ORIGINAL RESEARCH

Prevalence of malaria in HIV positive and HIV negative pregnant women attending antenatal clinics in south eastern Nigeria

Ezeoke Uchechukwu , Ndu Anne , Omotowo Babatunde, Okoye Micheal, Mbachu Chinyere, Agwu-Umahi Olanike.

Department of Community Medicine, College of Medicine, University of Nigeria, Enugu Campus

Date Received: 15-Jan-2018
Revision Received: 02-Apr-2018
Date Accepted: 02-Apr-2018

Correspondence: Ndu AC
anne_ndu@yahoo.com

https://dx.doi.org/10.4314/mmj.v30i4.8

Abstract

Introduction

Globally, malaria in pregnancy is a public health challenge. Malaria and HIV are among the two most important diseases contributing to the global health burden of our time. HIV positive pregnant women are at increased risk of all the adverse outcomes of malaria in pregnancy.

Objective

The objective of this study was to compare malaria parasitaemia between HIV positive and HIV negative pregnant women attending antenatal clinics offering Preventing Maternal to Child Transmission (PMTCT) services in Enugu metropolis, south-eastern Nigeria.

Methods

A descriptive cross sectional study was conducted among 200 HIV positive and 200 HIV negative pregnant women attending antenatal clinics in Enugu. Two out of five hospitals that provide PMTCT services were selected through balloting. Finger pricked blood samples were collected and thick blood films were examined for malaria parasite using giemsa expert microscopy. A structured interviewer administered questionnaire was used for data collection. Data was analysed using SPSS version 22.

Results

The HIV positive pregnant women (152) (76%) and HIV negative women (137) (68.5%) studied were mostly in the age range of 25-34 years. Mean gestational age of HIV positive and HIV negative participants were 23.4±10.7 and 23.2±10.1 weeks respectively (P=0.001). The prevalence of malaria infection among HIV positive pregnant mothers was 81% (162/200) and 75% (150/200) among HIV negative pregnant women (P < 0.001). The HIV positive mothers had more moderate parasitaemia (86/200: 53.1%) compared to 43/200: 28.7% in HIV negative mothers (P<0.001). Even though more HIV positive mothers (54.5%) used insecticide treated nets ITNs during pregnancy compared to 41.5% in HIV negative mothers, moderate malaria parasitaemia was higher in HIV positive mothers. HIV positive nulliparous pregnant women had the highest rate of malaria parasitaemia (32/36: 88.9%).

Conclusion

Moderate malaria parasitaemia was higher among HIV positive pregnant women. All malaria preventive strategies should be intensified in pregnancy as ITNs provided little protection.

Keywords: Malaria parasitaemia, HIV, pregnant women, Enugu, Nigeria

Introduction

Malaria in pregnancy, especially among HIV positive pregnant mothers, is a major cause of morbidity and mortality in sub-Saharan Africa. Malaria infection during pregnancy is indeed a major public health challenge in tropical and subtropical regions throughout the world[1]. Studies have established that malaria and HIV are among the two most important diseases contributing to the global health burden of our time and, together, they cause more than 4 million deaths every year[2,3]. Nearly 40% of the world's population lives in infected regions[4]. Every year, approximately 50 million women become pregnant in malaria endemic regions.[5] Approximately 1 million are estimated to be infected with both malaria and HIV which are preventable, and responsible for serious maternal and neonatal morbidity[5]. Malaria transmission is intense and occurs all year round in Nigeria[6]. It has been shown that at least 3 million pregnancies occur among women in malarious areas of Africa, most of whom reside in areas of relatively stable malaria transmission[6]. A good number of HIV infected individuals live in regions with different levels of malaria transmission[7]. Several studies have reported that malaria is a major public health problem affecting 300-500 million people annually[8,9]. It is also a major cause of maternal and infant morbidity and mortality in sub-Saharan Africa[10,11].

Much work has been done to show the relationship between malaria and HIV in pregnancy. Some studies among pregnant women in Sub-Saharan Africa have provided evidence of an important public health problem arising from the interaction of HIV and malaria. A study in Ibadan, south western Nigeria, revealed that HIV positive pregnant women had higher malaria parasite levels than those not infected with HIV[12]. This result was confirmed by another study in Abakaliki, south-eastern Nigeria[13]. In addition, data from Malawi suggested that infants exposed to both placental malaria and maternal HIV infection have a 3-8 fold increased risk for post neonatal death higher than infants born to mothers with either infection alone[14].

