

# Prevalence of Malaria Infection among HIV Infected Pregnant Women Receiving Care at Public Health Facilities in Ondo State of Nigeria

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author TAO designed the study, wrote the protocol and managed the literature searches. Authors MBA and MOO performed the statistical analysis, wrote the first draft of the manuscript and managed the analyses of the study. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Malaria and HIV are important challenging infections in Nigeria. Co-infections of this duo in pregnancy has been associated with various adverse pregnancy outcomes including anaemia, low birth weight, premature birth, maternal and neonatal death. This study was carried out to determine the prevalence of malaria infection among HIV infected pregnant mothers reporting for routine antenatal checkup in two major state owned hospitals in Ondo city. The cross-sectional study conducted between May and September 2018 had 93 HIV infected pregnant women as participants. The overall prevalence rate of malaria was 52.6% and the highest rate was recorded among separated/divorced participants (83.3%). Malaria infection was found to be statistically significant in relative to CD<sub>4</sub><sup>+</sup> cell counts where malaria infection prevalence ranges from 22.2% to 71.4% ( $\chi^2 = 9.22$ ,  $P = 0.03$ ). This study has found that the prevalence of malaria was high among HIV infected pregnant women in Ondo city and that factors such as gravidity, reported fever and residence do not vary significantly on the univariate analysis employed in this study.

**Keywords:** Malaria; HIV; prevalence; pregnant women; Ondo city.

## 1. INTRODUCTION

Sub-Saharan Africa harbours some of the world deadliest diseases, which has in no little measure contributed to the poor conditions of a large percentage of the inhabitants of the region [1]. It is widely documented that malaria and HIV/AIDS are the two most common infections in sub-Saharan Africa [2].

Malaria, a disease condition caused by the protozoan parasite (*Plasmodium*) and transmitted by the female Anopheles mosquitoes remains an important public health concern. This is because it is the most common cause of infectious disease-related death in the world after tuberculosis and accounts for over 10,000 maternal and 200,000 neonatal deaths per year according to the world health organization report [3]. Malaria during pregnancy poses substantial risk to the mother, her fetus, and the neonate; the infection contributes to as much as 15% of maternal anaemia, 14% of low birth weight infants, 30% of preventable low birth weight, 70% of intrauterine growth retardation, 36% of premature deliveries, and 8% of infant mortality [4].

The human Immunodeficiency virus (HIV) is a ribonucleic acid (RNA) retrovirus that infects the immune cells (especially the CD4 helper T cells) of its human hosts [5]. It is a pandemic virus affecting about 37.9 million people across the globe in 2018 according to UNAIDS, almost half of which are women in their reproductive years, and 1.7 million are children less than 15 years old [6].

Across the world, over 2 million HIV-infected women are pregnant each year, over 90% of them are in developing countries, and while close to 600,000 women die each year from pregnancy related complications and childbirth (McIntyre, 2003). HIV is therefore a leading cause of death in women of reproductive age globally; responsible for one quarter of deaths during pregnancy and the six-week postpartum period in sub-Saharan Africa [7].

Co-infection with malaria and HIV is of special concern especially for pregnant women. This is because co-infection during pregnancy imperils both maternal and newborn health outcomes. HIV-infected pregnant women are at increased risk of parasitaemia and clinical malaria

throughout their pregnancies, and this increased risk is particularly apparent in multiparous women who in the setting of HIV infection do not develop the parity-dependent anti-malaria immunity typically observed in areas of high malaria transmission (Bulterys, et al. 2011). Co-infected women are also at risk of developing severe anaemia and placental malaria. Malaria and HIV co-infection has been shown to predispose pregnant mothers to higher rates of neonatal mortality, preterm delivery, low birth weight, and, in some settings, increased risk of mother to child transmission of HIV [8] (Bulterys, et al. 2011).

