ADHERENCE TO NATIONAL GUIDELINES IN MALARIA-CASE MANAGEMENT AMONG PAEDIATRIC PATIENTS AT KAKAMEGA COUNTY REFERRAL HOSPITAL

DR SALIKU MERCY (MBChB- UON)

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2020

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Dr. Saliku Mercy **(**MB.Ch. B UON) H58/88900/2016

Department of Paediatrics and Child Health, University of Nairobi

Supervisors

This dissertation has been submitted for review with our approval as University supervisors:

Professor Nduati Ruth

MB.Ch. B (University of Nairobi)., M. Med(Paediatrics)., Certificate in Tropical Med.,

MPH (Epidemiology and International Health – University of Washington, USA)

Signed: ..... Date: .....

Dr. Owino Lawrence

MB.Ch. B (University of Nairobi), M. Med (Paediatrics and Child Health -University of Nairobi)., MPhil. (Paediatric rheumatology –University of Cape Town)

Signed: ..... Date: .....

Dr. Kumar Rashmi

MBBS Medicine (Utkal University, India)., M. Med Paediatrics (University of Nairobi)., Diploma Allergy and asthma (University of Colorado with CMC, India)., Fellowship Paediatric critical care (Child Trust Hospital, University of Madras, India)

Signed: ..... Date: .....

DEDICATION

In loving memory of my mother, the late Elma Saliku. My children Shirleen and Ethan.

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ABBREVIATIONS AND ACRONYMS

ACT – Artemisin-based combination Therapy

AL – Artemether Lumefantrine

BMC - Biomed Central

CDC - Centre of Disease surveillance and Control

CRFs – Care Record Forms

DOTS – Direct Observed Therapy

GPs – General Practitioners

HRPs – Histidine Rich Proteins

IM – Intramuscular

KNH – Kenyatta National Hospital

KMS –Kenya malaria strategy

KEMRI – Kenya Medical Research Institute

NSAIDS –Non steroidal antinflammatory Drugs

OPD – Outpatient Department

PLDH - Parasite Lactate Dehydrogenase

PMI – Presidents 'Malaria Initiative

RBCs - Red Blood Cells

RBS – Random blood sugar

RDTs - Rapid Diagnostic Tests

WHO -World Health Organization

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OPERATIONAL DEFINITIONS

Severe malaria - is defined as the detection of P. falciparum in the peripheral blood in the presence of one or more of the following clinical or laboratory features: Alteration in the level of consciousness, prostration, respiratory distress, multiple generalized convulsions (2 or more episodes within a 24-hour period) shock ,jaundice ,haemoglobinuria (black water fever ,acute renal failure, severe anaemia (Haemoglobin < 5g/dl or Haematocrit < 15%), pulmonary oedema, abnormal bleeding, hypoglycaemia (blood glucose level < 2.2.mmol/l), hyperlactatemia.

Non-severe malaria - Uncomplicated malaria: Symptomatic infection with malaria parasitaemia without signs of severity and/or evidence of vital organ dysfunction

Anaemia: A reduction in the quantity of the oxygen-carrying pigment haemoglobin in the blood. Severe anaemia: Haemoglobin concentrations of <5g/100ml (haematocrit <15%).

Artemisin-based combination therapy (ACT): A combination of Artemisin or one of its derivatives with an antimalarial or antimalarial of a different class.

Monotherapy: Antimalarial treatment with a single medicine. Parenteral: The provision of medication into the body by any means other than through the alimentary canal (oral route or rectal).

Cerebral malaria: Severe P. falciparum malaria with cerebral manifestations, usually including coma.

Clinical guidelines: Statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options

Cure: Elimination of the symptoms and asexual stages of the malaria parasite that caused the patient or caregiver to seek treatment

Immunity: The natural processes that prevent infection, re-infection or super-infection, or which assist in destroying parasites or limiting their multiplication, or which reduce the clinical effects of infection.

Drug resistance: Defined by the WHO as the ability of a malaria parasite to survive and/or multiply despite the administration and absorption of a medicine given in doses equal to or higher than those usually recommended but within the tolerance of the subject, provided drug exposure at the site of action is adequate.

Endemic: Occurring frequently in a particular region or population.

Plasmodium: A genus of protozoan vertebrate blood parasites that include causal agents of malaria. Plasmodium falciparum, P. Malariae, P. Ovale and P. vivax cause malaria in humans. Human infection with the monkey malaria parasite, P. knowlensi have also been reported from forested regions of South-East Asia. P. Falciparum is the commonest cause of severe life-threatening malaria in our setup.

Rapid diagnostic test (RDT): An antigen-based stick, cassette or card test for malaria in which a coloured line indicates that plasmodia antigens have been detected.

Sensitivity: The ability of a test to correctly identify cases. Specificity.

Specificity: The ability of a test to correctly identify non-cases.

ABSTRACT

Prompt diagnosis and effective malaria treatment is one of the main pillars of global malaria control programs. As a result, the WHO and various countries have put in place protocols and guidelines to help them achieve this objective. Strict adherence to and implementation of these policies is important to improve treatment outcomes and reduce antimalarial drugs-resistance.

Objectives: To evaluate compliance to the Kenya National guidelines on diagnosis and treatment of malaria in children managed for malaria at the Kakamega County Referral hospital.

Methodology: We conducted a hospital-based cross-sectional study involving retrospective review of patients' records; as well as interviews with healthcare workers on barriers to adherence to guidelines on malaria management in children. Scrutiny of hospital medical records identified children aged 4 days to 18 years treated for malaria between June and November 2019. Thorugh systematic sampling 384 files wer selected for study to determine the proportion of the patients treated according to the guidelines. Data was collected using pre-tested data collection forms and analysed using descriptive and inferential statistics. The level of significance was set at 0.05.

Results: Out of the 384 patients suspected of malaria recruited into the study, 73.7% were <5 years, with a median age of 3 (IQR 1-6) years. 364 of the 384 (94.8%) were tested for parasitaemia; 69.2% of them tested positive and 30.5% tested negative for malaria while 1 patient did not have results documented in the file. Overall, 108/121 (89.3%) patients with severe malaria as well as 115/131 patients with uncomplicated malaria as per WHO guidelines were treated with artesunate. Further, 55 patients with a negative blood slide were treated with artesunate. Reasons for non-adherence to the guidelines were reported as lack of resources, and inappropriate healthcare workers' beliefs and attitudes. Reasons motivating adherence to the guidelines included prevention of antimalarial drug resistance, emphasis on diagnosis and treatment of the right disease and prevention of inappropriate use of antimalarial drugs.

Conclusion: Antimalarial prescription in patients who test negative and those who are untested is still practiced in Kenya as in other countries. There is need for better management of febrile illnesses especially in children to avoid the high mortality in this population due to misdiagnosis and Healthcare workers should be reminded about the potential of other febrile conditions.

CHAPTER 1: INTRODUCTION

Malaria is among the top leading causes of death globally and is a threat to universal health. Approximately 2.3 billion of the population stay in places at risk of malaria transmission and there is about 300-500 million plasmodium falciparum malaria cases annually worldwide with 80% of burden of malaria disease in Africa (1). About 2 million of those infected with malaria die and 90% of deaths attributed to malaria are in Africa with the highest mortality occurring in children under the age of 5 years.

Africa recorded a decrease in mortality due to malaria by 30% in the year 2016, while America was 27% and South East Asia by 44%. In the Eastern Mediterranean region, mortality rates remained unchanged. The majority of the cases exhibiting symptoms of malaria in Africa are due to Plasmodium falciparum, 99% of the cases in 2016 attributed to it.

The Kenya Ministry of Health, in line with current WHO guidelines, has guidelines to support prevention, detection and timely treatment of malaria to reduce malaria case fatalities and guard against emergence of drug resistant malaria (2). Proper access to treatment may also work to decrease the parasite load in the community and hence reducing the spread of malaria. The WHO recommends that suspected cases of malaria be confirmed using rapid diagnostic test (RDT) or by microscopy pending treatment (3). Accurate diagnosis ensures that malaria drugs are only issued to those that require it. In areas in which testing is not available, malaria treatment can be initiated on clinical suspicion.

The President's Malaria Initiative of 2016, has greatly invested in malaria diagnosis equipment, treatment, and the supply chain management strengthening. As from the year 2008, they have acquired and made available more than 24 million malaria rapid diagnostic tests (RDTs) with more than 160 microscopes. About 59 million Artemether Lumefantrine (AL) drugs have been acquired and over 5,000 healthcare workers trained on management of malaria (4).

Adherence to the care guidelines is a critical step in the control of malaria, ensuring survival and preventing emergence of drug resistance. The study seeks to determine the extent to which paediatric health services at Kakamega County Hospital, which serves a serves a malaria endemic region, are adherent to the current guidelines.

1.1.1 Malaria burden, prevention and control strategies in Kenya

Malaria is a leading cause of morbidity and mortality in Kenya with more than 70% of the country's population living in regions of documented malaria transmission(5).In the year 2013, there were 2.3 million confirmed malaria cases.Malaria accounted for > 20% of outpatient departments visits,19% of hospital admissions and approximately 2-3% of all in-hospital deaths (6).

The most prevalent species of malaria in Kenya is *Plasmodium falciparum* accounting for an estimated 98.2% of all malaria cases. The species *P. Malariae* and *P. Ovale* occur in 1.8% of the cases mostly as mixed infections and of these. 40-50% are due to Vivax (usually as mixed infection with P. falciparum) an invariably almost always found in the North Eastern and the Northern Kenya.

The incidence of malaria in Kenya varies widely. There are four (4) epidemiologic zones based on the burden, pattern and risk of infection (7).The zones are determined by the altitude, rainfall patterns as well as the temperature. These zones are: (i) endemic regions, (ii) the epidemic-prone highlands, (iii) seasonal transmission areas and (iv) areas of low transmission risk.

- **Endemic regions** are found in Western Kenya especially near Lake Victoria as well as the coast. These regions have perennial malaria transmission. The two regions have high rainfall, humidity and temperature with altitudes that are from 0-1300 metres. This climate supports a shorter malaria cycle, and longer vector survival rates, which then favour malaria transmission throughout the year.

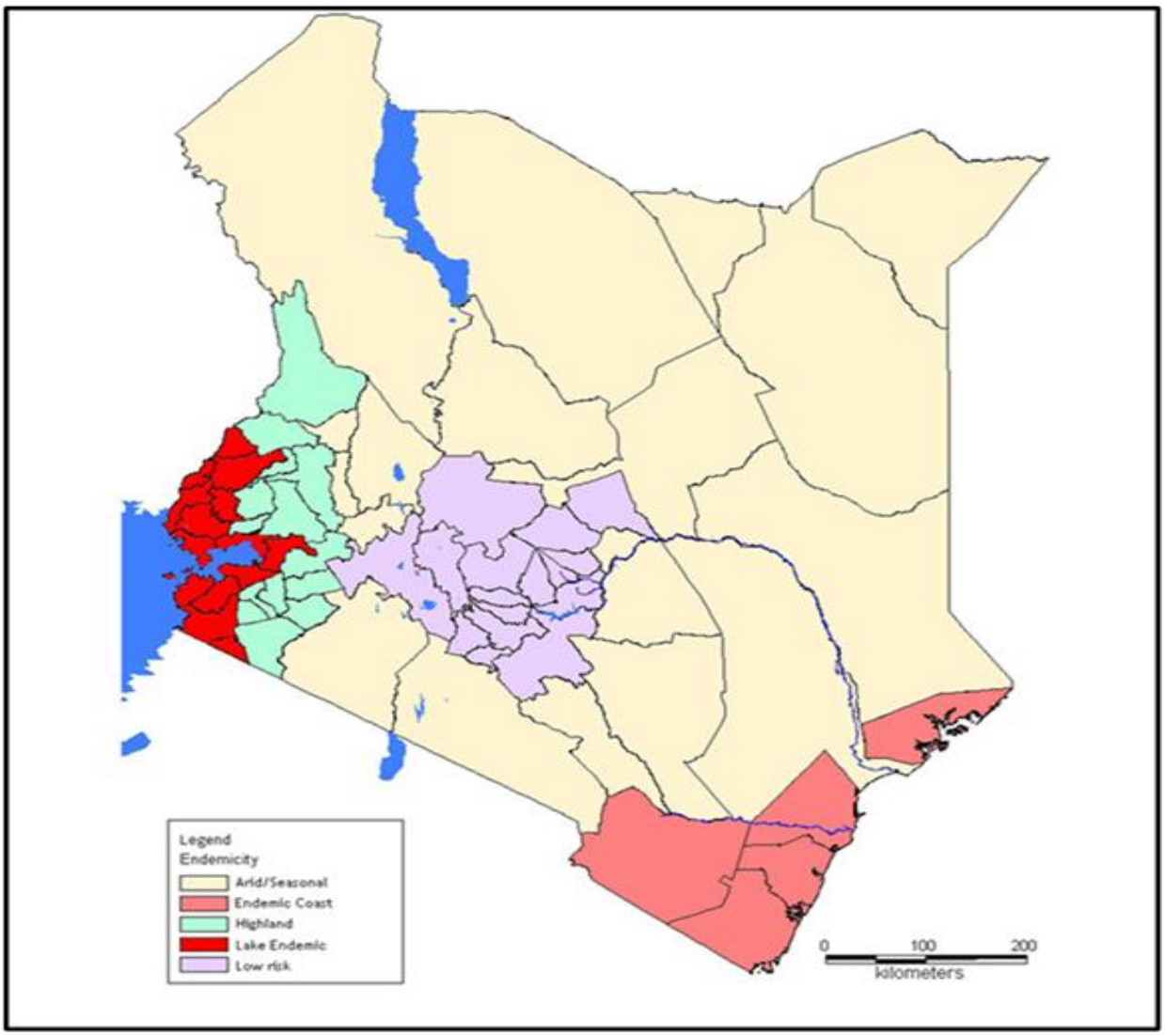
- **Epidemic-prone highland** areas of Rift Valley region and Western Kenya that have seasonal year-to-year variation of malaria transmission.