Some economists have estimated that the Gross Domestic Product (GDP) of African governments is reduced by $12 billion annually as a result of malaria infection[2]. It has also been estimated that up to 132 billion naira is spent each year on malaria treatment in Nigeria[11]. Although over-a-century of work to control or eradicate malaria has been done, more work needs to be done to examine the effects and public

health implications of malaria and HIV in pregnancy[15]. In malaria endemic areas, including Enugu State, malaria may account for up to 15% of maternal anaemia and 5-14% of Low Birth weight (LBW)[16]. Anaemia due to malaria causes up to 10,000 maternal deaths each year[16]. Available data indicates that Enugu State has very high maternal mortality with figures ranging from 772 to 998 per 100,000[17,18]. This is almost thrice the figure (286/100,000) reported for the entire southeast zone, and almost double the 545/100,000 national averages for the seven years period preceding the 2008 National Demographic and Health Survey[19].

At present, maternal mortality ratio in Enugu State approximates close to the national ratio of 1,000 maternal deaths per 100,000 live births[19]. Malaria and anaemia in pregnancy, amongst other causes, have been seriously associated with this high rate of maternal deaths[19]. Several studies have documented evidence that HIV impairs malaria immunity among pregnant women, because pregnant women infected with HIV demonstrate more frequent and higher density parasitaemia than pregnant women not infected with HIV[20-23]. The aim of this research was to compare malaria parasitaemia between HIV positive and HIV negative pregnant women attending antenatal clinics offering PMTCT services in Enugu metropolis, south-eastern Nigeria.

Materials And Methods

Study area

Enugu State is one of the six states in the south eastern part of Nigeria. It shares boundaries with Anambra, Abia, Kogi, Benue and Ebonyi States. The 2006 census recorded its population as 1,596,042 males and 1,671,795 females[24]. Enugu State has rich agricultural land because of its location within the tropical forest and savannah belts.

Study design and sampling technique

A simple random sampling technique, balloting, was used to select two from the five hospitals with maternal health services that offered PMTCT services in Enugu metropolis. The sample constituted 400 pregnant women that were consecutively selected during their registration exercise (booking) from the antenatal register. There were 200 HIV positive and 200 HIV negative pregnant women who were selected and those who consented were recruited for the study. Sample size was calculated using a formula for calculating sample size from a finite population using a previous prevalence of malaria infection in HIV positive pregnant women[12]. Any woman that did not give consent was replaced with the next consenting woman.

Specimen collection and data collection

Finger pricked blood samples were collected and thick blood films were made. The films were examined for malaria parasite using Giemsa expert microscopy. The socio-demographic data of respondents were collected using a structured interviewer administered questionnaire. HIV status was determined from the blood test results retrieved from the respondent's folders.

Data analysis

Data collected was analysed using SPSS version 17 (SPSS Inc, Chicago, Illinois, USA). Relationship of various variables and Chi-square was used to determine significance at $p<0.05$. Mild parasitaemia refers to levels of 1-999 mp/ml, moderate refers to 1000-9999 mp/ml, and high refers to >10,000 mp /ml. The parameters considered in the analysis included age, gestational age, parity and gravidity.

Ethical approval

Ethical approval was obtained from the Health Research Ethics Committees of the University of Nigeria Teaching Hospital and Annunciation Specialist Hospital, Enugu. Informed written consent was obtained from the participants.

Results

Socio-demographic characteristics of the study population

Table 1 shows the age range of HIV positive pregnant women and negative women who were enrolled for the study. Above half (106) (53%) had secondary education and 64 (32%) had tertiary education amongst the HIV positive women, whereas 92 (46%) and 74 (37.0%) had tertiary and secondary education, respectively, among the HIV negative women. Majority of the respondents were married, 188 (94%) and 190 (95%) for HIV positive and HIV negative mothers respectively. Occupations included trading (103) (51.5%) and civil service (34) (17%). Among the HIV positive respondents, 18% (36/200) were primigravidae, 38% (76/200) were secundigravidae and 44% (88/200) were multigravidae. Some of the mothers (23%) (46/200) were in their first trimester, 37% (74/200) in the second trimesters, while the remaining 40.5% (80/200) were in their last trimester. The parity revealed that 18% (36/200) of the HIV positive women were nullipara (had no children at the time of pregnancy), 31% (62/200) had one child and majority of them, 51% (102/200), had given birth to two or more children (multipara). In the HIV negative population, 20.5%, 40% and 39.5% were in the first, second and third trimester respectively. Primigravidae constituted 12%, secundigravidae were 32% and multigravidae constituted 56% of the mothers. Concerning parity, 33.5%, 23.0% and 43.5% were nullipara, primipara and multipara respectively.

