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The Impact of Malaria in Pregnancy among Women Attending Ante Natal Care in Imo State Nigeria

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Abstract: *The impact of malaria in pregnancy amongst women attending ante natal care in hospitals within Imo State Nigeria was studied, A total of 3000 pregnant women were initially recruited for the study, 2,871 (95.7%) gave full consent and consequently participated in the study. One hundred and twenty nine (4.3%) others did not complete their questionnaires properly or did not donate blood samples for laboratory investigation. Out of 2,871 persons examined using the Quantitative Buffy Coat (QBC) method 2,323 (80.9%) had malaria parasites. Similarly, the direct stained smear technique showed that 2,301 (80.1%) persons had malaria parasites while the Plasmodium falciparium (pf) antigen test showed that 1,801 (62.7%) persons were positive for malaria due to Plasmodium falciparium.Comparatively, the QBC and slide smear techniques were more effective for parasite detection than the pf antigen test. The age related prevalence showed that pregnant women within the age bracket 18 – 25 years had the highest prevalence (86.1%) of malaria infection, followed by those in the 36 – 40 (82.8%). The least prevalent age group was the 40 years and above group (74.7%) The overall mean infection according to zones showed that Owerri had the highest prevalence (83.9%), followed by Okigwe (72.1%) and Orlu (66.9%). Statistical analysis of the data showed a significant difference ($p < 0.05$) in the prevalence of plasmodiasis between the three zones of Imo State. Many pregnant women lost their jobs, some could not attend fully their businesses, some missed their religious activities due to malaria in pregnancy. Some women had low birth weight babies, some pre – term delivery etc due to malaria in pregnancy. This study has shown that malaria is a major public health challenge among pregnant women in Imo State Nigeria, leading to inestimable economic and social losses.*

Keywords: *Impact Malaria Pregnant Women Imo State*

1. INTRODUCTION

Malaria exerts a heavy toll of illness and death, especially amongst children and pregnant women. It is the most prevalent parasitic disease of the tropical world. Akogun (2008) described it as the king of all parasites of poverty. Mashaal (1993) estimated that between 1980 and 1990, the number of malaria cases in the world was more than three hundred million. At present, over 1 million children under 5 years of age die annually as a result of malaria. It also poses a risk to travelers and immigrants, with imported cases increasing in non-endemic areas (Mashaal, 2000). Treatment and control have become more difficult with the spread of drug-resistant strains of parasites and insecticide-resistant strains of mosquito vectors. Although malaria has existed since time immemorial, the aetiology of the disease was unknown until recent times. It was believed that bad air or gas from swamp "miasma" caused the disease (Volks and Wheeler, 1999; Mashaal, 2000). Present day medical science has proved that malaria is caused by microorganisms and transmitted by the bite of an infected female *Anophelese* mosquito (Becton, 2006a). Protozoan parasites belonging to the genus *Plasmodium* causes malaria. Four species of Plasmodium, namely *Plasmodium falciparium, Plasmodium vivax, Plasmodium ovale* and *Plasmodium malariae* are associated with human plasmodiasis (Chesbrough, 2002, Department of Parasitic Diseases, 2004). The female anopheles mosquito, which feed on human blood transmits *Plasmodium* parasites. The entry of malaria parasites into the body of the host provokes production of

phagocytic cells, especially from the liver, spleen and bone marrow, hence these organs become enlarged (Mashaal, 2000). The phagocytic activity of reticulo - endothelial system increases with increase in parasitaemia and results in the destruction of erythrocytes, which contains the parasite. Unparasitized erythrocytes are also destroyed by lysis at phagocytosis, resulting in anaemia. The biochemistry of malaria in relation to body organs has not been well documented in Nigeria, however it is known that malaria affects the spleen, liver, bone marrow and other parts of the viscera, like kidneys, adrenal, lungs, stomach, intestine etc. Furthermore, the brain shows pathologic features in severe cases clinically referred to as cerebral malaria.

Forbes and Jackson (1993) reported that malaria is the major cause of morbidity and mortality in many tropical and subtropical countries. Several previous studies showed that in endemic malarious areas, particularly in tropical Africa, placental malaria is a frequent occurrence in women at parturition (Mashaal, 2000, 1993, Ngele, 2008, Chukwuocha *et al.* 2008). These studies show that incidence of infection was highest in women with first pregnancy and thereafter declined progressively with increasing maternal parity. During pregnancy an increase occurs in the prevalence and intensity of *falciparum* malaria. This increase relative to non - pregnant women remains fairly constant with age though there is an overall decrease in prevalence and intensity of infection in both groups with age (Bray and Anderson, 1999).