- **Seasonal-transmission areas** are in the arid as well as the semi -arid areas of Southern, Eastern and Northern Kenya that get epidemic malaria outbreaks lasting shorter periods especially during rain seasons.

- **Areas with low malaria risk** which include Nairobi and central province where low temperatures do not favour the sporogonic cycle of the parasite to be completed within the vector(7). Malaria cases are mainly imported with limited local transmission.

Malaria accounts for a significant number of hospital consultations in Western Kenya, with the highest mortality and morbidity occurring in children who are below 5 years of age. A 2013 Kemri- CDC community-based study found malaria parasitaemia in 35% of children below age 5, 56% in those aged 5-15 years and 22% in those above 15 years. These results make Western Kenya the largest source of malaria countrywide as well as the region that has the highest malaria burden in Kenya.

Figure 1: Kenya malaria endemicity map 2009



1.2 Malaria Classification

Malaria can be classified as either severe or non-complicated malaria depending on what signs and symptoms the patient presents with (3).

1.2.1 Uncomplicated malaria – fever in the setting of parasitaemia in peripheral blood. Other symptoms are nausea, muscle pains, profuse sweating, chills, diarrhoea, abdominal pain, irritability (In young children this maybe the only sign of CNS involvement, or meningitis), nausea, joint pains, refusal to feed is a danger sign and vomiting >3 times in 24hrs is an adverse event. Either as a single sign or multiple of them occurring together.

1.2.2 Severe malaria – the presence of P. falciparum in a patients blood presenting with any of the following laboratory or clinical features: cerebral malaria(Altered consciousness level, lassitude, abnormal behaviour, seizures - generalized and multiple; 2 or more episodes in 24-hours , coma) jaundice, pulmonary oedema, shock (septicaemia or circulatory collapse), respiratory distress, convulsions (), abnormal bleeding (i.e. Disseminated Intravascular coagulopathy), haemoglobinuria, severe anaemia (a haematocrit < 15% or Haemoglobin < 5g/dl),acute renal failure- anuria/oliguria, metabolic acidosis(increased lactate levels) and hypoglycaemia (RBS < 2.2. mmol/l)

1.3. Malaria diagnosis and management guidelines

1.3.1 WHO guidelines:

Two themes guide approach to management of malaria, early accurate diagnosis and treatment of malaria and the other prolonging the life of the current malaria treatments by minimizing unnecessary use. According to WHO, early malaria detection and proper management is the most important way to reduce progression of a mild disease to a severe one that may lead to death. These may also work to decrease the source of infection hence the spread (3).Suspected cases of malaria confirmation be by either a rapid diagnostic test, RDT or by microscopy awaiting treatment is commenced (8).Accurate diagnosis ensures that malaria drugs are only issued as needed. In areas in which testing is not available, malaria treatment can be initiated on clinical suspicion. It is important to consider other causes of fever, some of which mosquitoes are a vector such as dengue, and chikungunya where out-breaks have been described in the same malaria endemic regions (9). The recommendation is that antimalarial

drugs should only be given to patients who actually have confirmed malaria. Suspected cases of malaria should be tested either by RDT or by microscopy establish the diagnosis. Both the RDT and Microscopy should be used in the background of a quality assurance programme. Proper access to malaria diagnostic tests with quality –assurance is important for both the community settings and primary health care. This recommendation creates a clinical conundrum where most clinical guidelines such as basic paediatric protocols have a syndromic approach to diagnosis and standardized empiric therapy for a child with fever. This presents a challenge especially in the care of a severely ill child where waiting may cost the patient's life.

In order to secure antimalarial medicines against resistance, all malaria episodes must be treated with more than one effective antimalarial medicines that have distinguished mechanisms of action (combination therapy). WHO guidance is that all patients with uncomplicated malaria should be given a 3-day course of Artemether based combinations, ACT (Artesunate + amodiaquine, Artemether + Lumefantrine, dihydraoartemisin + piperaquine artesunate+ mefloquine, Artesunate + sulfadoxine-pyrimethamine -SP).

In order to extend their important therapeutic life and see to it that patients do receive cure, maintaining the quality of antimalarial drugs and should be dispensed at optimal doses to patients in need of treatment. The administered treatment should enhance the probability of quick clinical and parasitological cure as well as reduce onward transmission from the treated person. For this to be attained, dosage ought to be established on the basis of the patient's actual weight to deliver effective concentrations of antimalarial drugs for an ample time to get rid of the infection in all target groups. Patients who have severe malaria ought to be treated with intramuscular or intravenous artesunate for at least 24 hours and until they are able to to cope with oral medications.A patient who has been on at least 24 hours of parenteral therapy and can tolerate oral therapy, he/she should then complete treatment with a 3 day course of ACT (10).

1.3.2 Kenya National Malaria Treatment Guidelines

The Kenya National guidelines in line with WHO directive require that patients with suspected malaria in all epidemiologic zones should have a malaria test either by RDT or by microscopy. Only those who test positive should be treated. Kenya Malaria Strategy 2009-2018 sets a target that all suspected malaria cases undergo a parasitological diagnosis by RDT or microscopy(8).

However, it also recommends that treatment should not be denied or delayed because of lack of capacity to do the tests.

1.3.3 Malaria diagnosis

Current guidelines recommend a confirmatory test in order to detect presence of malaria parasites using either RDTs or microscopy. All health facilities involved in diagnosis of malaria should maintain high Quality assurance of the tests for the specificity and sensitivity of the results obtained.

- **Microscopy** – routinely used for diagnosis of malaria. It is carried out by examining a stained thin or thick blood smear to check for existence of malaria parasites. It is advised that at least 3 slides are taken at least 6 hours apart especially during febrile episodes when RBCS rupture. Microscopy is not an up to perfect gold standard, very low false positive rates dramatically lower protective efficacy estimates in malaria prevention trials. The sensitivity of blood slide for malaria test is about 85% and its accuracy relates to innate ability, training, experience, motivation, and laboratory resource. Thin film being sensitive enough is a useful tool in malaria diagnosis and confirmation.(11). Thick films are to be used for detection of the parasite as well to be able to quantify the percentage of infection. It can also be used in monitoring response to treatment. Thin films being useful in identification of species.

- **Rapid diagnostic tests -** Tests that are based on detection of certain specific antigens in the parasite. The tests that detect histidine-rich protein 2 (HRP2) are usually specific for P. falciparum, while the test that recognize parasite aldolase or lactate dehydrogenase (pLDH) are able to differentiate non-P. Falciparum from P. Falciparum malaria (Malariae, Ovale and vivax). RDTS easy to use and accurate in detecting low parasitaemia.This is not recommended for follow-up of treatment, as most of the tests remain positive for about 2 to 3 weeks following effective antimalarial treatment and clearance of parasites from blood. Its not able to determine the density of the parasite infection. When using RDTs, it is important that the manufacturer's instructions be strictly adhered to especially while interpreting results.

1.3.4 Management of uncomplicated malaria

Antimalarial drugs

Artemether-Lumefantrine (AL) used for first line treatment for uncomplicated malaria in Kenya (6). Currently, it is available as a regular co-formulated tablet that is dispersible making it child friendly and contains 120 mg of Lumefantrine with 20 mg of Artemether.Administered as a 6-dose regimen that is taken over 3 days as indicated in the table below

Table 1:Artemether-lumefantrine Dosing Schedule (6)

Weight in kg	Age (years)	Number of tablets per dose					
		Day 1		Day 2		Day 3	
		1st dose	8 hours	24 hours	36 hours	48 hours	60 hours
5 – 14	5 months ≤ 3years	1	1	1	1	1	1
Is 15 -24	3 – 7 years	2	2	2	2	2	2
25 – 34	8 -11 years	3	3	3	3	3	3
Above 34	≥ 12 years	4	4	4	4	4	4

HIV/AIDS patients who have malaria should be treated with a similar regimen. Children who are <5 kg with malaria confirmed, ½ a tablet of AL should be taken as per the schedule in above with close supervision.

Dispersible tablets are available and should be administered to children who are less than 24kgs.

a) Counselling and follow up

It is recommended that a directly observation of therapy of the first treatment dose should be taken at the hospital. Young children's caregivers should be trained to prepare the dispersible tablets before it is taken and the dosing schedule should be clear. In case the patient vomits before 30 minutes lapse after taking the drug, repeat the dose. Insist that the six doses be taken over 3 days 'and should not be discontinued regardless of whether the patient improves. Encourage the patients to come back to the hospital immediately if there is deterioration of the clinical condition or if the symptoms do not improve after 3 days of treatment.

b) Supportive treatments

• Fever control: An antipyretic should be administered for fever. Paracetamol is preferred over Nonsteroidal anti-inflammatory drugs; the patient can also be exposed, fanned or tepid sponged to reduce fever.

•Advise on proper nutrition and proper hydration and continue breastfeeding where applicable. Small quantities food portions with small intervals between meals especially when the child is still very ill.

1.3.5 Severe Malaria Management

This being a medical emergency,delayed diagnosis and inappropriate treatment, often leads to rapid deterioration of the patient especially in children, infants and non-immune adults and can be fatal. Early recognition, assessment, and appropriate antimalarial is the key to effective management as well as supportive therapy. Severe malaria is mostly caused by P. falciparum.

Parasitological diagnosis is recommended in all patients in whom malaria is suspected however, the treatment process should be administrered if diagnosis is not possible.Begin presumptive treatment immediately while efforts to confirm the diagnosis are sort. Where possible, if RDT test is negative or if three consecutive blood slides, which are taken at least 6 hours apart, are negative other causes of illness should be considered. The precribed first-line treatment for severe malaria is parenteral artesunate and if it is not available, IM Artemether can be administered. If these pre-referral therapies are not available, IM quinine can be used (4). There should be careful attention to supportive management of the patient.

1.4 Challenges in malaria case management

1.4.1 Histidine rich protein deletions (HRP2)

In certain areas, increasing levels of (HRP2) gene deletions do threaten the capacity to diagnose and appropriately administer treatment to patients infected with falciparum malaria (12). A missing HRP2 generesults in the parasites to escaping detection by HRP2-based RDTs, which results in a false-negative test result. Despite the fact that the showing prevalence of HRP2 gene deletions in areas with high-malaria transmission countries is still low, further frequent monitoring is needed. The sensitivity of RDTs has been reported to be > 90%, while considering the impact of deletion of the HRP2 gene (12).

1.4.2 Antimalarial drug resistance

Drug resistance has been one of the greatest drawback in the control of malaria. ACT is currently the mainstay of malaria treatment in different regions of the world. The threat of drug resistance is real as illustrated by the detection of pockets of multidrug resistance, which includes Artemisin (partial) resistance as well as partner drug resistance, in the Greater Mekong sub region (GMS) in China, even as this region has had a large drop in malaria cases and mortality driven by the strong policies of tracking effectiveness of antimalarial drugs and updating treatment protocols as needed. Artemisin resistance hasn't been reported in Africa to date and that the first-line ACTs still remains efficacious in all malaria endemic areas(1)

1.4.3 Comorbidity

Prevalence of Chronic diseases such as malnutrition, HIV/AIDS, and sickle cell anaemia are common in children in developing countries.Children equally are suffering from malaria, being more severe than in the normal child (13). Managing these children poses a great challenge. Apart from the complications such as severe anaemia, which are more prevalent in these children, concurrent management of the underlying disease in the face of challenging finances often result in difficult decisions.

1.4.4 Hatchet classification of malaria endemicity

Background parasitaemia without symptoms i.e. Positive slide is an incidental finding especially in older children in malaria holoendemic regions (14).

