital may have been as a result of better staffing. This practice and aspect of treatment generally requires reinforcement to improve on adherence.

#### 4.2.2 Assessment on AL dispensing instructions

In assessing adherence, there were specific instructions related to AL which were used to determine how well the drug was to be given at home. Caregivers were expected to understand and recall dispensing instructions on how to give AL and were asked 9 questions to determine if they knew how to correctly administer the drug. Each correct response was assigned a score of 1 hence a possible minimum and maximum of 0 and 9 scores respectively.

##### 4.2.2.1 Knowledge on dispensed drugs

Caregivers are at most times given more than one drug for their children. Knowledge on what each dispensed drug is meant to treat is crucial and may impact on adherence. The results showed that 35.5% of the caregivers knew what all the dispensed drugs were meant to treat while 60.6% knew the use of some of them. Unfortunately, 3.9% knew nothing tangible about the drugs they were given. Figure 4.6 shows caregiver's knowledge on the dispensed drugs (n=355).

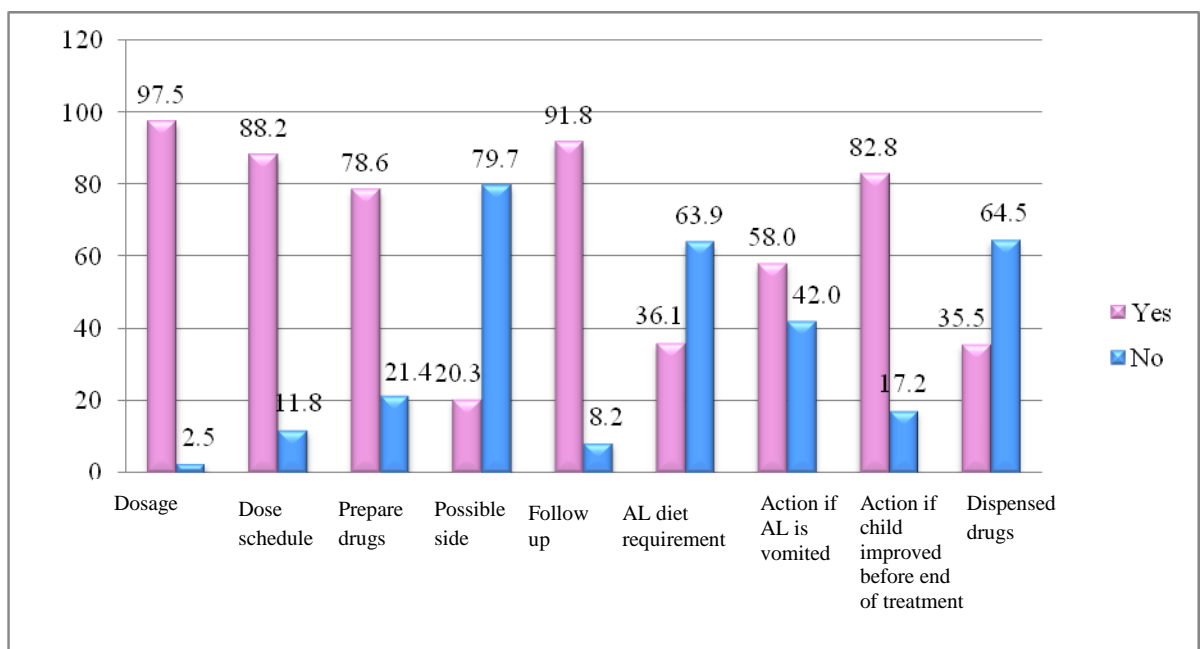


**Figure 4.6. Caregiver's knowledge on the dispensed drugs**

Whereas knowledge on what the dispensed drugs were meant to treat is very crucial in enhancing adherence, only 35.5% of the caregivers had the correct knowledge. Besides, some drugs like antipyretics can be stopped when fever is lowered while others like antibiotics and antimalarials must be completed. Not being able to differentiate the drugs may lead to a mix up. Low knowledge on this important aspect of treatment could imply that this information was not availed to the caregivers by the health care provider or may not have been understood.

#### 4.2.2.2. Knowledge on AL dispensing instructions

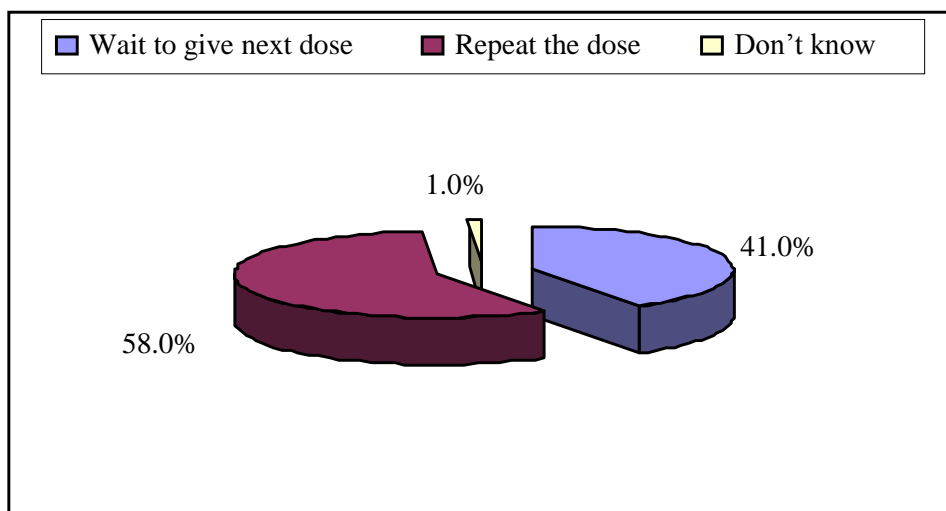
Most caregivers (97.5%) were able to tell the correct dose of AL, 88.2% could recite the correct schedule, 78.6% knew how to prepare the drugs for the child to take and 91.8% knew when to return for a follow-up visit. On the contrary, only 20.3% of the caregivers knew of the possible side effects that could result from treatment with AL and 36.1% knew that they needed to give the drug with milk and/or fatty foods. Figure 4.7 shows caregivers' knowledge on AL dispensing instructions (n=355).



**Figure 4.7 Knowledge on AL dispensing instructions**

#### 4.2.2.3 Action taken if AL dose was vomited

The results of this study showed that 58% of the caregivers knew that they needed to repeat a dose if vomited within half an hour of ingestion while 41.0% would wait to give the next dose. A small number (1.0%) did not know what to do as shown in Figure 4.8.



**Figure 4.8 Action taken by caregiver when a dose of AL was vomited**

#### 4.2.2.4 Action taken by caregiver when a child's health improved before tablets were finished

Most caregivers (82.8%) would continue treatment until the dose was finished even if the child's health showed improvement. A significant proportion of the caregivers (17.2%) would stop the treatment out of which 12.1% would spare the remaining tablets for future use. Table 4.3 shows the actions caregivers would take if the child's health improved before the tablets got finished.

**Table 4.3 Best actions if child's health improved before treatment was over**

<b>Action</b>	<b>Frequency</b>	<b>Percent</b>
Continue administering the dose	294	82.8
Keep remaining tablets for future use	43	12.1
Stop treatment	18	5.1
<b>Total</b>	<b>355</b>	<b>100.0</b>

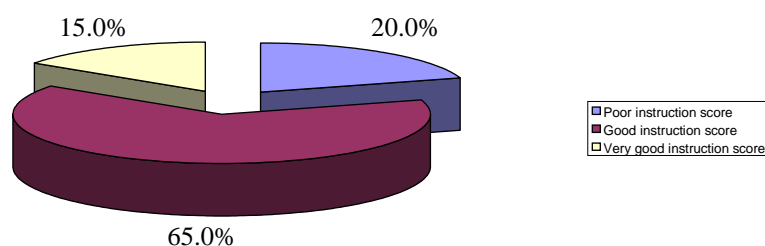
**4.2.2.5. AL instruction recall scores**

Each caregiver's recall on the dispensing instructions was scored on a scale of 0 to 9 thus a possible minimum and maximum score of 0 and 9 respectively. The caregiver who attained the lowest and highest scores had 2 and 9 respectively with a mean score of 5.8, range of 7 and variance of 2.9. The median and mode score was 6. Table 4.4 shows the caregivers' AL dispensing instruction score analysis.