There is paucity of information and published data on the prevalence of malaria and its socioeconomic consequences on pregnant women in Imo State. Maternities and gynaecology clinics appear to be the busiest clinics and wards in hospitals and health care centers in Imo State. Malaria appears to rank highest amongst the various illnesses commonly diagnosed and managed amongst pregnant women in Imo State yet the actual burden and socioeconomic consequences of malaria amongst pregnant women has not been adequately investigated and reported. This study was undertaken therefore to determine the epidemiology and socio – economic consequences of malaria in pregnant women in Imo State, Nigeria.

Many illnesses can have more serious consequences during pregnancy than when pregnancy does not exist. Women exposed to frequent re – infection in endemic areas appear to lose some of their acquired resistance during pregnancy and may consequently suffer severe malaria attacks. Severe attacks also appear often in the puerperium (MacGraith *et al*., 1980). During the second trimester of pregnancy there is multi – factorial transient immuno-suppression. The presence of high adrenal steroid levels, placental chorionic gonadotrophin, alpha – fetoprotein and the depression of the lymphocytes role, may play an important role in the immuno – suppression mechanism of a pregnant female. Therefore, malaria parasites occur at higher rates than in non-pregnant women in the same areas (Bruce-Chwatt, 1980).

Microcirculatory arrest in the placenta may cause intra – uterine death of the foetus, small babies and premature delivery (Bell, 1981; Russell *et al.*,2003). The complications in pregnancy resulting from malaria infections include abortion, difficult delivery, low birth weight, haemolytic anaemia, renal insufficiency and eclampsia, congenital malaria (Mashaal, 2000). There are risks associated with traveling while pregnant particularly during the first 3 months of pregnancy. Thus areas where (multi - resistant) malaria or yellow fever occurs should be avoided during pregnancy. Certain types of travel are not advisable during pregnancy. It is important that pregnant women should consult the vaccinations agency before booking up a trip. However, when taking any vaccination or drug against malaria, the benefits and uses must be weighed against the potential damage to the foetus. Several previous studies revealed that in many endemic malarious areas, particularly in tropical Africa, placental malaria is a frequent occurrence in women at parturition (Reinhardt, 1978). Incidence of infection was highest in women delivering their first babies and thereafter declined progressively with increasing maternal parity. In contrast with males, Ekpo *et al.* (2008) reported that Fulani females were significantly more infected ($p < 0.05$) than their male counterparts. During pregnancy an increase occurs in the susceptibility to *falciparium* malaria. The increase relative to the non – pregnant women remains fairly constant with age though there is an overall decrease in prevalence and intensity in both groups with age (Bray and Anderson, 1999). In Ebonyi State, south - eastern Nigeria, Ngele (2008) reported high incidence (72.0%) of malaria amongst pregnant women. According to this report, plasmodiasis amongst the study participants was associated with low (8.5g/dl to 10.3g/dl) haemoglobin (Hb) concentration.

Generally, preventive measures against malaria include mosquito control, personal mosquito – bite avoidance measures and often, prophylactic therapy for people entering or living in a malarious area. Advice given to travelers should take into account of the relative risk of acquiring infection, the degree of resistance (Forbes and Jackson, 1993). Some workers (Ngele, 2008) have suggested control of vectors of malaria parasites and the parasites through intensive educational campaign among the populace and the use of long lasting insecticides treated nets. In addition to this, Abdullahi *et al*., (2008) advocated for improvement on the environment by Public Health authorities to inhibit mosquito breeding. Chukwuocha *et al*.,(2008) stressed the need to restructure the ongoing malaria control strategies and implement them through integrated approach to achieve more reassuring results.

Chloroquine is the drug of choice for treating benign tertian or quartan malaria and for *falciparium* malaria acquired in areas where there is no resistance of parasites to chloroquine. Chloroquine is however contra – indicated in pregnancy. Also, chloroquine resistance is increasing and up – to – date advice is required before malaria is treated if the patient comes from an area of possible drug resistance. Lariam® can be taken after the third month of pregnancy. Malarone® and doxycycline may not be taken during pregnancy. Nivaquine® and Paludrin® may be taken throughout pregnancy, but offer less effective protection in many areas.

2. MATERIALS AND METHODS

2.1. Study Area,

This study was carried out in Imo State, Nigeria. Imo state situates in south eastern Nigeria. It enjoys a teaming population of young men and women engaged in all walks of life. It comprises of 3 political zones: Owerri, Orlu and Okigwe.

2.2. Test Samples

The samples used for this study are blood samples collected from pregnant women registered for ante natal care (ANC) at the Federal Medical Centre Owerri, Imo State University Teaching Hospital Orlu and Okigwe General Hospital.

2.3. Methods

A total of 3000 pregnant women aged 18 to 45 years registered for ante - natal care at the selected health institutions in the three zones of Imo State (Owerri, Orlu and Okigwe) were randomly selected for the study. The objectives of the study were carefully explained to the participants and their willingness to participate in the study was sought for and those who voluntarily accepted to be included in the study were selected.