CHAPTER 2: LITERATURE REVEIW

2.1 Clinical guidelines utility

Guidelines are principles that present proper rules of policy that assist healthcare practitioners' make in-patient care decisions on diagnosis, treatment or related clinical circumstances. They are intended to optimize care of patients and being informed systematically reviewing evidence and assessment of the pros and cons of alternative options available for care. They provide recommendations on which screening tests to order, how to provide medical or surgical services, patients duration of hospital stay, as well as other details of clinical practice (15). Guidelines aim is at reducing inappropriate alteration in clinical practice and to promote delivery of health care that is evidence based. They are developed by World Health organization, professional societies and then adopted/domesticated government agencies at different levels including institutional level, [10]. There are guidelines on how to make guidelines to ensure accuracy and safety. World health Organization uses the GRADE system to inform guidelines. They convene an expert panel and Commission a systematic review then grade recommendations based on quality of evidence. The cost-benefit analysis of implementing the guideline is put into consideration. Expert panel then develops the generic guidelines taking cognizance of different scenarios. Once approved, the guidelines are disseminated and the same progressively adopted by various countries including Kenya.

There is proof that health care that is driven by guidelines is effective in altering the process and outcome of care offered by health professionals. Successful application of clinical practice guidelines has been associated with improved quality of care(16) .Guidelines make it possible for professional roles to be substituted well as in the case of health care facilities that do not have doctors and are run by other health care providers through use of guidelines.

In a systematic review comparing the introduction of clinical guidelines with a no guidelines control by Steen N, Soutter J and three other colleagues, nine studies were conducted and that seven out of those nine yielded results indicative of improved patient outcomes with the interventions that followed guidelines compared to the control (no guidelines used). The two studies that yielded results of no difference were compromised by unit of analysis errors and the sample size that was small and were thus unreliable(17) .

Hospitals adhering to guidelines resulted in 50% lower charges for emergency department or observation patients with uncomplicated AGE without adversely affecting outcomes. For the Emergency and observation patients, charges were significantly (*t* test; $P < .001$) less in highly adherent hospitals ($412 vs $702), with a mean difference of $290 (95% confidence interval: 284–296). In the admitted population, charges in highly adherent hospitals were (*t* test; $P < .001$) more than those in less adherent hospitals ($4404 vs $4127, respectively), with a mean difference of $277 (95% confidence interval: 174–380) (18).

Implementation of guidelines is not optimal worldwide. The use of guidelines in clinical practice is influenced by various factors such as patient factors, external factors and physician's attitudes and behaviours. Some guidelines are not applicable to particular patients and patient preferences may be barriers use of clinical guidelines. Physicians may have a difficult time in adopting new practices and unlearning outdated ones. In a study on physicians experience on changing clinical practice by Divya M.Gupta, Richard and David 15 physicians were interviewed and of the physicians interviewed, 35% had a problem with changing their routines and habits to adhere to guidelines while 14% lacked the skills and knowledge required to implement the guidelines(19).

A study evaluating the perceptions and attitudes of Spanish physicians concerning clinical guidelines identified two factors that influenced the physician's attitudes. One was knowledge, which referred to the theoretical meaning of the guidelines, and the other was usefulness, which indicated a pragmatic approach to the guidelines. The tension between the pragmatic and theoretical constructs influenced the extent of the use of the guidelines by the physicians as well as their attitudes towards them. The factors were intercalated through a series of categories including usability, accessibility confidence, dissemination, and formats of the guidelines (20).

Several studies have been done to identify barriers to health care worker's adherence to clinical practice guidelines. In a study that aimed to determine and synthesize qualitative survey on General Practitioners' (GPs') attitudes to and experience with clinical practice guidelines, 6 themes were identified as presented in Table 1 below; questioning the guidelines, General practitioner's experience, professional responsibility, preserving the doctor-patient relationship, practical issues and guideline format (19).

Table 2: Themes representing General Practitioners' attitudes to and experience with clinical practice guidelines.

Theme	**Example**
Questioning the guidelines	The GPs stated that trials were population based were not appropriate to individual patients. Some disagreed with the guidelines as they clashed with their beliefs/encounters.
GPs experience	Some were reluctant to change practice for concern for the patient e.g. patient resource limitations. Some resisted discontinuation of the current practice. Some had negative experiences with guidelines e.g. patient non-compliance
Preserving the doctor-patient relationship	If clinical guidelines implied rationing of services to the patient which would jeopardize the doctor-patient relationship**.**
Professional responsibility	Risk aversion leading to defensive practice. This is fuelled by a fear of litigation and the emotional burden of missing a diagnosis.
Practical issues	Lack of time to read, understand and assess the guidelines. Lack of skills required for new procedures. Inadequate resources required for new procedures.
Guideline format	Guidelines that are difficult to read and understand. Guidelines that are too complex to explain to patients.

A review on factors that hinder adherence to clinical guidelines in chronic obstructive pulmonary disease (COPD) management revealed that only one in four clinicians adhered to the recommended guidelines. The sub-optimal adherence was attributed to certain barriers to adherence. a) Guideline familiarity led to non-adherence with less than a third of the clinicians citing high familiarity with the guidelines b) There was disparity in the level of confidence in the guidelines by the clinicians. Some reported high confidence in them while others did not). Their attitudes towards the guidelines determined their behaviour in implementing the guidelines d) External barriers to guideline implementation e.g., resource availability was a factor that contributed to poor adherence to the guidelines. Lack of equipment e.g. spirometers limited the capacity of the clinicians to adhere to the guidelines (21).

Although many healthcare workers knew of existence of clinical practice guidelines, very few cited knowledge and understanding of these guidelines. Many were unaware of the specific contents of the guidelines. In a study analysing knowledge of ACTs and malaria treatment practices in Malawi, 95.7% of the participants reported knowledge of at least one ACT with the most commonly mentioned ACT being AL (94.6%). However, only 31.5% of the respondents had received training on management of malaria using ACTs (22). This supports other studies that reveal that few healthcare professionals receive training after changes in treatment policies (22).

Several factors have been shown to influence correct treatment of patients with confirmed malaria. According to a study carried out and funded by public health facilities in Malawi, patient level symptoms and cadre of the healthcare worker influenced correct patient treatment. Aside from clinical presentation, a factor significantly associated with malaria management quality being health worker type,medical assistants and nurses providing the bulk of outpatient care in Malawi,prescriptrion of first-line anti-malarial treatment to patients compared to clinical or medical officers. Further studies concluded that lower-level cadres of health workers are more likely to adhere to guidelines, including for malaria treatment, than more qualified ones, who may rely more on their clinical experience and intuition. This analysis shows , no other health worker-level, facility-level, or regional factor, including training, supervision, equipment, drug stocks, or availability of treatment guideline, was related to correct malaria treatment or overtreatment (23). There were factors that were pointing to overtreatment of patients without malaria. Symptoms of the patients and cadre of the healthcare workers significantly influenced overtreatment. The patients who complained of fever and chills were

more likely to be over-treated while those who complained of fatigue were less likely to be over-treated. Those attended to by medical assistants or nurses were more than 3 times more likely to be over-treated compared to those seen by medical officers or clinical officers. Overall, only 66.7% of patients suffering from parasitological confirmed malaria received correct management. Nearly 33.3% of patients with unconfirmed malaria received malaria treatment resulting in 31% of all outpatients being incorrectly treated for malaria (23).

A retrospective evaluation of malaria care management in several health facilities in Zambia concluded that malaria management was daunted by poor adherence to the laid down guidelines. Out of 4,891 cases of suspected malaria, only 67% were tested for parasitaemia by either microscopy or RDT.Approximately 25% were not subjected to either of the confirmatory tests for malaria. Out of 2,247 reported cases of malaria, 71% were parasitological confirmed while 29% were clinically diagnosed. When it came to treatment, 56% of the reported cases were treated with AL while 35% were treated with SP. Those treated with quinine were 8% while 1% did not receive any treatment for malaria. Approximately 30% of those testing negative for malaria were still treated with an antimalarial(24).

The extent of adherence to clinical guidelines by health care workers can be evaluated using voluntary inspection systems or external inspection systems. The purpose of these systems is to promote quality improvements in healthcare organizations' behaviour, healthcare workers' behaviour and patient outcomes. In a study comparing the effectiveness of external inspection systems to no intervention (no external inspection) on compliance with accredited standards in healthcare facilities, it was found that there was improved healthcare worker's behaviour and patient outcomes in the intervention group. Externally authorized and driven inspection processes are therefore superior in promoting adherence to treatment guidelines (25). External inspection systems are likely to provide more reliable results compared to self-reporting, as they are less susceptible to bias.

Self-reporting bias is likely to overestimate the impact of guidelines compared to monitoring of actual practice. The self-reports provide information on clinician's knowledge of guideline recommendation rather than the measure of guideline adherence. Self-reports can not be the sole measure of guideline adherence(26). Monitoring and evaluation of uptake and adherence to clinical guidelines is important as it highlights processes of care that are weak or sub-par and thus provide a reference for quality improvement. The degree of adherence to clinical guidelines can also be used as a measure of the quality of care received by patients(27).

Methods that can be used to measure the degree of adherence to clinical guidelines include prescription or dispensing data, clinician survey data and review of patient records. Methods that measure adherence essentially relate clinicians' adherence to guidelines to favourable patient outcomes (28). All these methods however suffer methodological limitations, as there is a lack of well-validated adherence measuring methods. Measures of adherence are usually a specific guideline recommendation. The most common method used to study clinicians' adherence to clinical practice guidelines is the use of clinician self-report questionnaire. The advantages of this method are the efficiency and ease of distribution while the main disadvantage is the possibility of poor response rates. A retrospective analysis of medication prescription records can also be used to determine the level of compliance.

Some studies measure the degree of adherence before and after the implementation of an intervention designed to promote guideline adherence. These studies could compare adherence to guidelines before and after dissemination of the guidelines(29). In a survey of hypertension guideline implementation in Finnish health centres, trained interviewers administered questionnaires over the telephone. The main problem encountered was poor response rates and dropouts as clinicians cited difficulty in finding time for the interviews. Unwillingness to participate and recall bias also compromised the quality of the results(30).

Comparison of the prescription patterns and dispensing patterns with the specific guideline can be used to measure adherence to the guidelines. After diagnosis of the patient through structured clinical interviews, prescriptions were assessed. The advantages of this method are the efficiency and ease of distribution while the main disadvantage is the possibility of poor response rates(31).

In summary gaps identified from the literature review include: 1.Guidelines may clash with beliefs and previous encounters hence the fear of compliance. 2. Use of guidelines imply rationalization of services to services, which would jeopardize the doctor –patient relationship. 3. Risk aversion leading to defensive practice, with fear of litigation and emotional burden of missing the diagnosis. 4. Inadequate resources required for new procedures may hinder utilization of new guidelines.5. Cadre of health care workers involved in patient care may influence adherence to guidelines.

CHAPTER 3: PROBLEM STATEMENT, RESEARCH QUESTIONS AND OBJECTIVES

3.1 Justification for the study

Malaria continues to be a leading global public health problem causing thousands of deaths annually especially in less developed countries. In Kenya, where over 70% of the population live in areas of malaria transmission, it is a significant cause of morbidity and mortality particularly in children younger than 5 years and in pregnant women. The WHO has developed guidelines to assist counties reduce the burden of malaria through effective prevention and control strategies. One of the strategic pillars in these guidelines is the proper diagnosis and management of malaria.

Kenya government has developed and implemented standardized diagnostic and treatment guidelines for malaria informed by the WHO guidelines. Further to this, there is substantive investment in consumables required for diagnosis and treatment. The basic paediatric protocols that is used as first line guide for treatment of sick children in Kenya have incorporated the guidelines and, training is carried out as part of the standard ETAT plus training. Healthcare delivery in Kenya is devolved to the County Governments. The County referral hospitals are local centres of excellence used for training and standard setting for the county.

Health care delivery in Kenya is devolved to the county governments with the county referral hospitals serving as local centres of excellence used for training and standard setting. To achieve this goal there is a need for high level of adherence to standards recommended in the guidelines. Periodic review of guideline adherence is a reliable method of monitoring quality of care. Kakamega is in a malaria endemic area and therefore prioritizing review of quality of care of malaria in childhood could have great benefits.

