EFFECTIVENESS OF COUNSELLING ON THE USE OF ANTIMALARIALS AMONG CAREGIVERS ATTENDING HEALTH FACILITIES AT TANO DISTRICT

A THESIS SUBMITTED TO THE DEPARTMENT OF CLINICAL AND SOCIAL PHARMACY, FACULTY OF PHARMACY AND PHARMACEUTICAL SCIENCES, COLLEGE OF HEALTH SCIENCES, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

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DEDICATION

I dedicate this work to all the health-workers in the Tano South District who are fighting tooth and nail to reduce the malaria burden in the district

DECLARATION

I, DUUT BEDIMA, do hereby declare that

1. This dissertation is my own work towards the award of a Master of Science [Clinical Pharmacy] degree

2. To the best of my knowledge, this dissertation contains no material previously published by another person or material which has been accepted for the award of any other degree by this or any other university. Where specific references have been made, due acknowledgement has been given.

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ABSTRACT

Resistance of *Plasmodium falciparum* to cheap and commonly used anti-malaria drugs, such as chloroquine, has been the bane of most African countries including Ghana. This phenomenon is mainly due to the inappropriate use of these drugs. The impact of parasite resistance to anti-malaria drugs on patients, especially pregnant women and children under five years, has been devastating. Currently resistance to chloroquine in Ghana is estimated to be over 25%. Thus most malaria-striken patients treated with chloroquine do not experience improvement in their clinical status. The Ministry of Health of Ghana, in an effort to improve patient outcomes, introduced a new drug policy that recommends the use of artesunate-amodiaquine combination as a first line drug in the treatment of malaria. However the success of this policy also hinges on the appropriate use of the new drug by patients, prescribers and caregivers

This study examined the effectiveness of counselling on the use of antimalarials among caregivers attending health facilities in the Tano District. In this study, three variables [dose of drug, frequency of drug administration and duration of drug treatment] were used to assess whether or not respondents were effectively counselled on the use of anti-malarials. The study also assessed the effectiveness of counselling on malaria prevention and home-based remedies for malaria control.

Most respondents [63%] did not know how to treat malaria appropriately with anti-malaria drugs. Similarly the study revealed that over 62% of the respondents did not know how to treat fever appropriately with an antipyretic.

About 35.6% of the respondents did not know how often to administer anti-malarials and over 60% of them did not either know what quantity of anti-malarial to administer at all, or knew doses that were sub optimal or super optimal.

Also, only about 20% of the respondents knew the appropriate duration of anti-malaria drug treatment. Majority of the respondents could not tell how long they were to administer the anti-malarial they were supplied.

Though over 90% of respondents said they had been educated on malaria prevention, which includes use of ITNs, the percentage of children under five years who slept under an ITN the previous night, as reported by their caretakers, was only about 42%. Majority of respondents [about 58%] did not sleep under a treated bed net the previous night.

Over 92.3% of respondents said health workers counselled them on home-based care remedies for malaria control.

In conclusion, policy makers as well as health workers and all stakeholders must institute measures, in the light of these findings, to ensure that patients who are treated of malaria obtain the best out of that treatment. A child less than five years can only benefit from drug treatment if the caregiver knows how to administer the drug appropriately. Caregivers supplied with drugs must therefore be effectively counselled on the use of such drugs.

LIST OF ABBREVIATIONS

AMDP	Anti-Malaria Drug Policy
ARDS	Acute Respiratory Distress Syndrome
GDP	Gross Domestic Product
HBC	Home-Based Care
HIV/AIDS	Human Immuno-deficiency Virus/Acquired Immuned Deficiency Syndrome
IPT	Intermittent Presumptive Treatment
ITNs	Insecticide-Treated Nets
IRS	Indoor Residual Spraying
PCR	Polymerase Chain Reaction
RBM	Roll Back Malaria
RDTs	Rapid Diagnostic Tests
RUM	Rational Use of Medicines
WHO	World Health Organization

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CHAPTER ONE:
INTRODUCTION

1.1 EPIDEMIOLOGY OF MALARIA

Malaria is a disease caused by protozoa of the genus *Plasmodium*. The infection is transmitted by the bite of an infected female anopheles mosquito belonging to the genus *Anopheles*. There are three species of the *Anopheles* that transmit human malaria: *Anopheles gambiae, Anopheles arabiensis and Anopheles funestus*. The four species of the parasite that cause infection in humans are: *Plasmodium falciparum, P. vivax, P. ovale and P. africanum. P falciparum* is the commonest species in virtually all parts of Africa accounting for 90-98% of malaria cases. *P. falciparum* infection is associated with considerable morbidity and mortality. The other species, which include *P. malariae* and *P. ovale,* cause only up to 2% of malaria cases. *Plasmodium vivax* is rare in Africa.[i]

1.2 PEOPLE AT RISK OF MALARIA INFECTION

Malaria threatens the lives of over 40% of the world's population. According to the World Health Organization, some 3.2 billion people lived in areas at risk of malaria transmission in 107 countries and territories at the end of 2004. Pregnant women and children less than five years old are those mostly at risk of infection. Worldwide, between 350 and 500 million clinical episodes of malaria occur annually, and about 80% of malaria cases and more than 90% of malaria deaths occur in Africa, south of the Sahara. [ii]

Refugees and people who are internally displaced because of civil war and natural disasters are particularly vulnerable to epidemics of malaria[iii]. Afghanistan recorded over 300,000 cases in a year, as a result of interruption of malaria control activities and the displacement of the population due to war. In Sierra Leone, where health facilities have been destroyed and half of the health staff displaced because of war, almost half the patients seen at referral hospitals are

suffering from malaria.[iv] Other people at greater risk of malaria include immigrants, people with sickle cell anaemia or HIV/AIDS and visitors from non-malarious areas.

1.3 BURDEN OF MALARIA

Although the effect of malaria on people of all ages is immense, it is most serious among pregnant women and children aged less than five years. In areas of intense perennial malaria transmission, infants become vulnerable from the age of about three months when immunity acquired from the mother is wearing off.

Malaria causes anaemia through haemolysis and increased splenic clearance of infected and uninfected red blood cells, accompanied by a decreased production of red blood cells. Repeated episodes of malaria or failure to adequately clear parasites as a result of anti-malaria drug resistance may exacerbate anaemia, which can be fatal. An estimated 2% of children who recover from cerebral malaria suffer brain damage including epilepsy.[v] When malaria infection is not properly treated in pregnant women, it can lead to miscarriages, stillbirths, underweight babies and maternal deaths.[vi] Frequent cerebral malaria can lead to disabling neurological sequelae in children.

Malaria is one of the leading causes of death among young children especially in developing countries. Malaria is responsible for 25% of childhood deaths in Africa and accounts for 10% of the continent's disease burden. It is estimated that malaria kills between 1.5 million and 2.7 million people annually, majority of who are young children.[vii] While malaria contributed 2.05% to the total global deaths in 2000, it was responsible for 9.03% of all deaths in Africa in the same year. The World Health Organization [WHO] and the World Bank rank malaria as the largest single component of the disease burden in Africa, causing an annual loss of 35 million

future life-years from disability and premature mortality. In Africa, malaria is responsible for about 20-30% of hospital admissions and about 30-50% of outpatient consultations. [viii]

Malaria accounts for a reduction of 1.3% of the annual economic growth on the African continent. Malaria morbidity and mortality slow economic growth by reducing capacity and efficiency of the labour force. Malaria costs Africa an estimated amount of approximately US $12 billion in loss of gross domestic product (GDP) every year and consumes 40% of public health spending.[ix] It is estimated that a single episode of malaria in Ghana costs the household about US $15.79. Almost 53.4% of this total direct cost is spent on drugs.[x]

On the average economically active persons who suffer from malaria lose 9.03 workdays per episode, with males losing more time off than females. It prevents agricultural workers from planting and harvesting. It has been shown that malaria-inflicted families are able to harvest only 40% of their crops compared to healthier families.[xi] In addition, caretakers sacrifice an average of more than five workdays to care for the sick, who are mostly children. Malaria in school children is a major cause of absenteeism in endemic countries.