2.4. Analysis of Samples

The blood samples were examined for malaria parasites using the Quantitative Buffy Coat (QBC) technique, stained slide smear techniques and *Plasmodium falciparium* (pf) antigen technique according to the methods described in Cheesbrough (2002) and Njoku *et al*, (2000).

2.5. Quantitative Buffy Coat (Qbc) Technique

The QBC centrifugal test for detecting malaria parasites is based on the centrifugal stratification of *Plasmodium* parasites, which greatly enhances their visibility by concentrating them, thereby enabling extremely rapid and highly sensitive detection and identification.

Thick and thin blood films of each blood sample were made on grease free slide and stained with Field stain A & B, Geimsa and Leishman stains as described in Cheesbrough (2002) and Njoku *et al*, (2000).The stained blood films were examined microscopically using oil immersion objective as described by Cruickshank *et al*, 1985; Njoku *et al* (2000).

2.6. Ethical Consideration

Ethical permit for this study was obtained from Imo State Ministry of Health, Owerri

2.7. Statistical Analysis

Data obtained from this study were analysed using simple per cent and Chi – square statistics according to the methods described by Philips (2012), Onuh and Igwenma, (1998) .

3. RESULTS

Out of 3000 pregnant women targeted for this study, 2,871 (95.7%) gave full consent and consequently participated in the study. One hundred and twenty nine (4.3%) others did not complete

their questionnaires properly or did not donate blood samples for laboratory investigation after completing their questionnaires or declined after giving initial consent to participate in the study.

Out of 2,871 persons examined using the Quantitative Buffy Coat (QBC) method 2,323 (80.9%) had malaria parasites. Similarly, the direct stained smear technique showed that 2,301 (80.1%) persons had malaria parasites while the Plasmodium falciparium (pf) antigen test showed that 1,801 (62.7%) persons were positive for malaria due to Plasmodium falciparium. Comparatively, the QBC and slide smear techniques were more effective for parasite detection than the pf antigen test. However, the overall mean infection determined by the 3 diagnostic methods was 74.6%. The age related prevalence showed that pregnant women within the age bracket 18 – 25 years had the highest prevalence (86.1%) of malaria infection, followed by those in the 36 – 40 (82.8%). The least prevalent age group was the 40 years and above group (74.7%) (Table 1). Similarly the stained smear microscopy showed that pregnant women aged 18 – 25 years had the highest prevalence of malaria (85.1%), while the least prevalence (71.9%) was amongst those aged 41 years and above. The Pf – Antigen test showed also that those aged 18 – 25 years had the highest prevalence of malaria (77.5%) while those aged 41 years and above had the least prevalence (47.9%). Overall, the age – related mean infection showed that women in the 18 – 25 years age bracket had highest prevalence (82.9%), while the least prevalent group was those 41 years and above (64.8%).

The prevalence of malaria amongst pregnant women in relation to the different zones in Imo State showed that out of 783 persons examined from Okigwe zone, 601 (76.8%) had malaria parasites using the QBC test, 499 (63.7%) were positive for malaria by in vitro blood antigen test while 595 (71.7%) were positive by the slide test (Table 2). Out of 977 persons examined from Orlu zone, 712 (72.9%) had malaria parasites in their blood samples using the QBC method, while 539 (55.2%) were positive for malaria by in vitro blood antigen test and 710 (72.7%) were positive by the stained – slide test. Similarly, in Owerri zone, out of 1,111 pregnant women examined, 1,010 (90.9%), 763 (68.75%) and 995 (89.6%) had malaria parasites in their blood samples as estimated by the QBC test, in – vitro blood antigen test and stained – slide test respectively. The overall mean infection according to zones showed that Owerri had the highest prevalence (83.9%), followed by Okigwe (72.1%) and Orlu (66.9%). Statistical analysis of the data showed a significant difference ($p < 0.05$) in the prevalence of plasmodiasis between the three zones of Imo State.

The trimester – related prevalence of plasmodiasis amongst pregnant women in Imo State showed that the highest prevalence of plasmodiasis (84.7%) occurred amongst pregnant women in their second trimester as estimated using the QBC method (Table 3). Similarly 77.5% of women in the first trimester and 79.5% in the third trimester were infected with malaria parasites as determined by the QBC method. In stained smear microscopy, the highest prevalence of malaria (83.7%) was amongst pregnant women in their second trimester, followed by those in their 3rd trimester (78.6%). Pf – antigen test showed that women in their second trimester had the highest prevalence of malaria (74.5%) and the least prevalence (50.3%) was amongst those in their third trimester. The mean infection was highest in women in the second trimester (81.0%), followed by those in the first trimester (72.6%) and third trimester (69.5%).