**Table 4.4: Recall of the AL dispensing instructions**

<b>N</b>	<b>355</b>
Mean	5.8
Median	6.0
Mode	6.0
Variance	2.9
Range	7.0
Minimum	2.0
Maximum	9.0

When grouped, score 3 and below were graded as a poor, 4 – 6 were good scores while score 7 and above were classified as very good scores. Out of the 355 caregivers, 15% attained score 7 and above on AL dispensing instructions, 65.0% had between score 4 and 6 while 20.0 % scored poorly (score 3 and below). Figure 4.9 shows the scores (n=355).



**Figure 4.9 Grouped AL dispensing instructions score**

#### **4.2.2.6. Comparison of grouped AL dispensing instruction scores by health facility**

When the grouped AL instruction scores were cross tabulated against the four participating health facilities and chi square test applied, the differences were found significant ( $\chi^2 = 22.410$ ,  $P = 0.001$ ). Table 4.5 shows how AL dispensing instruction scores compared in the health facilities.

**Table 4.5 Comparison of grouped AL instruction scores per health facility**

	<b>Embu PGH n=153</b>	<b>Gatunduri Disp. (n=65)</b>	<b>Dallas disp. (n=82)</b>	<b>Itabua disp. (n=55)</b>	<b>Total</b>
	Frequency/ %	Frequency/ %	Frequency/ %	Frequency/ %	
Poor scores (3 and below)	38 (24.8%)	6 (9.2%)	19 (23.2%)	9 (16.4%)	72 (20.3%)
Good scores (4 to 6)	87 (56.9%)	42 (64.6%)	57 (69.5%)	43 (78.2%)	229 (64.5%)
Very good scores (7 and above)	28 (19.3%)	17 (26.2%)	6 (7.3%)	3 (5.4%)	54 (15.2%)
Statistic	$\chi^2 = 22.410, P = 0.001$				

Further, the mean scores were compared for the four health facilities using a one way Analysis Of Variance (ANOVA) and found significant at 0.05 confidence level (P = 0.001). A tukey test which is more powerful in multiple comparison of means was therefore performed to determine which means were significant. The results showed significant differences between mean scores of Embu PGH and Gatunduri dispensary, Gatunduri versus Dallas and Itabua dispensaries as shown in Table 4.6.

**Table 4.6 Multiple comparison of mean instruction scores versus the health facilities using Tukey test**

Comparison of AL instruction means by health facility	Mean difference	P value	95% CI
Embu PGH vs. Gatunduri disp.	-9.914	0.002	-1.56 to - 0.27
Embu PGH vs. Dallas disp.	0.211	0.796	- 0.38 to 0.80
Embu PGH vs. Itabua disp	- 0.077	0.991	- 0.76 to 0.60
Gatunduri vs. Dallas disp	1.124	0.001	- 0.40 to 1.84
Dallas vs. Itabua disp	- 0.288	0.758	- 1.04 to 0.47
Gatunduri vs. Itabua disp	0.836	0.034	- 1.04 to 0.47

Much of the dispensing information measured in this study was specific to AL and was meant to find out whether caregivers fully understood how to administer the drug to their children because inadequate knowledge is a threat to adherence. It was thus encouraging to note that 97.5% and 88.2% of the caregivers knew the correct dose and correct schedule respectively. This could have been attributed to the WHO recommended weight specific blister packs which have easy to follow pictorial demonstration on the dosage and schedule (Qingjun *et al.*, 1998).

In addition, the instructions from the health facility on how to administer AL determine how well the drug will be taken. Clear instructions given can substantially improve adherence as shown by Okonkwo *et al* (2001); Nosten and Brasseur (2002). The results of this study showed that 91.8% of the caregivers knew when to return to the health facility for follow up visit if there was an indication, 78.6% knew how to

prepare AL for the child to be able to swallow, 20.3% knew of the possible side effects of AL, 36.1% knew they needed to give AL together with milk or fatty foods, 58% knew of need to repeat a vomited AL dose while 82.8% knew they needed to continue with treatment till tablets were finished even if the child's health improved.

From the results above, it is clear that caregivers left the health facility without clear information on how to administer AL. The fact that caregivers would walk out of a health facility with incomplete information or instructions may mean they were not given the instruction or they did not seek clarification. This compares favourably with results of a study conducted in Costa Rica by Homedes *et al* (1993) which documented that patients were rarely active in asking for clarifications during a consultation and that 27 – 83% of patients left the consultation room with incomplete knowledge on how to take the medication. There is therefore a need to strengthen the interaction between health workers and caregivers as an effective strategy for helping the patient to be able to follow treatment regimen as was reported by Hayness (2002).

Whereas side effects to any medication can occur and patients need to be aware of them, 79.7% of the caregivers in this study did not know of any possible side effects that could result from AL therapy which include gastro intestinal disturbances, hypersensitivity to any component of AL and blurring of vision. With this knowledge gap, caregivers are less likely to complete the treatment in an adherent manner especially if they encountered issues emerging out of the treatment. Similar findings were documented in a study conducted in Thailand by Lefevre *et al* (2001).

One of the components of AL, lumefantrine which is responsible for sustained action of AL and hence its effectiveness (White, 2004) requires presence of fats in order for the drug to be adequately absorbed into the body. This is the basis of the advice that AL be taken with milk or fatty foods. This study showed that only 36.1%

of the caregivers knew of this requirement which is a rather low rate and a potential risk to the efficacy of AL and the success of treatment with AL.

Though caregivers could recall much of the instructions given, key aspects of AL dispensing instructions like knowledge on possible side effects, AL dietary requirements and knowledge on dispensed drugs had weaknesses that could affect adherence negatively. There is therefore need to improve counseling on this aspect to empower caregivers achieve full adherence.

#### **4.3.0 Adherence to Artemether Lumefantrine (AL)**

Deviation in medicine taking occurs as omission of doses or delays in taking doses (Paes *et al.*, 1997). In this study, adherence was assessed according to the caregivers' reports on how they gave the treatment, particularly the timing, counting the remaining pills (tablets) and a composite measure of both.

##### **4.3.1. Adherence by pill count and dose timing**

Table 4.7 shows that 75.2% of the children were adherent according to pill count analysis (expected number of remaining pills on the third day were actually counted) while 55.8% adhered to dosage timing requirements of AL. A composite measure of both pill count and dose timing however showed that only 46.8% were completely adherent (reported giving AL in an adherent manner and the expected pills were actually counted on the day of follow up). Nearly sixteen percent (15.8%) of the caregivers neither adhered to dose timing nor the pill count while 28.4% and 9.0% were non adherent in timing and pill count respectively. Overall, more than half (53.2%) of the caregivers did not adhere to malaria treatment with AL.

**Table 4.7 Cross tabulation of adherence**

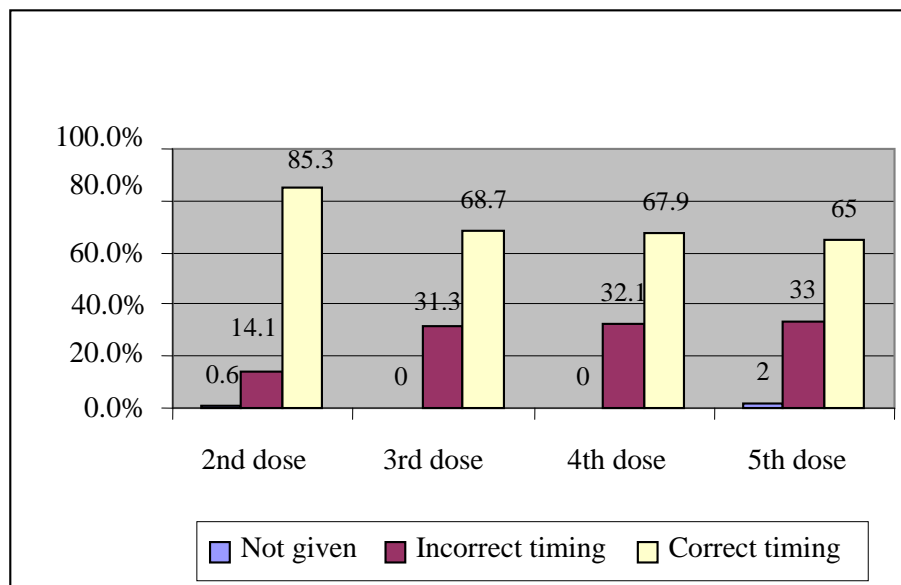
	Adherence status	Adherence to pill count			P Value
		Not adherent	Adherent	Total	
<b>Adherent to dose timing</b>	Not adherent	15.8%	28.4%	44.2%	0.001
	Adherent	9.0%	46.8%	55.8%	
Total		24.8%	75.2%	100%	

More than a half (53.2%) of the children did not receive the treatment in an adherent manner which is surprising considering that AL is supplied in the WHO approved blister packs which have pictorial instructions meant to improve adherence (Qingjun *et al.*, 1998). This low adherence rate could undermine the use of AL, a drug which is meant to address the multiple drug resistant *Plasmodium falciparum* parasites which is a concern similarly expressed by White (2004) on the use of Artemisinin Combination Therapy (ACT).