Gestational age and CD4 counts of the study population

Table 2 shows that the mean gestational age was 23.4±10.7 weeks for HIV positive women and 23.2±10.1 weeks for HIV negative pregnant women. Among the HIV positive women 64 (32%) had CD4 levels of ≤250 cells/mm^3 and 136 (68%) of the pregnant women had CD4 levels ≥250 cells/mm^3.

Malaria parasitaemia in the study population

Figure 1 shows that the prevalence of malaria infection for HIV positive pregnant women was 81% (162/200) and 75% (150/200) for HIV negative pregnant women. Table 3 shows that out of the 162 HIV positive pregnant women with parasitaemia, 76/162 (46.9%) had mild (1-999/uL) infection, 86/162 (53.1%) had moderate (1000-9999/uL) malaria infection and none of the women had high malaria parasitaemia. Among the HIV negative women, 107/150 (71.3%) had mild parasitaemia, 43/150(28.7%) had moderate and 50/150 (25%) no parasites seen and none had severe parasitaemia. There was a highly significant difference in degree of parasitaemia between HIV positive and HIV negative women.

Relationship between malaria prevalence and gravidity, trimester and parity

Table 4 shows that among HIV positive pregnant women,

Table 1: Socio-demographic characteristics of HIV positive and HIV negative work participants

Variables	Categories	HIV Positive		HIV Negative	
		N	%	N	%
Age Group (Years)	15-19	0	0	2	1.0
	20-24	14	7.0	26	13.0
	25-29	66	33.0	74	37.0
	30-34	86	43.0	63	31.5
	35-39	26	13.0	25	12.5
	40-44	8	4.0	10	5.0
Education Level	None	4	2.0	3	1.5
	Primary	26	13.0	31	15.5
	Secondary	106	53.0	74	37.0
	Tertiary	64	32.0	92	46.0
Marital Status	Single	2	1.0	2	1.0
	Married	188	94.0	190	95.0
	Widowed	10	5.0	8	4.0
Occupation	Civil servants	34	17.0	41	20.5
	Teachers	18	9.0	5	2.5
	Traders	103	51.5	71	35.5
	Health workers	13	6.5	16	8.0
	House wives	21	10.5	3	1.5
	Others	11	5.5	61	30.5
Trimester	1st	46	23.0	41	20.5
	2nd	74	37.0	80	40.0
	3rd	80	40.5	79	39.5
Gravidity	Primigravidae	36	18.0	24	12.0
	Secundigravidae	76	38.0	64	32.0
	Multigravidae	88	44.0	102	56.0
Parity	Nullipara	36	18.0	67	33.5
	Primipara	62	31.0	46	23.0
	Multipara	102	51.0	87	43.5

Table 2: Relationship of some variables with HIV positive and negative participants

Variables	HIV Positive =200	HIV Negative N=200	P-value
Age(years) Mean ± Sd	37±6.1	35.6±5.4	0.001
Gestational age in months	5.4±2.48	5.38±2.34	0.001
PCV (%) mean± SD	35.34±3.78	28±3.2	0.005
CD4 Levels			
≤250 cells/mm3	64 (32.0%)	N/A	
>250 cells/mm3	136(68.0%)	N/A	
Total	200	200	

the multigravidae were found to have the highest malaria prevalence with 76/88 (86.4%); while the primigravidae had the least malaria prevalence, 22/36 (61.1%). Women in their third trimester were mostly affected (79/80:98.8%) while those in their first trimester had the least prevalence (26/46:56.5%). The distribution of malaria among different parity groups showed that nullipara (32/36: 88.9%) were more affected than the multipara (46/102: 45.1%).