Proper managemntof cases is central for malaria control but worth nhoting is that not all those affected by malaria in Kenya have access to prompt, effective treatment. The “test and treat” policy was adopted in Kenya in 2010 and since its adoption, major improvements have been noted including improvement in availability of parasitological diagnosis (55.2% to 90.7%), testing increased by 34.0% (23.9% to 57.9%; $P< 0.001$), training coverage (0 to 50.2%); guidelines access (0 to 58.1%) while testing and treatment according to test result increased by 34.2% (15.7% to 49.9%; $p<0.001$). Treatment adherence for test positive patients improved from 83.3% to 90.3% ($p=0.138$)(32). The success of the new policy in Kenya may be hindered

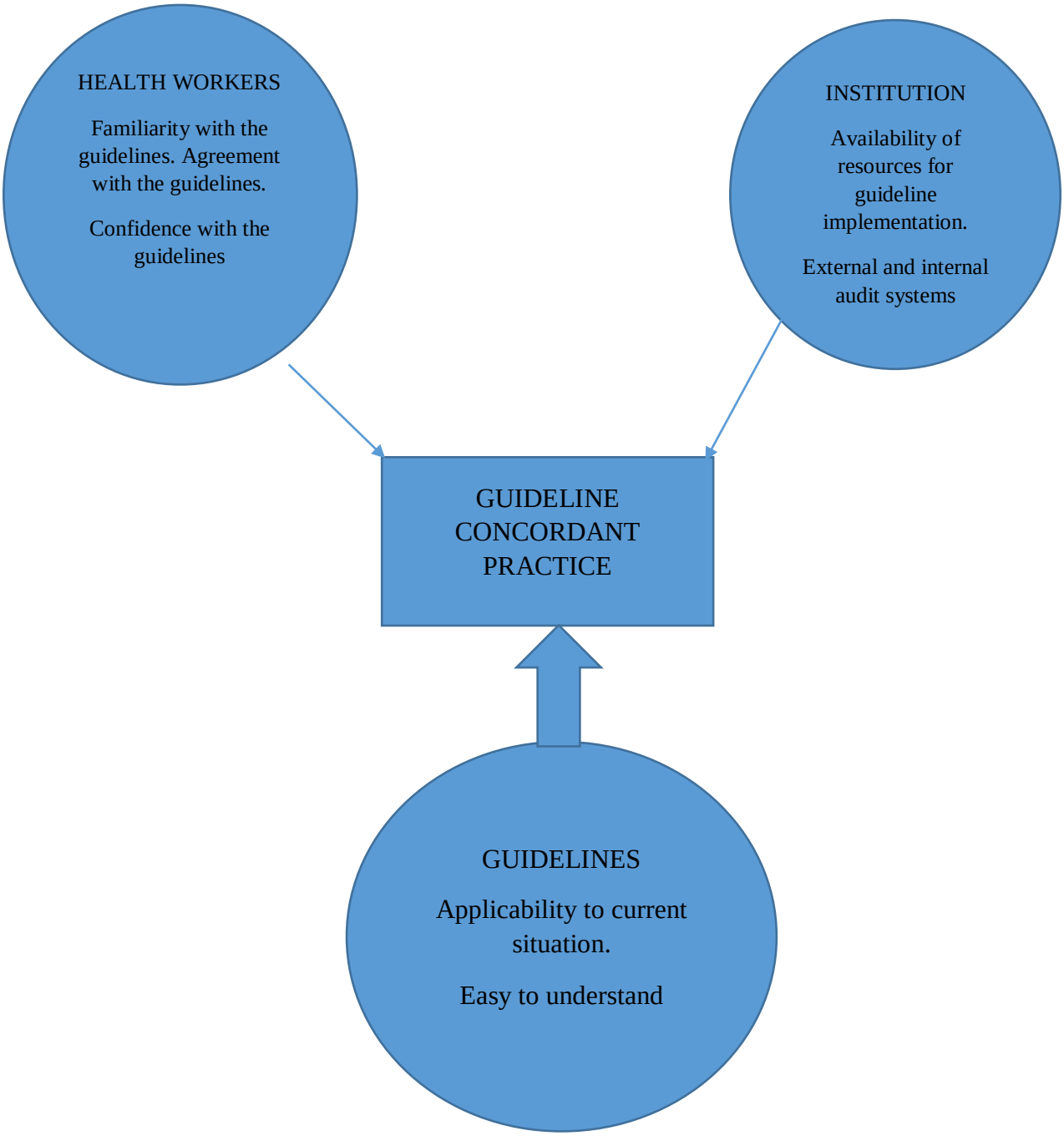
by frequent drug stock outs, as well as lack of training of health care workers, antimalarial treatment for patients testing-negative, in correct AL dispensing and counselling practices with nearly half of the patients leaving the facility without being given the first dose at the facility. This practice does not only delay prompt treatment but also misses opportunities to demonstrate administration of dispersible AL to children and therefore increases the risk of inappropriate administration at home.

3.2 Conceptual framework:

Mant factors are known to contribute to less than optimal adherence to malaria treatment guidelines by healthcare workers.Together the factors determine the level of guideline-concordant practice that is rendered to patients.Some factors are related to healthcare workers' knowledge and attitudes towards the guidelines, institutional factors and factors relating to the nature of the guidelines themselves as demonstrated in Figure 2 below.

Healthcare workers' who are familiar with set guidelines and attitudes towards the guidelines influences guideline adherence.Dissemination of the guidelines and frequent training of healthcare workers improves knowledge and understanding of the guidelines. Understanding of the guidelines in turn influences health care workers attitudes towards the guidelines. Workers showing a positive attitude towards the guidelines and those with more than a casual awareness of the guidelines are more likely to implement them.Those with dissenting views on the guidelines are more likely to fail to implement them in their practice. Guidelines that are written in a clear and straightforward language that is easily understood by the practitioners are easier to follow. Guidelines that are ambiguous or with conflicting information evoke negative attitudes towards. The guidelines should be applied to the target setting by taking into consideration the availability of the resources necessary for implementation of the recommendations. If the resources are available, external audit systems will ensure accountability and thus influence guideline adherence. These factorswill at the end interact to influence the general level of adherence to the recommended guidelines by healthcare workers.

Figure 2: Factors influencing optimal adherence to malaria treatment guidelines by healthcare workers



3.3 Research Question:

What proportion of paediatric patients managed for malaria were diagnosed and treated as per the Kenya National guidelines on Management of malaria at Kakamega County Referral Hospital.

3.4 Study Objectives

3.4.1 General objective

To determine the level of adherence by health care workers to National guidelines for malaria-case management among Paediatric patients aged 6months -18years at Kakamega County Referral Hospital.

3.4.2 Specific objectives:

1. To determine the proportion of malaria cases in children that was diagnosed in accordance with the National malaria guidelines at Kakamega County Referral Hospital between August and November 2019.
2. Determining the number of paediatric patients with malaria that was treated with antimalarial drugs in accordance with the National malaria guidelines at Kakamega County Referral Hospital between August and November 2019.
3. To determine health worker's perception on factors influencing the quality of care of malaria cases in this facility

CHAPTER 4: METHODOLOGY

4.1 Study design

This was a cross sectional study making use of both qualitative and quantitative data collection methods.

4.1.1 Quantitative technique

In retrospect the survey of patient files was used to assess current practice at the hospital and to compare the practice with the national treatment guidelines for management of patients with malaria. Records for patients admitted with a diagnosis of malaria in the 6 months preceding the study period (June-November 2019) were analysed to determine the proportion of patients diagnosed and treated with antimalarial drugs according to the guidelines and to identify the nature of deviations from the national guidelines. Data was collected in December 2019.

4.1.2 Qualitative study

In depth interviews with healthcare workers was done to assess knowledge, attitudes and practice using interviewer-administered questionnaires. The questionnaires contained both closed-ended and open-ended questions formulated guided by the 2014 MOH guidelines for malaria management.

4.2 Study location

The study site was at Kakamega County Referral Hospital located in Western Kenya. The hospital serves as a referral facility for the Western part of Kenya including the neighbouring county hospitals. Malaria is endemic in this zone and malaria transmission is intense throughout the year. It has nine wards with a bed capacity of 500 with additional 80 cots in the nursery and offers various services including inpatient and outpatient services, laboratory services, maternal services, antenatal and postnatal services, pharmacy among others. Paediatric patients aged up to 13 years are admitted in the Paediatric wards while the rest of the older patients are admitted to the adult wards. The total number of paediatric admissions are 450 patients per month, out of which 40% are due to malaria. Majority of the malaria cases are in children below 5 years of age. At the time of admission, a malaria blood test is carried out on those eligible before treatment is commenced. Patients get to the ward with the blood test results already in the file.

4.3 Target population

For the quantitative component of the study, the study population were patients aged <18 years admitted to Kakamega County Referral Hospital with a diagnosis of malaria. For the qualitative component, the study population were healthcare workers who are directly involved in management of suspected cases of malaria in children. They are the clinicians (doctors and clinical officers), pharmacists and pharmaceutical technologists, the laboratory technicians and the nurses.

4.3.1 Inclusion criteria

1. In-patient records of patients aged <18 years who were seen at Kakamega County Referral Hospital and diagnosed to have malaria by the clinician between June and November 2019. Outpatient records could not be assessed as the hospital had upgraded from manual documentation to computerised system and the systems had not been updated.

2. For the qualitative component, included are healthcare workers involved in management of suspected malaria cases from diagnosis, testing, treatment and follow-up.

4.3.2 Exclusion criteria

1. Healthcare workers who declined to give consent.

2. Files with no malaria diagnosis or treatment documented.

4.4 Sample size

The number of patients to be reviewed will be determined using the Fisher's formula (33)

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where,

n = desired sample size

z=the standard normal deviate at 95% confidence interval (1.96).

p= the proportion of the target population estimated to be non-adherent to the treatment guidelines (estimated at 50% due to lack of available literature).

d= statistical level of significance set (0.05)

n= 1.96×1.96× (0.5) × (1_0.5) ÷ (0.05)2

= 384

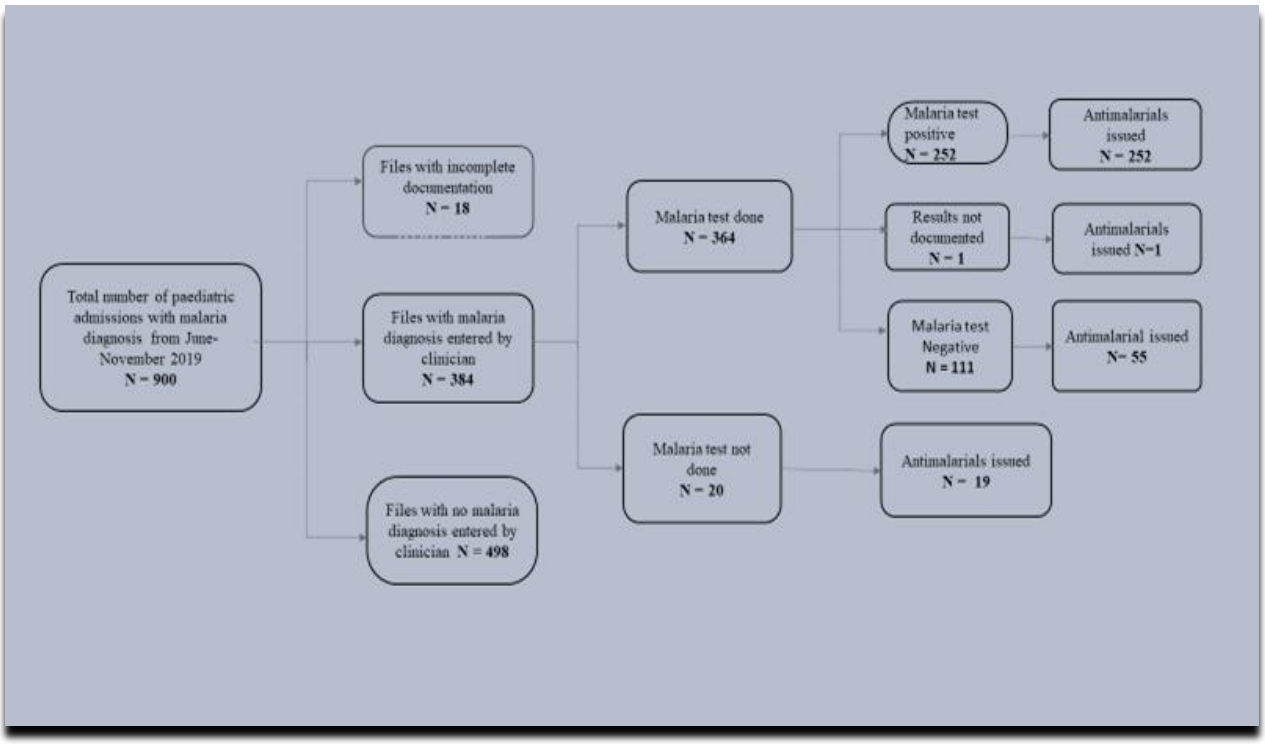
384 patients' files were sampled for this study.

In the qualitative component, the sample size of health care workers was arrived at through the progressive evaluation for theme saturation. The minimum sample size was set at 20 as per the recommendations for qualitative analysis(34).

4.5 Sampling procedure

Records of all patients seen at Kakamega County Referral Hospital between June and November 2019 as inpatients were analysed to identify those that met the study eligibility: an entry of malaria diagnosis at admission.