Occupational – related prevalence of plasmodiasis amongst the pregnant women showed that 77.8% of civil servants, 78.9% of housewives, 81.4% of traders, 85.7% of artisans and professional had malaria parasites using the QBC method (Table 4). A comparative analysis with Plasmodium falciparium antigen test showed that 57.9% of housewives, 58.1% of traders, 66.4% of artisans and professional and 74.1% of civil servants were infected with malaria parasites while stained – slide method showed that 76.8% of civil servants, 78.1% of housewives, 81.2% of traders and 85.0% of artisans and professionals were infected. The mean infection was similar in all occupational groups, however with a slightly higher prevalence in Artisans / Professional (79.0%) and Civil servants (76.2%). Statistical analysis of the data using chi square showed no significant difference ($p > 0.05$) in the prevalence of plasmodiasis between pregnant women of different occupational groups.

Table 5 summarizes the symptom – related prevalence of malaria amongst pregnant women in Imo State. The results showed that 43.9% of pregnant women having general body weakness, 52.3% of apparently healthy asymptomatic pregnant women, 88.5% of those with fever, 94% of those with headache and 96.8% of those with both fever and headache were infected with malaria parasites as shown by the QBC test. Statistical analysis of the data using chi square showed significant difference ($p < 0.05$) in the prevalence of malaria infection between pregnant women with different symptoms.

The stained smear microscopy showed that 43.0% of pregnant women who had general body weakness, 87. 9% of those with fever, 92.9% of those with headache and 96.6% of those with both fever and headache had malaria. Similarly, the pf – antigen test showed that 26.1% of pregnant women with general body weakness, 76.5% of those with fever, 80.6% of those with headache and 90.5% of those with fever and headache were infected with malaria parasites.

However, for patients without symptoms, QBC method showed that 52.3% had malaria, while the stained smear microscopy showed that 51.5% were infected and Pf – antigen test showed that 25.5% were infected. This is a further confirmation that the QBC and slide smear techniques were more efficient in the detection of parasites. Statistical analysis of the data using chi square showed no significant difference ($p > 0.05$) between QBC and stained slide smear in parasite detection.

The overall mean infection showed that patients with a combined symptom of headache / fever (94.7%) was the most prevalent group while those with general weakness was the least prevalent group (37.7%).

Table 6 summarizes the intensity of plasmodiasis amongst pregnant women in three zones of Imo State. Overall results from the stained – slide method showed that 1,132 (39.4%) of women examined had scanty malaria parasites (one parasite per high power field (pHF) in not less than 50% of the total number of fields examined), 819 (28.5%) persons had moderate plasmodiasis (1 – 2 parasites per high power field in not less than 50% of the fields examined) while 350 (12.2%) persons had heavy parasitaemia (2 or more parasites in at least 50% of the fields examined)

Out of 2,871 pregnant women examined in this study, 164 (5.7%) reported they have had pre – term delivery in previous pregnancies as a result of malaria. Three hundred and fifty (12.19%) have had miscarriage due to malaria infection while 201 (7.0%) have had low birth weight due to malaria.

Table1. *Age – Related Prevalence of Malaria in Imo State*

AGE (Years)	NUMBER EXAMINED	NUMBER INFECTED (%)			MEAN (%) INFECTION
		QBC	SLIDE SMEAR	Pf ANTIGEN	
18 – 25	503	433 (86.1)	428 (85.1)	390 (77.5)	417 (82.9)
26 – 30	887	730 (82.3)	726 (81.8)	556 (62.7)	670 (75.6)
31 – 35	859	657 (76.5)	652 (75.9)	534 (62.2)	614 (71.5)
36 – 40	476	394 (82.8)	390 (81.9)	251 (52.7)	345 (72.5)
41 - ABOVE	146	109 (74.7)	105 (71.9)	70 (47.9)	95 (64.8)
TOTAL	**2,871**	**2,323 (80.9)**	**2,301 (80.1)**	**1,801 (62.7)**	**2,141 (74.6)**

Key: QBC = Quantitative Buffy Coat Pf - Antigen = *Plasmodium falciparium* antige

Table2. *Prevalence Of Malaria Among Pregnant Women In Imo State According To Zones*

ZONE	NUMBER EXAMINED	NUMBER INFECTED (%)			MEAN (%) INFECTION
		QBC	SLIDE SMEAR	Pf ANTIGEN	
OWERRI	1,111	1,010	995 (89.6)	763 (68.7)	922 (83.9)
ORLU	977	(90.9)	710 (72.7)	539 (55.2)	653 (66.9)
OKIGWE	783	712	595 (71.7)	499 (63.7)	565 (72.1)
		(72.9)			
		601			
		(76.8)			
TOTAL	**2,871**	**2,323 (80.9)**	**2,301 (80.1)**	**1,801 (62.7)**	**2,141 (74.6)**