In regions of high malaria endemicity, the specific immunity that women of childbearing age have developed is compromised by pregnancy [9]. The progressive cellular immune-suppression effect of the infection with HIV and the resulting impairment in the immune response to malaria, which might be associated with failure to prevent infection or to suppress parasitemia and clinical diseases further, exposes pregnant women, co-infected with HIV and malaria to several opportunistic infections. Therefore, severely immune-compromised HIV patients may develop a variety of opportunistic infections that have a significant impact on their well being, quality of life, health care cost, and survival [10].

Majority of people living with HIV in Nigeria are women of childbearing aged between 15-49 years [11]. UNAIDS [12] report rated Nigeria lowest in the reduction of new HIV infections among children since 2009. According to the report, Nigeria has only 36% of her HIV infected pregnant women receiving ART and just 21% reduction in new HIV infections among children. Consequently, Nigeria is rated least in the prevention of mother to child transmission progress against the 2015 global plan targets in some selected priority countries and further confirms HIV infections, as a disease condition that is still on the increase in Nigeria.

In Ondo state, most of the studies conducted on HIV has been done in Akure, an urban and the capital city of the state [13,14,15]. However, very little is known about disease situation in Ondo town, a growing semi-urban community where a state of the art mother and child health facility is situated which attends to pregnant women in the community and many other surrounding rural villages.

Personal observation revealed that some of the HIV infected pregnant women enrolled for antenatal attention at the clinic are women from rural areas who are uneducated, poor and are at a heightened risk of malaria. This group of women are said to be understudied in Nigeria according to Houmsou, et al. [16]. The severity of the various health outcomes of co-infection with malaria and HIV for the mothers, the babies and especially its role in the vertical transmission of HIV which is a major route for the increasing cases of new HIV infection in Nigeria demands special consideration for pregnant women co-infected with malaria and HIV. Therefore, the importance of an evidence-based assessment of the prevalence of co-infection and their associated risk factors, in defining local priorities and informed targeted expenditure on the care and treatment of concerned pregnant women cannot be overemphasized, hence this study.

## 2. MATERIALS AND METHODS

### 2.1 Study Site

Ondo town is located in Ondo Central Senatorial District of Ondo state, Nigeria. It comprises of two Local Government Areas, viz: Ondo West and Ondo East. The study was conducted in the antenatal clinics of the two major public health facilities in ondo town. These include the Ondo State Specialist Hospital and the Mother and Child Hospital, Ondo. The specialist hospital is located at the centre of the town and therefore usually patronized by majority of the patients. The mother and child hospital, which was recently established and excellently equipped with the sole aim of attending to pregnant women and children is located almost at the outskirts of the town. Although many patients from the town also visit the clinic, some of their patients are referred from neighboring towns including the State Capital, Akure. The hospitals have well established HIV care units affiliated to the antenatal ward where all patients on their first visit are tested for HIV. Individuals with positive results were then given a call, interviewed, counseled, retested and followed up on separately organized clinic days (usually Fridays) till delivery.

### 2.2 Study Design and Sample Size

The cross-sectional study was done between May and October 2018. All HIV infected pregnant women attending the routine separately organized antenatal clinic who consented were

enrolled in the study. A well structured questionnaire which sought to obtain their socio-demographic, clinical and obstetrical data was administered on the patients. Their hospital registration cards were also examined to corroborate those information especially for those who do not have certain medical information such as their CD4 cell count and ART duration. Blood samples were collected with the assistance of qualified laboratory phlebotomists.

### 2.3 Microscopic Examination of Malaria Parasite

Thick and thin blood smears were prepared for each patient and the smears were allowed to air dried following the method described in WHO [17] method manual. The thin films were fixed with methanol for 30 seconds and the stained with diluted Giemsa solution for 20 minutes. Each slide was examined under oil immersion microscopic objective of the light microscope and positive slides were identified with the assistance of a certified laboratory scientists.

