MALARIA PARASITAEMIA AMONGST PARTURIENTS AT FEDERAL MEDICAL CENTER NGURU, YOBE STATE NIGERIA

BY

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ATTESTATION

I declare that the work in this dissertation entitled "Malaria Parasitaemia amongst Parturients at Federal Medical Center Nguru Yobe State, Nigeria" was conducted by me in the Department of Community Medicine, Ahmadu Bello University, Zaria under the supervision of Dr. Fatima J Giwa and Prof A.T. Olayinka

The information derived from the literature has been duly acknowledged. No part of this dissertation was previously presented for another degree or diploma at any university.

_____ _____

Hamzat Umar M. **Date**

CERTIFICATION

This dissertation titled **"MALARIA PARASITAEMIA AMONGST PARTURIENTS AT FEDERAL MEDICAL CENTRE, NGURU, YOBE STATE NIGERIA"** by Hamzat Umar Muhammad meets the regulation governing the award of the degree of Masters of Public Health in Field Epidemiology of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my family, Teachers, friends and relatives who gave me moral support and encouragement in the course of my study.

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LIST OF ACRONYMS

AIDS	Acquired Immuned Deficiency Syndrome
ACDS	Artemisinin Combined Drugs
AKTH	Aminu Kano Teaching Hospital
ANC	Ante natal care
DRC	Democratic Republic of Congo
DOTS	Directly Observed Treatment Strategy
EDTA	Ethylene DiamineTetraacetic Acid
FMC	Federal Medical Centre
HIV	Human Immuno-defficiency Virus
HRP2	Histidine Rich Protein2
IPTp	Intermittent Preventive Treatment in pregnancy
ITNs	Insecticide treated nets
IRS	Indoor residual spray
LBW	Low Birth Weight
LLITNs	Long Life Insecticide Treated Mosquito Net
MDG	Millennium Development Goals
MiP	Malaria in pregnancy
MC	Malaria Control
MP+	Malaria parasite Positive
NDHS	National Demographic Health Survey
NFELTP	Nigeria Field Epidemiology and Laboratory Training Program
PAM	Pregnancy Associated Malaria
PCR	Polymerase Chain Reaction
RBC	Red Blood Cell
RBM	Roll Back Malaria
RH	Reproductive Health
SD	Standard Deviation
SP	Suphadoxine Pyrimethamine

SUMMARY

Malaria infection during pregnancy is a major health problem with substantial risks for the mother, fetus and the neonate. In Nigeria, malaria contributes to an estimated 11% of maternal mortality. An estimated 65% of Nigeria's population lives in poverty and poverty is a major factor affecting malaria prevention and treatment as it affects the accessibility to and affordability of the limited interventions. One of the effective strategies that reduce maternal mortality is the prevention of malaria in pregnancy. The World Health Organization (WHO) formulated a strategic framework for the prevention and control of malaria during pregnancy by recommending a three pronged approach using the Intermittent Preventive Treatment during pregnancy (IPTp), Vector control including using of Insecticide Treated mosquito Nets (ITNs), and Case management of malaria illness and anemia.

A cross-sectional study was conducted to measure the association between the use of preventive strategies during pregnancy from antenatal records and the risk of malaria and other adverse outcome among parturients in FMC Nguru, Yobe State between July and November 2014. Interviewer-administered questionnaires were used to obtain data from one hundred and eighty-four parturients who satisfied the inclusion criteria. Both venous and cord blood samples were collected and tested for malaria and anemia.

Seventy four parturients tested positive for malaria giving a prevalence rate of 40%. Age group <25years accounted for the highest proportion of the positive mothers. The presence of malaria infection at ANC enrollment, dosage of IPTP received during pregnancy, and method used to administer the IPTp drugs showed significant effect on the presence of the infection at delivery respectively (OR: 6.6 CI 1.5-6.7; OR:3.08 CI 1.5-6.7; OR 4.6 CI2.2-9.5). The prevalence of

maternal anaemia (PCV<30%) was 41% and malaria positive mothers were mostly affected (58%).

The prevalence of malaria parasitaemia and maternal anaemia at delivery were found to be 40% and 41% respectively. There was generally low uptake and adherence to the standard regimen of the IPTp. Recommendations include education and social mobilization activities on the importance and adherence to malaria prevention practices to women during pregnancy, Prompt procurement of IPTp drugs and ITNs with monitoring the process of administration at the facility level and ensuring the implementation of DOTS in the IPTp policy to enable effective prevention of malaria in pregnancy and its adverse effects on pregnancy outcomes.

Key words: Malaria, Parasitaemia, Parturients, Yobe state Nigeria

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Malaria affects 3.3 billion people or half of the world's population in 106 countries and territories.[1] WHO estimates that 216 million cases of malaria occurred in 2010, of which 81%occurred in the African region. WHO estimates that there were 655,000 malaria deaths in 2010, 91% of which occurred in the African region, and 86% were in children under 5 years of age. Malaria is the third leading cause of death for children under five years worldwide, after pneumonia and diarrheal disease.[2]

Thirty countries in sub-Saharan Africa account for 90% of global malaria deaths. Nigeria, Democratic Republic of Congo (DRC), Ethiopia, and Uganda account for nearly 50% of the global malaria deaths. Malaria is the second leading cause of death from infectious diseases in Africa, after HIV/AIDS. Almost 1 out of 5 deaths of children under 5 in Africa is due to malaria.[2]

Malaria causes anemia which may necessitate blood transfusions, a procedure that increases the risk for HIV infection where universal blood screening is yet to be achieved. People living with HIV/AIDS (PLWHA) are at an increased risk of clinical malaria, severe illness, hospitalization, and death. Malaria contributes to a temporary increase in viral load among HIV-infected people which may worsen the clinical disease, increase mother-to child transmission, and augment transmission in adults .[2]

Malaria is a major public health problem in Nigeria where it accounts for more cases and deaths than any other country in the world. Ninety seven percent of Nigerian population is at risk of

malaria. The remaining 3% of the population live in the malaria free highlands. There are an estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria. This compares with 215,000 deaths per year in Nigeria from HIV/AIDS. Malaria contributes to an estimated 11% of maternal mortality.[1]Malaria accounts for 60% of outpatient visits and 30% of hospitalizations among children under five years of age in Nigeria. Malaria has the greatest prevalence, close to 50%, in children aged 6-59 months in the South West, North Central, and North West regions. Malaria has the least prevalence of 27.6 percent in children aged 6 to 59 months in the South East region.[3]

Malaria infection during pregnancy is a major health problem with substantial risks for the mother, her fetus and the neonate. In Nigeria, malaria contributes to an estimated 11% of maternal mortality. An estimated 65% of Nigeria's population lives in poverty and poverty is a major factor in malaria prevention and treatment as it affects the accessibility to and affordability of the limited interventions. The National Demographic Health Survey (NDHS) conducted in 2003, 2008, and 2013gave the maternal mortality ratios as (800/100,000 live births, 545/100,000 live birth, 576/ 100,000 live birth) respectively, thus indicating disparities in the effort of the government towards achieving the MDG of reducing maternal mortality in the country.[3]

One of the effective strategies that reduce maternal mortality is the prevention of malaria in pregnancy. The WHO formulated a strategic framework for the prevention and control of malaria during pregnancy by recommending a three pronged approach using Intermittent Preventive Treatment during pregnancy (IPTp), vector control including using of ITNs, and case management of malaria illness and anemia.[4]

These guidelines emphasize initiating preventive measures from the first antenatal visit through the post postpartum and newborn periods.[5]

1.2 Problem Statement

Malaria in pregnancy is a common social and medical problem requiring a multi-disciplinary and multi-dimensional intervention.[6]

In endemic countries, pregnant women constitute the main adult risk group for malaria and 80% of deaths due to malaria in Africa occur in pregnant women and children below 5 years. Every year, more than 30 million women in Africa become pregnant in malaria endemic areas and are at risk of *Plasmodium falciparum* malaria infection.[7]

Nigeria has recorded the world's second worst maternal statistics with one in 13 women dying in child birth and bears up to 25% of malaria burden in Africa, hence contributing significantly to the one million lives lost per year in the region which consists mainly of children and pregnant women.[8]*P. falciparum* infection during pregnancy is estimated to cause as many as 10,000 maternal deaths each year, 8% to 14% of all low birth weight babies, and 3% to 8% of all infant deaths.[2]In 2008, the National Demographic and Health Survey (NDHS) however highlighted some wide disparities across regions of the country with mortalities lower in the southern parts (South West, Nigeria; 89per 1000 live births) and higher in the northern parts of the country (North East; 219 per 1000 live births). In Nigeria, malaria contributes to an estimated 11% of maternal mortality.[3]

The Nigerian Government has since implemented the recommendations of WHO for controlling malaria during pregnancy in areas with stable transmission of malaria which include the use of insecticide treated nets (ITNs), the administration during pregnancy of at least 2 doses of

intermittent preventive treatment (IPTp) with Sulphadoxine-pyrimethamine (SP) after quickening(6weeks) and effective case management of malaria.[11]

Preliminary data from recent observational studies have suggested reduced effectiveness of SP for IPTp in Malawi, the first country where IPTp-SP was implemented in 1993. In addition, there is a growing concern over the decreasing effectiveness of the 2-dose regimen of SP for IPTp in other countries with a high level of resistance to SP.[9]

The NDHS,2013 showed the percentage of pregnant women who slept under ITNs as 13.3% in the North East (YobeState as 18.7%) and access to IPTp among pregnant women during ANC visit as 24.0% (YobeState as 16.7%). The women who took 2+ and 3+ doses of IPTp with SP as 16.7% and 4.5% respectively in the region (YobeState:7.4% and 3.7%).[3] This situation is further worsened particularly in the north-eastern part of Nigeria by political unrest, terrorism that resulted to dilapidated health services, displacement of communities to refugee camps leaving large proportion of pregnant women to limited health intervention.