Key: QBC = Quantitative Buffy Coat

Pf - Antigen = *Plasmodium falciparium* antigen

Table 3. *Trimester – Related Prevalence Of Malaria In Imo State*

TRIMESTER	NUMBER EXAMINED	NUMBER INFECTED (%)			MEAN (%) INFECTION
		QBC	SLIDE SMEAR	Pf ANTIGEN	
FIRST	769	596	594 (77.2)	484 (62.9)	558 (72.6)
SECOND	1,073	(77.5)	898 (83.7)	799 (74.5)	868 (81.0)
THIRD	1,029	909	809 (78.6)	518 (50.3)	715 (69.5)

		(84.7) 818 (79.5)			
TOTAL	**2,871**	**2,323 (80.9)**	**2,301 (80.1)**	**1,801 (62.7)**	**2,141 (74.6)**

Key: QBC = Quantitative Buffy Coat Pf - Antigen = *Plasmodium falciparium* antigen

Table 4. *Occupational – Related Prevalence Of Malaria In Pregnant Women In Imo State*

OCCUPATION	NUMBER EXAMINED	NUMBER INFECTED (%)			MEAN (%) INFECTION
		QBC	SLIDE SMEAR	Pf ANTIGEN	
HOUSE WIVES	836	660 (78.9)	653 (78.1)	484 (57.9)	599 (71.7)
CIVIL SERVANTS	526	409 (77.8)	404 (76.8)	390 (74.1)	401 (76.2)
TRADERS	902	734 (81.4)	732 (81.2)	524 (58.1)	663 (70.2)
ARTSANS / PROFFESSIONALS	607	520 (85.7)	516 (85.0)	403 (66.4)	479 (79.0)
TOTAL	**2,871**	**2,323 (80.9)**	**2,301 (80.1)**	**1,801 (62.7)**	**2,141 (74.6)**

Key: QBC = Quantitative Buffy Coat Pf - Antigen = Plasmodium falciparium antigen

Table 5. *Symptom – Related Prevalence Of Malaria In Pregnant Women In Imo State*

SYMPTOMS	NUMBER EXAMINED	NUMBER INFECTED (%)			MEAN (%) INFECTION
		QBC	SLIDE SMEAR	Pf ANTIGEN	
HEADACHE	711	668	661 (92.9)	573 (80.6)	634 (89.2)
FEVER	680	(94.0)	598 (87.9)	520 (76.5)	573 (84.3)
HEADACHE/FEVER	506	602	489 (96.6)	458 (90.5)	479 (94.7)
GENERAL WEAKNESS	230	(88.5)	99 (43.0)	60 (26.1)	87 (37.7)
		490			
	744	(96.8)	383 (51.5)	190 (25.5)	321 (43.1)
NO SYMPTOM		101			
		(43.9)			
		389			
		(52.3)			
TOTAL	**2,871**	**2,323 (80.9)**	**2,301 (80.1)**	**1,801 (62.7)**	**2,141 (74.6)**

Key: QBC = Quantitative Buffy Coat Pf - Antigen = *Plasmodium falciparium* antigen

Table6. *Intensity Of Plasmodiasis Amongst Pregnant Women In Imo State Using Stained – Slide Method*

ZONE	NUMBER EXAMINED	NUMBER INFECTED (%)		
		Scanty	1 - 2pHF	2 – 3pHF
OWERRI	1,111	488 (43.92)	307	187 (16.83)
ORLU	977	390 (39.92)	(27.63)	87 (8.90)
OKIGWE	783	254 (32.44)	281	76 (9.71)
			(28.76)	
			231	
			(29.50)	
TOTAL	**2,871**	**1,132 (39.4)**	**819 (28.5)**	**350 (12.2)**

Key: pHF = parasites per high power field

Table7. *Complications Associated With Malaria*

COMPLICATION	No. EXAMINED	No. WITH COMPLICATION	PREVALENCE (%)
Pre-term Delivery		164	5.7
Miscarriage	2,871	350	12.19
Low Birth weight		201	7.0
TOTAL	**2,871**	**715**	**24.90**

Of 2,871 pregnant women examined in the study, seven hundred and twenty three (25.2%have missed some religious programmes or failed to keep up with their religious programmes due to malaria in the present pregnancy.Eight hundred and ninety four (31.1%) have failed to carry out some domestic responsibilities due to malaria episode (Fig. 1).