In their HIV negative counterparts (Table 5), multigravidae had the least malaria parasitaemia (66/92: 71.7%) with the

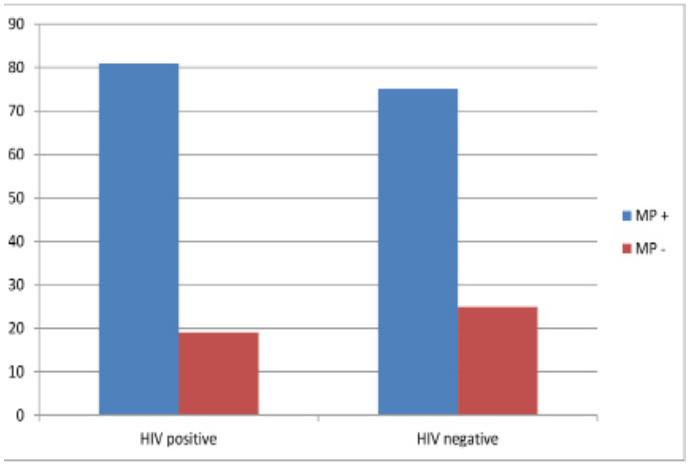

Figure 1: Prevalence of Malaria infection in HIV positive and HIV negative pregnant women

Table 3: Malaria Parasitaemia among HIV Positive and HIV Negative participants

Malaria Parasite (MP)	HIV Positive		HIV Negative		P-Value
	n	%	n	%	
Not seen	38	19.0	50	25.0	
Mild (1-999)	76	46.9	107	71.3	
Moderate (1000-9999)	86	53.1	43	28.7	
High	0	0	0	0	P<0.001

primigravidae and secundigravidae following closely with 38/49: 77.6% and 46/59:78% respectively. HIV negative women in their first trimester had the highest malaria parasitaemia with 35/41:85% Tables 4 and 5 show that the distribution of malaria among HIV positive pregnant women was higher at all levels compared to HIV negative pregnant women. Malaria prevalence was higher among HIV positive pregnant women that were Secundigravidae (84.0%) and Multigravidae (86.4%) compared to HIV negative women (78.0%) and 71.1% at the same gravid levels respectively. The prevalence among the primigravidae that were HIV negative was 77.6% compared with the HIV positive group at the same gravida level (61.1%). More of the HIV negative women had mild infection compared to HIV positive pregnant women. The difference in the distribution of malaria among the two groups was statistically significant (P<0.05). The highest malaria prevalence among HIV infected pregnant women occurred between the ages of 30 – 34years (88.4%), while the least occurred between the age of 15 to 19 years. The differences in the result of this distribution was statistically significant (P<0.05). Few women with no formal education (4) participated among the HIV positive mothers and scored the highest malaria prevalence (100%) and the least malaria prevalence was found among those with secondary and primary education. Pregnant women with tertiary education recorded high malaria prevalence for both HIV positive and HIV negative group (93.8% and 82.6% respectively), with HIV positive pregnant women having more. The trimester related prevalence result of HIV positive pregnant women compared to HIV negative women shows that HIV positive women had the highest level of malaria prevalence at all trimester levels (78.3%, 77.0% and 86.3%) compared to HIV negative women (85.4%, 71.3%, 73.4%). The difference in the distribution of malaria among the two groups was statistically significant (P<0.05). The parity related prevalence result of

Table 4: Relationship between factors and prevalence of malaria among HIV positive participants

Category	Variables	No Examined N	No Malaria Seen N %	Mild Infection N %	Moderate Infection N %	Total Malaria Prevalence N %	P-Value
Trimester	1st	46	20(43.5)	16(61.5	10(38.5)	26(56.5%)	
	2nd	74	17(22.9)	25(43.9)	32(56.1)	57(77.0%)	<0.0001
	3rd	80	1(1.3)	45(57.0)	34(43.0)	79(98.8%)	
Parity	Nullipara	36	4 11.2	16 44.4	16 44.4	32 88.8	
	Primipara	62	12 19.4	29 46.8	21 33.8	50 80.6	< 0.0001
	Multipara	102	56 54.9	20 19.6	26 25.5	46 45.1	
Gravidity	Primigravidae	36	14 38.9	14 38.9	8 22.2	22 61.1	
	Secundigravidae	76	12 15.8	36 47.4	28 36.8	64 84.0	< 0.05
	Multigravidae	88	12 13.6	36 40.9	40 45.5	76 86.4	
CD4 Count	≤250 Cells/mm^3	64	16 25.0	24 37.5	24 37.5	48 75.0	
	>250 cells/mm^3	136	22 16.2	60 44.1	54 39.7	114 83.8	< 0.0001
Age grp(years)	15 – 19	0	0 0	0 0	0 0	0 0	
	20 – 24	14	4 28.6	4 28.6	6 42.8	10 71.4	
	25 – 29	66	16 24.2	32 48.5	18 27.3	50 75.8	
	30 – 34	86	10 11.6	34 39.5	42 48.9	76 88.4	
	35 – 39	26	4 15.4	12 46.2	10 38.4	22 84.6	<0.005
	40 – 44	8	4 50.0	4 50.0	0 0	5 62.5	
Educational Level	None	4	0 0	2 50.0	2 50.0	4 100	
	Primary	26	6 23.0	10 38.5	10 38.5	20 76.9	<0.0001
	Secondary	106	28 26.4	50 47.2	28 26.4	78 73.6	
	Tertiary	64	4 6.3	24 37.5	36 56.2	60 93.8	