1.3.1 Malaria Burden in Ghana

In Ghana malaria is hyper endemic and accounts for over 44% of all outpatient attendance and over 22% of deaths in children less than five years. Crude parasite rates range from 80-90%. Over 3.5 million cases and 40,000 deaths are recorded every year; most of these are children under five years and pregnant women. It is estimated that over 45 children under five years and 7 pregnant women die of malaria daily in Ghana. [xii]

As noted earlier, the cost of malaria to both the household and the health system is substantial. A single episode of malaria in Ghana costs the household about US $15.79, most of it spent on drugs. [x]

1.3.2 Impact of Malaria Infection in Pregnancy

Pregnancy decreases immunity of women against many infectious diseases. Women who have developed protective immunity, in high transmission areas, against *P. falciparum* tend to lose this protection when they become pregnant [especially during the first and second pregnancies].

In high transmission areas, malaria infection during pregnancy can have adverse effects on both mother and foetus, including maternal anaemia, foetal loss, premature delivery, intrauterine growth retardation and delivery of low birth-weight infants [babies who weigh less than 2500 g]. Low birth weight is the greatest risk factor for neonatal mortality and a major contributor to infant mortality. Although many factors such as poor nutrition, anaemia and other infections contribute to low birth weight, malaria is the major causative factor of low birth weight. [ix]

In sub-Saharan Africa, malaria infection is estimated to cause 400,000 cases of severe maternal anaemia. Maternal anaemia contributes significantly to maternal mortality and causes an estimated 10,000 deaths per year. Malaria is a problem particularly for women in their first and second pregnancies and for women who are HIV- positive. [ix]

In low transmission areas, women generally do not develop any protective immunity to malaria disease. Malaria infection in these areas is more likely to result in severe malaria disease, maternal anaemia, premature delivery, or foetal loss.

The WHO in its effort to reduce the global malaria burden launched the *Roll Back Malaria [RBM]* initiative in 1998. The overall goal of the initiative is to reduce the malaria burden by 50% by 2010 of the 2000 levels.[xiii] Four main strategic components are pursued under this initiative. These are

i. Improved Malaria Case Management
ii. Multiple Prevention
iii. Focused Research
iv. Improved Partnerships

1.4 OCCURRENCE AND DISTRIBUTION

The occurrence and distribution of malaria depends mainly on climatic, host and vector factors.

1.4.1 Climatic Factors

Climatic factors such as temperature, rainfall and humidity determine the seasonality and geographical distribution of malaria. Climate can influence all the components of the life cycle of the vector, parasite and the behaviour of the human host. Human behaviours between dusk and dawn [when the vector is most active] may increase contact with *Anopheles* mosquitoes. During harvest seasons, agricultural workers might sleep in open fields without protection against mosquito bites.[xiv]

Temperature

Malaria is mostly a disease of hot climate and therefore temperature is particularly critical in its epidemiology. The disease is transmitted in the tropical and subtropical areas where *Anopheles* mosquitoes can survive and multiply. Generally, in warmer regions closer to the equator transmission is more intense and malaria is transmitted all year-round. Hot weather may encourage people to sleep outdoors or discourage them from using treated bed nets.[xiv]

At temperatures below 20°C, *Plasmodium falciparum* [which causes the severe form of malaria] cannot complete its growth cycle in the *Anopheles* mosquito, and thus cannot be transmitted. Once adult mosquitoes have emerged, the ambient temperature will determine the chance of their survival. To transmit malaria successfully, female *Anopheles* mosquitoes must survive long enough after they have become infected [through a blood meal on an infected human being] to allow the parasite they now harbour to complete their growth cycle. That cycle takes between 9-21 days at 25°C. Warmer ambient temperatures shorten the duration of the extrinsic cycle, thus increasing the chances of transmission. Conversely below a minimum ambient temperature of 15°C the extrinsic cycle cannot be completed and malaria cannot be transmitted. This explains in part why malaria transmission is greater in warmer areas of the globe, particularly for *P. falciparum.* [xiv]

Rainfall

Rainfalls create collections of water [breeding sites] where *Anopheles'* eggs are deposited, and larvae and pupae develop into adulthood [a process that takes approximately 9-12 days in tropical areas]. Such breeding sites may dry up prematurely in the absence of further rainfall, or conversely they can be flushed and destroyed by excessive rains. The anopheles mosquito breeds in clean, calm water collections. Breeding increases dramatically in the rainy season because many artificial water collections occur at

i. Domestic sources such as empty bottles, cans, buckets
ii. Irrigation sites and water sources such as wells, dams, water tanks
iii. Construction sites

Even after adult mosquitoes have emerged the amount of rains will determine their chances of survival. As stated earlier, the female *Anopheles* must survive long enough to be able to transmit

malaria. This survival also requires a certain amount of water. In Ethiopia repeated epidemics in highland areas, which were previously not vulnerable, were attributed to high rainfall patterns and degraded environment. [ix]

1.4.2 Vector Factors

The types [or species] of *Anopheles* mosquitoes present in an area at a given time will influence the intensity of malaria transmission. Not all *Anopheles* species are good or effective vectors for transmitting malaria from one person to another. Some species are biologically unable to carry human malaria parasites, whilst others are readily infected and produce large numbers of sporozoites [the parasite stage that infect humans].

Different *Anopheles* species may differ in selected behaviour traits, with important consequences on their abilities as malaria vectors. In some species, the females prefer to get their blood meals from humans [anthropophilic] while in others they prefer other animals [zoophilic]. Some species prefer to bite indoors [endophagic], and others prefer outdoor biting [exophagic]. All other factors being equal, the anthropophilic, endophagic species will have more frequent contacts with humans and thus will be more effective malaria vectors. Some species prefer to rest inside the dwellings where they have just obtained their blood meals [endophilic] while others prefer to rest outdoors [exophilic]. All theses have an effect on the rate of transmission of malaria.[xv]

1.4.3 Host [Human] Factors

Biologic characteristics and behavioural traits of an individual can influence his risk of developing malaria and, on a larger scale, the intensity of transmission in a population.

Behavioural Factors

Human behaviour, often dictated by social and economic reasons, can influence the risk of malaria for individuals and communities. For example poor rural populations often cannot afford the housing and bed nets that would protect them from exposure to mosquitoes. These persons often lack the knowledge to recognize symptoms of malaria and to treat it promptly and correctly. Often, cultural beliefs result in use of traditional and ineffective methods of treatment. Even when people know what to do, they often cannot do it because of financial reasons [for instance when there is no money to buy drugs] or physical impossibility [e.g. the nearest health post may be so many kilometres away].