Adherence in this study was lower than that reported in Sudan by Depoortere *et al* (2004b) in which adherence to AL was 59.1% and another study done in Uganda by Fogg *et al* (2004) where adherence was documented at 90%. This study however recorded higher adherence than was documented by Depoortere *et al* (2004a) in a Zambian refugee settlement which reported an adherence rate of 39.4%. Similarly, the adherence rate was much lower than documented in a rural Tanzanian study with ACTs that reflected an adherence rate of 75% (Kachur *et al.*, 2004).

### 4.3.2. Adherence to AL dose timing

Out of the 355 caregivers interviewed, 85.4% adhered to timing of giving the 2<sup>nd</sup> dose, 68.7% adhered to timing for the 3<sup>rd</sup> dose, 67.9% to the fourth and 65% to the 5<sup>th</sup> dose. Missed doses were only 0.6% for the 2<sup>nd</sup> dose but increased to 2.0% by the 5<sup>th</sup> dose. Adherence reduced as the days of treatment progressed with the 5<sup>th</sup> dose recording the lowest adherence. Figure 4.10 shows adherence to dose timing (n=355).



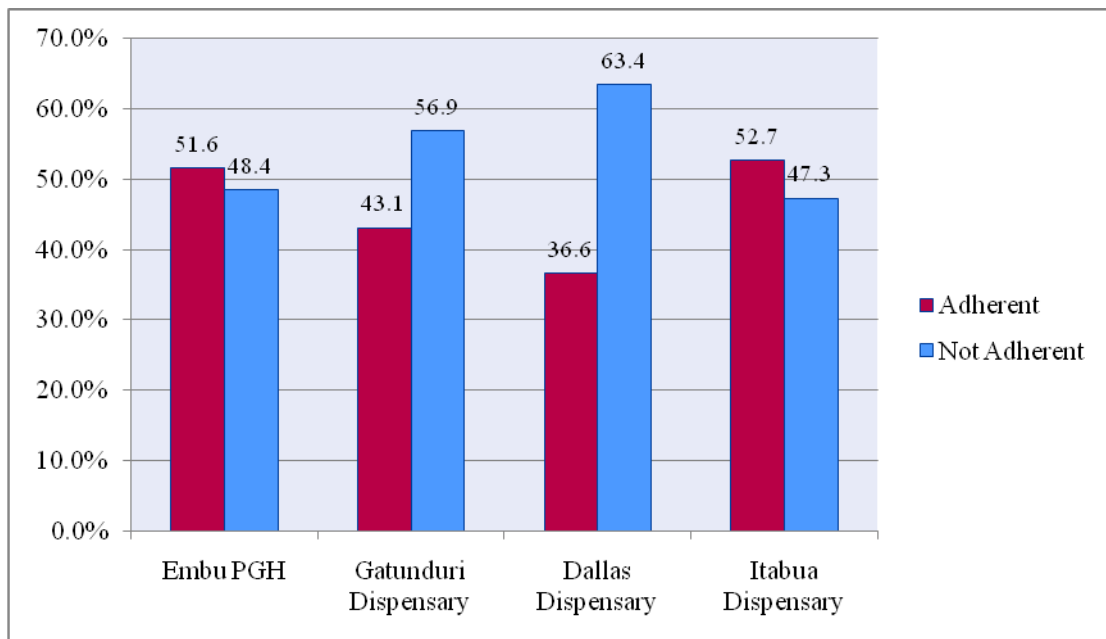
**Figure 4.10. Adherence to dose timing**

There is a tendency to stop treatment when a child's health improves before the treatment is over which hinders completion of the treatment. In the current study, this appeared to be the case as the results showed that adherence to dose timing was lowest towards the end of treatment as compared to the second dose (85.4% in second dose compared to 65.0% in the 5<sup>th</sup> dose,  $p=0.001$ ). Further, missed doses increased from 0.6% for the second dose to 2.0% at the 5<sup>th</sup> dose, further indicating that the caregivers relaxed as the child's health improved on treatment which agrees with the

findings by Fogg *et al* (2004) and Osterberg *et al* (2005) who reported that most patients relaxed in taking medication when their condition improved.

#### 4.3.3 Comparison of adherence in the participating Health facilities

Caregivers whose sick children were treated at Itabua dispensary and Embu PGH appeared to have higher proportions of adherence to treatment than those in the other health facilities (52.7% and 51.6% respectively). Gatunduri dispensary had adherence level of 43.1% while Dallas dispensary had the lowest adherence level (36.6%). Figure 4.11 shows how adherence in the four health facilities compared (n=355).



**Figure 4.11 Adherence levels in the four health facilities**

This study found no significant differences in adherence in the four health facilities ( $\chi^2 = 1.563$ ,  $P = 0.67$ ). This could be due to the fact that the communities have similar characteristics and that the health workers attending to children in each of the participating health facilities have been trained on the Integrated Management of Childhood Illness (IMCI) hence offer the same quality of services.

#### 4.3.4. Whether children were given AL together with fatty foods or milk

One of the components of AL, Lumefantrine requires fatty food or milk for its absorption into the body. This component is responsible for effective prolonged action of AL and is the basis of the advice that AL be taken with fatty foods. In this study, 17.2% of the caregivers did not adhere to this requirement as they were neither breastfed nor given fatty foods while 55.8% of the children were given the required foods; a proportion which is sub-optimal. In total, 82.8% of the children were either breastfed or were given the required foods. Table 4.8 shows a cross tabulation of children breastfed and those given AL with fatty foods or milk.

**Table 4.8 Children breastfed versus those given AL with fatty foods or milk**

Child given AL with milk or fatty food		Does the child breastfeed?				Total	
		No	Percent	Yes	Percent		
	No	61	17.2	96	27.0	157	44.2%
	Yes	85	23.9	113	31.8	198	55.8%
Total		146	41.1	209	58.8	355	100%

Counselling on this aspect of treatment was weak as shown by the number of caregivers (63.9% in Figure 4.7) who did not know about this dietary requirement. It follows that even the 55.8% who complied with this requirement may have done so by coincidence. Though this dietary requirement was cushioned by the fact that more than half of the children in this study (55.8%) were still breastfeeding, some

breastfeeding sessions needed to be timed to coincide with the time of AL administration to aid in lumefantrine absorption.

It is clear from these findings that adherence to AL is an important factor to consider in the treatment of malaria in under five children. These findings underscore the need to monitor patients on treatment with AL which is consistent with findings by Price and Nosten (2001); Yeung and White (2005).

#### **4.4. Factors influencing adherence**

Various variables were compared against adherence to determine which ones influenced adherence. These variables included the demographic characteristics of the children, the socio-demographic characteristics of caregivers, presence of other disease classifications, knowledge on malaria, knowledge on the AL dispensing instructions, the time first dose of AL was given to the child, vomiting AL and previous AL use.

##### **4.4.1 Demographic characteristics of the children**

Out of the 355 children included in the study, 49.9% were male while 50.1% were female. Their age varied from 2 and 59 months with the mean and mode age as 21 and 7 months respectively. The median age was 18 months. The children under 6 months were 14.9%, those 7 to 12 months were 19.7%, 32.4% were aged 13 up to 24 months while those aged above 24 months were 33.0%. Majority of the children (67.0%) were aged 24 months and below. Table 4.9 shows the distribution of children by sex and age.