Table 5: Relationship of factors and Prevalence of Malaria among HIV Negative participants

Category	Variables	No Examined N	No Malaria Seen N %	Mild Infection N %	Moderate Infection N %	Total Malaria Prevalence N %	P-Value
Parity	Nulipara	67	19 41.3	33 71.7	15 32.6	48 71.6	<0.0001
	Primipara	46	11 16.4	26 38.8	9 13.4	35 76.1	
	Multipara	87	20 23.0	50 57.5	17 19.5	67 77.0	
Gravidity	Primigravidae	49	11 22.4	27 71.1	11 28.9	38 77.6	
	Secungravidae	59	13 22.0	29 63.0	17 37.0	46 78.0	
	Multigravidae	92	26 28.3	51 77.3	15 22.7	66 71.7	
Age grp(Yrs)	15 – 19	2	0 0.0	0 0.0	2 100.0	2 100.0	
	20 – 24	26	5 19.2	13 61.9	8 38.1	21 80.8	
	25 – 29	74	25 33.8	40 81.6	9 18.4	49 66.2	
	30 – 34	63	12 19.0	35 68.6	16 31.4	51 81.0	
	35 – 39	25	3 12.0	14 63.6	8 36.4	22 88.0	
	40 – 44	10	5 50.0	5 100.	0 0.0	5 50.0	
Educational Level	None	0	0	0	0	0	
	Primary	34	14 45.2	14 41.2	6 35.3	17 54.8	
	Secondary	74	20. 27.0	38 70.4	16 29.6	54 73.0	
	Tertiary	92	16 17.4	55 72.4	21 27.6	6 82.6	

HIV positive pregnant women compared to HIV negative women shows that HIV positive women had the highest level of malaria prevalence at all parity levels (nullipara (88.9%), primipara (80.4%_ and multipara(81.0%) compared to HIV negative mothers (nullipara (71.6%), primipara (76.1%) and multipara (77.0%). Among HIV positive pregnant women, the nullipara groups had the highest malaria prevalence (88.9%) whereas among the HIV negative groups, the

https://dx.doi.org/10.4314/mmj.v30i4.8

multipara had the highest malaria prevalence rate of (77%). The difference in the distribution of malaria among the two groups was statistically significant (P<0.05). Table 6 shows that both HIV positive and negative mothers that use ITNs had lower levels of parasetaemia (75.5% and 73.6%) compared to those that did not use ITNs (89.4% and 89.4%). This was found to be statistically significant (P<0.05).

Table 6: Use of ITNs and parasitaemia among HIV positive and negative participants

	ITN use	ITN non-use		
HIV status	Frequency (%)	Frequency (%)	X^2	P value
Positive	80 (75.5)	84 (89.4)	6.512	0.016
Negative	78 (73.6)	84 (89.4)	8.058	0.006