Human activities can create breeding sites [standing waters, irrigation ditches, burrow, pits, etc] for larvae. Agricultural work such as harvesting may increase the time of exposure to mosquito bites. Raising domestic animals near the household may provide alternate sources of blood meals for *Anopheles* mosquitoes and thus decrease human exposure to mosquitoes. [xv]

Genetic Factors

Biological characteristics present from birth can protect against certain types of malaria. Two genetic factors, both associated with human red blood cells, have been shown to be epidemiologically important.

i. Persons who have the sickle cell trait [heterozygotes for the abnormal haemoglobin gene HbS] are relatively protected against *P. falciparum* malaria and thus enjoy a biologic advantage. Due to the fact the sickle cell trait is now more frequently found in Africa and in persons of African ancestry, than in other population groups, as a response to the high malaria infection on the continent.

ii. People who are negative for the Duffy blood group have red blood cells that are resistant to infection by *P. vivax*. Since the majority of Africans are Duffy negative, *P. vivax* is rare in sub Saharan Africa, especially in West Africa. In West Africa the niche of *P. vivax* has been taken over by *P. ovale*, a very similar parasite that does infect Duffy-negative persons.

Acquired Immunity

Acquired immunity greatly influences how malaria affects an individual and a community. After repeated attacks of malaria, a person develops a partially protective immunity. Such semi-immune persons can often still be infected by malaria parasites but they do not develop severe disease and, in fact, frequently lack any typical malaria symptoms.

Newborns in areas with high *P. falciparum* transmission, e.g. in sub Saharan Africa, are protected during the first few months of life presumably by maternal antibodies transferred to them through the placenta. As these antibodies decrease with time, these young children become vulnerable to disease and death by malaria. If they survive to an older age they will acquire some protective immunity.[xvi]

1.5 PATTERNS OF MALARIA ENDEMICITY

The patterns of malaria endemicity in any area can be described as stable, unstable or malaria-free.

i. Stable malaria areas – these are areas where malaria is transmitted all year round, but may have seasonal variations. Adults living in these areas usually acquire partial immunity to malaria. In Ghana malaria transmission can be described as stable.

ii. Unstable malaria areas – these areas are characterized by intermittent transmission of malaria, which may be annual, bi-annual or variable. People living in these areas have poor immunity against malaria.

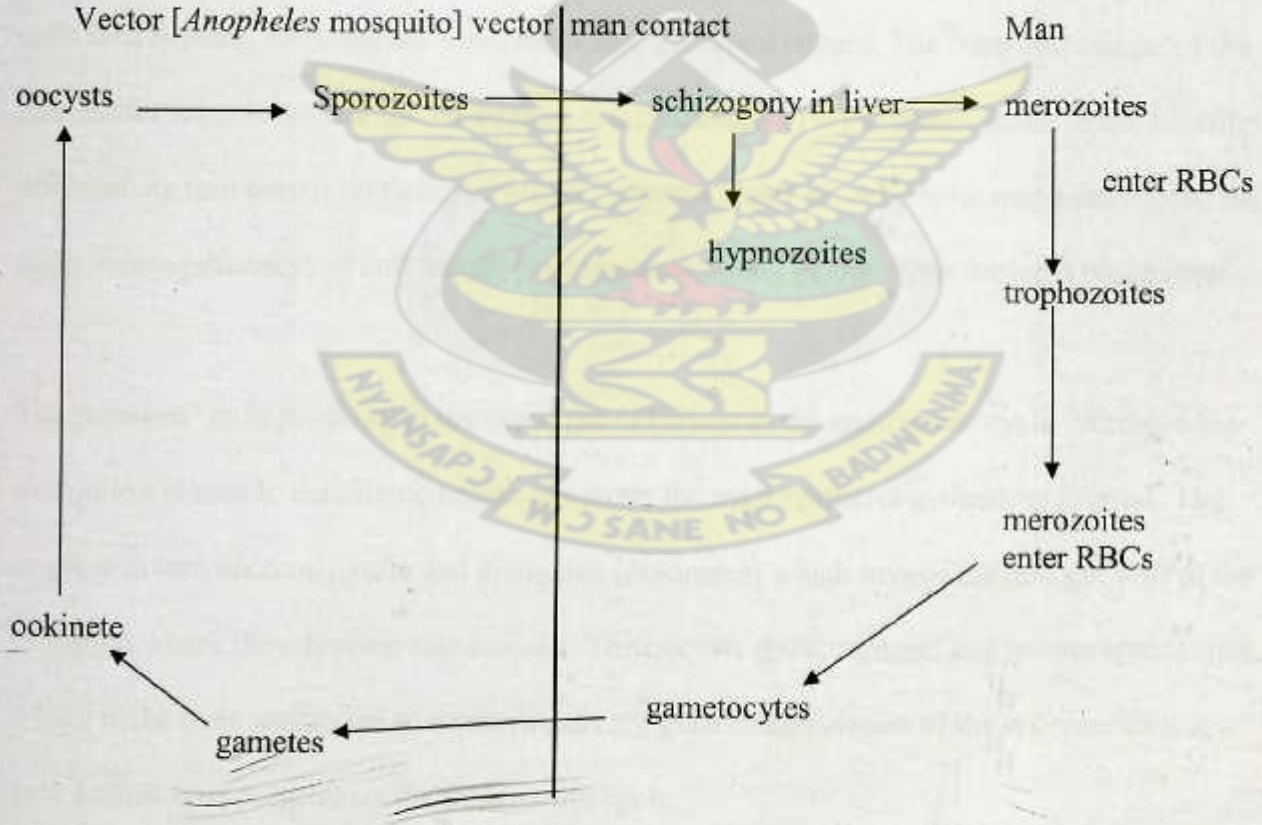
iii. Malaria-free areas – these are areas where malaria is not a public health problem. People living in these areas have no immunity to malaria and are therefore prone to severe malaria.

1.6 LIFE CYLE OF THE MALARIA PARASITE

Malaria is transmitted through the bite of an infected female *Anopheles* mosquito, and occasionally through blood transfusion. Thus the mosquito carries the plasmodium parasite from one human to another [acting as a vector]. The mosquito vector, unlike the human host, does not suffer from the effect of the parasites.[1]

The life cycle of the malaria parasite is in two stages; the first stage occurs in the host [man] and the second stage occurs in the vector [*Anopheles* mosquito]. Below is the life cycle of the parasite:

Schematic Presentation of the Life Cycle of the *Plasmodium* Parasite



When an infective female *Anopheles* mosquito bites its victim, it sucks up blood. If the person has malaria, some of the parasites in the blood will be sucked into the mosquito. The malaria parasites multiply and develop in the mosquito into sporozoites. After 10-18 days the

sporozoites mature, migrate into the salivary glands of the mosquito and are ready to be transmitted to another person.

During a blood meal, a malaria-infected female *Anopheles* mosquito inoculates the sporozoites into the human host. These sporozoites infect liver cells and mature into schizonts, by a process called schizogony. The liver cells rupture and release merozoites into the blood stream. In *P. vivax* and *P. ovale* infection, a dormant stage [hypnozoites] can persist in the liver and cause relapses by invading the bloodstream weeks, or even years later. After this initial replication in the liver [exo-erythrocytic schizogony], the parasites infect red blood cells and undergo asexual multiplication in the erythrocytes (erythrocytic schizogony). Within the erythrocyte, the parasites develop into the ring stage [trophozoites] that later mature into schizonts. The blood cells then rupture, releasing the merozoites into the blood stream. The burst and release of the merozoites are responsible for the clinical manifestations of the disease. Some of the parasites differentiate into sexual erythrocytic stages [gametocytes]. An *Anopheles* mosquito ingests the male [microgametocytes] and female [macrogametocytes] gametocytes during a blood meal.