Figure 3: Sampling procedure



Systematic sampling was employed to select the 384 files for inclusion in the study. All the 900 files of the paediatric patients admitted with an entry of malaria diagnosis in the file in the course of the study period were identified for sampling. Coming up with a sampling frame and the corresponding intervals, n, derived at by dividing the total number of files (900) by the target sample size of 384. The files set chronologically, and every third (n=3) file was selected for inclusion in the study population. Files bearing incomplete recods were omitted and the immediate next file in the sequence was picked.

Purposive sampling was used to select the healthcare workers who would participate in the study in order to select healthcare workers relevant to the research. The healthcare workers were selected based on their direct and indirect involvement in diagnosis and management of cases of suspected malaria in children at the hospital. The cadres from which these healthcare workers were selected are clinicians, laboratory technologists, nurses and pharmacists. These are the healthcare workers involved in testing for malaria, prescribing, dispensing and administration of antimalarial drugs.

A written Consent by the healthcare workers was sought before enrolment into the study. Representatives from each of the cadres were selected and interviewed. Themes were identified from each interview and reviewed after every interview until the point of theme saturation was reached. This is the point in data collection where no new or relevant themes emerge. The decision that theme saturation has been reached was made by constant analysis of the interviews for new themes. Three interviews with no new or relevant information were considered indicative of theme saturation. Theme saturation was sought within-cadre for each of the groups.

4.6 Data collection techniques

The data collection instruments that were used are an interviewer-administered questionnaire formulated guided by the 2014 MOH guidelines for malaria management for the qualitative component and a data collection form for the qualitative survey. The data collection forms were utilised for recording data on the treatment of the selected malaria patients at the facility, their demographical features and their treatment outcomes. Data collection was carried out by the lead principal investigator between 8am and 5pm on Monday to Friday during the data collection period (appendix 3).

For the healthcare workers' recruitment, I introduced myself to the potential participants and provided a brief summary of the research, its purpose, benefits of participation in the study, any potential risks of participation and my contact information. Since this health care worker interview did not include any intervention, it was considered a minimal risk study. Agreement indicated confidence that the guidelines are based on solid evidence and that they were reliable in-patient management. Neutrality of feelings indicated neither agreement nor disagreement i.e. lack of opinion on the guideline recommendations. Disagreement indicated lack of confidence that the guidelines are based on solid evidence and that they are applicable to their setting. A signed informed consent by the potential participant was then sought for their

inclusion in the study. Those who consented were then enrolled into the study. The participants were made aware of their right to decline to answer any questions, stop the interview and to ask any questions concerning the subject. An Informed Consent Form was used for this purpose (Appendix I).A pretested interviewer-administered questionnaire was used to collect information from the healthcare workers (Appendix II). The questionnaire collected information on barriers to guideline adherence and factors that lead to guideline non-adherence by healthcare workers. The healthcare workers were interviewed face to face and their responses entered into the questionnaire. The interviews were carried out daily over three weeks 'period. This covered the entire shift cycle and ensured that the healthcare workers selected were representative of their specific cadres.

4.7 Data quality control

Before the study, the questionnaire was pretested at KNH. Two representatives of each involved cadre were randomly selected and interviewed in the pre-testing of the questionnaire. The findings were then used to adjust the questionnaire accordingly. The data was keenly verified for accurate and complete data and any errors and omissions were rectified.

4.8 Data security

The Data for the quantitative arm was collected using manual CRF and transferred directly to an electronic database (Excel sheet) in a computer on the day it was collected. The data was then exported to SPSS statistical software for analysis. The computer was secured by a password and access allowed to the principal investigator only. The data was backed up daily in a secure external hard disk and stored under lock and key. The external hard disks were stored at a location separate from the personal computer. Filled questionnaires and consent forms for the healthcare worker interviews were stored under key and lock by the investigator**.**

4.9 Data analysis

For process of analysing data,the definitions below were applied.

i. Malaria diagnosis being considered only if microscopy detected the malaria parasites. The diagnosis being further classified into severe malaria or uncomplicated malaria
ii. National malaria guidelines adherence included correct treatment (defined as attempted parasitological diagnosis, correct disease classification, correct choice of

drug, correct drug dosage, frequency of administration and duration of treatment) for each case.

iii. Age classification; ages below 5 year olds were categorized as the young children, ages 6-13-year-olds as the older children and patients whose age was above 13 years to 18 years were classified as adolescents.

A study database developed in a Microsoft Excel Spreadsheet and exported to SPSS statistical software for analysis. Statistics gathered were Descriptive and inferential. The significance level was set at 0.05. Data was summarized and presented as pie- charts, tables and bar charts.

I carried out content analysis of the qualitative data. The interview scripts were scrutinized and the identified themes were then coded, compiled and presented in tabular and narrative form.

4.10 Ethical considerations

Ethical approval was sought from the Kenyatta National Hospital and University of Nairobi Ethics and Research Committee **(*study reference KNH-ERC/RR/885).*** Permission to carry out the study was also obtained from the research committee at the Kakamega County Referral Hospital prior to commencing of the study.

A written consent was sought from the health care providers and only consenting participants took part in the study. Participants were always assured of confidentiality,no participant identifiers were recorded. The findings from the study are be shared with the participating institution.

CHAPTER 5: RESULTS

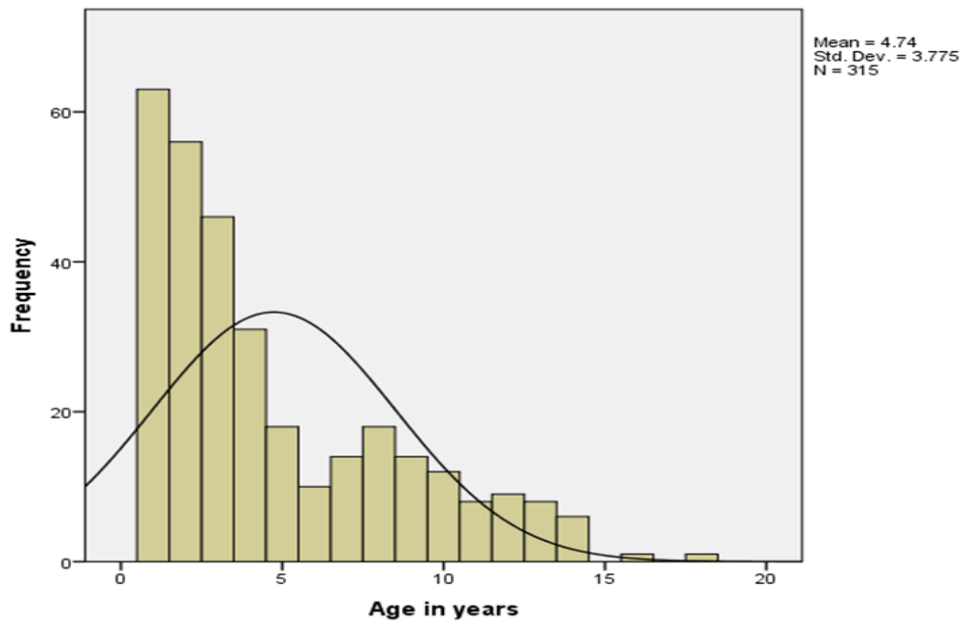
5.1.1 Demographic characteristics of the Patients

384 patient records with a written clinical diagnosis of malaria from the Kakamega County Referral Hospital were recruited into the study. The median age was 3.0 (IQR 1-6) years with a range of 4 days to 18.0 years. Majority of the patients 283 (73.7%) were below 5 years of age with only eight [2.1%] with more than 13 years. A bigger margin of these patients were male 217 [56.5%], while females 167(43.5%) The shapiro-wilkinson test for normality was significant. These findings are summarized in table 3 below.

Table 3: Demographic characteristics of Patients

Characteristics	**Frequency**	**Percentage**
Age(years)	**N**	**%**
<5	283	73.7
6-13	93	24.2
>13	8	2.1
Gender		
Male	217	56.5
Female	167	43.5
Total	**384**	**100**

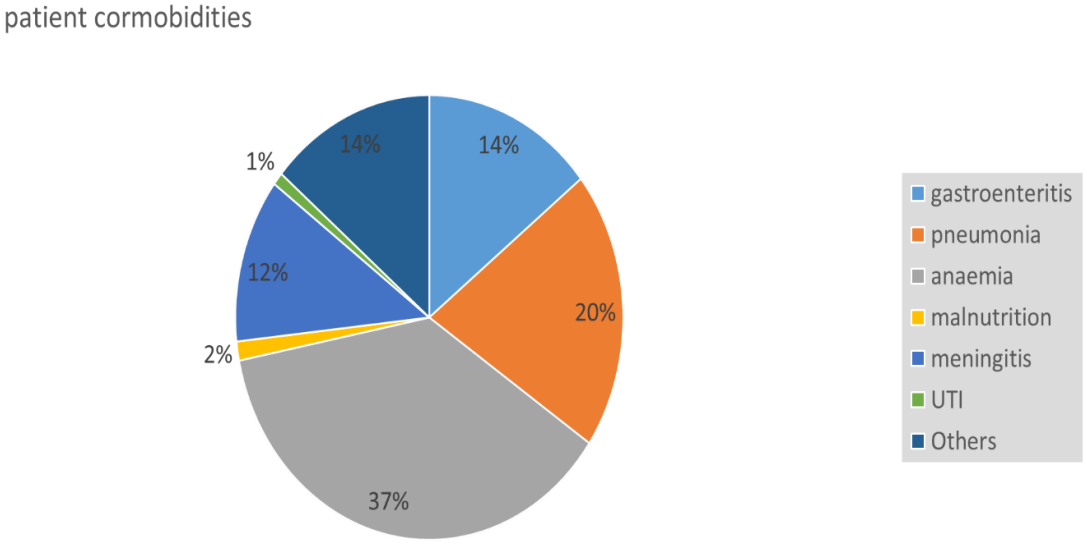
Figure 4: Histogram showing g the demographic characteristics of the patients



5.1.2 Co-morbidities in Patients diagnosed with Malaria

Participants with malaria positive slide, 203/252 (80.6%) had at least one documented co-morbidity (table 3) although this could still be considered as features of severe malaria. The most common co-morbidity was anaemia [81/252 (32.1%)] followed by pneumonia [44/252 (17.5%)], gastroenteris [31/252 (12.7%)] and meningitis [26/252(10.3 %)]. Malnutrition was diagnosed in 3/252(1.2%) of the patients, UTI in 2/252 (0.8%) and other co- morbidities accounted for less than 30/252 (11.9 %). Some patients had more than one comorbidity documented. These findings are summarized in figure 5 below.

Figure 5: Co-morbidities associated with malaria in Kakamega County referral hospital



5.2 Guideline concordance with management of malaria

5.2.1 Adherence to set guidelines in the diagnosis of malaria

364 (94.8%) patients underwent a confirmatory laboratory test for malaria while 20 (5.2%) patients were not tested. One (0.3%) patient was tested but results were not documented in the file as tabulated in table 4 below. All the patients tested being diagnosed using microscopy as this is the only available test in the facility. Out of the 364 patients who underwent laboratory confirmation of malaria, 252(69.2%) tested positive while 111 (30.4%) tested negative as per table 4 below.

Table 4: Proportion of patients tested for malaria Variable

Variable	**N** **N=384**
Laboratory tests done	364/384 (94.8%)
Microscopy Rapid diagnostic test (RDT)	364/364 (100%) None
Test Results	N=364
Positive malaria smear	252 (69.2%)
Negative malaria smear	111 (30.5%)
Results not documented	1 (0.3%)

5.2.2 Malaria classification based on National guidelines

Of the 252 patients who tested positive, 215 (85.3%) of them were classified as severe malaria,23 [9.1%] were classified as uncomplicated malaria by the clinician while 14 (5.56%) did not have any classification documented. Out of the 252 patients with a positive blood slide; 132 (52.3%) patients qualified to be classified as severe malaria as per the National recommendations on features of severe malaria outlined in appendix III(page 63) , while 108 (42.9%) fitted the classification of uncomplicated malaria.12/252 patients did not have adequate information documented in the file to enable classification to be done. There was a significant disparity in classification of malaria cases done by the clinician with reference to the Kenya National guidelines (P< 0.001).

Table 5: Adherence to malaria classification guidelines

	Clinician Performance N=252	**%**	**National Recommended standards? N=252**	**%**	**P value**
Classification of patients with positive results					
Severe malaria	215	**85.3**	132	**52.3**	<0.001
Uncomplicated malaria	23	**9.1**	108	**42.9**	<0.001
Not classified	14	**5.6**	12	**4.8**	P = 0.686
Total	**252**	**100**	**252**	**100**	

5.2.3 Adherence to guidelines in treatment of malaria

Treatment with artesunate was given to 293 out of the 384 patients recruited into the study as indicated in Table 6 below. Of these, 250 were classified to have severe malaria by the clinician with 215 of them having a positive blood slide for malaria as per table 5 above. There were 26 patients who were treated with artesunate despite having been classified to have uncomplicated malaria by the clinician out of which 23 had had a positive blood slide for malaria.17 patients who had no classification entered in the file by the clinician received artesunate with only 14 of them having tested positive for malaria.