**Table 4.9 Sex and age of the children**

Demographic characteristic	Frequency	Percentage
Sex of child		
Male	177	49.9
Female	178	50.1
Total	355	100
Age of child in months		
Under 6 months	53	14.9
7 – 12 months	70	19.7
13 – 24 months	115	32.5
25 – 59 months	117	33.0
Total	355	100

There was no positive association between the sex of children and adherence in this study (Chi – square = 2.387, P = 0.12). Similarly, there was no significant relationship between the age of children and all the three adherence parameters (pill count, dose timing and composite adherence). Table 4.10 shows comparison of child's age and adherence.

**Table 4.10 Comparison of child's age and adherence (n = 355)**

Age of child in months	Pill count		Dose timing		Composite adherence	
	Not Adherent (%)	Adherent (%)	Not Adherent (%)	Adherent (%)	Not Adherent (%)	Adherent (%)
Under 6 (n=53)	54.7	45.3	28.3	71.7	64.2	35.8
7 -12 (n=70)	51.4	48.6	28.6	71.4	60.0	40.0
13 – 24 (n=115)	40.0	60.0	26.1	73.9	52.2	47.8
25 – 59 (n=117)	39.3	60.7	9.7	80.3	44.4	55.6
Statistic	$\chi^2 = 2.644, P = 0.45$		$\chi^2 = 5.813, P = 0.12$		$\chi^2 = 7.491, P = 0.06$	

#### 4.4.2. Socio - demographic characteristics of the caregivers

Key socio- demographic characteristics were selected as possible factors that could influence adherence and were cross tabulated to find out if they had a relationship with adherence to malaria treatment with AL. The characteristics considered were the age of caregiver, marital status, education level, occupation and the number of children under the care of caregiver.

#### **4.4.2.1 Selected socio – demographic characteristics of the caregivers**

Table 4.11 shows a summary of selected socio – demographic characteristics of the caregivers. The youngest caregiver was aged 15 years, the oldest 73 years. The mean and mode age of caregivers was 27 years. Majority of the caregivers (46.2%) were aged between 25 and 35 years followed by 18 up to 25 years (39.7%). Those aged 35 up to 45 years were 9.6%, 3.1% were below 18 years while only 1.4% were above 45 years. Majority (95.8%) of the caregivers were female with only 4.2% being male of who 96.9% were the child's parents and 3.1% being guardians. Further, Majority of the caregivers recruited (84.5%) were married while the rest (15.5%) were single at the time of the study.

On education, most of the caregivers (53.6 %) had attained primary school level education. A smaller proportion (36.6%) had attained secondary school education with only 8.5% having gone beyond secondary school. Only a small proportion (1.4%) of the caregivers had no formal education.

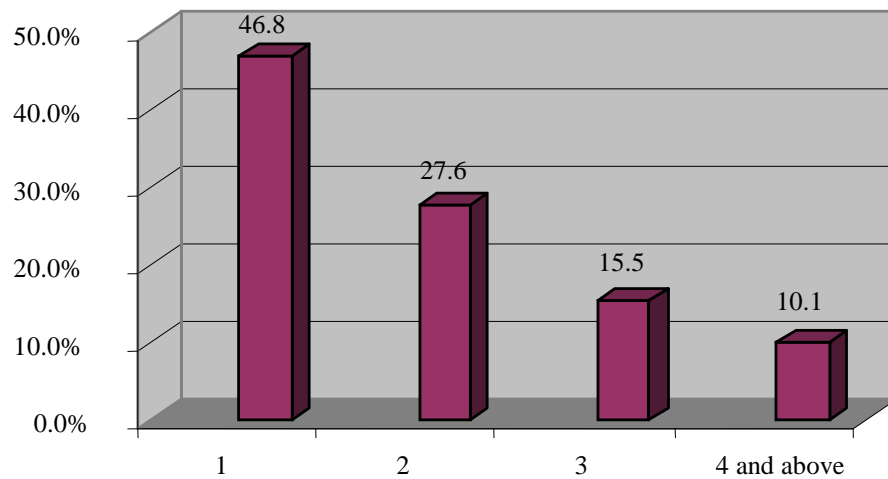
Twenty eight percent (28.2%) of the caregivers were housewives, 27.3% were farmers, and 27.0% were engaged in business. Those in formal employment were 11.5% while 5.4% were working in the informal sector (casual labour) and only 0.6% were students.

**Table 4.11. Selected socio-demographic characteristics of the caregivers (n=355)**

<b>Demographic characteristic</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Age of caregiver</b>		
Under 18 years	11	3.1
18 up to 25 years	141	39.7
25 up to 35 years	164	46.2
35 up to 45 years	34	9.6
Above 45 years	5	1.4
<b>Marital status of caregiver</b>		
Single	55	15.5
Married	300	84.5
<b>Education level</b>		
None	5	1.4
Some primary	84	23.7
Completed primary	106	29.9
Some secondary	44	12.4
Completed secondary	86	24.2
Post secondary	30	8.5
<b>Occupation of caregiver</b>		
Student	2	0.6
Informal employment (casual)	19	5.4
Housewife	100	28.2
Formal employment	41	11.5
Business	96	27.0
Farmer	97	27.3

#### 4.4.2.2 Number of children under caregiver

Most caregivers (46.8%) had one child under their care while 27.6% had two. Those who had three children were 15.5%, while 10.1% of caregivers had four or more under their care. The mean and median number of children under caregivers was two and a mode of one child. The caregiver who had most children under their care had 9. Figure 4.12 shows the number of children under caregiver (n = 355).



**Figure 4.12. Number of children under caregiver**

#### 4.4.2.3. Comparison of composite adherence against age of caregivers

Higher composite adherence was recorded in the age 25 up to 35 years (57.3%) followed by 18 up to 25 years (51.8%). Caregivers under age 18 years, those 35 up to 45 years and those above 45 years exhibited much lower adherence levels (36.4%, 23.5 and 40.0% respectively). There were significant differences between the age of caregivers and composite adherence ( $P=0.02$ ). Table 4.12 shows comparison of the age of caregiver and composite adherence (n = 355).

**Table 4.12 Comparison of caregiver's age and composite adherence**

Age (years)	Composite adherence			
	Not Adherent	Percentage	Adherent	Percentage
Under 18 (n=11)	7	63.6	4	36.4
18 up to 25 (n=141)	68	48.2	73	51.8
25 up to 35 (n=164)	70	42.7	94	57.3
35 up to 45 (n=34)	26	76.5	8	23.5
Above 45 (n=5)	3	60.0	2	40.0
Statistic	$\chi^2 = 11.740$ , P = 0.02			

**4.4.2.4 Adherence versus marital status of caregiver**

There were no significant relationship between marital status of the caregivers and composite adherence ( $\chi^2 = 8.001$ , P = 0.97) as shown in Table 4.13 (n = 355).

**Table 4.13 Comparison of marital status and composite**

Marital status	Adherent	Composite adherence		Percentage
		Percentage	Not Adherent	
Single (n=55)	26	47.3	29	52.7
Married (n=300)	141	47.0	159	53.0
Statistic	$\chi^2 = 8.001, P = 0.97$			

**4.4.2.5 Comparison of composite adherence and caregivers level of education**

Caregivers who had no formal education had adherence rate of 60%, those who had some primary school education had adherence rate of 39.3%, those who had completed primary school had 48.1%, those with some secondary and those who had completed secondary school had 45.5% and 48.4 % respectively while those with post secondary school education recorded adherence rate of 60%. The differences in adherence in the various levels of education were not statistically significant ( $P = 0.47$ ), implying that the level of education did not directly influence adherence in this study as shown in Table 4.14.

**Table 4.14 Level of caregivers' education and composite adherence**

Education level	Composite adherence			
	Not Adherent	Percentage	Adherent	Percentage
None (n=5)	2	40.0	3	60.0
Some primary (n=84)	51	60.7	33	39.3
Complete primary (n=106)	55	51.9	51	48.1
Some secondary (n=44)	24	54.5	20	45.5
Complete secondary (n=86)	44	51.6	42	48.4
Post secondary (n=30)	12	40.0	18	60.0
Statistic	$\chi^2 = 4.592, P = 0.47$			

#### 4.4.2.6 Comparison between adherence and the caregivers' occupation

Caregivers who were students and those who were farmers had the highest adherence proportions at 100% and 57.7% respectively. The housewives recorded an adherence rate of 46.0% while those in business had adherence rate of 44.8%. The lowest adherence was recorded in persons in the informal and formal employment (42.1%, 29.3%). There were significant differences between caregivers occupation and composite adherence ( $P = 0.03$ ). Table 4.15 shows comparison of adherence with caregivers' occupation.