The parasites' multiplication in the mosquito is known as the sporogonic cycle. Whilst in the mosquito's stomach, the microgametes penetrate the macrogametes generating zygotes. The zygotes in turn become motile and elongated [ookinetes] which invade the mid gut wall of the mosquito where they develop into oocysts. The oocysts grow, rupture, and release sporozoites, which make their way to the mosquito's salivary glands. Inoculation of the sporozoites into a new human host perpetuates the malaria life cycle.

1.7 MANAGEMENT OF MALARIA

The management of malaria is a process that includes the following elements:

i. Early recognition of symptoms

ii. Prompt diagnosis and effective treatment

iii. Education of the patient or caregiver

Persons who are sick with malaria should be treated promptly and correctly. Treatment eliminates an essential component of the parasite's cycle and thus interrupts the transmission cycle. Malaria is often a debilitating disease that, when caused by *Plasmodium falciparum*, can be fatal.

The World Health Organization recommends that anyone suspected of having malaria should receive diagnosis and treatment with an effective drug within 24 hours of the onset of symptoms. When the patient cannot have access to a health care provider within that period [as is the case for most patients in malaria-endemic areas], home treatment is acceptable.

Malaria can be categorized as uncomplicated or severe. In general, malaria is a curable disease if diagnosed and treated promptly and correctly. Treatment of both uncomplicated and severe malaria consists of pharmacological treatment [including the use of antipyretics] and non-pharmacological or supportive treatment [including referrals].

The delay in the diagnosis and inappropriate treatment of uncomplicated malaria, especially in infants and children, leads to rapid development of severe malaria. Thus the primary goals of assessment and treatment of uncomplicated malaria are to avoid progression to severe disease and limit the duration of disease. Effective use of anti-malaria drugs minimizes the risk of developing drug resistance. Similarly, in severe malaria the objective of management is to prevent deaths from the direct effect of the disease or its complications by the prompt use of appropriate emergency supportive measures and the recommended anti-malaria drug. When

malaria infection is not properly treated in pregnant women it can cause anaemia and lead to miscarriages, stillbirths, underweight babies and maternal deaths. [v]

The anti-malaria drug of choice in any country usually depends on the National Anti-Malaria Drug Policy of that particular country. In most cases however any anti-malaria drug chosen, among other factors, would incorporate the following factors. The anti-malaria drug should

i. Rapidly relieve the symptoms of the disease
ii. Be harmless to the patient and have no unpleasant side effects
iii. Preferably destroy all the stages of the malaria parasite including the gametocytes
iv. Be relatively cheap and easy to administer

1.7.1 Presumptive Treatment

In highly endemic areas [particularly in Africa], the high prevalence of asymptomatic infections and lack of resources [such as microscopes and trained personnel] have led peripheral health staff to use "presumptive treatment". Patients who suffer from a fever that does not have any obvious cause are presumed to have malaria and are treated for that disease, based only on clinical suspicion, and without the benefit of laboratory confirmation. This practice is dictated by practical considerations and allows the treatment of a potentially fatal disease. But it also leads frequently to incorrect diagnoses and unnecessary use of anti-malaria drugs. This results in additional expenses and increases the risk of development of drug-resistant parasites

1.8 CLINICAL FEATURES OF MALARIA

Following the infective bite by an *Anopheles* mosquito, a period [the incubation period] goes by before the first symptoms appear. The incubation period in most cases varies from 7-30 days. The shorter periods are observed most frequently with *P. falciparum* and the longer ones with *P.*

malariae. The first attacks are usually more severe and may persist for weeks, if untreated. Relapse occurs when parasites persisting in the liver reinvade the blood stream.

Infection with malaria parasites may result in a wide variety of symptoms, ranging from absent or very mild symptoms to severe disease and even death. Malaria characteristically presents with high-grade fever. In areas of high malaria transmission malaria is the commonest cause of fever in young children. Patients may complain of headache, muscle pains, joint weakness, chills and rigours. In most cases patients may just feel unwell or tired with loss of appetite. In young children they may complain of abdominal pain, vomiting and anorexia. Children may refuse to eat or feed, have decreased activity or sometimes symptoms may be non-specific.

1.8.1 Uncomplicated Malaria

A classical malaria attack lasts 6-10 hours. It consists of

i. a cold stage [sensation of cold, shivering]
ii. a hot stage [fever, headaches, vomiting; seizures in young children]
iii. a sweating stage [sweats, return to normal temperature, tiredness]

The classical attacks occur every second day with the "tertian" parasites [*P. falciparum*, *P. vivax*, and *P. ovale*] and every third day with the "quartan" parasite [*P. malariae*].

In uncomplicated malaria the patient usually presents with a combination of symptoms that include fever, chills, sweats, headaches, nausea and vomiting, body aches and general malaise. These symptoms may be attributed to influenza, a cold, or other common infections, especially if malaria is not suspected. In countries where malaria is frequent, residents often recognize the symptoms of malaria and treat themselves without seeking diagnostic confirmation [presumptive treatment].

Physical findings may include elevated temperature, perspiration, weakness and enlarged spleen. In *P. falciparum* malaria, additional findings may include mild jaundice, enlargement of the liver and increased respiratory rate.

1.8.2 Severe Malaria

Severe malaria occurs when *P. falciparum* infections are complicated by serious organ failures or abnormalities in the patient's blood or metabolism. The manifestations of severe malaria include:

i. Cerebral malaria, with abnormal behaviour, impairment of consciousness, seizures, coma, or other neurological abnormalities
ii. Severe anaemia due to haemolysis
iii. Haemoglobinuria due to haemolysis
iv. Pulmonary oedema or Acute Respiratory Distress Syndrome [ARDS], which may occur even after the parasite counts have decreased in response to treatment
v. Abnormalities in blood coagulation and thrombocytopoenia
vi. Cardiovascular collapse and shock

Other manifestations that should raise concern are: acute kidney failure, hyperparasitaemia [where more than 5% of the red blood cells are infected by malaria parasites], metabolic acidosis and hypoglycaemia. Hypoglycaemia may also occur in pregnant women with uncomplicated malaria, or after treatment with quinine.

Severe malaria occurs most often in persons who have no immunity to malaria or whose immunity has decreased. These include all residents of areas with low or no malaria transmission, and young children and pregnant women in areas with high transmission. In all areas, severe malaria is a medical emergency and should be treated urgently and aggressively.

1.8.3 *Malaria Relapses*

In *P. vivax* and *P. ovale* infections, patients having recovered from the first episode of illness may suffer several additional attacks [relapses] after months or even years without symptoms. Relapses occur because *P. vivax* and *P. ovale* have dormant liver stage parasites [hypnozoites] that may become active.

1.8.4 *Other Clinical Manifestations of Malaria*

Neurological defects may occasionally persist following cerebral malaria, especially in children. Such defects include trouble with movements [ataxia], palsies, speech difficulties, deafness, and blindness. Recurrent infections with *P. falciparum* may result in severe anaemia. This occurs especially in young children in tropical Africa with frequent infections that are inadequately treated.