108/132 patients who fitted the classification of severe malaria as per Kenya National guidelines were correctly treated with artesunate.24 of them received AL, but they did well and were discharged home.

55/111 [49.5%] patients with a negative blood slide as per table 4 above were also treated with artesunate, of which 32 of them had presented with symptoms of severe malaria and therefore may have prompted the clinician to administer artesunate despite the negative blood result for malaria because malaria test is not accurate.

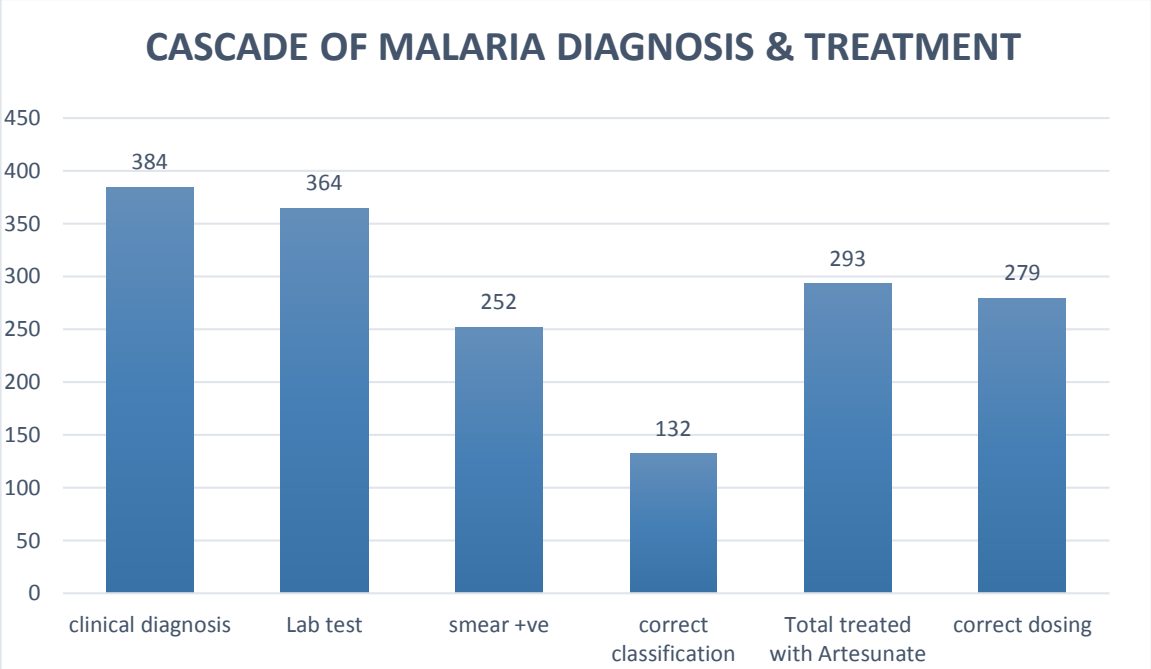
Table 6: Adherence to malaria treatment guidelines

Issue of artesunate			
	Clinician performance	**National Classification Guidelines**	**P value**
Severe malaria	250	108	<0.001
Uncomplicated malaria	26	115	<0.001
Unclassified	17	-	-
Total	**293**	**203**	**-**

5.2.4 Correct drug dosages

Of the 327 patients who received antimalarial in the ward, 279 were issued with the correct dose of antimalarial, while 45 had an incorrect dose.

Figure 6: Cascade of malaria diagnosis, treatment and correct drug dosages



From figure 6 above, 384 patients were recruited into the study based on clinical presentation, 364 of them underwent a laboratory test with 252 testing smear positive for malaria.132 of those who tested positive were correctly classified to have severe malaria out of which 108 of them received artesunate. A total of 293 patients out of the 384 recruited into the study were treated with artesunate, with 215 of them having had a positive blood slide for malaria, the rest were clinically diagnosed based on the presenting complaints documented. 279 of all patients who received treatment with antimalarial drugs (327) had appropriate drug dosage calculated and issued.

5.3 Health worker's perception on factors influencing quality of care of malaria cases

5.3.1 Demographic characteristics of healthcare workers

As presented in table 9 below, the distribution of genders in respect to healthcare workers took part in the study was 55% male and 45% female. The distribution of the 20 participants by cadre was as follows: 11 clinicians (medical officers and clinical officers), 1 Pharmacist, 6 nurses and 2 laboratory technicians.

Table 7: Demographic characteristics of healthcare workers

Characteristics	Frequency	Percentage
Gender	**N**	%
Male	11	55
Female	9	45
Designation		
Pharmacist/intern	1	5.0
Nursing officer	6	30.0
Medical officer/intern	3	15.0
Clinical officer /intern	8	40.0
Laboratory technologist	2	10.0
Total	20	100

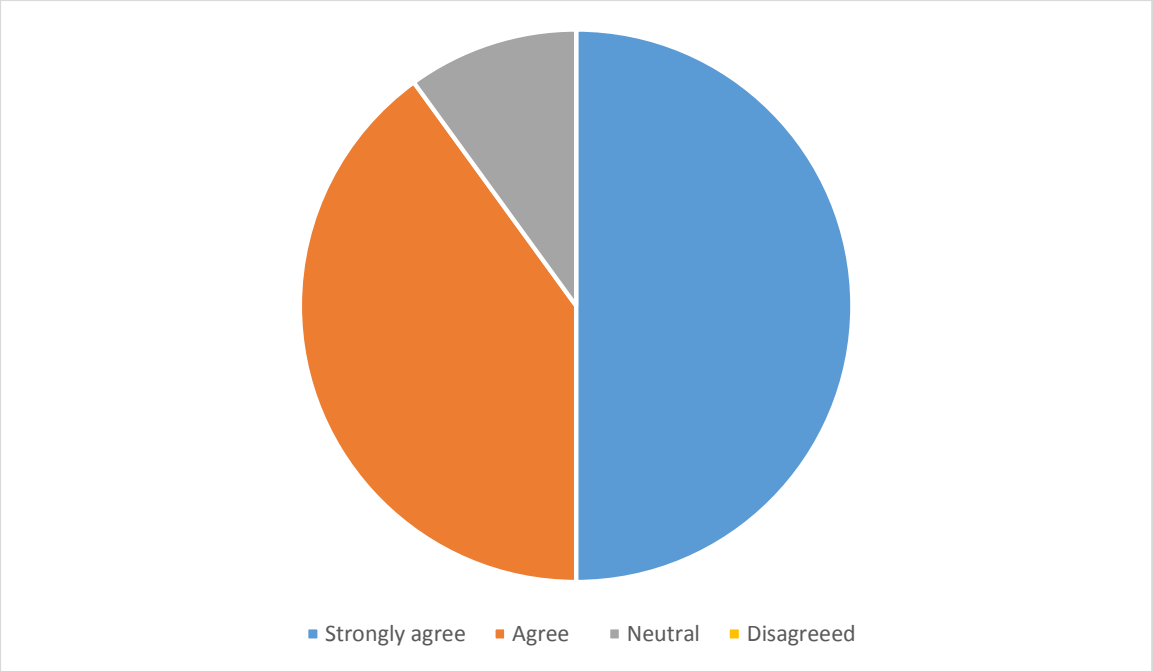
5.3.2 Awareness and Training on Malaria Treatment Guidelines

Healthcare workerscontatcted for interviews were aware of the existence of national treatment guidelines for malaria in Kenya and most of them reported to have attended a training on the current national guidelines for management of malaria.

5.3.3 Agreement with guidelines

Respondents were asked to rate their feelings concerning the malaria treatment guidelines on a 5- point scale. Most those interviewed indicated agreement with the guidelines (strongly agreed /agreed), only a few indicated neutrality in their feelings, and none of them disagreed with the guidelines. One of the health care-workers who had neutral feelings about the guidelines held the opinion that he had not come across evidence on the effectiveness of the drugs over the other antimalarial drugs not recommended in the guidelines.

Figure 7: Pie chart showing respondents agreement with usefulness of the guidelines



5.3.4 Perceived usefulness of malaria treatment guidelines

Healthcare workers who participated in the study had a positive opinion about usefulness of the malaria treatment guidelines with a minority of the respondents indicating that they did not find the guidelines useful in their practice. Of those who found the guidelines useful, a quarter indicated that the guidelines helped to reduce waste of drugs. These healthcare workers were concerned about wasteful use of antimalarial drugs.One specifically stated "Treatment of unconfirmed cases of malaria puts an unnecessary burden on the pharmacy as there are limited resources allocated to drug procurement".

A few of the respondents indicated that the guidelines simplified clinical decisions as it allowed them to know how to manage the patient and when to refer the patient to another facility. By simplifying clinical decisions, the guidelines allow paramedical personnel to manage cases of malaria in resource-limited settings such as dispensaries, which are run by nurses. One of the health workers specifically indicated this as a reason she found the guidelines useful: "When I was working at a dispensary and was the only healthcare provider, I was able to know when to refer patients with severe malaria by referring to the guidelines.

Table 8: Healthcare workers' awareness of guidelines and training

Characteristic	Frequency (n) N=20
Aware of guideline	20 (100%)
Trained on the guidelines	17 (85%)
Availability of equipment and reagents for diagnosis	20 (100%)
Adequately staffed with qualified personnel	17 (85%)
Adequate supplies of antimalarial in right doses	19 (95%)

5.4 Factors influencing the quality of care of malaria cases in the facility

a) Availability of resources necessary for malaria management

The healthcare workers interviewed indicated that there were some considerable external barriers to obtaining of a confirmatory diagnosis of malaria. Majority thought that there was availability of the necessary laboratory reagents and equipment for malaria diagnosis, and that the laboratory was adequately staffed with qualified personnel. A small number said there were staffing issues and felt that this was a major concern: "There are very many patients who come to the hospital every day and most of them require testing for malaria. We however have very few laboratory technicians who work long hours and this may compromise the quality of their work. The reagents and equipment are available but the technicians are few".

b) Availability of antimalarial drugs in right doses

In matters of treatment of malaria cases, one of the healthcare workers interviewed indicated that the hospital lacked sufficient quantities of antimalarial drugs in the right doses. While majority were of the opinion that the hospital had enough resources in terms of antimalarial drugs necessary to cater for their patients' needs. This influenced the outcome of patients in terms of treatment outcome and reducing mortality at the facility.

c) Health workers' beliefs and attitudes

Healthcare worker beliefs and attitudes influenced the choice of treatment they would offer to patients as some believed in continued confidence in clinical diagnosis in management of malaria; they said that at times the laboratory findings could be inaccurate. When asked whether it is recommended to give antimalarial drugs to all suspected cases of malaria, half of them responded yes while the other half said no; unless it is confirmed from the laboratory testing. Reasons motivating adherence to guidelines were prevention of antimalarial drug resistance, emphasis on diagnosis and treatment of the right disease and prevention of inappropriate use of antimalarial drugs. Analysis for possible associations between training of

health workers, cadre, and years of practice, feelings and adherence to malaria treatment guidelines revealed no statistically significant associations.

CHAPTER 6: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

6.1 Discussion

More than 50% of paediatric patients (< 18 years) seeking treatment for malaria at the facility were aged below 5 years [73.7%]. Evidently it depicts Kenya like the rest of Sub-Saharan Africa, children below the age of 5 years are the most vulnerable group suceptible to malaria infection [6].

Adherence level was measured in terms of parasitological diagnosis of malaria, proper classification of the disease and treatment method using the correct drug and proper dosage. Non-adherent to treatment was shown in terms of inconsistency in confirmatory diagnosis of malaria, wrong classification of disease severity, prescribing of antimalarial drugs, as well as prescribing antimalarial drugs to cases testing negative including wrong dosages for prescribed drugs. Malaria being endemic in this region throughout the year, there is unlikely to be an association between the study period and the outcomes of interest.

Co-morbidities showed presence in 80.6% of the patients although most of the symptoms described would still be a manifestation of severe malaria. Anaemia was the most common comorbidity (37%). 20% of the patients had pneumonia as a co-morbidity and 14% had Gastroenteritis.This is consistent with a study conducted in Western Kenya by Joseph koge that found that anaemia was present in 10-34% of patients with malaria. A similar study conducted in Ghana identified low haemoglobin levels, as the most reliable haematological change in predicting P. falciparum infection(35). In children, it is essential to differentiate malaria from other febrile illnesses to reduce morbidity and mortality from non-malarial dieseases as well reduce unnecessary use of antilmalarial drugs. Laboratory tests confirming malaria cases would lead to a great scale down of wasteful use of antimalarial drugs. Use of RDTs in public health facilities in Malawi decreased ACTs consumption(36).