Discussion

Malaria parasitaemia was mostly mild to moderate in both HIV positive and HIV negative pregnant mothers. This prevalence agrees with results of a study Olusi and Abe where prevalence of malaria in pregnant women was found to be 96.92%, with majority (93.17%) infected with low parasitaemia[25]. Similarly, Cameroon recorded high malaria prevalence of 86.5%.[26] This prevalence differs from findings in a previous study in Enugu that documented only 49.83% of HIV positive pregnant women with malaria[27]. Our study revealed a statistically significant difference concerning distribution of malaria parasitaemia density among HIV positive pregnant mothers and their HIV negative counterparts (P<0.05). Some studies have reported that HIV and AIDS causes immunosuppression thereby reducing the overall immune response to malaria parasitaemia, thus increasing the frequency of clinical attacks of malaria[28]. This agrees with previous studies carried out in southeastern and southwestern Nigeria where susceptibility to malaria among HIV positive mothers was higher than HIV negative mothers[29]. In this study, the HIV negative pregnant mothers had more mild malaria infection than HIV positive mothers. However, moderate malaria infection was more in HIV positive mothers. The result of these differences in malaria density was statistically significant (P<0.05). No high malaria prevalence was recorded among both HIV positive and HIV negative mothers (i.e. Parasite Density = 10,000/ uL). However, a recent study in rural areas of southeast Nigeria reported cases of high malaria prevalence in contrast to this study[26]. A possible factor could be that the national guideline recommends cotrimoxazole for HIV positive pregnant mothers and intermittent preventive therapy (IPTp) for HIV negative pregnant mothers which has been documented to avert severe malaria attacks among pregnant mothers[30]. Some studies have generally reported HIV as a major risk factor for malaria transmission in pregnancy, and have also reported HIV in pregnancy as a double burden for high malaria parasitaemic density in pregnancy due to immmunosuppression[28]. There was a statistically significant difference (P<0.05) between the HIV positive and negative mothers that used ITNs for the prevention of malaria. More HIV positive mothers used ITNs compared with the HIV negative mothers even though the HIV positive mothers had a higher prevalence of malaria infection. Those women that used ITNs were less infected than those who did not. This difference could probably be due to the pre-existing health condition that influenced better health practices.

The age related distribution of malaria parasitaemia showed that malaria prevalence was higher in women of age group 40-44 years and least prevalent among the 25-29 age range group in the HIV positive pregnant mothers. Our study found that the age group of 15-19 years among the HIV negative mothers had 100% malaria prevalence. Education should have a positive influence on malaria prevention substantiated by the fact that a previous study revealed that participants who satisfactorily responded to the questions about malaria transmission and prevention were less affected by malaria as compared to those who had a poor knowledge[31].Surprisingly, pregnant mothers with tertiary education recorded high malaria prevalence for both HIV positive and negative mothers in this study. In addition, this study observed that the illiterate pregnant women had the highest rate of malaria probably because they were more exposed to malaria parasite due to bad environmental condition and their lifestyles[31]. The parity related prevalence showed that HIV positive mothers who had not given birth before (nullipara) had the highest malaria prevalence while the pregnant mothers with two children and above (multipara) had the least malaria prevalence. At all parity levels, malaria prevalence was higher among HIV positive mothers compared to HIV negative mothers where the multipara group had the highest prevalence. This is consistent with findings from another study by Rogerson *et al*, where significant differences were seen among parity groups[32]. In our study, the multigravidae had the highest malaria prevalence while primigravidae had the least malaria prevalence among HIV positive mothers. On the other hand, among the HIV negative pregnant mothers, primigravidae had the highest malaria prevalence, (77.6%). This is consistent with a study that showed that among the HIV negative mothers, the primigravidae are more susceptible to high malaria prevalence[33]. The drug related malaria distribution showed that majority of the HIV positive pregnant mothers, 128(64%), did not take antimalaria therapy which can also be strongly linked to the reason for high malaria prevalence in this study. One of the most important factors for these observed differences in malaria parasitaemia among HIV positive and negative patients could be explained by the fact that HIV pregnant mothers have a compromised immunity due to low CD4 level. The immunosuppression caused by HIV virus leads to high malaria prevalence as has been documented[34]. From this study, it was obvious that women who used ITNs were less infected than women who did not. Studies have strongly supported and concluded on the fact that ITNs coverage was related to malaria control, has significantly reduced malaria and was associated with a malaria risk-protective effect[28].

Limitations of the study

The limitation of this study includes the fact that populations not visiting a hospital were not included in the study.

Conclusion

In this study, moderate malaria parasitaemia was commoner among HIV positive pregnant mothers than among HIV negative andITNs provided little protection against malaria in pregnancy among HIV positive pregnant mothers. It is therefore recommended that all malaria preventive strategies should be intensified in pregnancy especially among HIV positive women.

References

1. Nosten F. F. Terkuile and L. Malankiri. Malaria in pregnancy in an

area of unstable endemicity. Trans R Soc. Med. Hyg. 1991; 48:154-160.