Nephrotic syndrome [a chronic, severe kidney disease] can result from chronic or repeated infections with *P. malariae*. Hyperactive malarial splenomegaly [also called 'tropical splenomegaly syndrome'] occurs infrequently and is attributed to an abnormal immune response to repeated malaria infections. The disease is marked by a much enlarged spleen and liver, abnormal immunologic findings, anaemia and a susceptibility to other infections [such as skin or respiratory infections].

1.9 DIAGNOSIS OF MALARIA

Malaria must be recognized promptly in order to treat the patient in time and to prevent further spread of infection in the community. Malaria can be diagnosed either clinically or by laboratory analyses. Diagnosis of malaria can however be difficult under the following conditions:

i. Where malaria is not endemic any more [such as the United States]. In this case the health care providers are not familiar with the disease, so clinicians seeing a malaria patient may forget to consider malaria among the potential diagnoses and may not order the needed diagnostic tests. Laboratory personnel may lack experience with malaria microscopy and can fail to detect parasites when examining blood smears under the microscope.

ii. In areas where malaria transmission is so intense that a large proportion of the population is infected but not made ill by the parasites. Such people are carriers. Carriers have developed just enough immunity to protect them from malaria illness but not from malaria infection. In that situation, finding malaria parasites in an ill person does not necessarily mean that the illness is caused by the parasites.

iii. In many malaria-endemic countries where lack of resources is a major barrier to reliable and timely diagnosis. Health personnel are under trained, under equipped and underpaid. They often face excessive patient loads, and must divide their attention between malaria and other equally severe infectious diseases such as pneumonia, diarrhoea, tuberculosis and HIV/AIDS.[xvii]

Differential diagnoses of malaria include meningitis, encephalopathy, diabetes mellitus, septicaemia and epilepsy.

1.9.1 Types of Diagnosis

Clinical Diagnosis

Malaria is diagnosed clinically based on the patient's symptoms and the physical findings at examination. Due to the absence of laboratory facilities in the majority of health centres in malaria endemic areas, most diagnoses are made on the presence or history of fever. [xiii] Even where there are laboratory facilities, a negative blood film does not exclude malaria. As fever is non-specific this often leads to over prescription of anti-malaria drugs. The presumption of

malaria in patients with fever may also make clinicians miss other possible causes of fever. In areas with stable or high malaria transmission such as Ghana, a history or recent history of fever is enough a criterion for the diagnosis of uncomplicated malaria. In children and pregnant women the presence of pallor without any other cause is also taken as malaria.

Laboratory Diagnosis

The definitive diagnosis of malaria can only be made with microscopy and the presence of malaria parasites in the blood. In *P. falciparum* malaria, additional laboratory findings may include mild anaemia, mild decrease in blood platelets [thrombocytopaenia], elevation of bilirubin and aminotransferases, albuminuria and the presence of abnormal bodies in the urine [urinary casts]. Laboratory diagnosis may also involve antigen detection or polymerase chain reaction [PCR].

Laboratory Microscopy

Malaria parasites can be identified by examining, under the microscope, a drop of the patient's blood, spread out as a "blood smear" on a microscope slide. Prior to examination, the specimen is stained [most often with the Giemsa stain] to give the parasites a distinctive appearance. This technique remains the gold standard for laboratory confirmation of malaria. However, the success of the technique depends on the quality of the reagents, the microscope and the experience of the laboratory technologist.

Laboratory Molecular Diagnosis

Parasite nucleic acids are detected using polymerase chain reaction [PCR]. This technique is more accurate than microscopy. It is however expensive and requires a specialized laboratory.

Antigen Detection

Various test kits are available to detect antigens derived from malaria parasites. Such immunologic tests most often use a dipstick or cassette format, and provide results in 2-10

minutes. These "Rapid Diagnostic Tests" (RDTs) offer a useful alternative to microscopy in situations where reliable microscopic diagnosis is not available.

1.10 CONTROL OF MALARIA

The control of malaria entails improving malaria case management and the use of multiple prevention measures. The four elements of malaria control are

i. Intermittent Preventive or Presumptive Treatment [IPT] using anti-malaria drugs
ii. Insecticide-Treated Nets [ITNs]
iii. Malaria Case Management
iv. Vector control

Each of these interventions is considered safe, effective, affordable and deliverable.

1.10.1 Vector Control

Vector control aims to decrease contacts between humans and the *Anopheles* vector. Control of mosquitoes may prevent malaria as well as several other mosquito-borne diseases. Elimination of malaria in an area does not necessarily require the elimination of all *Anopheles* mosquitoes capable of transmitting the disease. In North America and Europe, *Anopheles* mosquitoes capable of transmitting malaria are still present but the parasite has been eliminated.[iii] Socio-economic improvements [e.g. houses with screen windows and air conditioning] combined with vector reduction efforts and effective treatments have led to the elimination of malaria without the complete elimination of the vectors. Vector control for the prevention of malaria includes

i. Source reduction [larval control]
ii. Indoor Residual Spraying
iii. Use of Insecticide-Treated bed Nets

Source Reduction [Larval Control]

Source reduction is the method of choice for mosquito control when the mosquito species targeted are concentrated in a small number of discrete habitats. The larval habitats may be destroyed by filling depressions that collect water, draining swamps, or by ditching marshy areas to remove standing water. Container-breeding mosquitoes are particularly susceptible to source reduction, as people can be educated to remove or cover standing water in cans, cups and rain barrels around houses. Mosquitoes that breed in irrigation water can be controlled through careful water management.

For some mosquito species, habitat elimination is not possible. For these species, chemical insecticides can be applied directly to the larval habitats. Other methods, which are less disruptive to the environment, are usually preferred. These include the following:

i. Oils may be applied to the water surface, suffocating the larvae and pupae. Most oils in use today are rapidly biodegraded

ii. Biological control agents include toxins from the bacterium *Bacillus thuringiensis* var. *israelensis* (Bti). These products can be applied in the same way as chemical insecticides. They are very specific, affecting only mosquitoes, black flies and midges.

iii. Insect growth regulators such as methoprene can be applied in the same way as chemical insecticides. Methoprene is specific to mosquitoes

iv. Mosquito fish (*Gambusia affinis*) are effective in controlling mosquitoes in larger bodies of water.

v. Other potential biological control agents, such as fungi [e.g. *Laegenidium giganteum*] or mermithid nematodes [e.g. *Romanomermis culicivorax*] are less efficient for mosquito control and are not widely used.

Source reduction is an ideal approach to mosquito control. Mosquito larvae are concentrated in defined areas, and source reduction eliminates mosquitoes before they reach the stage that is responsible for disease transmission. Unfortunately, source reduction is not always feasible. The larval habitats may be small, widely dispersed and transient. *Anopheles gambiae*, one of the primary vectors of malaria in Africa, breeds in numerous small pools of water that form due to rainfall. The larvae develop within a few days, escaping their aquatic environment before it dries out. It is difficult, if not impossible, to predict when and where the breeding sites will form, and to find and treat them before the adults emerge. Therefore, larval mosquito control for the prevention of malaria in Africa has not been attempted on a large scale.

Indoor Residual Spraying

Many malaria vectors are endophilic, resting inside houses after taking a blood meal. These mosquitoes are particularly susceptible to control through indoor residual spraying [IRS]. For several months, the insecticide will kill mosquitoes and other insects that are exposed to surfaces on which the insecticide is sprayed.