**Table 4.15 Comparison of composite adherence and caregiver's occupation**

Occupation	Composite			
	Not Adherent	Percentage	Adherent	Percentage
Farmer (n=97)	41	42.3	56	57.7
Business (n=96)	53	55.2	43	44.8
Formal employment (n=41)	29	70.7	12	29.3
Housewife (n=100)	54	54.0	46	46.0
Informal employment (casual) n=19	11	57.9	8	42.1
Student (n=2)	0	0.0	2	100
Statistic	$\chi^2 = 12.325, P = 0.03$			

Majority of the caregivers in this study (95.8%) were female which shows women are more involved in care of sick children. This corroborates favourably with the results of a study conducted in Southern Ghana (Ahorlyn *et al.*, 1997) which found out that over 80% of caregivers of children were female. Nearly ninety seven percent (96.9%) of the caregivers in the current study were actual parents to the children. Although the age of caregivers varied between 15 and 73 years, majority were middle aged below 35 years and the age class 25 up to 35 years being largest (46.2%). Further, majority of the caregivers interviewed (84.5%) were married which was higher than the national average of slightly above 60% (CBS *et al.*, 2004).

Generally, the caregivers had a reasonable level of education with majority (53.6%) having up to primary level and only 8.5% having gone beyond secondary school level of education which compares favourably with the national average of 57.4% and 8.1% of men and women who have gone through primary and secondary school respectively (CBS *et al.*, 2004). The main occupation of the caregivers tallied with the education standards with majority being housewives and farmers. Those in formal employment were only 11.5%.

The mean number of children under each caregiver was 2 while 46.8% of the caregivers had one child. Out of the 355 caregivers interviewed, 10.1% had four or more children under their care, most of who must have been guardians. The children in this study had ages varying from 2 to 59 months and mean age of 21 months. Most of the children assessed (67%) were aged 2 years and below.

The study compared various predictors of adherence and their association with adherence. The results showed that adherence was not directly associated with the caregivers' level of education as adherence rate did not significantly increase with higher education ( $P = 0.47$ ). This is different from findings by Ansah *et al* (2001) and

Osterberg *et al* (2005) who had reported that education significantly influenced adherence. It was surprising that the caregivers with more education did not exhibit higher adherence as may have been anticipated. This could probably be explained by the fact that these caregivers spend less time with their children as they are likely to be in formal employment. Although the caregivers' level of education was not significantly associated with adherence; it is a proxy determinant of other characteristics that affect adherence such as the occupation, knowledge on malaria, the ability to understand instructions and the quality of interaction with health care providers. There was a significant association between composite adherence and occupation of the caregiver. The caregivers who are more available at home or those controlling their own schedules as housewives and farmers exhibited better adherence than those in formal or informal employment such as casual labour ( $P = 0.03$ ).

The results further showed a significant association between the age of caregiver and adherence where caregivers under 18 years and those above 35 years had lowest adherence rates with middle aged caregivers (25 up to 35 years) having the best adherence levels ( $P = 0.02$ ). The caregivers below 18 years could probably be inexperienced in taking care of children while those above the age of 35 years are most likely to be so used to child care that they take some aspects of care lightly which could explain the differences in adherence.

Other factors that were not positively linked to adherence were the marital status of caregiver ( $P = 0.97$ ), the number of children under a caregiver ( $P = 0.589$ ) and the age of the child ( $P=0.12$ ). These findings are similar to findings documented in Tanzania and Zambia (Kachur *et al.*, 2004; Depoortere *et al.*, 2004a).

#### 4.4.3 Presence of other diseases

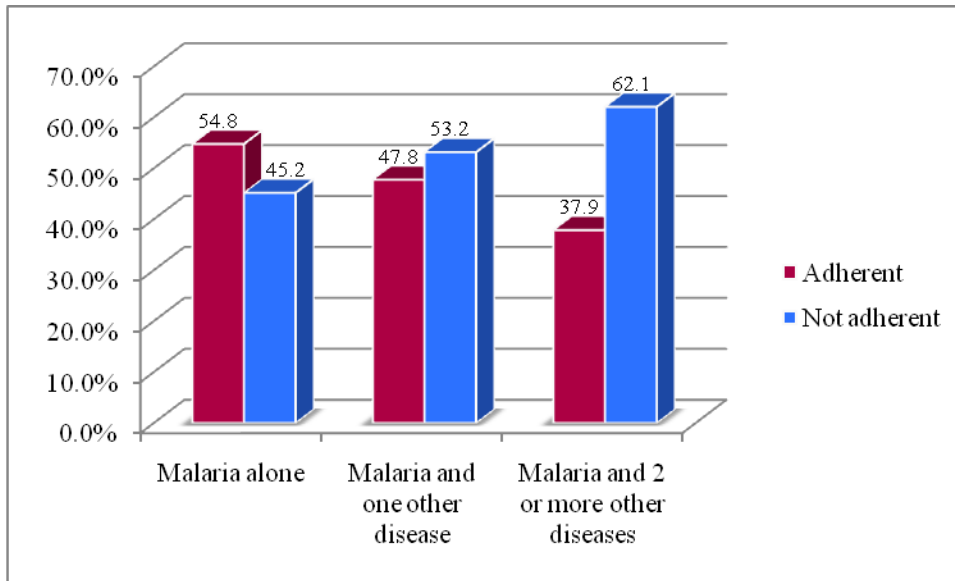
Malaria often occurs together with other diseases which often lead to multiple drug prescription and this could influence adherence. In this study, malaria was the only disease found in 11.8% of the children assessed; malaria and another disease occurred in 80.0% of the cases while in 8.2% of the cases, there were more than two other diseases as shown in Table 4.16.

**Table 4.16 Presence of other diseases in the children assessed**

<b>Classifications</b>	<b>Frequency</b>	<b>Percentage</b>
Malaria as only disease	42	11.8
Malaria combined with another disease	284	80.0
Malaria combined with two or more other diseases	29	8.2
<b>Total</b>	<b>355</b>	<b>100</b>

Presence of other diseases means the caregiver has more drugs to give to the child. Many of these drugs have different schedules. A comparison between composite adherence and this variable showed an increasing non adherence as the number of diseases increased. Pearson Product- Moment correlation however showed a negligible negative relationship (adherence reduced as the number of diseases increased) which was overall not statistically significant ( $r = - 0.073$ ,  $P = 0.17$ ;  $\chi^2 = 1.976$ ,  $P = 0.372$ ). These findings were similar to findings documented in Tanzania and Zambia (Kachur *et al.*, 2004; Depoortere *et al.*, 2004a) which showed a relationship between the number of drugs a child is given and adherence with those

receiving more drugs recording lower adherence rates. Figure 4.13 shows composite adherence in the presence of other disease classifications (n=355).



**Figure 4.13 Composite adherence to AL in presence of other diseases**

#### 4.4.4 Adherence against knowledge on malaria

Knowledge on malaria appeared to result in higher adherence scores. The proportion of composite adherence was higher among caregivers who had good and very good knowledge on malaria. There were significant differences between knowledge on malaria and composite adherence ( $P < 0.001$ ) as shown in Table 4.17.

**Table 4.17 Comparison of malaria knowledge scores with composite adherence**

Knowledge score	Composite adherence ( n =355).	
	Not Adherent (%)	Adherent (%)
Poor knowledge (Score 2 or less). n = 94	76.6	23.4
Good knowledge (Score 3 - 4). n = 202	36.6	63.4
Very good knowledge (Score 5) n = 59	30.5	69.5
Statistic	$\chi^2 = 30.243, P < 0.001, r = 0.3$	

Caregivers' knowledge on malaria was positively linked to adherence with the caregivers who had poor knowledge recording the lowest adherence. Adherence increased as the knowledge scores increased ( $P < 0.001, r = 0.3$ ). These results support the findings reported by Okonkwo *et al* (2001) which showed that knowledge greatly influenced adherence to treatment. This study takes the view that knowledge on malaria is an important factor to target in order to improve on adherence. Further, the higher level of knowledge shown in this study did not equal the level of adherence to AL. These results were similar to those by Agyepong *et al* (1999) who found that knowledge and practice did not necessarily have a positive linear relationship.