2. WHO. Malaria and HIV/AIDs Interactions and Implications: Conclusions of a Technical consultation convened by WHO, 23-25 June, 2004. (Cited 2017 May 12); Available from www.who.int>atoz>who_hiv_2004_08

3. Kakklilaya BS. Pregnancy and Malaria. Malariasite. 2006 (Cited 2017 June 12); Available from File://A:/:malaria%20 pregnancy % 20 and 20 malaria.htm

4. UNICEF. Malaria Basics: Global Impact and actions. (Cited April 2018); Available from https://www.prb.org/malariabasicsglobalimpactand actions

5. Malaria in pregnant women in an area with sustained high coverage of insecticide treated bednets. Malaria Journal. 2008; 217:133. doi :10.1186/1475-2875-7-133

6. Briabin, BJ. Failure of chloroquine prophylaxis for falciparum malaria in pregnant women in Madang. Papua New Guinea. Ann. Trop. Med. Parasitoal., 1990. 46: 176-200.

7. Nosten F. Rogerson SJ, Beeson JG, Mcgready R, Mutabingwa TK,Brabin B. Malaria in pregnancy and the endemicity spectrum:what can we learn? TrendsParasitolog2004;20: 9, 425 – 432. doi. Org/10.1016/j.pt.2004.06.007.

8. ter Kuile FO, Parise ME, Verhoeff FH, Udhayakumar V, Newman RD, Van Ejik AM et al. The burden of co-infection with human immunodeficiency virus type 1 and malaria in pregnant women in sub-Saharan Africa. Am J Trop Med Hyg. 2004; 71(2 Suppl): 2004, 41-54

9. Murphy SC, and Breman JG,. GAPS in the childhood malaria burden in Africa: cerebral malaria, neurological sequelae, anaemia, respiratory distress, hypoglycaemia, and complications of pregnancy. Am J of Trop Med Hyg. 2001; 64: (1-2 Suppl): 57-67.

10. Federal Ministry of Health. National code of health research ethics ISBN: 978-978-080-708-5 (cited 2017 May 16); Available from http://www.nhrec.net.2007.

11. Perrault SD, Hajek J, Zhong K,Owino SO, Sichangi M, Smith G et al. Human immunodeficiency virus co-infection increases placental parasite density and transplacental malaria transmission in Western Kenya. Am J of Trop Med Hyg 2009; 80(1):119-125.

12. Falade CO, Burden of malaria in HIV-Positive pregnant women in Ibadan, southwest Nigeria 2011.http://www.edctpforum.org/2011/wp-content/uploads/presentations/mo07_catherine_falade.pdf

13. Uneke CJ, Lyare FF, Oke P, Duhlinska DD. Assessment of malaria in pregnancy using rapid diagnostic tests and its association of HIV infection and hematologic parameters in South-Eastern Nigeria. Haematologica. 2008;93(1):143-4.doi.10.3324/haematol.11695.

14. Bloland PB, Wirima JJ, Boland PB, Chilima B, Mermin JH, Chitsulo L, et al. Impairment of a pregnant woman's acquired ability to limit plasmodium faciparum by infection with human immunodeficiency virus type-1. Am J Trop Med Hyg. 1996; 55: 42-9.

15. UNICEF. Malaria and HIV/AIDS. UNICEF Malaria Technical note #6 1, February, 2003(Cited 2017 May 15); Available from: http:;//www.unicef.org>health>files

16. WHO. Prevention and control of malaria in pregnancy. A workshop for health care providers on Maternal and neonatal health. JHPIEGO, 2008 (Cited 2017 May 15); Available from: www.malaria.org>JHPIEGO Workshop.

17. Onah H, Okaro J, Umeh U, Chigbu C. Maternal Mortality in Health Institutions with Emergency Obstetric Care Facilities in Enugu State, Nigeria. Obstet. Gynaecol. 2005;25 (6): 567-574. doi.org/10.1080/01443610500231484.

18. Ezugwu E, Ezegwu FO, Okafor II. Maternal Mortality in a Transition Hospital in Enugu, Southeast Nigeria. Afr. J. Reprod. Health, Afr J Reprod Health. 2009;13(4):67-72.

19. NPC and ICF Macro. Nigeria Demographic and Health Survey 2008. Abuja, Nigeria, National Population Commission and ICF Macro, 2009.