IRS does not directly prevent people from being bitten by mosquitoes. Rather it usually kills mosquitoes after they have fed, if they come to rest on the sprayed surface. IRS thus prevents transmission of infection to other persons. To be effective, IRS must be applied to a very high proportion of households in an area [usually >70%]. Though there are concerns about the high cost of IRS and environmental safety of the residual insecticides, IRS is currently used in many parts of the country.

Insecticide-Treated Bed Nets

Insecticide-treated bed nets [ITNs] are a form of personal protection that has repeatedly been shown to reduce severe disease and mortality due to malaria in endemic regions. In community-

wide trials in several African countries, ITNs have been shown to reduce all-cause child mortality by about 25%. [xix]

Untreated bed nets form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even few small holes provide little, if any, protection. The application of a residual insecticide greatly enhances the protective efficacy of bed nets. The insecticides used for treatment kill mosquitoes and other insects. The insecticides also have repellent properties that reduce the number of mosquitoes that enters the house and attempt to feed. In addition, if high community coverage is achieved, the numbers and longevity of mosquitoes will be reduced. When this happens, all members of the community are protected, regardless of bed net ownership.

1.11 JUSTIFICATION FOR THE STUDY

In Ghana malaria is hyper endemic with crude parasite rates ranging from 80-90%, [xi] with *P. falciparum* dominating. Malaria is the number 1 cause of morbidity and accounts for between 40-60% of outpatient attendance in public health facilities in Ghana. It is estimated that about 3.5 million cases of malaria are reported annually in Ghana, and almost 10% of the patients who report with malaria are usually admitted. [xi]

Malaria is a major killer and the leading cause of mortality in children under five years in Ghana. On the average, the disease accounts for 13.2% of all deaths and 22% of deaths in children under five. In pregnant women, 13.8% of those who report at health facilities suffer from malaria and 9.4% of all deaths in pregnant women are malaria-related.[xviii, xi]

In the Tano district of the Brong-Ahafo region of Ghana, malaria constitutes 59% of outpatient attendance, 30% of all admissions and over 8% of all deaths.[xix] Deaths occur because of lack of access to health care, life-saving drugs and insecticide treated nets. Effective case management of malaria at home by caregivers can reduce deaths due to malaria in children under five years and pregnant women.[xx] One of the major sources of information, to caregivers, on malaria treatment is counselling by health workers when health workers and caregivers interact.

It is therefore imperative to determine whether or not caregivers are effectively counselled on malaria control. This would enable us design appropriate strategies to reduce the malaria burden in the country. This dissertation assesses the effectiveness of counselling on the use of anti-malaria drugs among caregivers attending public health facilities in Tano District

1.12 OBJECTIVES OF THE STUDY

1.12.1 Aim

The main objective of the study is to assess the effectiveness of counselling on the use of anti-malarials among caregivers in the management of malaria in children under five years and make recommendations for improvement in patient outcomes.

1.12.2 Specific Objectives

i. To assess caregivers' understanding of malaria medication

ii. To determine the percentage of children with malaria who are started on home treatment before being sent to the clinic

iii. To determine whether or not caregivers are educated on home-based care for malaria

iv. To determine the proportion of children who sleep under insecticide-treated bed nets

1.12.3 Expected Outcomes

i. The proportion of children with malaria who are first started on home-based treatment would be known

ii. The understanding of caregivers of malaria medication would be assessed

iii. Whether or not health workers counsel caregivers on home-based remedies for malaria would be determined

iv. The proportion of children who sleep under treated bed nets would be determined

CHAPTER TWO

2.1 METHODS

2.2 Study Site

The study was conducted in public health facilities located in the Tano District of the Brong-Ahafo Region, Ghana.

2.3 Target Population

This was a descriptive study that involved the exit interview of caregivers of children aged 0-5years. The study population consisted of caregivers of children aged 0-5years with malaria who attended health facilities during the month of March 2006

2.4 Sample Population

For this kind of study, the WHO recommends the inclusion of at least 30 randomly selected patient records.[xxi] A total of fifty-two caregivers were interviewed.

Due to resource constraints, three government health care facilities were chosen. Of the government health care facilities, one hospital and two health centres were selected for the study. As a government policy all the health workers in these facilities were trained on Rational Use of Medicines [RUM] and on Roll Back Malaria [RBM]

2.5 Inclusion Criteria

i. Caregivers of children aged 0-5years were included in the study. This is because children in this age group are the most vulnerable to malaria disease.

ii. Caregivers without any formal education were included in this study. This was intended to remove the bias that formal education might introduce into the results.

2.6 *Exclusion Criteria*

Caregivers who were not living within the district were excluded. This was to prevent a situation where it would be very difficult to follow-up on respondents, if the need arose.

2.7 *Operational Definitions*

i. Adequate Knowledge: the ability of a respondent to demonstrate how to give or take an anti-malaria drug in the right dose, frequency and for the right duration [in other words the ability of a respondent to administer the drug in the right quantity, at the right time and for the appropriate length of time]

ii. Inadequate Knowledge: the inability of a respondent to demonstrate how to give or take an anti-malaria drug either in the right dose, frequency or for the right duration.

iii. Home-Based management of malaria – this involves the administration of appropriate remedies, at home, by caregivers who recognize signs and symptoms of malaria with the aim of assuaging such symptoms or treating the malaria before seeking treatment at health facilities

2.8 *Data Collection*

Data was collected using a designed questionnaire. The questionnaire was administered to the caregivers at the point of exit, after attending a public health facility.

2.9 *Data Analyses*

The data was entered and analysed using EPI Info Software.

3.0 RESULTS

The results are set out below

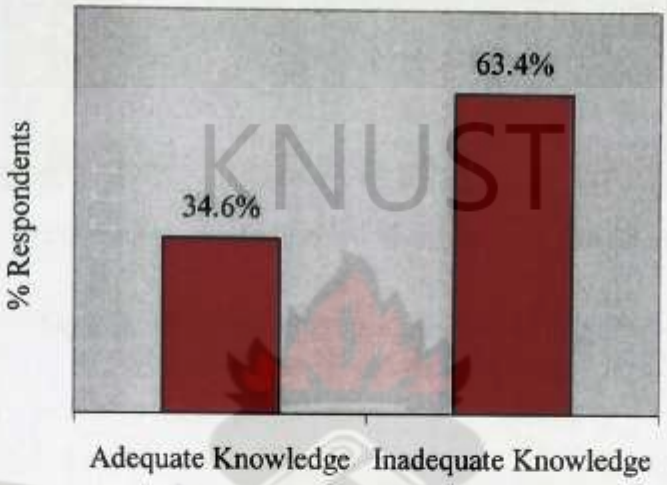


Fig 3.1: Knowledge of Caregivers on How to Appropriately Treat Malaria with Anti-malarial

The figure above shows the percentage of respondents who know how to treat malaria *appropriately* with an anti-malarial. In assessing the *appropriateness* of knowledge, three variables of the drug were used. These are the

i. dose of the drug
ii. frequency of administration and
iii. duration of treatment

Knowledge of all three was scored as adequate and if otherwise, it was scored as inadequate. From the graph, over 63% of the respondents did not have adequate knowledge on how to appropriately treat malaria with an anti-malaria drug.