#### 4.4.5 AL dispensing instruction scores against adherence

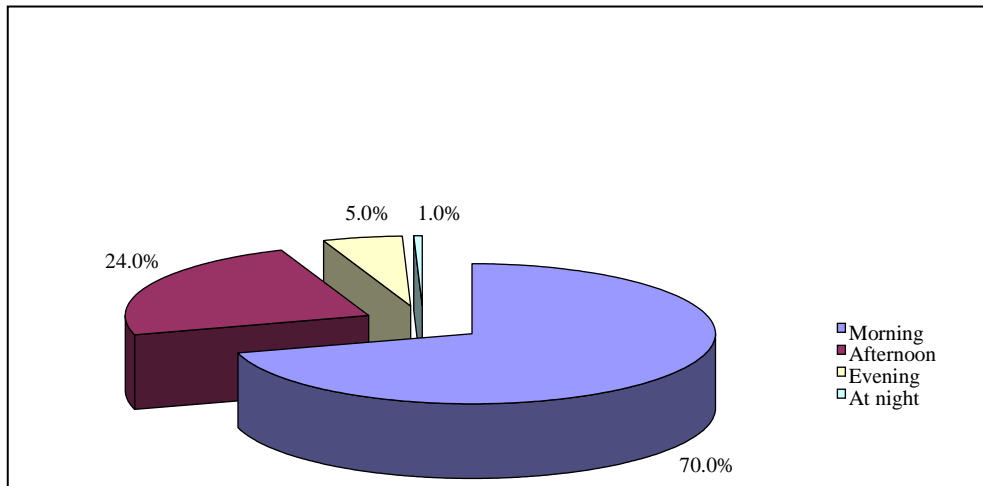
Caregivers' knowledge on how to give the drug was positively linked to the rate of adherence. Caregivers who had poor knowledge recorded the lowest rates and adherence increased as the knowledge scores increased ( $r = 0.3$ ;  $P = 0.001$ ). These findings supported the view by Okonkwo *et al* (2001) and Nosten and Brasseur (2002) who reported that clear instructions and laying emphasis on appropriate health education greatly improved adherence. This study showed that improving on the knowledge on dispensing instructions is an important factor to target to improve on adherence. Table 4.18 shows a cross-tabulation of adherence against the AL dispensing instruction scores.

**Table 4.18 Adherence versus AL giving dispensing instruction scores**

AL Instruction Score	Dose timing		Pill count		Composite adherence	
	Not Adherent (%)	Adherent (%)	Not Adherent (%)	Adherent (%)	Not Adherent (%)	Adherent (%)
Poor knowledge (score 3 or less). n=72	73.6	26.4	58.3	41.7	87.5	12.5
Good knowledge (score 4-6). n=229	39.7	60.3	21.4	78.6	25.8	74.2
Very good knowledge (score 7 and above). n=54	24.1	75.9	16.7	83.3	14.8	85.2
Statistic	$\chi^2 = 35.965$ , $P = 0.001$		$\chi^2 = 14.324$ , $P = 0.001$		$\chi^2 = 46.403$ , $P = 0.001$	

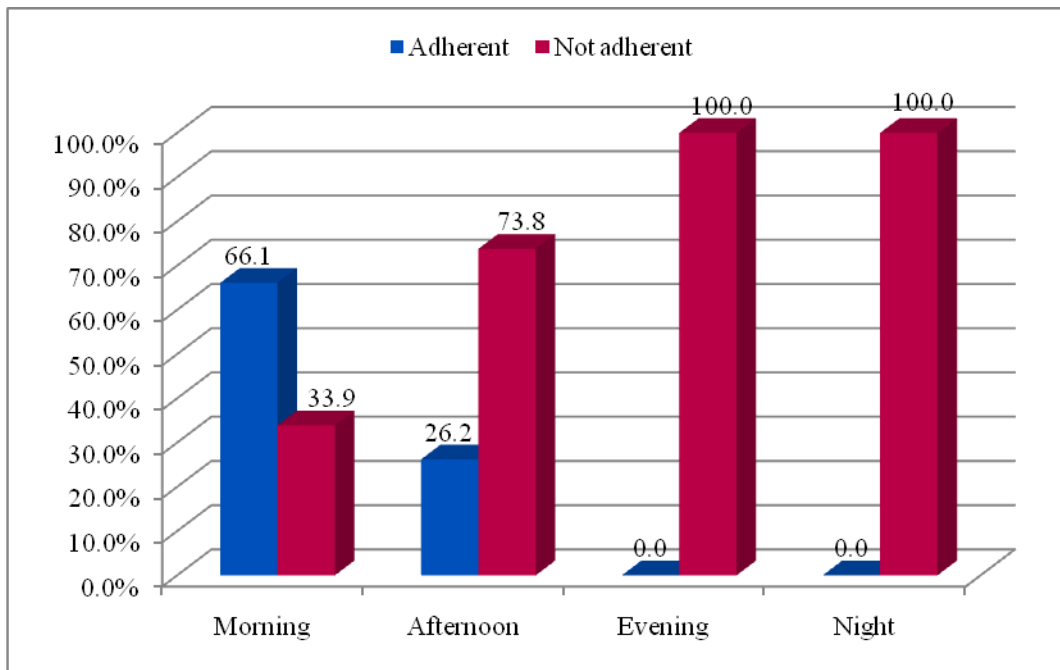
#### 4.4.6 Time the first dose of AL was given

The time the first dose of AL was given could have an influence on adherence since timing of the subsequent doses is based on the time first dose was taken. Figure 4.14 shows that most sick children (70.0%) were given the first dose of AL in the morning, 24.0% in the afternoon, 5.0% in the evening and only 1.0% in the night.



**Figure 4.14 The time the first dose of AL was given**

Higher proportions of adherence to treatment were obtained when the first dose of AL was given in the morning and diminished as the day advanced as shown in Figure 4.15. There was a significant relationship between the time the first dose was given and composite adherence ( $\chi^2 = 45.36$ ,  $P = 0.001$ ;  $r = -0.43$ ;  $P = 0.001$ ).



**Figure 4.15 Comparison of composite adherence and the time first dose of AL was given**

Children given the first dose in the morning hours had much better adherence rates compared to those who had their first dose in the afternoon or evening. This would be expected taking into account the schedule requirements of the second dose being taken 8 hours after the first and the timing of subsequent doses being influenced by the second. The health worker should therefore be aware of this and discuss with the caregiver on how best to adhere to treatment before the caregiver leaves the clinic.

#### **4.4.7. Vomiting of AL**

Vomiting of AL within 30 minutes of ingestion was reported in 16.3% of the children treated while 83.7% did not vomit which shows good tolerance of AL. Table 4.19 reports whether AL was vomited.

**Table 4.19 Whether AL dose was vomited or not**

	<b>Frequency</b>	<b>Percent</b>
No	297	83.7
Yes	58	16.3
<b>Total</b>	<b>355</b>	<b>100</b>

**4.4.7.1 The dose of AL vomited.**

The 2<sup>nd</sup> and 3<sup>rd</sup> doses of AL were the most frequently vomited (43.1% and 24.1% respectively) and 13.8% of the children vomited both of the two doses. The first dose was vomited by 3.5% of the children while only 8.6% of the children vomited the 5<sup>th</sup> dose. More than two doses were vomited in 20.7% of the children. Table 4.20 shows the AL dose vomited.

**Table 4.20 The AL dose vomited**

Dose vomited	Frequency	Percentage
First	2	3.5
Second	25	43.1
Third	14	24.1
Fifth	5	8.6
Second and third	8	13.8
Second and fourth	3	5.2
Third and fourth	1	1.7
Total	58	100

Out of the 58 cases in which vomiting was reported, 82.8% repeated the dose(s) while 17.2% waited for the next dose.

#### 4.4.7.2 Relationship between vomiting and composite adherence

There was a significant relationship between composite adherence and vomiting of AL doses whereby adherence was lowered by vomiting episodes ( $P = 0.001$ ) as shown in Table 4.21.