20. Steketee RW, Wirima JJ, Boland PB, Chilima B, Mermin JH, Chitsulo L, et al. Impairment of a pregnant women's acquired ability to limit plasmodium falciparum by infection with human immunodeficiency virus type-1. Am J Trop Med Hyg. 1996; 55:42-9.

21. Parise ME, Ayisi JG, Nahlen BL, Schultz LJ, Roberts JM, Misore A, et al. Efficacy of sulfadoxine-pryrimethamine for prevention of placental malaria in an area of Kenya with a high prevalence of malaria and human immunodeficiency virus infection. Am J Trop Med Hyg. 1998;59: 813-22.

22. Verhoeff FH, Brabin BJ, Hart CA, Chmsuku L. Kazembe P, Broadhead RL. Increased prevalence of malaria in HIV-infected pregnant women and its implications for malaria control. Trop Med Int Health. 1999:4:5-12. 1999 Jan. 4(1):5-12. doi: 10.1046/j.1365.1999.00349.x.

23. Van Ejik AM, Aysis JG, Ter Kuile FO, Misore A, Otieno JA, Kolezak MS, et al. Human immunodeficiency virus seropositivity and malaria as risk factors for third-trimester anemia in asymptomatic pregnant women in Western Kenya. AM J Trop Med Hyg. 2002; 65:623-30.

24. Federal Republic of Nigeria: 2006 Population Census. [Cited April 2017]. Available from http://www.nigerianstat.gov.ng.

25. Olusi TA, Abe AF. Co-infection of HIV and malaria parasites inpregnant women attending major ante-natal health facilities in Akure, Ondo State, Nigeria. J. Parasitol. Vector Biol. .2014. 6(9) 124- 130. doi: 10.5897/JPVB2014.0153.

26. WHO: A Strategic Framework for malaria Prevention and control during pregnancy in the Africa Region. In Report AFR/MA1/04/01. Brazzaville: World Health Organization Regional Office for Africa; 2004. [Cited June 2017]. Available from www.who.int>atoz>afr_mal_04_01.

27. Ogboi SJ, Uche AP,Akpoigbe JK, Fagbamigbe AF, Audu O, Obianwu IM, AkabuezeJ. Preventive and risk factors of malaria in HIV infected pregnant women on anti retroviral therapy in Enugu, South East Nigeria. J AIDS and Clin Res 2014 5:321. doi:10.4172/2155-6113.1000321

28. Whitworth J. [Internet]. California: HIV InSite Knowledge Base. Malaria and HIV; 2006. [Cited June 18 2017]. Available from http://hivinsite.ucsf.edu/Insite?page=kb-05-04-04

29. Catherine O.F. [Internet] Burden of malaria in HIV-Positive pregnant women in Ibadan, southwest Nigeria. 2011. [cited 2017 May 27] Available from http://www.edctpforum;org/2011/wpcontent/uploads/presentation/m007-catherinefaladade.pdf.

30. Theresa N A, Etienne E T, Frankline N, Elisabeth F, Isaac N E. "HIV/AIDS and malaria in pregnant women from Cameroon." Afr J Health Sci. 2011; 18:105-109.

31. Kavia Y, Sundil D, Bipul R, Saika P, and Vijay V. Socioeconomic determinants for malaria transmission risk in an endemic primary health center in Assan, India. In Journal of Behavioural nutrition and physical activity. Infectious dx of poverty; 2014,3:19.doi:10.1186/2049-9957-3-19.

32. Rogerson SJ, Brown HC, Pollina E. Abrams ET, Tadesse E, Lema VM, Molyneux ME. Placenta tumor necrosis factor alpha but not gamma interferon is associated with placenta malaria and low birth weight in Malawian women. Infect. Immun. 2003;71 (1) 267-270. Doi:10.1128/IAL71.1.267-270.2003.

33. Adeoti O. M, Anumudu C, Nwuba R. Awobode H. Olaniyan M. F. Olayiwola et al. Prevalence of HIV and malaria parasites co-infection in pregnant mothers and their babies post delivery. JBAH. 2012;2 (6).

34. Moses R Kamya, Pauline Byakika-Kibwika, Anne F Gasasira, Diane Havlir, Philip J Rosenthal, Grant Dorsey et al. The effect of HIV on malaria in the context of the current standard of care for HIV-infected populations in Africa. Future Virol. 2012 ; 7(7): 699–708. doi:10.2217/FVL.12.59