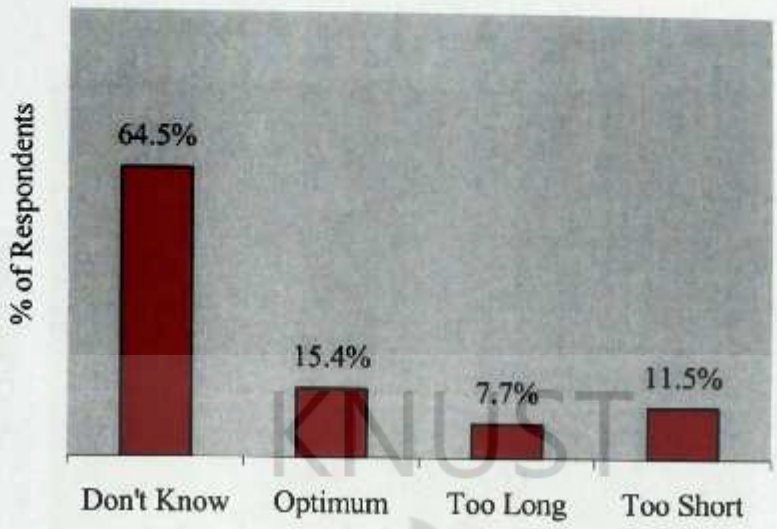


Fig 3. 2: Knowledge of Caregivers about the Duration of Anti-malaria Drug Treatment

The figure above shows the knowledge of caregivers about the duration of treatment with an anti-malaria drug. Only 15.4% of the respondents knew the appropriate duration of anti-malaria drug treatment. Majority of respondents could not tell how long they were to administer the anti-malaria drug.

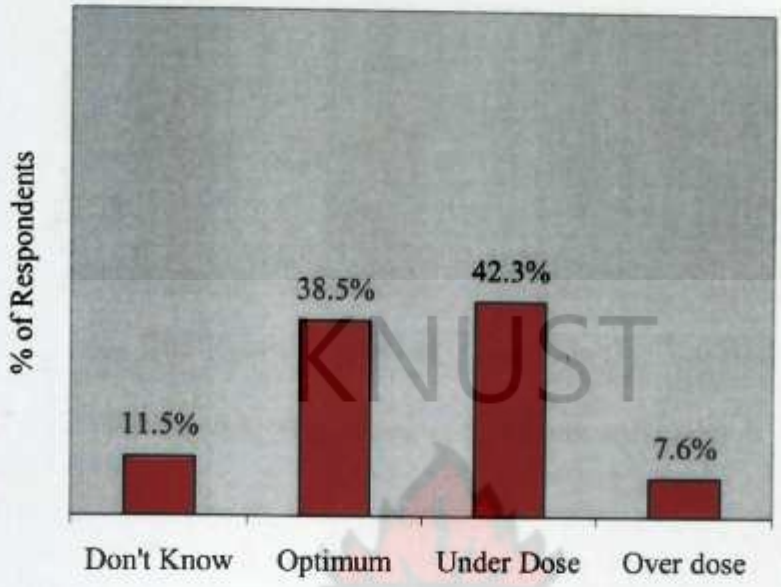


Fig 3.3: Knowledge of Caregivers about the Dosage of Anti-malarials

The figure above shows the knowledge of caregivers about the appropriate dose of an anti-malaria drug to administer. Less than 40% of the respondents knew the appropriate dose of anti-malaria drug to administer. Over 60% of the respondents either did know what quantity to administer at all, or knew doses that were sub or super-optimal.

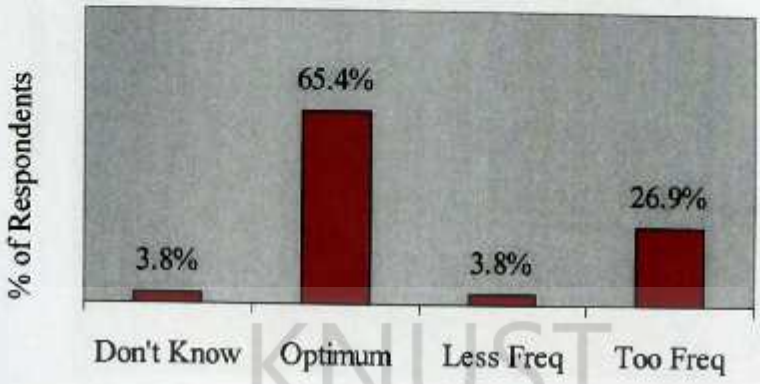


Fig 3.4: Knowledge of Caregivers about the Frequency of Anti-malaria Drug Treatment

The figure above shows the knowledge of caregivers about the frequency of treatment with an anti-malaria drug. Only 65.4% of the respondents correctly knew how often to administer an anti-malarial.

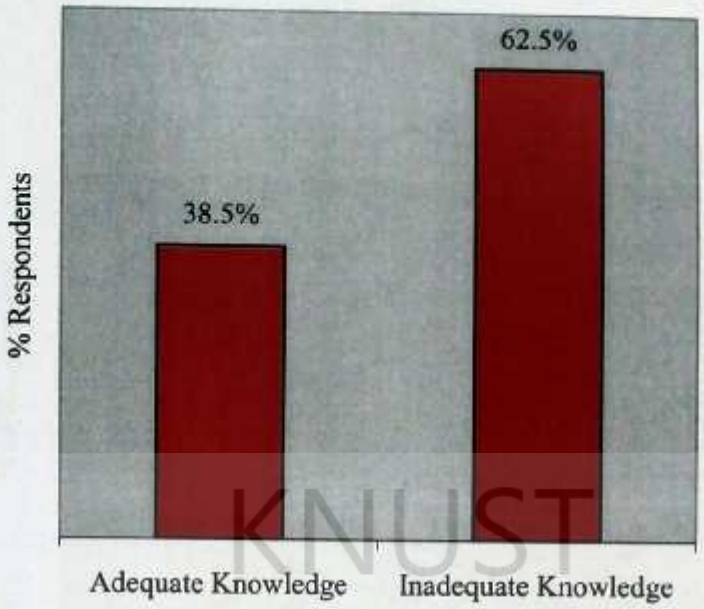


Fig 3.5: Knowledge of Caregivers on How to Appropriately Treat Pyrexia with Anti-pyretic

The figure above shows the percentage of caregivers who know how to treat pyrexia *appropriately* with an anti-pyretic. In assessing *appropriateness* of this knowledge, three variables of the drug were used. That is, the

i. dose of the drug
ii. frequency of administration and
iii. duration of treatment

Knowledge of all three was scored as adequate and if otherwise, it was scored as inadequate.

From the graph, approximately 63% of the respondents did not know how to treat fever appropriately with an antipyretic.