**Table 4.21 Vomiting AL versus composite adherence (n=355)**

Dose vomited	Composite adherence			
	Not Adherent		Adherent	
	Frequency	Percentage	Frequency	Percentage
No (n=297)	130	43.8	167	56.2
Yes (n=58)	58	100.0	0	0.0
Statistic	$\chi^2 = 61.583, P = 0.001$			

Vomiting drugs posed a real challenge to both the service providers and the caregiver and directly affected adherence in this study. A dose vomited within half an hour of ingestion should be repeated and since AL is dispensed in fixed weight/age specific packs (Qingjun *et al.*, 1998), any repeated doses meant that the child had fewer doses than the required six doses unless the supply is replenished. The need to repeat the

dose must be emphasized so that there can be a sustained drug levels in the body which enhances elimination of malaria parasites. The results of this study showed that overall, 16.3% of the children vomited the drug out of who 82.8% repeated the dose but did not seek for replenishment of the same, while 17.2% opted to wait for the next dose. In 6.9% of the cases, a dose was avoided and the reason given was that the child was vomiting. Vomiting thus brings a whole complex of issues that have negative impacts on adherence and caregivers need to be counselled on the need to seek for replenishment of the drugs when for whatever reason a dose is lost. Vomiting was positively associated with adherence ( $P = 0.001$ ).

#### 4.4.8 Effects of previous AL use on adherence

Previous experience in use of a drug can influence future use. This study compared composite adherence with this variable and found that 70% of the children had used AL before. The results as in Table 4.22 showed no significant differences in adherence between the children who had used the drug before and those who had not.

**Table 4.22 Composite adherence and previous AL use**

		Previous AL use				Total	
		No		Yes			
Composite adherence	Not adherent	55	15.5%	133	37.4%	188	52.9%
	Adherent	50	14.1%	117	33.0%	167	47.1%
Total		105	29.6%	250	70.4%	355	100

(Chi - square= 0.20,  $P = 0.888$ ).

Previous use of AL therefore did not influence adherence ( $P = 0.888$ ). These results were similar to findings documented in Tanzania and Zambia (Kachur *et al.*, 2004; Depoortere *et al.*, 2004a) in which previous use of the malaria drugs did not influence adherence.

#### **4.4.9 Reasons for non adherence**

In the cases where composite adherence was not achieved, 31.4% cited difficulties in following the required dose schedule, 25.6% repeated the AL dose hence the pills got finished before the expected time while 6.9% avoided a dose in fear of vomiting. Some caregivers (13.8%) cited their work schedules which conflicted with AL administration schedule while in 5.9%, the dosage schedule was not followed because the child was away at school. In 9.0% of the cases, caregivers forgot to give some doses and the tablets got spoilt in 7.4% of the cases. Table 4.23 shows the reasons given for non adherence.

**Table 4.23 Reasons for non adherence**

	<b>Reason</b>	<b>Frequency</b>	<b>Percentage</b>
1.	Schedule was hard to follow	59	31.4
2.	Dose repeated after child vomited	48	25.6
3.	Caregiver work schedules	26	13.8
4.	AL dose forgotten	17	9.0
5.	Some AL tablets got spoiled	14	7.4
6.	Avoided dose, child was vomiting	13	6.9
7.	Child going to school	11	5.9
	<b>Total</b>	<b>188</b>	<b>100.0</b>

Among the patients that were non-adherent, 31.4% indicated that the schedule was difficult to follow which is similar to findings by Kremsner (2005) in which complexity of dosing schedules was found to play a major role in determining adherence. Vomiting of AL was a reason for non adherence in 32.5% of the cases; a dose was forgotten in 9.0%, while work schedules of the mother also had an influence on adherence. These reasons for non adherence agree with findings reported in studies done in Sudan, Zambia, Uganda and Tanzania which documented similar findings as the reasons for non- adherence (Depoortere *et al.*, 2004a, b; Kachur *et al.*, 2004; Fogg *et al.*, 2004).

## **CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Summary**

This study sought to determine adherence to antimalarial treatment using Artemether Lumefantrine in children below five years in Embu district. Malaria being a priority disease in the study area and the use of Artemether Lumefantrine as the first line treatment of malaria having been introduced about three years ago, it was necessary to investigate adherence to the treatment since such study had not been previously done. Since non-adherence has severe consequences, among them being development of resistance to the treatment, this study was urgent and hypothesized that adherence to the treatment of malaria with AL was satisfactory.

The findings of the study have demonstrated that adherence to Artemether – Lumefantrine (AL) in the treatment of malaria is low among the children under the age of five years in Embu district (46.8% as compared to the ideal of 95% for acute illnesses). The study has therefore also provided the information on the status of adherence to AL in the study area which was missing. Further, the results showed that the primary caregivers of the children under the age of five years were the children's mothers and that men's involvement in the care of a sick child was minimal.

The adherence rates did not significantly differ in the four health facilities and that in nearly all the cases (88.2%), malaria occurred together with other diseases.

Knowledge on malaria was average in that whereas all the caregivers interviewed were aware of malaria as a disease, weaknesses were noted in the areas of malaria prevention, health care seeking behaviour and knowledge on the most vulnerable groups. Although majority of the caregivers could tell how malaria was transmitted,

there were wrong perceptions that malaria could be transmitted through eating mangoes and exposure to cold or rain. This perception was uniform in all the participating health facilities.

As expected in the national malaria treatment guidelines, the first dose of treatment should be given at the clinic and in this study, slightly more than three quarters of the children received the first dose at the health facility. Majority of the caregivers whose children did not receive the first dose at the clinic experienced difficulties particularly in preparing the tablets for their children. Further, instructions given to the caregivers on how to give AL were not emphatic. While majority knew the correct amount of AL to give and knew when to return for a follow up visit, certain aspects which could affect adherence like knowledge on the possible side effects, the AL dietary requirements and what to do if the child's health improved before the treatment was over or the child vomited any dose were not well understood. The results further showed that the caregivers did not always understand how to give AL to their children.

The results also showed that the health facility where treatment was received did not affect adherence. Similarly, the sex and age of the child, caregiver's marital status, the level of education, presence of other diseases and previous AL use were not significantly associated with adherence. Several factors in this study were positively associated with adherence and included the age of the caregivers, the caregiver's occupation in which the caregivers in formal and informal employment had lowest adherence rates, knowledge on the malaria and knowledge on dispensing instructions on how to give AL. Further, the time the first dose was given and whether a child vomited any of the doses affected adherence. The major challenges to adherence in this setting were related to difficulties in following expected dosing schedule and

vomiting which could be sorted out through improved counseling on taking the medication.

Going by the results, the efficacy of AL would be at stake in this setting unless urgent measures are taken to address the above mentioned issues.

## **5.2 Conclusion**

1. Though caregivers in this area have average knowledge on malaria, there are gaps on some key areas like malaria prevention measures and appropriate health seeking behaviour.
2. Caregivers did not always have adequate knowledge on the dispensed drugs and particularly how to administer them. This could imply that the quality of caregiver - service provider interaction and particularly counseling on how to administer the dispensed drugs is weak.
3. Adherence to Artemether Lumefantrine in the children below five years in Embu district was low which may compromise the efficacy of the drug.
4. Factors positively associated with adherence were the age of caregiver, the occupation, knowledge on malaria, knowledge on AL dispensing instructions, time first dose is given, vomiting of doses and the complexity of the dosing schedule. The health care provider must aware of these factors and address them.
5. The current malaria treatment guidelines indicate that children treated for malaria return to the health facility on the third day for follow up only if the child does not improve on treatment (if fever persists). In view of the challenges demonstrated in this study, it is important for AL administration to be monitored hence a definite follow up would be useful in the management of malaria.

6. The findings of this study provided enough evidence to reject the research hypothesis that adherence to AL among the children under the age of five years in Embu district was satisfactory.

### **5.3 Recommendations**

Based on the results of this study, the discussion and conclusions thereof, the following recommendations are made.

1. Educate the community to boost knowledge on malaria which was positively associated with adherence.
2. Re- train health workers on communication skills for effective counseling on disease and treatment issues and develop communication materials.
3. Reinforce the requirement that all first doses of AL be administered before the child leaves the health facility.
4. The children under treatment for malaria with AL should be followed up after 2 days of treatment to monitor the response to treatment and sort out challenges that arise from treatment like replenishing the supply of AL if needed.
5. Health managers to take up adherence to malaria treatment as an urgent challenge and address the factors that hamper adherence.
6. Another antimalarial drug with a simpler dosing schedule should be identified.