Fig. 2 shows the economic consequences of malaria on pregnant women in Imo State in the last 6 months of this study. Of 930 pregnant women who have been hospitalized or received bed rest, 41 (4.4%) spent approximately N1,000. 00 for treatment, 83 (8.8%) spent about N2,000. 00 while 217 (23.1%) spent about N3,000. 00, 443 (47.2%) spent about N4,000. 00 and 155 (16.5%) spent above N5,000. 00. All together, the women spent about N3,364,000.00 (₦3.36 million) for treatment of malaria within a period of 6 months. Similarly, 179 (19.1%) lost revenue worth about ₦ 1,000. 00 due to malaria, 299 (31.8%) lost revenue of about ₦ 2,000. 00, 387 (41.2%) lost revenue of about ₦ 3,000. 00, 63 (6.7%) lost revenue of about ₦4,000. 00 while 11 (1.2%) lost revenue of about ₦5,000. 00 due to malaria. In all, the women lost a total revenue of about ₦2, 447,500.00 (₦ 2.44 million) due to malaria during pregnancy in 6 months of survey.

A review of the prevalence of malaria in Imo State from 1999 to 2004 based on data obtained from the Epidemiology Unit, Imo State Ministry of Health revealed that in 1999 a total of 40,102 malaria cases comprising 14,526 (36.22%) males and 25,576 (63.78%) females were reported (table 9). Of this number, 7,709 (19.22%) cases were confirmed by laboratory diagnosis and 71 (0.17%) malaria - related deaths comprising 43 (0.30%) males and 28 (0.11%) females were also reported. In 2000, 66,180 malaria cases comprising 29,001 (43.82%) males and 37,179 (56.18%) females were reported. There was no available data on laboratory confirmed cases while 115 (0.17%) malaria – related deaths comprising 65(0.22%) males and 50 (0.13%) females were reporte4d. in 2001, the number of reported malaria cases in the State dropped to 33,897 cases comprising 16,083 (47.45%) males and 17,814 (52.55%) females. Of this number, 2568 (7.58%) cases were confirmed by laboratory diagnosis while reported cases of malaria – related deaths stood at 19 (0.05%) comprising of 10 males and 9 females. In 2002, 69,238 malaria cases comprising 32,511 (46.96%) males and 36,727 (53.04%) females were reported, out of which 14,734 (21.28%) laboratory confirmed cases were recorded. Malaria – related deaths in the year stood at 163 (0.24%) comprising 93 (0.29%) males and 70 (0.19%) females. In 2003, there were 64,817 reported malaria cases and 171 (0.26%) malaria – related death cases as against 66,195 malaria cases and 176 (0.27%) malaria – related death cases reported in 2004. There was no data on laboratory confirmed cases and gender – related cases of malaria and malaria – related deaths in 2016 and 2017. As shown (table 8), the prevalence of malaria rose from 2012 to 2013 and dropped in 2014 and rose again in 2015 with a slight drop in 2016 and 2017.

This is compared with the prevalence of malaria in the present study

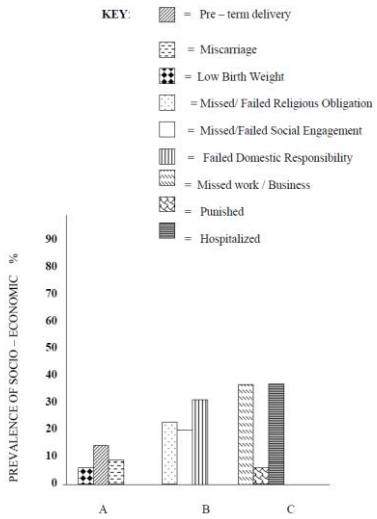

Fig.1: *Socio – Economic Impact of Malaria on Pregnant Women in Imo State*

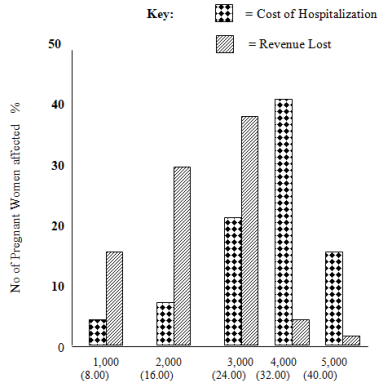

Fig.2. *Economic Impact of Malaria on Pregnant Women in Imo State*

Table8. *Prevalence of malaria in Imo State 2012 to 2017*

Year	Sex	Number Reported	Laboratory Confirmed Cases	Reported Death
2012	M	14,526	7,709	43
	F	25,576		28
	T	**40,102**		**71**
2013	M	29,001	NAR	65
	F	37,179		50
	T	**66,180**		**115**
2014	M	16,083	2,568	10
	F	17,814		9
	T	**33,897**		**19**
2015	M	32,511	14,734	93
	F	36,727		70
	T	**69,238**		**163**
2016		64,817	NAR	171
2017		66,195	NAR	176
Total		**330,429**		**715 (0.22%)**

