

Full Length Research Paper

A study of the socio-economic effect and epidemiology of malaria in pregnant women in Imo State Nigeria

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Human infected with malaria parasites (*Plasmodium* sp.) and its socio-economic consequences were investigated in parts of Imo State Nigeria between August 2007 and September 2008 using standard parasitological and socio-economic methods. Blood samples were collected by vein puncture from 2,871 consenting pregnant women registered for ante natal care at Federal Medical Centre, Owerri, Imo State University Teaching Hospital, Orlu and Okigwe General Hospital Okigwe as well as Imo State University Teaching Hospital Community Health Outreach Centre, Ogbaku, Mbaitoli L. G. A. The samples were analysed parasitologically for detection of malaria parasite using three different methods namely Quantitative Buffy Coat (QBC) technique, Slide smear technique and *Plasmodium falciparum* antigen. Similarly, questionnaires were administered to the same patients to elicit vital information on socio-economic consequences of malaria. The results showed that out of 2,871 persons examined, 2,323 (80.9%), 2,301 (80.1%) and 1,801 (62.7%) had malaria parasite determined by the QBC stained smear and *P. falciparum* antigen techniques respectively. The total loss due to malaria in pregnancy within a six month period was estimated at 5.8 million naira. The study has confirmed that the burden of malaria in pregnant women in Imo State Nigeria is high.

Key words: Epidemiology, socio-economic, consequences, malaria, pregnant women, Imo State, Nigeria.

INTRODUCTION

Malaria is the most prevalent parasitic disease in the tropics, and thus the king of all parasites is poverty (Akogun, 2008). Forbes and Jackson (1993), Ngele (2008), Obiukwu and Okwuonu (2008), Bray and Anderson (1979), exerts that in endemic malarious area particularly in tropical Africa, placental malaria is a frequent occurrence in women at parturition. These studies show that incidence of infection was highest in women with first pregnancy and their after declined progressively with increasing maternal parity. Malaria exerts a heavy toll of illness and death, especially amongst children and pregnant women. At present over one million children under 5 years of age die annually as

a result of malaria (Mashal, 1986).

Malaria is caused by the protozoan parasite belonging to the genus *Plasmodium*. Four species of *Plasmodium* has been implicates with human malaria viz *Plasmodium ovale* and *Plasmodium malariae*. Female anopheles mosquitoes, which feed on human blood transmits *Plasmodium* parasites. The entry of these parasites into the body of the host provokes the production of phargo-citic cells from the liver, spleen, and bone marrow, thus causing the organs to become enlarges (Mashaal, 1986).

Treatment and control of malaria proves difficult with the spread of drug resistance strains of parasites and insecticides resistance strains of mosquito vectors.

MATERIALS AND METHODS

Study area

This study was carried out in Imo State, Nigeria. Imo state is one of the 36 states of Nigeria. It is located in the South Eastern Zone of

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Nigeria between the latitudes 5°29'N, 7°2'E and longitude Imo State comprises of three geo-political zones, namely, Owerri, Orlu and Okigwe. There are good network of roads linking the zones as well as urban and rural centers. The citizens are greatly diversified professionals including traders, farmers, artisans, public/civil servants, politicians, students, etc. The standard of living is average while the literacy level is high with a remarkably high level of youth unemployment.

The level of environmental sanitation has been remarkably high over the years until the long period of military intervention in national politics and governance. The urban centers in particular Owerri, the capital city was characterized by unsightly refuse dumps, over filled and blocked gutters and drainages and consequently denied Owerri the beauty and glory of being the cleanest city in the Federation. Stagnant water bodies, over grown bushes and fields even around homes and offices were easily noticeable in both urban and rural communities in the state. These changes in the environment increased vector breeding sites and consequently increased transmission of the malaria parasites in the area.