This has made it necessary to implement rapid surveillance in existing health facilities that are relatively functional to assess the accessibility, availability and impact of preventive strategies used during pregnancy to prevent and control malaria infection and reduce maternal mortality.

1.3 Justification

The greater part of our knowledge about malaria in pregnancy is the data obtained from various studies across the region that estimated the prevalence. However studies conducted on post-administration surveillance to access the impact of preventive strategies used during pregnancy to prevent malarial infection and its consequences on the life of mothers and their babies are not readily available. This information will help to develop strategies for good implementation and

maintenance of preventive practices in pregnant women and as a good measure to control the risk of adverse outcomes of pregnancy and maternal death.

1.4 Research Questions

1. Do preventive strategies used during pregnancy decrease the prevalence of malaria parasitaemia among parturient?
2. Do these strategies decrease the prevalence of maternal anaemia?
3. What is the level of adherence to the national guidelines on administration of these strategies?
4. What is the effect of dose response to IPTp plus or minus other preventive measures?

1.5 General and Specific Objectives

1.5.1 General Objectives

To measure the association between the use of malaria preventive strategies during pregnancy and the risk of adverse pregnancy outcomes among parturients in FMC Nguru, Yobe State.

1.5.2 Specific Objectives

1. To determine the prevalence of malaria parasitaemia at delivery among parturients in Federal Medical Center NguruYobe State.
2. To determine the prevalence of anemia at delivery among parturients in Federal Medical Center NguruYobe State.
3. To assess the level of utilization of malaria preventive strategies among parturients.
4. To determine the relationship between the preventive strategies and pregnancy outcome.

1.6 Scope of the Study

This study determined the effect of malaria prevention practices and the presence of malaria and other adverse effect related to malaria at delivery mainly amongst the parturients in federal Medical Center Nguru in Yobe state.

CHAPTER TWO

LITERATURE REVIEW

2.1 Background

2.1.1 History of malaria in pregnancy

Malaria can be life-threatening but it is preventable. Malaria is caused by the bite of the female *Anopheles* mosquito, which results in infection of the red blood cells.[7]The problem of malaria infection in pregnant women, was initially described nearly 65 years ago.[11] Descriptive studies in sub-Saharan Africa from the 1950s through 1984 focused on *Plasmodiumfalciparum* infections and described the frequency of placental infection and specific adverse consequences. Relatively few population-based studies have been reported from Asia or the Americas, and where studies do exist, most have focused on high transmission.[10]

In 2000, countries across sub-Saharan Africa signed the Abuja Declaration pledging to fight malaria in pregnancy (MiP); specifically, committing to give pregnant women access to IPTp-SP and ITNs as well as effective case management. By 2007, all 39 African countries with stable malaria transmission had adopted the World Health Organization (WHO) three-pronged approach: IPTp-SP during the 2nd and 3rd trimester, sleeping under an ITN, and prompt case management among pregnant women with symptoms of malaria.[11]

2.1.2 Effect of malaria in pregnancy

Malaria in pregnancy is a maternal and newborn health issue, impacting both the mother and her newborn. In the best circumstances, countries have forged partnerships between Reproductive Health (RH) programs and Malaria Control (MC) programs to manage comprehensive implementation of MiP on a platform of focused ANC (where IPTp-SP and ITNs are accessed) and ensure technical oversight.[12]The devastating consequences of *Plasmodium falciparum*

malaria in pregnancy (MiP) are well documented; these include higher rates of maternal anemia and low birth weight (LBW) babies in areas of stable malaria transmission. In areas of unstable *P. falciparum* malaria transmission, pregnant women are at increased risk of severe malaria, death and still birth of the fetus. Approximately 11% of neonatal deaths in malaria endemic African countries are due to low birth weight resulting from *P. falciparum* infections in pregnancy. However, until recently, there was limited documented evidence of the protective effect of malaria prevention in pregnancy on neonatal mortality.[11]Pregnancy-associated malaria (PAM) remains a major source of poor mother-child health in areas with stable transmission of malaria parasites.[13] However, the understanding of the pathogenesis of PAM and of the acquired protective immune response to this syndrome is progressing at a rapid pace. Malaria causes serious complications in pregnant women, especially in those who have a low level of acquired immunity before pregnancy. In these women, the rates of maternal mortality, stillbirth, and premature delivery are high. In areas where malaria is highly endemic, in which protective immunity is acquired during childhood, these effects of malaria are less marked.[14] Nonetheless, the frequency and severity of malaria are greater during pregnancy than before pregnancy and among pregnant women than among those who are not pregnant.[15] In endemic/high transmission areas for malaria, baseline immunity to malaria decreases by pregnancy and sufferers are more likely to experience severe anemia. A non-immune pregnant woman (or one with low immunity from a low transmission area) is likely to develop a severe form of the illness and complications.[9] The mechanism underlying the susceptibility is not fully understood. It has been suggested that despite the acquired anti-malarial immunity of these pregnant women, the uteroplacental vascular space apparently provides a site for parasite sequestration and development. This parasite replication presumably reduces nutrient transport across the placenta

and allows for passage of parasitized red blood cells to the fetus that may compromise fetal growth and infant survival.[16] In another school of thought malaria and pregnancy are mutually aggravating conditions. The pathological changes due to malaria and the physiological changes associated with pregnancy have a synergistic effect on the course of each other.[17] Pregnancy exacerbates malaria through a non specific hormone-dependent depression of the immune system; protective anti plasmodial activity is suppressed at pregnancy. The following hypothesis to explain the altered immunity associated with pregnancy were offered: reduced lymphoproliferation response sustained by elevated levels of serum cortisol, loss of cell mediated immunity in the mother, the presence of placenta, a new organ in the primigravidae, allows the parasite to bypass the existing host immunity, or allows placenta-specific phenotypes of *P. falciparum* to multiply. Pregnant women display a bias towards type-2 cytokines and are therefore susceptible to disease requiring type-1 response for protection like TB, malaria and *P. falciparum* has the unique ability of cytoadhension; condroitin sulfate A and hyaluronic acid are the adhesion molecules for parasite attachment to placental cells.[17] Congenital malaria may occur by placental spread but has always been considered rare in children born in endemic areas and is more common in offspring of non-immune mothers with malaria. Treatment of the mother may not eradicate parasite from the fetus, due to lower drugs level. Congenital malaria tends to present with fever, irritability, feeding difficulties, hepatosplenomegally, jaundice or anemia. It is most commonly due to infection with *P. falciparum* and can be diagnosed with blood films of cord or heel- prick within week after birth.[7]The special features of maternal malaria are thought to end with delivery, a view that is consistent with the hypothesis that adhesion of parasites to the placenta is responsible for the increased susceptibility of pregnant women to malaria.[18]

2.1.3. Transmission and life cycle of malaria parasite

Malaria is caused by the four species of the protozoa of the genus *Plasmodium* (These are *P. falciparum, P. vivax, P. ovale,* and *P. malariae*.) which is transmitted by the bite of the female anopheline mosquito, congenitally, or through exposure to infected blood products.[19]