NAR = No Available Report

M = Male

F = Female

T = Total

4. DISCUSSIONS

Malaria has been described as a major cause of morbidity and mortality in many tropical and subtropical countries (Forbes and Jackson, 1993). The number of cases imported from endemic areas grow each year as a result of ever increasing global travel. Increasing geographic spread of resistance of *Plasmodium* parasites to chloroquine and other antimalarial drugs is causing major problems in the management and control of the disease. Previous studies (Mashaal, 2000) reported that malaria consists of about 10 – 30% of all hospital admissions in malaria endemic areas. The high prevalence of malaria by QBC method (80.9%) observed amongst pregnant women in this study agrees with similar report by Ngele, (2008), who obtained a 72% prevalence amongst pregnant women attending ante – natal care at secondary health facility in Ebonyi State Nigeria. The slight variation in the two reports may be attributed to the difference in the diagnostic methods used. While the present study used pf antigen test, stained smear microscopy and QBC methods, Ngele (2008) used only the stained smear microscopy method. Furthermore, Ngele (2008) studied pregnant women in a secondary health facility only whereas the present study was carried out in three zones of Imo State, covering two tertiary and one secondary health facilities with a population size 10 times more than that of Ngele (2008). However, both studies emphasized the public health importance of malaria in the tropics. Furthermore, the studies show that malaria is a major public health problem amongst pregnant women in Nigeria.

The age – related prevalence showed a decrease in infection with increase in age from 86.1% to 74.7% (QBC), 85.1% t0 71.9% (stained smear microscopy) and 77.5% to 47.9% (pf antigen test), with a mean of 82.7% to 64.8% amongst pregnant women in the age group 18 – 25 years and those in

the 40 years and above age brackets. Statistically, this difference in prevalence in various age groups was not significant ($p > 0.05$). This observation agrees with the findings of previous workers (Bruce – Chwatt, 1980; Mashaal, 2000; Usip and Opara, 2008) who stated that age and sex have no bearing on the incidence of malaria. Bray and Anderson (1999) further added that the increase relative to non pregnant women remains fairly constant with age, however there is an overall decrease in prevalence and densities in both pregnant and non pregnant women with increase in age.

The prevalence of malaria in relation to zones in this study showed that Owerri was significantly higher (90.9%) than Okigwe (76.8%) and Orlu (72.0%) zones. This may reflect the more deteriorating environmental conditions of the urban city (Owerri) than the sub – urban areas of Okigwe and Orlu. The accumulation of refuse dumps and irregular disposal of municipal wastes as well as the blockages of gutters in Owerri serve as breeding sites for the vectors of malaria parasites. In Orlu, and Okigwe, the population is smaller with people living in more spacious environments and waste management constitutes little or no problem since most household have evolved effective ways of disposing their wastes regularly.

Malaria infection was highest (84.7%) amongst pregnant women in the second trimester of pregnancy, followed by those in the third and first trimesters (79.5%) and (77.5%) respectively. This finding corroborates the report of Mashaal, (2000) who observed that during the second half of pregnancy (2^{nd} to 3^{rd} trimesters), there is multifactorial transient immunosuppression. The presence of high adrenal steroid levels, placental chorionic gonadotrophin, alpha fetoproteins and the depression of the lymphocytes role, may play an important role in the immunosuppression mechanism of a pregnant female. Therefore malaria relapses of infection due to *Plasmodium vivax, P. malariae, P. ovale* or recrudescences of *P. falciparium* are frequently seen at a higher rate in pregnant women than in non pregnant women.

Pregnant women having a combination of headache and fever had the highest prevalence (96.8%) than those who have headache alone (94%) and those with fever alone (88.5%). The least prevalence (43.9%) was observed amongst those with general body weakness and followed by those without any manifest symptom (52.3%). This finding agrees with previous reports (Mashall, 2000; Forbes and Williams, 1981), who stated that features of an acute malarial attack may include fever, rigors, sweating, headache, myaglia, gastrointestinal upset and respiratory symptoms. In severe *falciparium* malaria, there may be collapse, convulsions and coma (cerebral malaria). Elsewhere, Chukwuocha *et al*., (2008) reported that fever, vomiting and headache were the most common clinical symptoms observed in 32.9% of their study participants. Other workers (Mashall, 2000; Forbes and Williams, 1981) reported that the presence of retinal haemorrhage in non – comatose patient often heralds the rapid onset of cerebral symptoms. Spleenomegally and anaemia are common in acute attacks. Acute haemolytic crises may also be associated with haemoglobiuria (blackwater fever). Chronic infection may be associated with massive spleenomegaly (tropical spleenomegaly syndrome) or with the nephritic syndrome.