### 2.4 Data Analysis

Collected data were entered into Excel 2007 worksheet and imported into SPSS version 19.0 for Windows. The chi-square test was used to compare malaria occurrence between socio-demographic variables, while the logistic regression was used to find association between risk factors that could influence malaria occurrence among HIV infected pregnant women. The adjusted odd ratios with 95% confidence interval were used to measure the strength of associations. All tests were 2-tailed and P-values less than 0.05 were considered statistically significant.

## 3. RESULTS

### 3.1 Study Participants

HIV infected pregnant women excluded from this study include those on admission in the hospitals for life threatening infections or delivery. However Ninety-three (93) of the one hundred and two (102) patients approached agreed to participate in the study. These HIV positive patients were subsequently tested microscopically for malaria parasite. All the positive slides had *Plasmodium falciparum* parasite species.

### 3.2 Socio-demographic Characteristics of Study Participants

Table 1 describes malaria infection in relation to the socio-demographic characteristics of the HIV infected pregnant women examined. The prevalence of malaria among the pregnant women was 52.6%. In relation to age, malaria infection ranges from 41.6% to 59.2% while it ranges from 37.5% to 65.1% in relative to their educational status with majority of those with primary education positive for malaria parasite. With regard to marriage, divorcees/separated among the participants had the highest prevalence (83.3%) for malaria infection. Prevalence in relation to employment ranges from 45.5% to 75.0% with the highest recorded among participants who are students.

### 3.3 Selected Risk Factors for Malaria Infection among HIV Infected Pregnant Women

Malaria infection in relation to CD4 cell count of studied participants varied significantly from 22.2% to 71.4% ( $\chi^2 = 9.22$ ,  $P=0.03$ ) so also is temperature where HIV infected pregnant women who had high temperature had the highest prevalence (73.7%) for malaria infection. Variables such as gravidity, trimester of pregnancy, residence and others were not statistically significant as shown in Table 2.

## 4. DISCUSSION

This study found the overall prevalence of malaria among HIV infected pregnant women reporting for routine antenatal clinic in the two major hospitals located in Ondo town to be 52.6% (Table 1). This is an improvement over the findings reported for HIV infected pregnant women in Akure, a neighboring city where all the HIV infected women examined harbored malaria parasite though some had lower parasitaemia [14]. The difference could be due to increase in awareness and accessibility to malaria control and prevention measures and the routine counseling available for the HIV infected pregnant women during their antenatal visits where they are usually advised by health officials to as much as possible avoid being infected by malaria parasites.

The high malaria prevalence associated with low CD4<sup>+</sup> cell count of patients (Table 2) is likely due to their characteristic lower immunity usually associated with the depletion of CD4 cells of such patient by the virus, which consequently reduces the production of anti-malaria antibodies. Patients with higher CD4<sup>+</sup> count however recorded a lower prevalence of malaria infection. Such patients belong to the group that had been on ART drugs prior to getting pregnant. This is in agreement with the findings of Houmsou et al. [16].

**Table 1. Prevalence of malaria infection among women in Ondo-State according to socio-demographic characteristics**

Variables	No examined N=93	No (%) infected N=49(52.6%)
<b>Age group</b>		
< 21	2	1 (50.0)
21-30	27	16 (59.2)
31-40	52	27 (51.9)
41 & above	12	5 (41.6)
<b>Marital status</b>		
Married only once	76	39 (51.3)
Married more than once	11	5 (45.5)
Divorced/separated	6	5 (83.3)
<b>Educational level</b>		
Primary	43	28 (65.1)
Secondary	34	15 (44.1)
Tertiary	16	6 (37.5)
<b>Employment</b>		
Student	8	6 (75.0)
Civil servant	11	5 (45.5)
Business/self employed	57	27 (47.4)
Farming	3	2 (66.7)
Not employed/ full-time house wife	14	9 (64.3)

**Table 2. Univariate analysis of some selected risk factors for malaria infection in the HIV infected pregnant women in Ondo State**