Instrument for data collection

The instrument for socio-economic data collection in this study was a structures questionnaire administers on all respondents who were also part of clinical study. Blood samples were for ante natal care (ANC) at the Federal Medical Centre Owerri, Okigwe General Hospital and Imo State University Teaching Hospital Orlu. A total of 3000 pregnant women aged 18-40 years who registered for ante-natal care at various selected health institution in the three Zones of Imo State were randomly selected for the study.

Administration of questionnaires

A structured questionnaire comprising of two sections (a) socio demographic information and (b) socio-economic information, was administered all the participant. This was to elicit necessary information to correlate the clinical and laboratory findings.

Parasitological studies

Blood sample by vein-puncture was collected from each study participant by laboratory scientist at each selected health institution and analyzed within 2-4 h of collection.

Analysis of blood sample

The blood samples were examined for malaria parasites using QBC technique, stained slide smear techniques and *Plasmodium falciparum* (pF) antigen technique according to the methods described in Chessbrough (1998) and Njoku et al. (2000).

QBC 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.

The QBC tubes were filled with 55-65 uL of patients' blood. A clear plastic closure was attached to each tube. A precisely made cylindrical float designed to be suspended in the packed red cells was inserted. The tubes were centrifuged at 12,000 rpm for 5 min. The components of the Buffy coat were separated according to their densities forming discrete bands. The components of the Buffy coat were separated according to their densities forming discrete bands. The QBC tubes were placed on the paraviewer microscope

tubes holder and examined using a standard white light microscope equipped with the paralens UV microscope adapter and epi-illuminated microscope objective. Fluorescing parasites were then observed at the red blood cells/white blood cell interface (Patton et al., 1987).

Stained slide smear technique: thick and thin blood films of each blood sample were made on grease free slide and stained with field stained A and B, Geimsa and Leishman stains as described in Cheesbrough (1998) and Njoku et al, (2000).

Thin blood film

A drop of each blood sample was placed near one end of a grease-free glass slide; the edge of a cover slip held at approximately angle 45 was used to smear the blood evenly on the slide to produce a uniform spread thin smear of the sample. It was labeled with diamond pencil at the margin and allowed to dry in a horizontal position at room temperature. Duplicate copies of thin film smear of each blood sample were made.

Thick blood film

A drop of each blood sample was place at the center of a clean grease-free glass slide and the edge of another glass slide was used to smear the sample to produce a circular thick film of about 2-3 cm in diameter. It was labeled with a diamond pencil at the margin and allowed to dry at room temperature. This was carried out in duplicates for each blood sample.

Staining techniques

All the blood films were allowed to stay overnight before staining. The blood films were dehaemoglobinized by immersing in buffered solution. Thin blood films were fixed in absolute alcohol for 60 s and allowed to dry in the air. Both thin and thick blood films were stained accordingly and examined microscopically using oil immersion objective as described in Cruickshank et al. (1985) and Njoku et al. (2000).

***Plasmodium falciparum* (pF) antigen test**

Malaria parasite *in vitro* antigen test kits (product of Global Devices) LOT No: MAL 6090006 was used for malaria infection. The test was carried out according to the manufacturer's instruction on the product literature.

A drop of each respondents blood sample was placed inside the test well of the antigen test kit using a Pasteur pipette, one drop of the test buffer was added. The sample was allowed to migrate through the test kit membrane and the result read within 5 min. The tests that gave indeterminate or doubtful results were repeated. All blood samples were tested within 4 h of sample collection.

RESULTS

Prevalence of malaria plasmodiasis amongst pregnant women in Imo State was carried out. Out of 3,000 pregnant women, 2,871 (95.7%) completed their questionnaire and donated blood samples for laboratory investigation while 129 (4.3%) did not complete the questionnaire properly or did not donate blood samples for laboratory investigation.

Table 1. Age-related prevalence of malaria in Imo State.

Age (Years)	Number examined	Number infected (%)	
		QBC	
18–25	503	433 (86.1)	
26–30	887	730 (82.3)	
31–35	859	657 (76.5)	
36–40	476	394 (82.8)	
41 - Above	146	109 (74.7)	
Total	2,871	2,323 (80.9)	

Key: QBC, Quantitative Buffy Coat; pF-antigen, *P. falciparum* antigen.