The diagnostic methods used in this study showed that quantitative buffy coat centrifugal method (80.9%) and the direct blood smear technique (80.1%) was more sensitive in detection of malaria parasites than the pf antigen test (62.7%). This finding agrees with previous reports (Amadi *et al*., 2008), which observed that rapid malaria test based on soluble antigen detection gives significant false positive and false negative results and fails to detect low infection densities. Over the years, the thick blood film method has remained the predominant and acceptable malaria detection method worldwide. The thick – film method, which involves the microscopic examination of Giemsa stained dried blood films demands a degree of technical skill, training and experience. Understandably, these skills levels are rarely in adequate supply in regions devastated by malaria (Becton, 2006a). The thick – film method requires that diagnosis be made in specialized laboratories with qualified laboratory scientists. Such laboratories are often located far from the village, where patients live. Slide preparation and interpretation are tedious and time consuming. Obscuring debris, poor contrast from inadequate staining and other random "noise" significantly reduce sensitivity. The delay between specimen collection and positive diagnosis can be from days to weeks and when positive cases of malaria are diagnosed, it is often impossible to find the patients and treat them because they have left the area or they are too sick to leave home or they have died. Consequently, malaria continues to spread. Millions of children, women and men continue to die annually. The limitations of the thick film method for detecting malaria have prompted the need for more effective, sensitive and reliable alternative. A more efficient, less technically demanding and more sensitive diagnostic method is

required in order to reduce transmission rates, disease incidence and morbidity. Prompt and accurate diagnosis can lead to selective rather than presumptive use of anti – malarial drugs. Immediate diagnosis within the community will also allow for more selective and targeted insecticide use, conserving resources and minimizing the possibilities of resistance.

The QBC malaria test provides markedly increase levels of accuracy and sensitivity, simple to learn, potable and cost effective. It enables non – technical health workers to test large numbers of patients and rapidly diagnose early cases. The typical processing time for the thick film slide technique is 40 minutes for a batch of 25 slides. With QBC batches of 20 tubes can be centrifuged simultaneously (total time to collect and process QBC samples is 60 seconds per specimen).

Although the pf antigen technique appears to be less effective in the diagnosis of malaria, it is the simplest technique and requires no skill. The patient can do the test without consulting a laboratory scientist or technician. The test can be completed in a few seconds. The disadvantages are the high cost of kits presently in Nigeria and low sensitivity of the test leading to false negative results especially in cases of low parasitaemia.

The socio – economic consequences of malaria are many. In the present study, about 25.2% failed in their religious obligations, while 20.8% failed or missed social activities or engagements. Another 31.1% failed in their domestic obligations due to malaria. Economically, the women lost about ₦3,364,000. 00 and ₦2,447,500. 00 within 6 months, for treatment of malaria and expected revenue lost due to malaria respectively. In addition to these are other unestimated expenses incurred, such as cost of transport while seeking treatment, funeral expenses for children and adults who die as a result of malaria, aerosol sprays, mosquito coils, mosquito nets and other mosquito control expenses. It is estimated that 40% of health facility expenditures in sub-Saharan Africa are spent on malaria treatment. In industry and agricultural enterprises like livestock and crop farms, malaria accounts for the greatest number of man – hour lost, which may be up to or more than 50% of all the man – hours lost. This affects production and revenue for the industry, families and the nation as well. There is loss of investment funds thus affecting the economy of the nation. It is known that investors are not much interested in investing in countries where most of their profits will be lost through absenteeism from work due to malaria and on treatment of malaria infected workforce.

Malaria has serious socio – cultural consequences on families by causing absenteeism from school and thus affecting academic performance and loss of investment funds thus affecting the economy of Nigeria. Malaria has caused many people to fail in their religious obligations, marriage and domestic duties, etc. while it is known that investors are not much interested in investing in countries where most of their profits will be eroded through absenteeism from work. It can hardly be estimated how much this country loses through potential investors who dread malaria and its impact on the workforce.

This study showed that malaria is endemic amongst pregnant women in the State and amongst the Imo populace in general. The data available from the State Ministry of Health showed increase in the prevalence of malaria amongst Imo populace and pregnant women in particular. From 2012 to 2013, the prevalence of malaria increased by 65% and dropped in 2014 but rose again from 2014 to 2015 by 104% with a slight drop in 2016 but rose again from 2015 to 2017 by 2.1%. One obvious fact from the available data is that malaria has remained endemic and increases at a very high rate in Imo State over the years. This finding corroborates the report of previous workers (Nwokeocha, 2004) who reported increasing prevalence of malaria amongst children in Imo State. The increasing prevalence of malaria in Imo over the years may be related to deteriorating environment and poor sanitary condition prevalent in Imo State for over a decade now.

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