Factors	Number examined	Number(%) positive	$\chi^2$	P
<b>CD4 count of subjects</b>			9.22	0.03
101-200	14	10 (71.4)		
201-350	42	24 (57.1)		
350-500	19	11 (57.9)		
>500	18	4 (22.2)		
<b>Temperature</b>			11.36	0.00
Normal (36.1°C -38°C)	55	21 (38.2)		
High (>38°C)	38	28 (73.7)		
<b>Reported fever</b>			2.32	0.13
Yes	72	41 (56.9)		
No	21	8 (38.1)		
<b>Gravity</b>			5.29	0.07
Primigravidae	22	16 (72.7)		
Secundigravidae	25	10 (40.0)		
Multigravidae	46	23 (50.0)		
<b>Trimester of 1<sup>st</sup> visit</b>			3.38	0.18
1 <sup>st</sup>	11	3 (27.3)		
2 <sup>nd</sup>	39	21 (53.8)		
3 <sup>rd</sup>	43	25 (58.1)		
<b>Residence</b>			3.11	0.08
Urban	59	27 (45.8)		
Rural	34	22 (64.7)		
<b>Use of ITN</b>			2.16	0.14
Yes	28	13 (46.4)		
No	65	36 (55.4)		

The high prevalence of malaria (73.7%) among patients with high temperature values (>37.5°C) is consistent with what was observed in Enugu (Ogboi, et al. 2014) where high body temperature significantly increase the odds of having malaria infection by 90%. This study found no significant association between the risk of malaria infection and types of residence (rural or urban). This is consistent with the report of other studies [18] and it could be because Ondo is a town recently pronounced a City and therefore may not have an elaborate difference in housing patterns compared to its neighbouring villages classified as rural in this study.

The high malaria prevalence (72.7%) reported among the primigravids may not be unconnected with the fact that being pregnant for the first time predisposes women to greater risk of malaria because such women lack the specific immunity to placental malaria which was usually acquired from exposure to *Plasmodium* parasites during pregnancy [19] Certain studies have however reported a higher prevalence of malaria infection among multigravid women [16,18].

Variation in malaria infection in relation to trimester of pregnancy was not statistically significant in this study. However, the lower

prevalence recorded among those that visited the clinic in their first trimester may be due to their early registration and consequent treatment because all patients are conventionally treated for malaria on their first visit. However, HIV infected pregnant women in their first trimester have been reported as having the highest prevalence of malaria infection [20].

Fever was not significantly associated with malaria infection in this study. Antecedent studies have suggested that fever alone is a poor determinant further confirmatory tests are necessary because fever may be a pointer to other infections [21]. The relationship in the use of insecticide treated bed nets and malaria infection is not statistically significant. This may be due to the characteristic habit of staying outside the house before finally withdrawing into their bed-nets where they are already exposed to unrestricted mosquito bites therefore making little or no difference with those who do not sleep under bed nets. Discomfort due to heat, perceived low density of malaria parasite vector are some of the reasons reported for low patronage of insecticide treated bed nets [2].

The present study was limited to HIV infected pregnant women because of logistic limitations. Further studies aimed at investigating malaria

infection among HIV free pregnant women in the same study area is suggested as this will provide more insight into the distribution of malaria parasite among pregnant women in Ondo town.

## 5. CONCLUSION

Malaria and HIV are leading causes of maternal and infant mortality especially in sub Saharan Africa. Although efforts are been geared towards the control and eradication of these infections, but has yet to yield an appreciable outcome as obtained in developed countries. It is however necessary to come up with sustainable programs that may include conducting epidemiological studies for collating dependable data that will provide basis for robust and effective decision making on intervention measures that best addresses the situation and gives better hope for positive improvements

## CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the Ondo State Ministry of Health, Akure before the commencement of this study. The ethical committee of the Ministry granted the approval. Permission was sought from the management of the health facilities where studies were carried out and patients consented to participate in the study before their enrollment.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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