Pregnant women are more likely than non-pregnant women to become infected with malaria and to have severe infection.[20]The effects of malaria during pregnancy include spontaneous abortion, preterm delivery, low birth weight, stillbirth, congenital infection, and maternal death.[22] Human infection begins when a female anopheline mosquito inoculates plasmodial sporozoites from its salivary gland during a blood meal. These microscopic motile forms of the malaria parasite are carried rapidly via the bloodstream to the liver, where they invade hepatic parenchymal cells and begin a period of asexual reproduction. By this amplification process (known as intrahepatic or pre-erythrocytic schizogony or merogony), a single sporozoite eventually may produce from 10,000 to >30,000 daughter merozoites. The swollen infected liver cell eventually bursts, discharging motile merozoites into the bloodstream. These then invade the red blood cells (RBCs) and multiply six- to twentyfold every 48–72 h.[21]When the parasites reach densities of ~50/μL of blood, the symptomatic stage of the infection begins. In *P. vivax* and *P. ovale* infections, a proportion of the intrahepatic forms do not divide immediately but remain dormant for a period ranging from 3 weeks to a year or longer before reproduction begins. These dormant forms, or hypnozoites, are the cause of the relapses that characterize infection with these two species. After entry into the bloodstream, merozoites rapidly invade erythrocytes and become trophozoites. Attachment is mediated via a specific erythrocyte surface receptor. In the case of *P. vivax,* this receptor is related to the Duffy blood-group antigen Fy^a or Fy^b. Most West Africans and people with origins in that region carry the Duffy-negative FyFy phenotype and are therefore

resistant to *P. vivax* malaria. During the early stage of intra-erythrocytic development, the small "ring forms" of the four parasitic species appear similar under light microscopy. As the trophozoites enlarge, species-specific characteristics become evident, pigment becomes visible, and the parasite assumes an irregular or amoeboid shape. By the end of the 48-h intra-erythrocytic life cycle (72 hours for *P. malariae*), the parasite has consumed nearly all the hemoglobin and grown to occupy most of the RBC. It is now called a schizont. Multiple nuclear divisions have taken place (schizogony or merogony), and the RBC then ruptures to release 6–30 daughter merozoites, each potentially capable of invading a new RBC and repeating the cycle.[21] The disease in human beings is caused by the direct effects of RBC invasion and destruction by the asexual parasite and the host's reaction. After a series of asexual cycles (*P. falciparum*) or immediately after release from the liver (*P. vivax*, *P. ovale*, *P. malariae*), some of the parasites develop into morphologically distinct, longer-lived sexual forms (*gametocytes*) that can transmit malaria.[21]

After being ingested in the blood meal of a biting female anopheline mosquito, the male and female gametocytes form a zygote in the insect's midgut. This zygote matures into an ookinete, which penetrates and encysts in the mosquito's gut wall. The resulting oocyst expands by asexual division until it bursts to liberate myriad motile sporozoites, which then migrate in the hemolymph to the salivary gland of the mosquito to await inoculation into another human at the next feeding.[21]

Life Cycle of Malaria Parasite

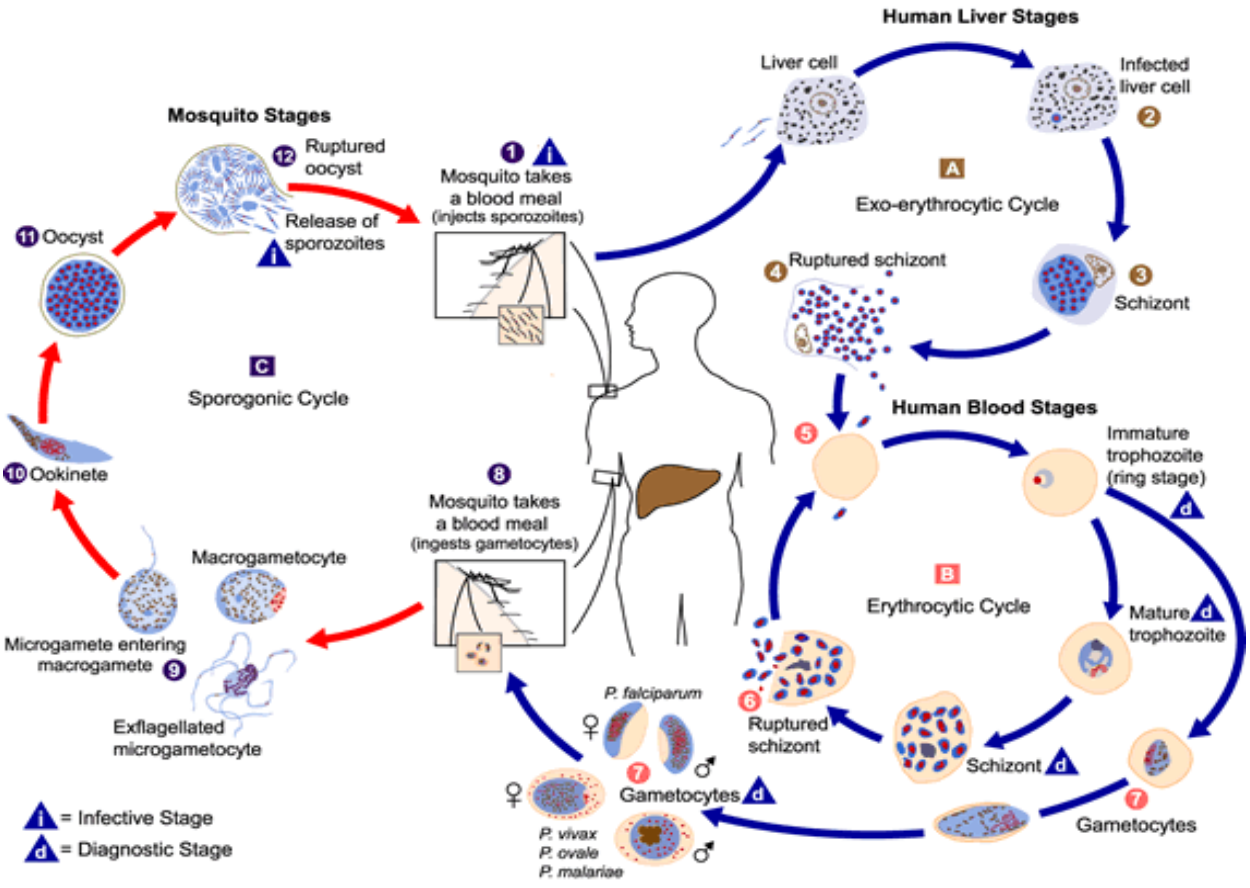


Plate 1: Life cycle of malaria parasite (courtesy CDC)

The above plate shows the life cycles of Malaria parasite

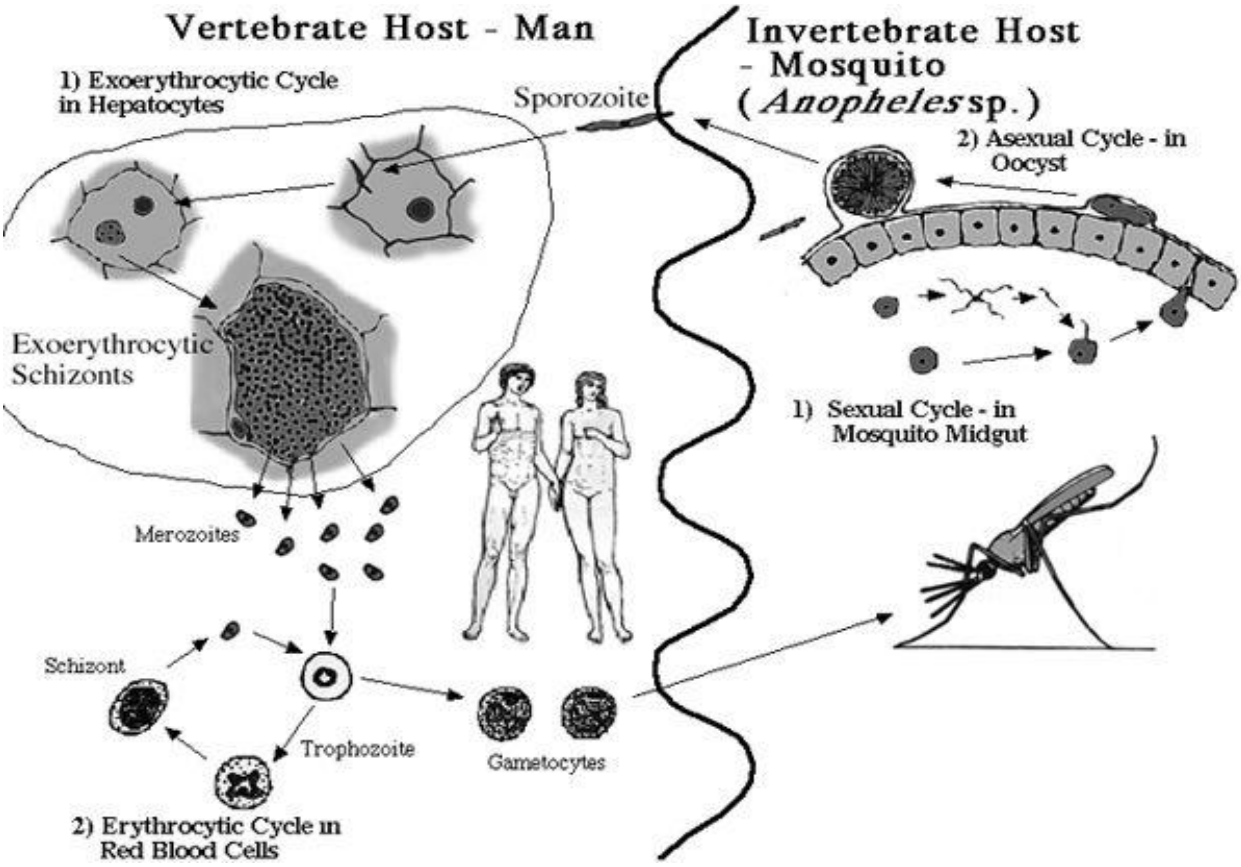


Plate 2: Development stages of malaria parasites in different hosts (courtesy Harrison 7)

The above plate shows the reproductive stages of malaria parasite in different hosts.