The polict to ‘test and treat’ was adopted in Kenya since the year 2010 with a monitoring and evalaution programme put in place to truck progress on changes effected. Since then there have been major improvements noted including improvement in availability of parasitological diagnosis (55.2% to 90.7%),testing increased by 34.0% (23.9% to 57.9%; P< 0.001)(32).Malaria case management in this facility was exhibited by sub-optimal adherence to existing guidelines regarding treatment. Of the 384 patients recruited for the study, 364 (94.8

%) took a test to confirm existence of malaria (microscopy) while 19(4.7%) of the patients were diagnosed clinically 1 patient had no result documented in the file. Compared to a study conducted in western part of Kenya on Malaria Investigation and Treatment of Children Admitted to County Hospitals in Western Kenya by Amboko et al.The study found that parasitological testing is done in 92.1% of all patients admitted in 5 hospitals in western Kenya(37). Parasitological confirmation is a key determinant,the findings help the clinician's whether or not to prescribe an antimalarial drug. Microscopy was the only available test in this facility (gold standard for detecting malaria) and is common in most facilities in this region.A study done by Dejan Zurovac ,Beatrice Muchini et al on Monitoring health systems readiness and inpatient malaria case-management at Kenyan county hospitals found that testing of suspected malaria case patients was high (88.6% vs 92.1%; $p = 0.080$) and nearly all patients had malaria microscopy performed at admission (99.0% vs 99.4%)(38).

The same study by Dejan Zurovac ,Beatrice Muchini et al on Monitoring health systems readiness and inpatient malaria case-management at Kenyan 47 county hospitals found that the percentage of patients who tested positive on admission was (60.0% vs 61.4%) respectively and only 5.2 and 8.1% of patients had at respective surveys malaria test repeated. From our study ,out of the 364 patients who were tested for malaria, 252(69.2%) had a positive result while 111(30.5%) tested negative. One patient did not have results documented. The existence of positive cases was higher in this study (69.2%) because this is a malaria endemic zone.Repeat testing was not common in patients who had completed treatement and a few patient (3.3%)who had initially tested negative turned positive on repeat test.

Of the patients 132 showing symptoms of severe malaria as per the National classification guidelines, 108/132(81.8%) received guideline-adherent management.. Overtreatment was highly displayed in this study as 293 patients were treated with artesunate yet only 132 had features of severe malaria as per WHO classification. Most of the patients who were classified to have uncomplicated malaria by the clinician (26) received treatment for severe malaria with only 23 of them testing positive for malaria .Out of the 111 patients with a negative blood side,55[49.5%] were treated with artesunate as severe malaria; 32 of them had presented with symptoms of severe malaria and this could have prompted the clinician to administer artesunate despite the negative blood result for malaria(39). This number is comparable to a study conducted by Nyaoke et al on factors Associated with Treatment Type of Non-Malarial Febrile Illnesses in Under-Fives at Kenyatta National Hospital in Nairobi that found that antimalarial

drugs are issued to 44% of patients with a negative microscopy result(40). These depicts significant disparity from the recommendations at the level of classification and treatment ($p<0.001$) of patients who present at the facility with probable malaria.

Combination of antimalarials used was artesunate and AL. There were adequate supplies of the antimalarial drugs at the facility without any stock outs during the study period. Artesunate was more preferred to quinine, the research showed that it decreases mortality in both adults and children with severe malaria(41). Artesunate is perceived to be an easier and safer drug to administer to patients compared to quinine. The hospital has fully adopted the new guidelines as we did not find cases of quinine still being prescribed.

Overall, the interviewed health care workers showed a positive attitude towards malaria treatment guidelines. Almost all indicated that the guidelines are a useful source of information on how to manage patients. This is consistent with other studies done elsewhere(42). However, there are a number of factors that cause a gap between the positive attitude and the practical use of the guidelines. These factors include limited knowledge of the guidelines, disagreement with guideline recommendations, perceived usefulness of the guidelines, inadequacy of staff and other resources, lack of training and supervision.

As in other studies, healthcare workers were generally aware of the existence of the malaria treatment guideline(42). It was however evident that awareness of the existence of guidelines did not translate into guideline familiarity or the ability to correctly implement them(42). In this study, most of the health workers interviewed indicated knowledge of both microscopy and RDT as laboratory tests for malaria diagnosis. The ever expanding and evolving body of knowledge in medicine has made it so that there are a lot of recommendations which healthcare workers are not able to keep up with. Interventions to improve the healthcare workers' knowledge of guideline content include trainings, job aids, support supervisions and external audits. Our study found no significant association between previous proper training of health workers and adherence to malaria treatment guidelines.

This should not be construed to mean that training and supervision do not lead to better adherence to treatment guidelines by health workers. Studies on the efficacy of training as a method to improve guideline adherence have however yielded conflicting results. Some studies show improvement (43) while other show minimum or no improvement on healthcare workers practice(23). As the overall effect of training would be to translate guideline knowledge into

practice, it remains an important intervention to improve healthcare workers' adherence to guidelines.

There were considerable external barriers to guideline implementation in terms of obtaining laboratory confirmation and treatment of malaria. Some of the respondents indicated that the laboratory was inadequately staffed and though most of them indicated that there were sufficient supplies of the medicines required in malaria treatment. Shortage of staff leads to increased workload and this affects the quality of care offered to the patients. This is a common problem in public health facilities as evidenced by other studies(44).

6.2 Strengths and Limitations of the study

The study was carried out at one public health facility in Kenya due to limited resource, that is time for the study and money to spent. The findings therefore may not be a representative of a true picture for all other public health facilities in Kenya or to private health facilities in Kenya.The study site being located in a primary care facility as well as a referral facility and thus serves as an adequate catchment area for a generalizable survey.

The study only included inpatient patients who are presumably too sick and therefore would justify administration of artesunate depending on clinical presentation.

Recognizing that documentation of the clinical criteria may not have been optimal ,this would have influenced the way the clinician had done a clinical diagnosis hence reflecting on the choice of treatment issued.

A major limitation was the reliance on BS for diagnosis. There was no possibility of counter checking accuracy of the test. Sensitivity of BS is not 100% and declines with increasing anaemia.

The retrospective nature of data collection from patient particulars had encountered difficulties emanating from incomplete set of records or poorly documented records,this was minimized by excluding all incomplete records,requiring the perusal of more files so as to achieve the required sample size. The target sample size had been adjusted upwards to cater for this, and the final sample size was not compromised. The factors adherence was measured by healthcare workers' self-reporting. This information was not corroborated by any external audits and thus its reliability is limited. The healthcare workers' ability to accurately self-assess may have been limited thus resulting in collection of biased data. This is an inherent limitation of the use of self-reporting to assess aspects of adherence, and it was minimized by using well formulated,

pre-tested interviewer-administered questionnaires. In addition, no subject identifiers were recorded from the respondents.

6.3 Conclusions

There was lack of RDTs -this is one of the requirements regarding testing of malaria cases which is a cheap and rapid diagnostic test that allows quick diagnosis of malaria and does not require skilled personnel.There were gaps in clinical skills as evidenced by variance in what is labelled as severe illness that influenced the choice of treatment the patient received.Once diagnosis of malaria was made, there was reasonable performance in terms of dosing most patients received adequate drug dosages for the weight. Patients continue to be started on malaria treatment despite a negative test for malaria.

6.4 Recommendations

Proper documentantion of clinical data at admsision to enable proper disease classification hence choice of treatment for the patient.Healthcare workers be reminded about the potential of other febrile conditions presenting with similar symptoms to malaria and carry out confirmatory diagnostic tests on all febrile patients suspected of having malaria. Patients who test negative for malaria should not be put on antimalarials but instead should be investigated for other factors causing the symptoms.

Proper communication of the set guidelines and increased training of healthcare workers on the same is recommended.

Progressive medical sensitization on pre-existing guidelines should carried out to augment the trainings and inform healthcare workers on any changes in the recommendations.

Availing job aids, carry out internal and external audits, enhanced proper supportive supervision and feedback sessions.

More studies should be carried out to explore factors related to lack of adherence and formulation of strategies geared towards addressing the same.

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APPENDICES

Appendix 1: Written consent to be sought from the health care providers.

Title of the study: Assessment of adherence to national management guidelines for malaria at Kakamega County Referral Hospital in Kenya

Institution: Department of Paediatrics, University of Nairobi,

P.O. BOX 30197-00400, Nairobi.

Investigator: Dr. Saliku Mercy Mwanisa,

P.O. BOX 105404, Nairobi-00101. Tel: 0720867926

Supervisors: Professor Nduati, Dr. Kumar, Dr. Owino from the Department of Paediatrics and Child Health University of Nairobi.

Ethical Approval Kenyatta National Hospital, KNH-UoN ERC

Email: uonknh_erc@uonbi.ac.ke,

Website: http://www.erc.uonbi.ac.ke

Facebook: http://www.facebook.com/uonknh.erc

University of Nairobi Ethical and Research Committee,

P.O BOX 20723-00202, Nairobi. Tel 2726300/2716450 Ext 44102

Introduction:

In this study I, Dr. Saliku Mercy Mwanisa from the University of Nairobi Department of paediatrics and child health, will be assessing the adherence to national management guidelines for malaria diagnosis and management at Kakamega County Referral Hospital. The purpose of the study is to find out the proportion of patients with suspected malaria in this facility who are treated according to the national treatment guidelines and to assess the reasons for non-adherence to these guidelines by healthcare workers. Permission is requested from you to enrol you in this research study.

The following are general principles which apply to all participants in a medical research:

I. Your agreement to participate in this study is voluntary.
II. You may withdraw from the study at any time without necessarily giving a reason for your withdrawal without any consequences to you.
III. After you have understood the explanation please feel free to ask any questions that will enable you to better understand the nature of the study.

Procedure to be followed

With your permission, I will ask you some questions about your knowledge of and attitudes towards the national malaria treatment guidelines. All information will be handled with confidentiality and will only be used for the purpose of this study.

Benefits and rewards

I will inform you of the latest guidelines for malaria management as well as the benefits of guideline adherence to the patient, to the healthcare worker and to the government. There is no reward for your participation in the study.

Discomfort and Risks

Some questions that you will be asked will be of a personal nature and may make you uncomfortable. You are free to decline to answer these questions if you so wish. You may also stop the interview at any time. Participation will require 15-20 minutes of your time and may slow service provision by yourself at the hospital**.**

Assurance of confidentiality

All information obtained from you will be kept confidential. At no point will you or your name be mentioned or used during data handling or in any resulting publications. Serial numbers will be used instead to maintain confidentiality**.**

Contacts

If you need to contact me, my academic department or the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee concerning this study please feel free to do so using the contact information provided above.

CONSENT FORM (STATEMENT OF CONSENT)

Participant's statement

I have read this consent form or had the information read to me. I have had the chance to discuss this research study with a study counsellor. I have had my questions answered by him or her in a language that I understand. The risks and benefits have been explained to me. I understand that I shall be given a copy of this consent form after signing it. I understand that my participation in this study is voluntary and that I may choose to withdraw it any time. I understand that all efforts shall be made to keep information regarding me confidential. By signing this consent form, I have not given up my legal rights as a participant in this research study.

I voluntarily agree to participate in this research study**: Yes** **No**

I agree to provide contact information for follow-up**: Yes** **No**

Signature /Thumb stamp: _____ Date _____

Printed name: _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has knowingly given his/her consent.

Printed Name: _____

Date: _____

Signature: _____

Role in the study: _____

Witness Printed Name _____

Signature: _____ Date; _____

APPENDIX 1b: IDHINI YA KUSHIRIKISHWA KATIKA UTAFITI

Kufuata miongozo ya kitaifa kwa kutibu ugonjwa wa malaria kwa watoto katika Hospitali ya Rufaa ya Kakamega

Appendix 1: Written consent to be sought from the health care providers.

Title of the study: Assessment of adherence to national management guidelines for malaria at Kakamega County Referral Hospital in Kenya

Jina la mtafiti: Dr Saliku Mercy

Mimi ni mwanafunzi wa Uzamili katika Chuo Kikuu cha Nairobi anayesomea shahada ya afya na magonjwa ya watoto. Ili kuhitimu shahada hii, ninafanya utafiti huu unaongalia jinsi ambavyo miongozo ya kitaifa inavyotelekelezwa katika hospitali kuu ya rufaa ya Kakamega kwa kutibu ugonjwa wa malaria kwa watoto.