Table 2. Trimester-related prevalence of malaria in Imo State.

Trimester	Number examined	Number infected (%)	
		QBC	
First	769	596 (77.5)	
Second	1,073	909 (84.7)	
Third	1,029	818 (79.5)	
Total	2,871	2,323 (80.9)	

Key: QBC, Quantitative Buffy Coat; pF-antigen, *P. falciparum* antigen.

Table 3. Occupational-related prevalence of malaria in pregnant women in Imo State.

Occupation	Number examined	Number infected (%)	
		QBC	Mean (%) infection
House wives	836	660 (78.9)	599 (71.65)
Civil servants	526	409 (77.8)	401 (76.24)
Traders	902	734 (81.4)	663 (70.18)
Artisans/professionals	607	520 (85.7)	479 (79.02)
Total	2,871	2,323 (80.9)	2,141 (74.6)

Key: QBC, Quantitative Buffy Coat; pF-antigen, *P. falciparum* antigen.

Out of the 2,871 persons examined using QBC method, 2,323 (80.9%) had malaria parasite in their blood samples. Similarly, the direct stained smear technique showed that 2,301 (80.1%) persons had malaria parasites while the *P. falciparum* (pF) antigen test showed that 1,801 (62.2%) persons had malaria parasites.

Age-related prevalence of malaria parasite

The age-related prevalence showed that pregnant women within the age of 18-25 years of age had the highest of 86.1% of malaria infection, followed by those within the age range of 36-40 years (82.8%) and 26-30 years (82.3%) respectively (Table 1).

Trimester-related prevalence of plasmodiasis

Trimester-related prevalence of plasmodiasis amongst women showed that the highest prevalence of

plasmodiasis (84.7%) occurred amongst pregnant women in their second trimester estimated by the QBC method. While 77.5 and 79.5% of women in the first and third trimester respectively were infected with malaria parasites (Table 2).

Occupational-related prevalence of plasmodiasis

The occupational-related prevalence of plasmodiasis amongst the pregnant women showed that 85.7% of artisans/professionals, 81.4% of traders, 78.9% of housewives and 77.8% of civil servants had plasmodiasis respectively using the QBC method (Table 3).

Table 4 summarizes the symptom-related prevalence of malaria amongst pregnant women in Imo State. The results showed that, 43.9% of pregnant women in Imo State. The results showed that 443.9% of pregnant women having general body weakness 52.3% of apparently health asymptomatic pregnant women, 88.5%

Table 4. Symptom-related prevalence of malaria in pregnant women in Imo State.

Symptoms	Number examined	Number infected (%)
		QBC
Headache	711	668 (94.0)
Fever	680	602 (88.5)
Headache/fever	506	490 (96.8)
General weakness	230	101 (43.9)
No symptom	744	389 (52.3)
Total	2,871	2,323(80.9)

Key: QBC, Quantitative Buffy Coat; pF-antigen, *P. falciparum* antigen.