2.2 Prevalence of Malarial Infection among Parturients

Infected group may be defined on the basis of parasitaemia during pregnancy or placental infection at the time of delivery.[22] Subdivision according to the density of infection is straight forward for patient with parasitaemia, but parasite densities in placental infection are difficult to assess with accuracy and cannot readily be standardized.[9]There appears to be no correlation between parasite density in peripheral blood and in the placenta in pregnant women with well-developed immunity and in both primigravidae and multigravidae, placental infection are substantially heavier than peripheral blood density.[23] The placenta may contain large numbers of infected red blood cells(as many as 65%) while the peripheral blood is free of parasite. Infected erythrocytes containing ring stage of the parasite are found in the peripheral blood where as trophozoites and schizonts accumulate in the placenta. Placental infection may be detected in the absence of peripheral blood parasitaemia and may persist after the initiation of ant malarial treatment. Because not all malaria-exposed pregnant women in areas of malaria endemicity suffer from placental malaria and its serious consequences, a number of studies have assessed the prevalence and risk factors of placental malaria in sub-Saharan Africa, while others have attempted to elucidate protective immune responses against placental infection and/or immune pathogenesis.[23]However, results from the various studies are often discordant, due in part to different techniques of sample collection and analysis in different studies, based on the differences in the definition of placental malaria.[24]Some studies based their definition on the presence of malaria parasite and/or pigments in blood smears from placental blood, others based their definition on histological findings, while yet others based their definition on the use of histidine-rich-protein-2 (HRP2) capture test and polymerase chain reaction (PCR). In various parts of sub-Saharan Africa, malaria prevalence rates varied depending on the specimen used to

determine the malaria parasitaemia. This ranged from 12.5%[16] to 17%[25] when peripheral blood samples were used, while rates of 22.9%[26], 9.6 [27] 10.4,[28] 14%[25]17.5%[29], 24.5%[30], 31.3%[31], were obtained by placental blood smear microscopy. PCR gave values of 66.2%[29] 69%[32], and 28.1%.[29]

Recent studies in sub-Saharan Africa have shown the relationship between maternal peripheral parasitemia and placental malaria. The studies suggested whether placental infection reflects the existence of peripheral infection over a short period preceding the delivery or whether it is related to infection during pregnancy.[24] In one study [33] the occurrence of peripheral parasitemia at the beginning and at the end of pregnancy was significantly related to placental infection, whereas peripheral parasitemia in the middle of pregnancy was not. This suggests that a peripheral parasitemia at the beginning of pregnancy may persist within the placenta throughout gestation, with possibly more severe consequences for the placenta and the newborn than an infection acquired later in pregnancy. Other studies have shown that peripheral infection confers a five-fold increased risk for placental malaria, thus confirming the importance of late maternal infections.[2]

It is pertinent to state that most studies in sub-Saharan Africa relied on the results of the placental smear, the sensitivity of which is low compared with placental histopathology. Although microscopy with placental blood is less sensitive than placental histology, it is considerably more sensitive in the diagnosis of maternal malaria than peripheral blood smears.[24]

Conversely, susceptible immigrants to endemic areas often show high parasitaemia without heavy potential infection.[34] Atypical presentation of malaria is common in pregnancy,

particularly in second and third trimesters, a high index of suspicion should be maintained in susceptible pregnant mothers.

The relationship between malaria parasitaemia (peripheral or placental) and parity is well established. Many studies have found the prevalence to be higher in primigravidae than multigravidae, and in these studies, results are controlled for age.[24, 35, 36, 37]

2.3 Prevalence of Anaemia among Parturients

Malaria in pregnancy is associated with maternal anemia[33] which causes restricted fetal growth and preterm birth. Gestational anemia is common in developing countries where it affects more than 57% of pregnancies and adversely impacts the cause of gestation and its outcomes.[27]Anemia is the most common consequence of *P. falciparum* malaria infection. In sub-Saharan Africa, it is estimated that between 200,000 and 500,000 pregnant women develop severe anemia as a result of malaria; and *P. falciparum* malaria in pregnancy is the primary cause of up to 10,000 maternal anemia-related deaths in the region annually.[38]

There have been conflicting reports from parts of sub-Saharan Africa on the relationship between placental malaria and maternal anemia[24] that malarious placentas had no consistent relationship to maternal anemia.[9] In other studies,[39,19] maternal anemia and placental malaria were associated with all gravidity and age groups. with maternal anemia higher among women with placental malaria than those without placental malaria. By gravidity, prevalence ranged from28.8 percent to 31.6 percent and 15.3 percent to 16.7 percent for positive and negative cases respectively. By age, prevalence ranged from26.5 percent to 31.8 percent and 15.3 percent to 17.7 percent for positive and negative cases respectively. The reason for this variation is not clear, but it may be

connected to the complex and multi-factorial etiology of anemia in pregnancy in sub-Saharan Africa.[24]

The mechanisms by which malaria causes anemia are fairly well understood. The pathophysiology of malaria-associated anemia is multi factorial. The most likely mechanisms include (1) hemolysis or the direct destruction of parasitized red blood cells that occurs both intravascularly and by sequestration in the microcirculation, mainly in the spleen; (2) specific/nonspecific immune responses, whereby red cell survival is shortened; (3) non-specific, defective red cell production, which depresses erythropoiesis, inhibits reticulocyte release, and prematurely destruct red cells during maturation in the bone marrow; and (4) hypersplenism associated with a reduction in all three blood cell series, that is, causing not only anemia but also thrombocytopenia and leucopenia.[27]

The role of malaria as a cause of anaemia during pregnancy has been underestimated for various reasons.[39] First, the parasite count, a preferred indicator of malaria infection at the individual level, probably lacks sensitivity in high transmission areas because it is an intermittent and transitory phenomenon. Secondly in almost all previous studies, monitoring of malaria parasitaemia morbidity or the introduction of malaria control strategy usually occurred during the second or third trimester of gestation.[34]

2.4 Strategies to Prevent Malaria Infection during Pregnancy

To reduce the burden of malaria and improve birth outcomes, the World Health Organization has recommended the use of intermittent preventive treatment in pregnancy (IPTp), use of long lasting insecticide impregnated nets (LLITNs) and proper case management of anemia and malarial illness during pregnancy with effective antimalarial drugs.[40]

2.4.1 Intermittent preventive therapy

The World Health Organization recommended intermittent preventive therapy during pregnancy consisting of at least two full treatment doses of sulfadoxine-pyrimethamine for HIV-negative women and at least 3 doses for HIV-positive women not receiving cotri-moxazole, administered presumptively in the second and third trimesters, each dose should at least be 1 month apart, suppresses or clears any existing asymptomatic infections from the placenta and provides up to 6 weeks of post treatment prophylaxis. Recent systematic review[12] indicates that, the standard 2-dose regimen provides at most 12 weeks of prophylaxis, has been shown to be effective in reducing low birth weight (LBW) and was adopted by 31 of 37endemic countries in Africa with a policy for intermittent preventive therapy during pregnancy; the remaining countries use a 3-dose or monthly Nevertheless, re-infections are common with the 2-dose regimen, especially among women who complete their last dose early in the third trimester.

Antimalarial drugs have been widely used to prevent the infection or its consequences. Variety of drugs used for prophylaxis to prevent, suppress or eradicate malaria parasites have been tested in the 1980s. This practice was modified in the 1990s and renamed intermittent preventive therapy (IPTp). In this practice, women are treated for malaria presumptively at fixed time during the pregnancy usually with drugs that has a long half-life such as Sulphadoxine-pyrimethamine. There remains a debate as to whether the mechanism of IPT actually differs a lot from prophylaxis which in the past has been recommended for pregnant women in malaria endemic areas, but the regimens are very different.[41]IPT requires only two or three doses during pregnancy, compared to prophylaxis regimens that may be daily (e.g. with proguanil) or weekly (e.g. with chloroquine). Moreover, antimalarial chemoprophylactic therapy has been limited in many settings by poor adherence by pregnant women to weekly or more frequent drugs regimen

and increasing level of antimalarial resistance.[30]IPTp with two or more doses of Sulphadoxine-pyrimethamine (SP) given during the second and third trimester of gestation represents an alternative prevention strategy that has been shown to be effective throughout the continent.[29]

The delivery channel of IPTp is almost exclusively antenatal clinics (ANC). Although data from demographic and health survey would suggest that a varying proportion of pregnant women across the countries of sub-Saharan Africa obtain IPTp during pregnancy outside of ANC, almost nothing is known about the dosage received and from where they are received and whether these may constitute IPTp SP.[42] In addition, there are several factors directly impacting upon the effectiveness of pregnant women receiving IPT-SP at ANC, the first of which is misunderstanding of the policy for when the doses should be given. This misunderstanding is a link between complicated policy guidelines, poor implementation of this policy (training, information communication and leadership) and poor implementation of intervention.[43]