Ushiriki wako katika utafiti huu utanisaidia kudhibitisha idadi ya watoto wanaotibiwa kulingana na miongozo hii. Kuamua iwapo utaruhusu kushirikishwa kwenye utafiti huu :

Tafadhali elewa yafuatayo: -

1. Ushiriki ni kwa hiari.
   -Nitaitunza siri yako. Habari ambayo utatupa itahifadhiwa kwenye kompyuta iliyo na neno siri na kufungiwa kwa kabati iliyo na kufuli Kukataa kushiriki katika utafiti hautavutia adhabu yoyote. Hakuna hatari inayotarajiwa kwa kushiriki katika utafiti huu.
2. Hakuna fidia ya fedha kwa ajili ya kushiriki katika utafiti huu.
3. Uko na uhuru wa kukataa kuhusishwa katika utafiti huu wakati wowote kupitia **nambari 0720867926**. Utakapobadilisha nia ya uhusisho unaweza andika barua pepe au kupiga simu kwa kamati ya maadili ya hospitali kuu ya Kenyatta kwa **nambari 2726300 Ext. 44102 ama barua pepe: uonknh_erc@uonbi.ac.ke.**

Kauli ya mhudumu wa afya

Nimeisoma fomu hii ya idhini na kuelewa inavyoagiza. Nimejadiliana na mshauri wa utafiti barabara na maswali yangu yamejibiwa kwa ugha ninayoielewa. Nimeelezwa hatari na faida

za ushirikisho kwa utafiti huu. Ninaelewa kuwa nitapewa nakalaya idhini hii nitakapoisahihisha. Ninaelewa kuwa habari yeyote nitakayotoa itatunzwa vyema. Ninaelewa kuwa ushirika wangu katika utafiti huu ni kwa hiari na ninweza kukataa kuhusishwa kwa utafiti wakati wowote. Katika kusahihisha idhini hii sijasalimisha haki za sheria zangu.

Nimekubali kwa hiari kushirikisha mtoto wangu kwa utafiti huu: Ndio ____ La _____

Nimekubali mtoto wangu kukaguliwa hali ya lishe: Ndio _____ La _____

Nimekubali kumpa mtafiti nambari ya simu: Ndio _____ La _____

Jina la mzazi _____

Sahihi ya mzazi _____ Tarehe _____

Kauli ya mtafiti

Mimi niliyesahihisha idhini hii nimeeleza mzazi barabara maelezo muhimu kuhusu utafiti huu na ninaamini kuwa ameelewa na kukubali kushirikishwa katika utafiti huu.

Jina la mtafiti _____ Tarehe _____

Sahihi _____

Jina la shahidi _____ Tarehe _____

Sahihi ya shahidi _____

Appendix 2: Questionnaire

o be administered to the respondent by the principal investigator.

Title: Assessment of adherence to national management guidelines for malaria at the Kakamega County Referral Hospital.

Please answer the following questions as accurately as you can. The information given will be handled as confidential.

Questionnaire number ……

1. Gender of respondent

   Male: □

   Female: □

2. Age (in years)

   ≤ 25 □

   25 – 34 □

   35 – 44 □

   45 – 54 □

   ≥ 55 □

3. Cadre of respondent

Consultant	□	Nurse	□
Medical officer	□	Laboratory technician	□
Clinical officer	□	Pharmacist	□

4. Years of practice

0 – 5	□	16 - 20	□
6 -10	□	21 - 25	□
11 – 15	□	> 25	□

5. Have you been trained on malaria case management?

□ Yes □ No

If yes, how many times have you been trained?

1 □

2 □

3 □

≥ 4 □

6. Are you aware of availability of malaria case management guidelines?

□ Yes

□ No

7. Have you read the 2016 guidelines on malaria -case management?

□ Yes

□ No

If yes, do you understand the National guidelines on malaria case management in Kenya?

□ Yes

□ No

8. Please state based on the scale below whether or not you agree with the national malaria treatment guidelines:

1= strongly agree

2= Agree

3= Neutral

4= Disagree

5= strongly disagree

Elaborate on your response

……

9. Do you find the recommended guidelines helpful in your practice, specifically in management of cases of suspected malaria?

   1= strongly agree

   2= Agree

   3= Neutral

   4= Disagree

   5= strongly disagree

10. Do you think adherence to the national guidelines for management of malaria would make a difference in patient outcomes?

    □ Yes

    □ No

    If No, elaborate…….

11. When a case of suspected malaria comes to your facility, what is the first thing that is done?

    ……

    ……

12. If a patient with suspected malaria says that they have no money to pay for a lab test, what do you do at your facility?

……

……

……

13. Does your laboratory have the equipment and reagents necessary for diagnosis of malaria?

    □ Yes

    □ No

14. Is your hospital laboratory adequately staffed with qualified personnel for carrying out the malaria lab test?

□ Yes

□ No

□ I don't know

15. What lab tests do you know that detect malaria and what exactly do each of the tests detect?

……
……
……

16. In your opinion, should you always prescribe antimalarial drugs for suspected cases of malaria?

□ Yes

□ No

□ Other (elaborate)

……
……

17. Do you have adequate supplies of antimalarial and in the right doses?

□ Yes

□ No

18. Are you conversant with the dosing schedule of AL and artesunate?

□ Yes

□ No

19. Do you do directly observe therapy (DOT) for the first dose of AL?

    □ Yes

    □ No

    □ Sometimes

    □ No response (specify)……

20. What factors would influence your decision on the type of antimalarial medication prescribed

    a. ----------

    b. ----------

    c. ----------

    d. ----------

APPENDIX 3: QUANTITATIVE DATA COLLECTION FORM

1. Inpatient/ outpatient number…….

2. Age documented……

3. Gender of the patient

□ Male

□ Female

□ not documented/can't be determined

4. Lab test done?

□ Yes

□ No

5. Type of malaria lab test done

□ Microscopy

□ RDT

□ Other (specify) ----------

6. Result of patient's lab test for malaria

□ Positive

□ Negative

□ Not documented

7. Malaria severity classification by the clinician

□ Severe

□ Non severe

□ No classification recorded

8. Clinical status of the patient

	Y	N	Not indicated
• Prostration (inability or difficulty to sit upright, stand or walk without support in a child normally able to do so, or inability to drink in children too young to sit)			
• Alteration in the level of consciousness (ranging from drowsiness to deep coma)			
• Cerebral malaria (unarousable coma not attributable to any other cause in a patient with falciparum malaria)			
• Respiratory distress (acidotic breathing)			
• Multiple generalized convulsions (2 or more episodes within a 24-hour period)			
• Shock (circulatory collapse, septicaemia)			
• Pulmonary oedema			
• Abnormal bleeding (Disseminated Intravascular coagulopathy)			
• Jaundice			
• Haemoglobinuria (black water fever)			
• Acute renal failure - presenting as oliguria or anuria			
• Severe anaemia (Haemoglobin < 5g/dl or Haematocrit < 15%)			
• Hypoglycaemia (blood glucose level < 2.2. mmol/l)			
• Hyperlactatemia			

9. Malaria disease severity classification as per national guidelines (investigator).

□ Severe

□ Non severe

□ inadequate information to classify

10. Antimalarial drug issued to the patient for positive lab result?

□ Yes

□ No

□ No information

11. Antimalarial issued to the patient for negative result?

□ Yes

□ No

12. Correct drug choice based on clinician classification of disease

□ Yes

□ No

□ Difficult to tell (no information on disease classification).

13. Correct drug dosage prescribed/issued

□ Yes

□ No

□ Difficult to tell (no information on patient weight).

14. Correct drug choice based on national guidelines (investigator) classification of disease

□ Yes

□ No

□ Difficult to tell (inadequate information for disease classification).

15. Other treatments issued to the patient,

□ Yes

If yes, specify the drugs ……

□ No

□ Not indicated (no information in the patient records)

16. Patient's other co-morbidities

□ Yes

If yes, specify the comorbidity ……

□ No

□ Not indicated (no information in the patient records)

17. Outcome at discharge of patient treated for malaria

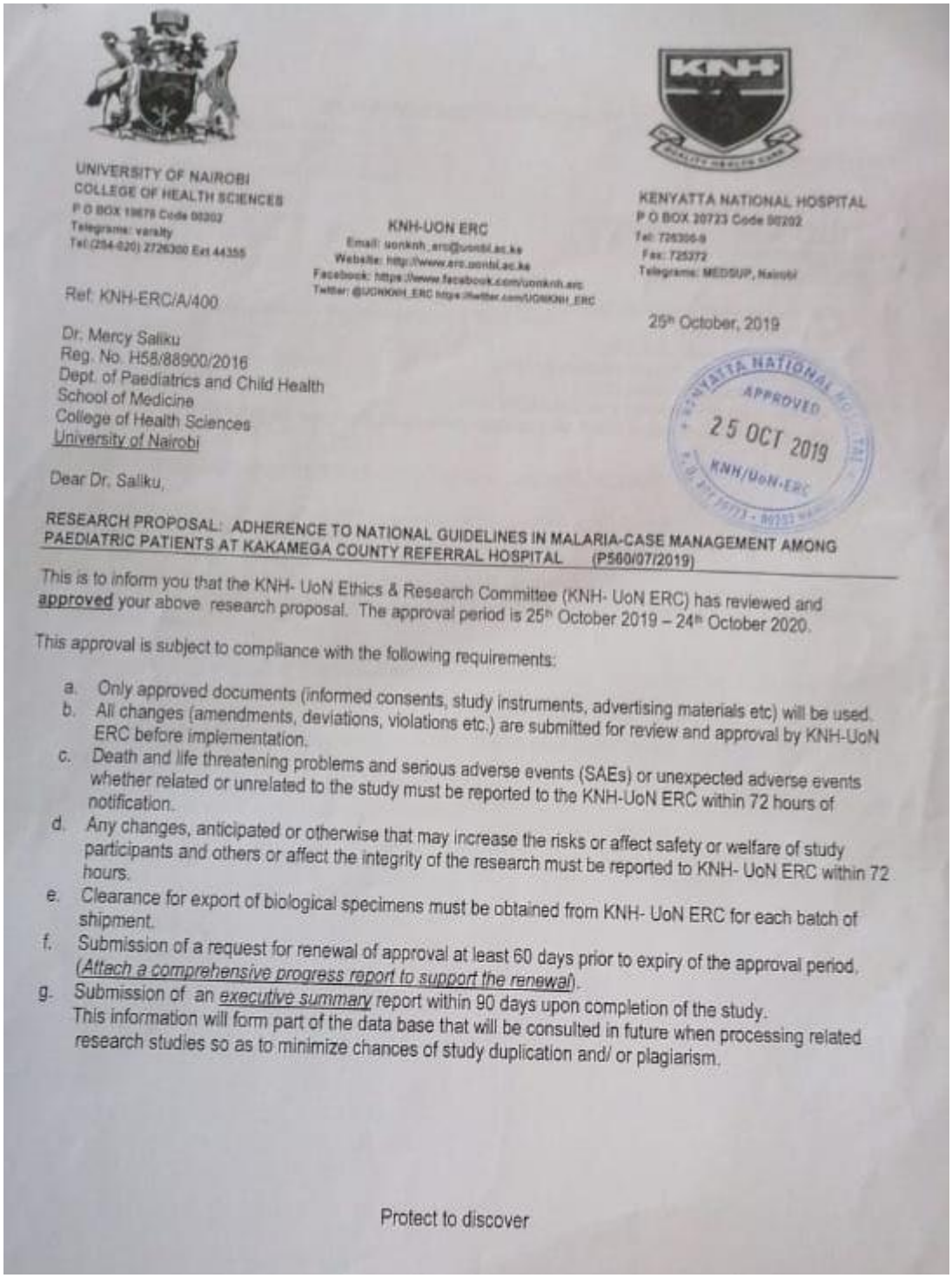
□ Alive

□ Dead

□ Unknown

□ Referred

APPENDIX 4: KNH ETHICAL APPROVAL LETER



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725372
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/400

25th October, 2019

KENYATTA NATIONAL HOSPITAL APPROVED 25 OCT 2019 KNH/UoN-ERC

Dr. Mercy Saliku
Reg. No. H58/88900/2016
Dept. of Paediatrics and Child Health
School of Medicine
College of Health Sciences
University of Nairobi

Dear Dr. Saliku,

RESEARCH PROPOSAL: ADHERENCE TO NATIONAL GUIDELINES IN MALARIA-CASE MANAGEMENT AMONG PAEDIATRIC PATIENTS AT KAKAMEGA COUNTY REFERRAL HOSPITAL (P560/07/2019)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 25th October 2019 – 24th October 2020.

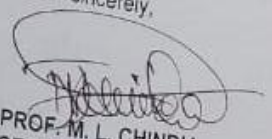
This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
d. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

Protect to discover

For more details consult the KNH- UoN ERC website http://www.erc.uonbi.ac.ke

Yours sincerely,



PROF. M. L. CHINDIA
SECRETARY, KNH-UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Dean, School of Medicine, UoN
The Chair, Dept. of Paediatrics and Child Health, UoN
Supervisors: Prof. Ruth Nduati (UoN), Dr. Lawrence Owino (UoN), Dr. Kumar Rashmi (UoN)

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ADHERENCE TO NATIONAL GUIDELINES IN MALARIA-CASE MANAGEMENT AMONG PAEDIATRIC PATIENTS AT KAKAMEGA COUNTY REFERRAL HOSPITAL by Dr Saliku Mercy

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