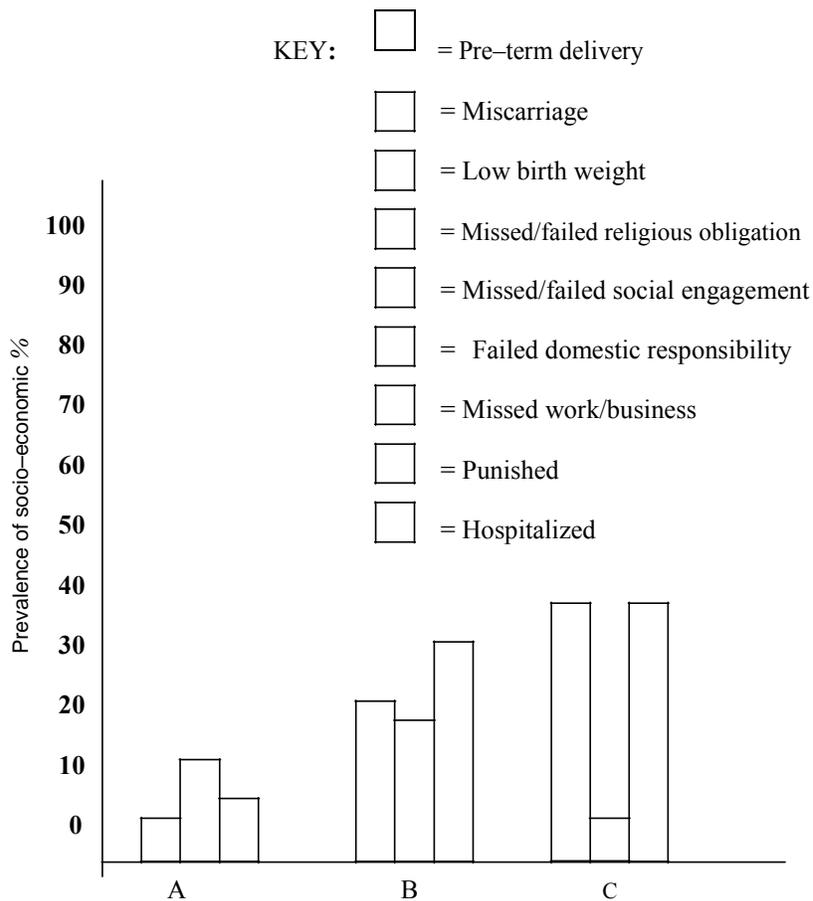


Figure 1. Socio-economic impact of malaria on pregnant women in Imo State.

had fever, 94% had headache while 96.8% of pregnant women with both fever and headache were infected with malaria parasite as shown by the QBC test.

Socio-economic consequences of malaria on pregnant women

Figure 1 shows that, of the 2871 pregnant women examined in the study 723 (25.2%) missed some

religious programmes due to malaria while 894 (31.1%) failed to carry out some domestic responsibilities due to malaria episode.

Figure 2 shows the economic consequences of malaria in pregnant women in Imo State in the past 6months. Of 930 pregnant women who have been hospitalized, 41 (4.4%) spent approximately #1,000.00 for treatment, 83 (8.8%) spent about #2,000.00 while 217(23.1%) spent about #3,000.00, 443 (47.2%) spent about #4,000.00 and 155(16.5%) spent about #5,000.00. All together, the