Drugs have been widely used to prevent infection or its consequences. Prophylaxis and IPTp are used in addition to good care during pregnancy, which include prompt treatment of women when present clinically with fever and anemia. In the past, WHO recommended routine malaria drug prophylaxis throughout the pregnancy for women living in endemic malarious areas. Routine chemoprophylaxis is still recommended, but it is not always easy to ensure good compliance even with targeted health promotion activities. Good compliance has been achieved in the context of special research studies.[41] The potential efficacy of chemoprophylaxis with chloroquine is likely to be reduced with emergence of chloroquine resistance *Plasmodium falciparum*. Daily proguanil is an alternative and good compliance has been reported in studies in Tanzania and Nigeria.[44] However there is a question over whether a daily schedule will be acceptable in other settings. Pyrimethamine has few side-effects but its use is limited by parasite

drug resistance. The safety of other drugs, such as maloprim (dapsone and pyrimethamine) or mefloquine, is less well established and they are more expensive. While the benefit of chemoprophylaxis in non-immune women are clear, the possible benefits in indigenous semi-immune women are not so obvious.[44] Currently, WHO recommends that "in settings where placental parasitaemia is associated with low birth weight, and an effective antimalarial drug can be provided on regular basis, chemoprophylaxis may be considered. The ambiguity of this statement reflects the current dilemma of policy makers balancing efficacy of a potential prophylactic agent against its potential adverse effects and the problems in delivering it.[41]Before recommending chemoprophylaxis, with whichever drug regimen, to all pregnant women living in malarious endemic area, clear evidence is required of its efficacy.[44]

In October 2012, the WHO provided an updated policy of IPT delivery taking cognizance of standardized means method to deliver IPTp to pregnant women to provide effective prevention for the mother and the fetus. The policy stated that:

In areas of moderate-to-high malaria transmission, IPTp with SP is recommended for all pregnant women at each scheduled antenatal care visit. WHO recommends a schedule of four antenatal care visits. The first IPTp-SP dose should be administered as early as possible during the 2nd trimester of gestation. Each SP dose should be given at least 1 month apart. The last dose of IPTp with SP can be administered up to the time of delivery, without safety concerns. IPTp should ideally be administered as directly observed therapy (DOT). SP can be given either on an empty stomach or with food. Folic acid at a daily dose equal or above 5 mg should not be given together with SP as this counteracts its efficacy as an antimalarial. SP should not be administered to women receiving co-trimoxazole prophylaxis.[11]

2.4.2 Long Lasting Insecticide Treated Nets (LLINs)

As one of the three-pronged approaches in the prevention and management of malaria infection during pregnancy by WHO, the use of long-lasting insecticides treated mosquito bed nets (LLITNs) has emerged in recent years as a promising tool.[19] Various studies have shown the impact of ITNs in the prevention of malarial infection. The use of ITNs has significantly reduced the number of primigravida with parasitaemia, preterm deliveries, and low birth weight in villages where it was used compared with control villages.[45] ITNs have been the main stay of vector control in many countries in which the disease is endemic and where infrastructure limits or precludes the implementation of indoor residual spray strategy (IRS).[46] Long lasting insecticide treated nets(LLNs) are most cost effective and less technically demanding to implement, allowing targeted distribution to the most at risk individuals such as pregnant women and children or to the entire communities via universal coverage campaigns.[47]However as a vector control strategy it has to be well-planned, targeted and done in a timely manner.[40] Drawbacks associated with adherence and retention of LLN includes personal confinement and discomfort when humidity and indoor temperature are high. A study on the skepticism towards ITNs in rural communities[48] showed that the reasons for low uptake from traditional approach was mainly low uptake of health interventions in terms of structural practical constraints, cost, accessibility, everyday priority or in terms of cognition as insufficient knowledge of benefits e.g. ignorance of public health message. Numerous studies have investigated the effectiveness of ITNs or IRS separately but none has conclusively determined whether having both ITNs and IRS provide additional protective benefit.[49]

2.4.3 Case management

Pregnant women are more susceptible than the general population to malaria: they are more likely to become infected, suffer a recurrence, develop severe complications and to die from the disease.[7]

Treatment can be more difficult due to restrictions on anti-malarial agents. Many are unlicensed in pregnancy due to lack of clinical trials involving this important population, for fear of damaging the fetus. There is frequently a lack of good post-marketing surveillance where these drugs are routinely used in pregnancy. However, data support the safety of artemisinin-combined drugs (ACDs) and their advent has provided a useful therapeutic option.[41]

Drugs should be used at adequate doses and according to clinical condition and local resistance patterns. Whilst a Cochrane review pointed to the lack of quality data, particularly with regard to drug safety in pregnancy, several innovations have since improved the risk-benefit ratio.[50] Chloroquine and quinine can be used safely in any part of the pregnancy but resistance is common.

2.5 Relationship between Prevention Strategies and Pregnancy Outcomes

A number of factors influence the prevalence of placental malaria in pregnant women, including maternal age, gravidity, use of prophylaxis, nutrition, host genetics and level of anti-parasite immunity, as well as parasite genetics and transmission rates.[24] Maternal age as an important determinant of malaria infection has been reported by Panti and Mokuolo(Sokoto and Ibadan respectively) That the parasitaemia among parturients is more prevalent among maternal age group less than 25 years of age. This may be due to the fact that pregnancy associated with acquired immunity is low in younger women than in the older ones who have obtained immunity

from repeated exposures to malarial infection. Also the dose effect of the IPT during pregnancy has been shown in many studies to have a strong association with the presence of malarial infection at delivery.[6,26] Similarly the influence of parity on the presence of malaria infection at delivery and other risks has been reported in many studies.[39] Moreover the impact of transmission rate has been demonstrated to have a strong association with prevalence of malarial infection and pregnancy outcomes.[16,11]

CHAPTER THREE

METHODOLOGY

3.1 Study Area

Nguru is a Local Government Area in Yobe State, Nigeria. Its headquarters is in the town of Nguru near the Hadejia River at 12°52′45″N10°27′09″E. It has an area of 916 km² and a population of 150,632 as at the 2006 census. There is a variety of landscape types in the area, including the protected Hadejia-Nguru wetlands of Nguru Lake. Majority of the people are Farmers and Businessmen. Nguru town is a malaria endemic area with transmission all the year round due to the presence of the Nguru Lake that provides a breeding ground for the vector all year round and peaks during the rainy season. There is a federal tertiary health institution FMC Nguru located in this town which serves as a reference health center for Yobe and neighboring states of Jigawa, Borno, Bauchi and Niger Republic. FMC Nguru is a tertiary health institution with a 390 bed capacity providing effective ANC services that includes malaria chemoprophylaxis, distribution of free insecticide treated nets (LLITN), hematinics, nutritional advice and general health education to more than 5000 women annually across the state.

3.2 Study Design

This was a prospective cross-sectional study in which 184 parturients were enrolled at every delivery consecutively after fulfilling the inclusion criteria. The study was conducted during the rainy season from June to November, 2014. This is the peak period transmission of malaria and infection is common across all age groups including pregnant women.

3.3 Study Population

The study population were pregnant women who attended ANC services and presented in labor at 36-40 weeks of gestation within the study period (June to November 2014) at the Federal

Medical Center Nguru in Yobe State Nigeria. They were recruited consecutively until the sample size was attained.

3.3.1. Inclusion criteria

All booked women at term (≥36 weeks of gestation) who delivered at the labor ward in FMC Nguru.

3.3.2. Exclusion criteria

Women with an eventful antenatal period and those with coexisting premorbid condition e.g. HIV, Cancer and absence of antenatal care and supporting records.

3.4 Sample Size Determination

Sample size was determined using the following formula

$$N = \frac{Z^2pq}{d^2}$$

Where N= number of sample to be collected

Z= confidence level,

p = prevalence from previous study, d=precision level (Lwanga and Lameshow, 1991).

From previous study in Sokoto[16] where the prevalence of parasitaemia at delivery was recorded as 12.5%. Therefore using 95% confidence interval and precision level of 0.05, a sample size of 168 was determined as follows:

z=1.96

p=0.125

q=0.85

d=0.05

Substituting into the formula gives

$$\frac{1.96^2\,(0.125)(.875)}{0.05^2} = 168$$

3.5 Sampling Technique

Patients who fulfilled the inclusion criteria and consented were recruited consecutively as they presented for delivery.

3.6 Sample Collection, Processing and Laboratory Testing

3.6.1 Training of sample and data collectors

A total of five research assistants were trained on sample and data collection. These included Two Midwives, one Matron, one Laboratory scientist, one Laboratory Technician and one Medical Officer.