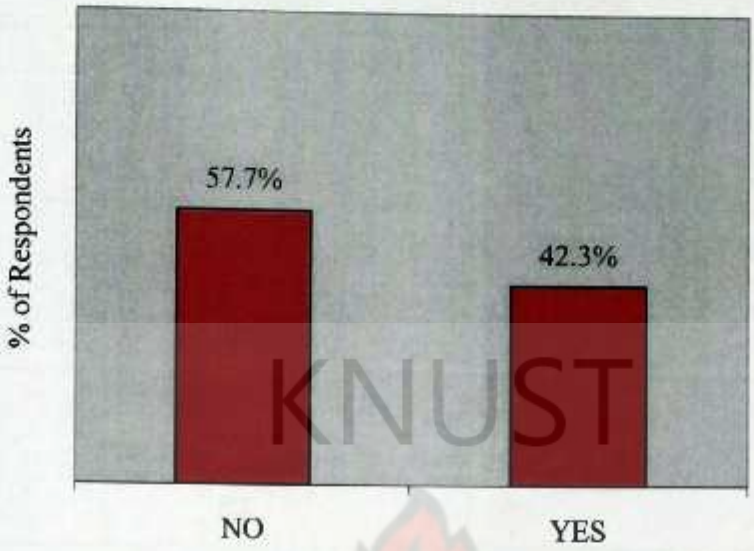


Fig 3.6: % of Caregivers' Children Who Slept under ITN the Previous Night

The figure above shows the percentage of children under five years who, as reported by the caregivers, slept under an ITN the previous night. Majority of respondents [over 57%] said their children did not sleep under a treated bed net the previous night.

TABLE 1: Respondents Educated on Home-Based Care by Health Workers

	Frequency	Percentage
No	4	7.7
Yes	48	92.3
Total	52	100

The table above shows the percentage of respondents who were educated on home-based remedies in the treatment of malaria. From the table, health workers counselled over 90% of respondents on home-based remedies for malaria control.

TABLE 2: Patients Treated with different Anti-malaria Drugs

No	Drug	Frequency	Percentage
1	Chloroquine	29	55.8
2	Artesunate + Amodiaquine	15	28.8
3	Others	8	15.4
Total		52	100

The table above shows the frequency of people treated with chloroquine and other anti-malarials.

CHAPTER THREE

3.1 DISCUSSION

Adequate Treatment of Malaria with Anti-malaria Drugs

Proper malaria case management continues to be one of the main strategies for malaria control in Ghana. Treatment of malaria has been presumptive; parasitological diagnosis being reserved for severe malaria and treatment failure. Adequate treatment of malaria is essential if we are to avoid drug resistance and treatment failures[xxii]. Widespread drug resistance against commonly used anti-malaria drugs is as a result of inappropriate use of these drugs. [ii]

Currently, the drug of choice is artesunate-amodiaquine combination. However, if this drug is not used according to the Ghana Standard Treatment Guidelines [STG] the parasites will soon develop resistance. The study revealed that about 56% of respondents were treated with chloroquine. The government's policy of changing from chloroquine to artemisine-based compounds as first line of drug treatment was in the process of being fully implemented. This is probably why a high percentage of chloroquine was still being prescribed.

From Fig 3.1, over 63% of caregivers did not know how to appropriately treat malaria with an anti-malaria drug. This definitely has dire consequences. It may lead to treatment failures and emergence of drug resistance, even with the introduction of a new anti-malarial. Conservative figures for malaria treatment failure using chloroquine are between 6% and 25%. This level of treatment failures cannot be attributed to poor quality of chloroquine as tests performed on samples on chloroquine tablets used for efficacy testing showed that the drugs were of generally good quality. [ii]

It may be that the health workers did not educate the caregivers on the dosage, frequency and duration of treatment or that the caregivers had forgotten the instructions given to them. Further research is needed in this area.

Responses given by caregivers reflected mainly their knowledge on how to treat malaria using chloroquine or artesunate-amodiaquine combination. The poor knowledge of how to treat malaria appropriately with chloroquine might have accounted for the widespread chloroquine resistance experienced in the country. This poor knowledge also poses a great challenge to the introduction of artesunate-amodiaquine combination therapy and may undermine the new anti-malaria drug policy.

Home-Based Care Treatment of Malaria

The two main ways to reduce the spread of malaria are the use of insecticide-treated nets and early diagnosis and prompt treatment of malaria cases. The health worker needs a good working knowledge of the diagnosis and correct treatment of the disease. Sharing this knowledge with caregivers is probably the single most important tool in preventing and controlling malaria.

Most cases of mild malaria can be cared for at home but the patient or caregiver should be aware of the dosage and frequency of the medication, and that symptoms will return if treatment is not completed. According to the Tropical Diseases Research Institute, 80% of malaria episodes particularly in children are dealt with at home using available resources, whether traditional, herbal or medical. [xviii] This treatment, if appropriate, can reduce malaria morbidity and mortality. In Burkina Faso trained mothers treated 56% of potentially malarious fevers with drugs within a day of onset of illness, and reduced the progression of those fevers to severe

malaria by 47%. In Ethiopia, home management of malaria reduced under-five mortality by 40%. [xxiii]

From Table 1 above over 92.3% of respondents were educated on home-based care for malaria. This is commendable since this will invariably lead to a reduction in child morbidity and mortality.

Antipyretic Treatment

Supportive treatment of malaria facilitates the recovery process and prevents the patient from suffering febrile convulsive attacks. One important principle is to reduce fever in children either by sponging with tepid water and/or administering an antipyretic [usually paracetamol]. The caregiver's knowledge of how to administer antipyretic appropriately is therefore critical to the prevention of severe disease.

In this survey, caregivers were assessed on their knowledge of how to administer an antipyretic. From Fig 3.5, as high as 63% of respondents did not know how to administer antipyretic appropriately to their sick children. This finding suggests that we should make conscious efforts to educate caregivers on how to administer supportive treatment in malaria management.

Insecticide-Treated Nets

The promotion and use of insecticide-treated bed nets has become the leading strategy in malaria control and prevention. Three large trials in The Gambia, Kenya and Ghana has demonstrated that regular use of insecticide-treated materials reduced all-cause child mortality by about 25%[xxiv]. Children sleeping under treated nets are less prone to anaemia, malnutrition and severe malaria. In communities where a substantial proportion of the people are using

treated nets, fewer people are being bitten by mosquitoes and this provides some community protection.

From Fig 3.6 only 42% of respondents reported that their children slept under a treated bed net the previous night. This is not commendable considering the targets set by the Roll Back Malaria Initiative and the Abuja Declaration to achieve 60% ITN coverage by 2010. Further investigation is even required to ascertain the proportion of children continuously sleeping under treated bed nets.

3.2 LIMITATION OF STUDY

Due to limited resources the survey could not cover private health facilities.

3.3 CONCLUSION

The findings of this survey on the effectiveness of counselling on the use of anti-malaria drugs among caregivers in malaria case management have been variable. Even though most caregivers are counselled on home-based treatment for malaria, a considerable number of them do not know how to appropriately treat children using anti-malaria drugs. On the dose, duration and frequency of administration of anti-malaria drugs, respondents did not demonstrate sufficient knowledge to indicate that they were effectively counselled. The study also revealed that a high proportion of children did not sleep under a treated bed net the previous night.

In the light of these findings, counselling of caregivers, by health workers, in the use of anti-malaria drugs was generally ineffective. The following recommendations are therefore made for improvement.

3.4 RECOMMENDATIONS

i. The Ghana Health Service should make the education of caregivers as one of the main components of the Rational Use of Medicines Programme. To ensure consistency, caregivers should be given face-to-face education on anti-malaria treatment by health workers based on printed material

ii. The Ghana Health Service, in collaboration with the District Assemblies, should vigorously promote the use of ITNs at the community level. These nets should be made available to the community members at subsidized prices to make it affordable to the larger population.

iii. The District Health Directorate should spearhead a refresher-training programme for all health workers on the Roll Back Malaria Initiative to enable health workers appreciate the role of effective counselling in malaria control.

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