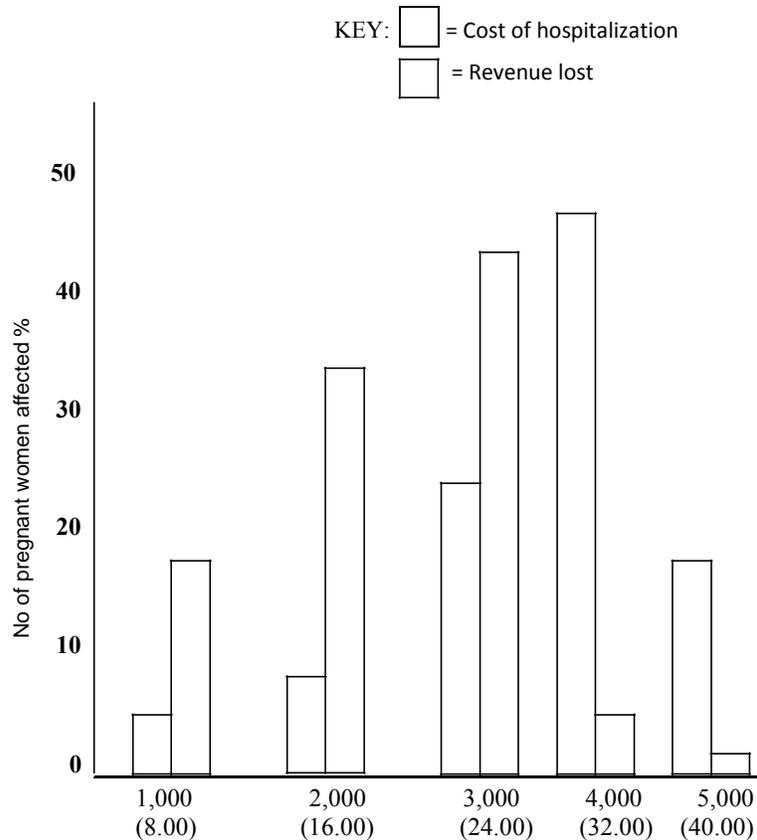


Figure 2. Economic impact of malaria on pregnant women in Imo State.

women spent about #3,364,000.00 (#3.36million) 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 #2,447,5000.00 (#2.44million) due to malaria during pregnancy.

DISCUSSION

The high prevalence of malaria by QBC method (80.9%) observed amongst pregnant women in this study agrees with similar report by Ngele (2008) which obtained 72% prevalence amongst pregnant women attending antenatal care at secondary health facility in Ebonyi State Nigeria. Both studies emphasized the public health importance of malaria in the tropics and 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% in women in the age group 18-25 years to 74.7 in those in the 40-above

years age bracket for QBC method. Statistically, this difference is not significant. This observation agrees with the findings of previous workers (Bruce-Chwatt, 1980; Mashaal, 1986; Usip and Opara, 2008) which stated that age and sex have no bearing on the incidence of malaria.

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 (1986) who observed that, during the second half of pregnancy (2nd to 3rd trimesters), there is multifactorial transient immunosuppression. The presence of high adrenal steroid level, placental chorionin gonadotrophin, alpha fetoproteins and the depression of the immunosuppression mechanism of a pregnant female. Therefore, malaria relapses of infection due to *Plasmodium vivax*, *P. malariae*, *P. ovale* or recrudescences of *P. falciparum* are frequently seen at a higher rate in pregnant women than in non pregnant women.

The occupational-related prevalence of malaria among pregnant women in Imo State showed the highest prevalence (85.7%) amongst artisans and professional, followed by traders (81.4%), housewives (78.9%) and civil servants (77.8%). This findings agrees with similar reports (Usip and Opara, 2004), who reported highest prevalence of injection amongst peasant farmers. This

may be related to exposure to arthropod vectors, which transmit malaria parasites. Civil servants stay mostly in offices often provided with electric fan which keep away mosquito vectors. Traders and artisans spend most of their time in open places such as shops, open shade etc. which exposes them to vector bites and transmission of malaria parasite than occupational groups.

The analysis of the system-related prevalence of malaria in pregnant women agrees with previous reports of (mashaal, 1986; Forbes and Jackson, 1993), which states that features of an acute malarial attack may include fever, rigors, sweating, headache, gastrointestinal upset and respiratory symptoms. In severe falciparum malaria, there may be collapse, convulsions and coma (cerebral malaria). Chukwuocha et al. (2008) reported that fever, vomiting and headache were the most common clinical symptoms observed in 32.9% of their study participants.

Some complications due to plasmodiasis in pregnant women reported include miscarriage 12.2%, low birth weight 7.0% and pregnancy within a six month period was estimated at 5.8 million naira.

Conclusion

This study has shown that the burden of malaria in pregnant women in Imo State Nigeria is high. There is need therefore to introduce appropriate intervention strategies against malaria and its vectors in order to enhance the health of pregnant women and other inhabitants of the study area.

RECOMMENDATIONS

For effective management of malaria in pregnant women in Imo State, the following are recommended:

- (1) Pregnant women in the State should be given free malaria treatment in all government hospitals until delivery so that those who could not go to hospital due to treatment costs will avail themselves of such opportunities receive quality medical attention.
- (2) There should be policy directive on the use of alternative method of diagnosis of malaria in pregnant women especially in areas where the traditional slide technique may have limitations.

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