3.6.2 Malaria parasite test

Using an aseptic procedure, 5ml each of both venous and cord blood were collected into an EDTA bottle from each study participant. Each sample was given a number and labeled with the patient's information. (Name and date of collection). The whole blood from both venous and cord were used to make a thick and thin films, stained with Giemsa stain and Leishman's stain respectively and were examined microscopically using oil immersion objective (X100) for the presence of malaria parasite (Trophozoites, asexual stages or pigments). Parasites present were identified and graded. Those without parasites were indicated as; No Malaria Parasites Seen (NMPS) while parasitaemia were graded as follows; low (1-999), moderate (1000-9999), high (≥10000). The stained slides were read by trained microscopists (Medical Lab. Scientist).

The rapid test kit "*CareStart*" (manufactured by Access Bio, Inc. USA) Malaria HRP2 contains a membrane strip, which is pre-coated with a monoclonal antibody as a single line across a test

strip. The monoclonal antibody is specific to the HRP2 (Histidine-rich protein 2) of the *P. falciparum.* The conjugate pad is dispensed with antibody absorbed on gold particles, which are specific to HRP2 of *P. falciparum*. The kit pack consist of the test device (plastic cassette enclosed the membrane), Assay buffer (Borax buffered SDS and saponin solution) and sample pipette.

The test was done by using the kit micro-pipette to collect a 5µl of the blood sample. The whole blood was dropped into the sample well and two drops of the assay buffer was added to the well and the results were read after twenty minutes. The results were interpreted as:

1. Invalid: the test is invalid if the line in the "C" (control) does not appear. If this occurs the test should be repeated using new device.
2. Negative: the presence of only on line in the "C" area indicates negative results.
3. Positive: The presence of two color bands (on band in the "C" and another band in the "T") indicates a positive test for *P. falciparum*.

36.3 Hemoglobin Estimation: Hemoglobin levels were estimated using the packed cell volume (PCV) technique.The RBCs were filled into the hematocrit tube and sealed with Plastacin. The tubes were placed in the hematocrit centrifuge and spun at 5000 revolution per minute for 5minutes by hematocrit technique .The PCV was then read using a Hawskley microhamatocrit reader and recorded accordingly.

3.7 Study Instrument

A Structured questionnaire was used to obtain the relevant information (socio demographics, use of preventive strategies, Parity etc.) and relevant laboratory information (presence of malaria parasite and hematocrit value etc.) were recorded on the column provided for laboratory results.

3.8 Data Collection Methods

Relevant information was obtained through face-to-face interview with trained research assistants and standard questionnaires were administered. Data was recorded on the questionnaire and pre-coded case form. This included demographics, preventive strategies used, number of times the IPTp was taken, period of time taken (trimesters), and hematocrit values during the ANC visits and at delivery etc. A clinical record of previous use of IPTs, and malaria infection and treatment during pregnancy was obtained from the ANC records.

3.9 Data Management

Information collected from the respondents was recorded and kept confidential in both hard and soft copies. Patients' names were omitted during analysis and presentation.

3.9.1. Measurement of variables

For some of the variables like age we relied on the patients' information while others like weights, hematocrit values and parasitaemia were measured using standard scales and laboratory instruments respectively. Statistical significant was considered positive at alpha level of < 0.005

3.9.2. Statistical Analysis

Data collected for the study was cleaned and analyzed using Epi-info and Microsoft excel. Descriptive statistics was computed for all relevant data. Chi square test was used to compare proportions within and among groups for statistical significance. Simple and multiple regressions were done to consider multi-factorial causes of effect.

3.10 Ethical Consideration

Ethical approval for this study was obtained from the ethical committee of Federal Medical Centre Nguru. Informed written consent was obtained from all participants and for mothers younger than 18years this was obtained from a legal guardian.

3.11 Limitations

1. Reliance on patients recall with regards to the administration of IPTp through prescription (not DOTS) and has to be verified through evidence of prescription from the patient's folder.
2. Statements and information from some respondents cannot be verified like the use of ITNs in the previous night when there is no evidence of ITNs collection.

CHAPTER FOUR

RESULT

Table 1. Socio-demographic characteristics of the respondents (n=184)

Characteristics	Frequency	Percentage
Age group(years)		
15-24	100	54
25-29	60	32
≥30	24	14
Parity		
0-2	114	62
3-4	37	20
≥5	33	18
Education Level		
None	44	35
Primary	42	33
Secondary	74	40
Tertiary	24	13
Monthly Income(N)		
<5000	115	62.5
≥5000	69	37.5
Body Weight (Kg)		
<50	4.0	2.0
50-70	151	82
>70	29	16

A total of 184 parturients were recruited for the study .The age of the participants ranged from 16 to 45 years while the mean age was 25.1±2.5. About half of the participants aged 15-24(54%) years and were mainly primigravidae (62%). More than half 115 (63%) of the participants were low income earners (<N5000 per month), weighted 50-70 Kg (82%) and most of them (63%) had secondary school education.

Table 2. Prevalence of Parasitaemia among Parturients (n=184)

Variables	Number of Parturients (%)	MP+ (%)
Age group		
15-24	87 (47)	39 (21)
25-34	73 (40)	25 (14)
≥35	24 (13)	10 (5)
Booking Status		
Booked	173 (94)	68 (37)
Unbooked	11 (6)	6 (55)
Parity		
0-2	114(62)	45(24)
3-4	37(20)	12(7)
≥5	33(18)	17(9)

Parturients in the age group 15-24 years have the highest prevalence (21%) of malaria parasitemia at delivery. The pooled prevalence was 40%. The prevalence was also found to be higher among the unbooked parturients (55%) and those with parities between zero and two (24%).

Table 3. Prevalence of Maternal Anaemia (PCV <30%) by age group

Age group(years)	Number (%)	PCV<30%
15-24	87(47)	46(25%)
25-34	73(40)	21(11%)
≥35	24(13)	9(5%)
Total	**184(100)**	**76(41%)**

The prevalence of anaemia among parturients was found to be 41% and is more prevalent among age group 15-24 years

Table 4. Association between Anaemia (PCV), age group and malaria status

Age group	PCV <30% (%)	MP (+) (%)	OR	95%C.I	P-value
15-24	46(25)	39(21)	0.7	0.3-2.1	0.78
25-34	21(11)	25(14)	1.1	0.4-3.1	0.44
≥35	9(5)	10(15)	Ref.		
Total	**76(41)**	**74(40)**			

Bivariate analysis showing the statistical association between anaemia and parasitaemia by age group. There was no significant statistical association found between anaemia and parasitaemia using bivariate analysis.

Table 5. Level of Utilization of Preventive Strategies in relation to Gravidity

IPTp Doses received	Primigravidae	Multigravidae	Total	χ^2	p-value
0	3(33%)	6(67%)	9(4%)		Ref.
1	36(25%)	59(75%)	95(53%)	0.008	0.464
2	**17(34%)**	**63(66%)**	**80(43%)**	0.161	0.343
Total	**56(30%)**	**128(70%)**	**184(100)**		

The overall coverage for up to two doses was 43%. The level of utilization for up to two doses was higher (66%) among the multigravidae than primigravidae (34%). There is no statistical significant difference between these groups.

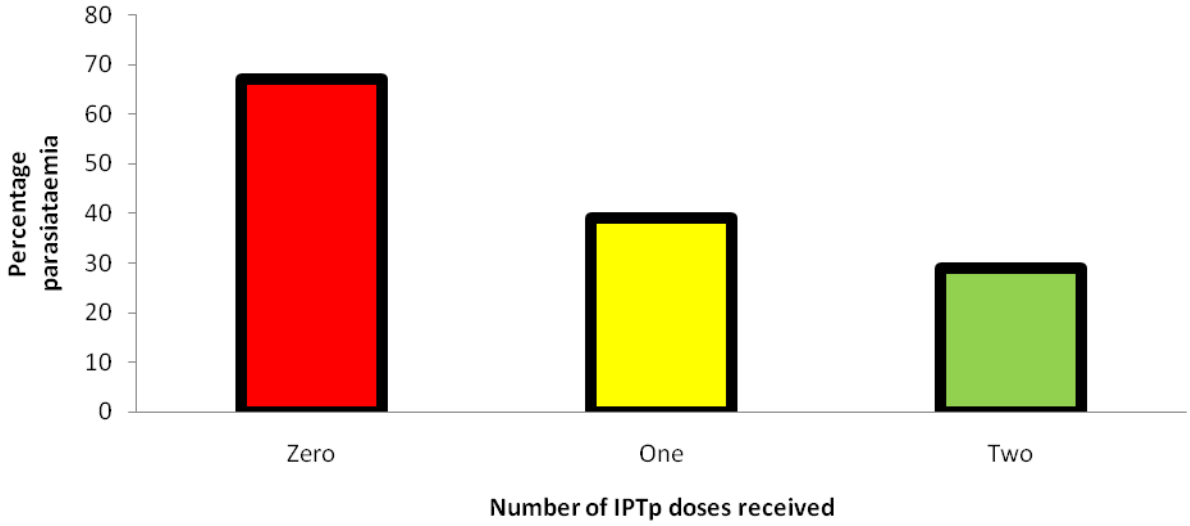


Figure 1: Utilization of IPTp by dosages among parturients

Parturients who had received up to two doses of IPTp had malaria parasitaemia detection rate (percentage of malaria positive cases) of 29% at delivery while about 39% and 67% detection rates were recorded for one and zero doses respectively.(Fig. 1)

Table 6. Relationship between the utilization of prevention strategies and parasitaemia at delivery

Types of Intervention(s) Used	MP(+)	MP(-)	Percent (%)	OR	P-value
Neither ITNs nor IPT	5	2	70	Ref.	
ITN Only	1	1	50	2.5	0.7
Both ITNs and IPT	68	107	39	3.9	0.04

Those who used both IPTp and ITN have a detection rate of 39%. While detection rate of parasitaemia was 55% and 75% in those who used ITN only and those who did not use any of the two respectively. Those who use ITNs only were two times more protected from having malaria parasitaemia at delivery than those who do not use it. Meanwhile those who use both ITNs and IPT were almost four times more protected from having malaria at delivery than those who do not use any prevention strategy during pregnancy.