#### **5.4 Suggestions for further research**

Further research related to this study that needs to be carried to fill the gaps revealed by the study include:-

1. Assessment of adherence to Artemether – lumefantrine using biological measures such as blood serum levels of lumefantrine.
2. Assessment of the health workers adherence to national malaria treatment guidelines and comparing it with adherence to malaria treatment.
3. Assessment of quality of communication and dispensing instructions given to caregivers.
4. Assessment of adherence to other drugs used by children under five years.

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### **Appendix 1: Millennium Development Goals (MDGS)**

The Millennium Project was commissioned by the United States Secretary General in 2002 and is headed by Professor Jeffrey Sachs under the auspices of the Millennium Development Goals (MDGs). The eight goals – which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by 2015 were agreed to by all the world's countries to meet the needs of the world's poorest. The Millennium Development Goals (MDGs) are the world's time-bound and quantified targets for addressing extreme poverty in its many dimensions-income poverty, hunger, disease, lack of adequate shelter, and exclusion-while promoting gender equality, education, and environmental sustainability. They are also basic human rights-the rights of each person on the planet to health, education, shelter, and security (Millennium Project, 2006). There are eight MDGs, namely:

Goal 1: Eradicate Extreme Hunger and Poverty

Goal 2: Achieve Universal Primary Education

Goal 3: Promote Gender Equality and Empower women

Goal 4: Reduce Child Mortality

Goal 5: Improve maternal Health

Goal 6: Combat HIV/AIDS, Malaria and other diseases

Goal 7: Ensure Environmental sustainability

Goal 8: Develop a Global Partnership for Development.

## Appendix 2: Interview Schedule

### Consent by caretaker

The researcher is a student from Kenyatta University carrying out a study to determine the usage of the new malaria drug, coartem (AL) which was introduced by the Ministry of Health in 2006. I would like to ask you some questions on this and also see your child on the 3<sup>rd</sup> day to find out how the child is faring on the treatment. The information provided will be confidential and used for the purpose of this study only.

#### A. Identifiers

Questionnaire Number .....

OPD/CWC No (Child) .....

Date recruited .....

Date followed up at home .....

#### B. Demographic information

Child

1. Age of the child ..... Months

2. Sex of the child      1. Male       2. Female

Caregiver

3. Sex of the caregiver    1. Male       2. Female

4. Relationship of the caregiver with child    1. Mother

2. Father

3. Guardian

5. Age of the caregiver ..... years
6. Number of children under care by caregiver .....
7. Marital status 1. Single  2. Married  3. Widowed  4. Separated
8. What is the highest level of education you attended?
1. None
2. Some primary
3. Completed primary
4. Some secondary
5. Completed Secondary
6. Post Secondary
9. What is your occupation? 1. Farming
2. Business
3. Informal employment
4. Housewife
5. Formal employment
6. Student

### C. Assessment and classification

Ask to see the child's treatment card and check if:

10. Temperature taken and recorded .....°C (Mark 0 if not taken)

11. Weight of child was taken and recorded .....Kg (Mark 0 if not taken)

12. General danger signs checked 1. Yes  2. No

13. Blood slide for malaria investigation done 1. Yes  2. No  Results.....

14. Other classifications (diagnosis) other than malaria

.....

#### **D. Perception on malaria and treatment**

15. Do you know of a disease called malaria? 1. Yes  2. No

*If Yes, go to question 16. If No, go to question 22*

16. What is the source of your information?

1. Health personnel

2. School

3. Mass media (Radio, TV, Newspaper)

4. Friends/ Relatives

5. Social gatherings (Groups, Baraza etc)

6. Church/Religious meeting

17. Which group is **most** affected by malaria? 1. Children

2. Pregnant women

3. The aged (elderly)

4. Everybody

5. Don't know

18. How is malaria transmitted?
1. Air
  2. Mosquito bite
  3. Eating mangoes
  4. Cold
  5. Rain
  6. Don't know

19. How fatal (serious) do you consider malaria to be?

1. Very serious
2. Serious
3. Not serious

20. What do you do when you suspect your child has malaria?

1. Buy malaria drugs from shop/chemist
2. Give the child panadol
3. Visit GoK clinic
4. Visit private clinic
5. Give herbal medicine
6. Others (specify)..... ..

21. How can malaria be **best prevented**?

1. Taking medicine
2. Sleeping under treated bed net
3. Eliminating mosquito breeding sites like stagnant water
4. Using mosquito repellants eg mosquito coil
5. Wearing long clothes
6. Don't know

### **E. Treatment**

*See the patient's treatment card and determine if*

22. Correct dosage of AL was prescribed 1. Yes  2. No  (If no, intervene)

*Compare with the dosage schedule provided*

23. 1<sup>st</sup> dose of AL given at the clinic 1. Yes  2. No

### **Check dispensed drugs against the prescription and determine**

24. If the caretaker knows what condition/illness each dispensed drug is meant to treat

1. Yes (All)  2. Yes (Some)  3. No

**For AL, determine how the drug will be given at home. Does the caregiver know:**

25. The correct schedule of giving the drugs 1. Yes  2. No

26. The correct amount of drug to be given each time 1. Yes  2.No

27. How to prepare the tablets for the child to take? 1. Yes  2. No
28. The possible side effects 1. Yes  2. No
29. The need to give AL to the child with milk/fatty foods 1. Yes  2. No
30. When to bring back the child for follow up?
1. Yes  2. No

**Ask the caregiver**

31. What will you do if the child vomits AL within half an hour after giving it?
1. Wait till time of next dose
2. Repeat after half hour
3. Don't know
32. What will you do if your child improves before the tablets get finished?
1. Stop the treatment
2. Continue till the tablets get finished
3. Keep the remaining tablets to use later
4. Don't know

**FOLLOW UP**

Thank you for participating in this study. I would like to ask you more about how you gave your child the medication.

**F. Drug taking at home**

33. Has your child improved on the treatment? 1. Yes  2. No

34. Record how the caregiver gave AL to the child against each dose on table below

(Mark 0 if not given)

Dose	Date given	Time given	Expected time	Amount given
1 <sup>st</sup>				
2 <sup>nd</sup>				
3 <sup>rd</sup>				
4 <sup>th</sup>				
5 <sup>th</sup>				
6 <sup>th</sup>				

35. a. Number of AL doses remaining .....

b. Number of doses expected to be remaining today if the schedule was followed

correctly.....

36. Is there disparity between responses in No. 36 and /or No. 37 above?

1. Yes  2. No

37. If Yes, what is the reason?.....  
.....

38. Did your child vomit any of the doses? 1. Yes  2. No

a. If yes, which dose .....

b. What did you do? .....

39. What foods did you give the child with each dose? .....

40. Does your child breastfeed? 1. Yes  2. No

41. Have you ever used AL on your child before?

1. Yes  2. No

**Thank you very much.**

**Appendix 3: Research Authorization**

REPUBLIC OF KENYA

**MINISTRY OF SCIENCE & TECHNOLOGY**

Telegrams: "SCIENCE TEC", Nairobi  
 Telephone: 02-318581  
 E-Mail: ps@scienceandtechnology.go.ke

JOGOO HOUSE "B"  
 HARAMBEE AVENUE,  
 P.O. Box 9583-00200  
 NAIROBI

When Replying please quote  
 Ref. NO. MOST 13/001/38C/22/2

4<sup>TH</sup> April, 2008

Elijah Njeru Mbiti  
 Kenyatta University  
 P.O. BOX 43844  
**NAIROBI.**

Dear Sir,

**RESEARCH AUTHORIZATION**

Following your application for authority to conduct research on:  
**"Assessment of Adherence to Anti-Malaria combination Therapy with ARTEMETHER –LUMEFANTRINE in children below age five years in Embu District"**, this is to inform you that you have been authorized to conduct research in Embu District for a period ending 30<sup>th</sup> September, 2008.

You are advised to report to the District Commissioner and the District Education Officer, Embu District before embarking on your research project.

On completion of your research, you are expected to submit two copies of your research report to this office.

Yours faithfully,

**M. O. ONDIEKI**  
**FOR: PERMANENT SECRETARY**

CC: The District Commissioner  
 Embu District

The District Education Officer  
 Embu District