Table 7. Association between Preventive Strategies and Parasitaemia (outcome) at Delivery

Exposure factor	Infected n=74	Uninfected n=110	OR (95% CI)	P-value
Doses of IPTp Received				
<2 doses	63	78	**3.08 (1.5-6.7)**	**<0.001**
≥2 doses	11	42		
Method of IPTp administration				
Prescription	62	58	**4.6 (2.2-9.5)**	**<0.001**
DOTS	12	52		
Parity				
0-2	114	45	1.0(0.5-1.6)	0.45
≥2	70	29		
Malaria at ANC enrolment				
Positive	44	20	**6.6 (3.4-13.0)**	**<0.001**
Negative	30	90		
Monthly Income(Naira)				
<5000	50	65		
≥5000	24	45	1.4 (0.8-2.6)	0.11
Type of Delivery				
Caesarian section	4	13		
Self- delivery	70	97	0.4(0.13-1.3)	0.11

There was a significant statistical relationship between parasitaemia among parturients and dosing effect of IPTp, method of IPT delivery, anaemia and malaria infection during pregnancy.

This shows that pregnant women who received up to two doses or more of IPT during pregnancy were three times protected from having malaria at delivery than those who received less than this dose . Also those who use received the IPT through DOT strategy were four times protected from having malaria infection at delivery than those who received IPT through prescription. Meanwhile those who were not diagnose of having malaria at ANC enrollment were six times more protected from having malaria at delivery than those who were malaria positive at the ANC enrollment.

Table 8. Multivariate Analysis (Logistic regression) showing multifactorial effects on Parasitaemia

Term	OR	95%	C.I.	P-Value
IPTp dose(<2 and≥2)	**3.06**	**1.8**	**5.2**	**<0.01**
Parity(0-2and≥2)	0.95	0.68	1.72	0.39
Monthly income (≥5000/<5000)	0.93	0.43	2.06	0.88
Malaria Infection at ANC (Yes/No)	**5.58**	**3.20**	**7.47**	**<0.01**
Method of administration (Prescription/DOTS)	**3.50**	**2.71**	**15.00**	**<0.01**

The independent significant predictors of malaria parasitaemia at delivery were; dose of IPTp taken, presence of malaria infection at initial enrolment into ANC, method used to dispense IPTp.

CHAPTER FIVE

DISCUSSION

The prevalence of malaria parasitaemia among parturients in this study was found to be 40%. Previous studies from Nigeria and other African countries reported different prevalence rates of parasitaemia at delivery (12.5% to 69%) from a study done by Panti *et al* in Sokoto[16] and by Peter *et al* in Ekiti[21] respectively. This wide variation may be due to the method used in diagnosis, variations in IPTp uptake and dose regimen. The intensity of transmission in this study site which is endemic for malaria and the peak season of transmission during which this study was conducted may be contributory factors. Other factors may be the inconsistent supply of intervention drugs and lack of direct monitoring of drug administration (DOTS). Parasitaemia was found to be higher amongst mothers less than 25 years of age (36%) in this study which may be due to the fact that pregnancy associated malaria infection is more common in younger women than in the older ones who have obtained immunity from repeated exposures to malaria infection as reported by a multicenter study on malaria parasitaemia at parturition in Nigeria done in Ibadan, Kaduna, Ilorin and Enugu by Panti *et al*[16] and others done in Sokoto and other tertiary health institutions in Ilorin and Abuja by Mokuolu *et al*[18] on malaria infection at delivery in 2009and2012 respectively. Parasitaemia was also found to be higher amongst those diagnosed and commenced on treatment during ANC than those who were free of malaria infection at enrolment. This presents a gap in the effectiveness of the malaria case management either due to lack of adherence to the standard treatment guidelines or drugs efficacy. Parasitemia was also higher amongst the unbooked (55%) parturients than those who were booked (39%) and monitored during pregnancy. This may be due to the fact that the booked parturients had received antenatal care and monitoring including IPTp prophylaxis and other preventive health

talks. This is similar to findings of a study conducted in Cameroun by Anchng-Kimbi *et al* [6] on the relationship between Antenatal care attendance, IPTp and malaria at delivery where it was found that the length of antenatal visits had an effect on the delivery outcome.[6] Based on the specimen used for malaria screening in this study the use of cord blood for the screening of malaria was found to be more sensitive in detecting the positive mothers at delivery(93%) this is similar to what has been found in previous study in India by Sankar *et al* [23] on the use of cord blood on the screening of malaria. In this study, we found a considerable decrease in both peripheral and placental parasitaemia with increasing parity. About 60(16)% of the parturients with parities between 0 and 2 were found to have higher malaria parasitaemia than those with parities of 3 and above. This is consistent with findings of previous studies done in Benin, Ibadan, Sokoto and Mozambique on the role of parity on the risk of malaria parasitaemia at delivery by Mokuolo et al[18], Panti *et al*[16], Le Port *et al*[51], and Saute *et al*[52] respectively which found that primigravidae and secondigarvidae were more vulnerable to malaria parasitaemia and consequent development of malaria in pregnancy if not well monitored.

There was a strong relationship between parasitaemia and anemia. Maternal anaemia was found to be higher amongst parturients who had parasitaemia at delivery (Table 4).This was consistent with findings of studies done in Ebonyi and Benin by Uneke *et al*[24] and Ouedrago *et al*[27]on the assessment of maternal anaemia in pregnancy and the effect of routine prevention, which reported a significant association between the presence of malaria infection at delivery and the presence of anaemia. A positive correlation between the presence of maternal anaemia (PCV<30%) at booking and at delivery was also found. At booking, only 13% (baseline PCV) of the patients were anaemic while at delivery it was found to be 41%.A similar result was also reported in Benin in a study done by Huynh *et al*[33] who looked at the influence of timing of

malaria infection during pregnancy on maternal anaemia and birth weight and found that infection in the early phase of pregnancy had a significant relationship with the presence of maternal anaemia at delivery.[33] This study also found a significant association between malaria infection at delivery and birth weight which is similar to the finding of a study conducted in Benin by Uneke *et a*l [24] on the effect of malaria on pregnancy and perinatal outcome.

Assessment of the utilization of the prevention strategies (Fig1-2) showed that 95% of the parturients used both ITN and IPT. However only 58% received up to two doses of IPTp before delivery. It was also found that most of the parturients (89%) commenced the IPT at 14-28 weeks of gestation. A strong association was observed between the level of utilization (especially dosing effect) and risk of parasitaemia at delivery. (OR 3.08 P<0.01).Parturient who received up to two doses of IPTp were more protected than those that received 0 to 1 dose. This is similar to findings of a study conducted in Cameroun by Anchnag-Kimbi *et al* on Antenatal care attendance and IPTp[6] which showed a strong association between prevalence of parasitaemia at delivery with dose of IPT taken during pregnancy.

Findings from this study on the relationship between preventive strategies and pregnancy outcomes revealed the effect of IPT dosage on the presence of maternal parasitaemia at delivery. It is evident from this study that the risk of developing parasitemia at delivery upon administration of up to two doses of IPT was found to be protective compared to those who did not receive any dose. This is similar to findings of an earlier work on dosing effect of IPTp reported in Malawi by Gutman *et al*[5]*whose* findings suggested that there was a dose-dependent association on malarial infection at delivery. In addition, the method of IPT administration to the pregnant women during pregnancy was crucial to its effectiveness. It was found that the DOTS (Directly Observed Therapy Strategy) was a highly effective means of prevention than the mere

prescription of the drugs for patients to use at their own convenience (OR 4.6 P<0.01). Similar findings were seen in a study done in Kenya by Birungi *et al*[53] and a systematic review by Boel et al[34] which advocated the guideline (DOTS) stipulated by WHO with regards to the method of IPT uptake during pregnancy.

There was a considerable number of Low Birth Weight babies 68(37%) and almost 35(51%) of them were born to those who had parasitaemia at delivery. This explains one of the effects of malaria in pregnancy on the baby at delivery. Similar findings were reported in studies done by Gutman in Malawi[5]and Leport in Benin[51]on the association of IPTp using Sulphadoxine on maternal and birth outcome.

The logistic regression (Table 5) showed that the independent significant predictors of the presence of malaria parasitaemia at delivery were the dosing effect of IPTp, presence of malaria parasitaemia at ANC enrollment, and method of IPTp administration. While the monthly income type of delivery and parity were not found to be statistically significant as predictors of malaria parasitaemia at delivery. Similar studies done on multifactorial effects that logically linked the presence of parasitaemia and anaemia at delivery to various parameters were done in Benin by Ouedraogo *et al*[27] and Briand *et al* [54]where possible explanations included resistance to the antimalarial drug used during pregnancy, gravidity, number of antennal visits (dosage effect), maternal age and socioeconomic status.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The prevalence of malarial parasitemia at delivery among the parturients was found to be high (40%).

A high prevalence of maternal anaemia (41%) at delivery was also found amongst the parturients mainly affecting mothers positive for malaria parasitaemia. There was also low IPT uptake and adherence to the standard dose regimen and the use of preventive strategies was strongly associated with pregnancy outcomes.

6.3 Recommendations

There should be a joint effort from all tiers of Governments with regards to preventive care in pregnancy focusing specifically on:

1. Education and social mobilization activities on the importance and adherence to malaria prevention practices to pregnant women during pregnancy.
2. Prompt procurement of IPTp drugs and ITNs and monitoring the process of administration at the facility level.
3. Ensuring IPTp policy implementation particularly DOTS strategy to ensure proper dose regimen and effectively monitoring for any problem that may occur attributable to the prevention method based on the pregnancy outcome.

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APPENDICES

Appendix 1

QUESTIONNAIRE

Demographics.

I.D Number ☐ Age(yrs) ☐ Parity ☐ Month of gestation ☐

Education level ☐ Occupation ☐ LGA ☐

Booking status ☐ Primigravidae ☐ Multigravidae ☐

Monthly income ☐ Body weight ☐

Baseline clinical information.

Base line PCV (at booking) ☐ Blood group ☐

Presence of malarial infection : present ☐ Past ☐

Prevention strategy

IPTp only ☐ ITTN only ☐ Both ITN and IPTp ☐

Neither IPTp nor ITTN ☐ Use of ITN last night ☐

Taking malaria treatment during pregnancy ☐

Type of drugs combination:

Sulphadoxine PyrimethamineProguanil ☐ chloride pyrimethamine ☐

Dose of IPT given ☐ DOTS ☐ Prescription ☐

Delivery

Type of delivery ☐ Baby weight (kg) ☐ pre partum PCV ☐

Presence of malaria ☐ level of parasitaemia ☐

Duration of labor ☐

Appendix 2

Consent form

Malaria Parasitaemia among Parturients in Federal Medical Center Nguru Yobe State.

I have read the information provided above (it has been adequately explain to me).

I have had the opportunity to ask questions about it and any question I have asked have been answered to my satisfaction. I voluntarily accept to participate.

Yes ☐ No ☐

_____ Respondent

Signature/Thumb Date.

_____Person obtaining the consent

Signature/Thumb Date

GSM/ Telephone Number _____

	Appendix 3 Work plan												
S/N	ACTIVITY												PERSON(S) RESPONSIBLE
		START DATE	END DATE	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	
		1/2/14	5/10/14										
1.	Submission of research topic for Academic supervisors decision												Researcher
2.	Submission of draft of thesis proposal												Researcher
3.	Adoption of supervisor's commence corrections and deletion												Researcher
4.	Draft of questionnaire and moderation												Researcher
5.	Pretest												Research team
6.	Questionnaire administration												Research team
7.	Data entry and analysis												Researcher
8.	Report writing												Researcher

Appendix 4

Ethical Clearance

FEDERAL MEDICAL CENTRE
DEPARTMENT OF ADMINISTRATION
P.M.B. 02, NGURU-YOBE STATE
website:www.fmcnguru.govt.ng
email:fmcguruinfo@yahoo.com, info@fmcnguru.gov.ng

MEDICAL DIRECTOR: Dr. M. B. Kawuwa MMBS, FWACS, FICS, FLDM
HEAD OF ADMINISTRATION: Alh. Usman Sambo Bsc. MPA. Msc. MIDAN, AIHSAN, ANIM, FCAI
HEAD OF CLINICAL SERVICES & TRAINING: Dr. Abubakar Musa MBBS, FWACS (Orth) FICS

Ref: FMC/N/CL.SERV/355/VOL2/42

In reply to: _____ Date: 11/6/2014

HREC PROTOCOL NUMBER: 16/5/2014 – 2/6/2014

HREC APPROVAL NUMBER: 2/6/2014 – 11/6/2014

HAMZAT .U.M,

DEPT OF PATHOLOGY FEDERAL MEDICAL CENTRE,

NGURU, YOBE STATE STATE.

APPLICATION FOR ETHICAL APPROVAL

RE: "MALARIA PARASITAEMIA AMONG PARTURIENTS: FEDERAL MEDICAL CENTRE, NGURU, YOBE STATE". NIGERIA.

The health research ethical committee on 10/6/2014, reviewed your research protocol on "MALARIA PARASITAEMIA AMONG PARTURIENTS IN FEDERAL MEDICAL CENTRE, NGURU, YOBE STATE," and has granted you full approval for the study. This approval is effective from 11/6/2014 to 11/6/2015.

All participating subjects must voluntarily endorse your informed consent form. No change in the protocol is permitted without the committee's approval. The committee may conduct an oversight visit to your site without notice. A copy of all write ups will be submitted to the committee on completion of the study.

Yours Sincerely

DR. A.M. MUSA, FWACS.

Chairman Health Research Ethical Committee.

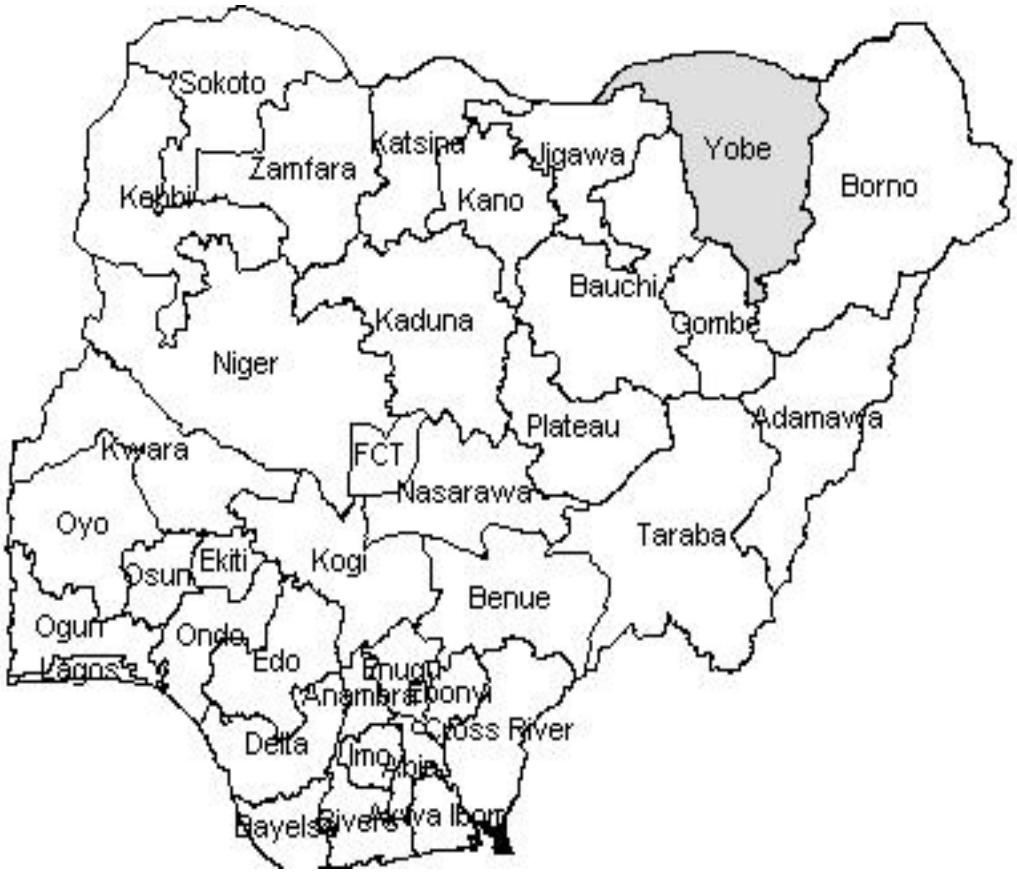
All correspondence to the Medical Director

Appendix 5.

Map of Nigeria showing YobeStae

Appendix 5

Map of Nigeria showing Yobe State



Appendix 6

Map of Yobe state showing the study area (Nguru)

