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Malaria and its burden among pregnant women in parts of the Niger Delta area of Nigeria

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ABSTRACT

Objective: To assess the epidemiology and burden of malaria among pregnant women in parts of the Niger Delta of Nigeria. **Methods:** About 140 pregnant women were selected from four communities for the study after consent was obtained from them and their husbands. Clinical malaria was confirmed using Giemsa staining technique, while social demographic data was obtained using structured pretested questionnaires. **Results:** Results showed that 57.1% patients were positive for malaria infection. The peak age specific incidence was 15-20 years (35%) and there was a significant difference among age groups ($P<0.05$). The incidence of malaria varied significantly according to the trimesters of the pregnant women, locations, level of education and occupation ($P<0.05$). The burden of the disease among pregnant women in the study area were in forms of symptoms($\chi^2= 7.67$, $P<0.05$), abnormalities ($\chi^2 = 21.38$, $P<0.05$) and cost of treatment ($\chi^2=6.62$, $P<0.005$). Pregnant women were mostly predisposed to malaria infection by presence of stagnant water (25.0%) and with farming/fishing activities (22.5%). The most perceived preventive/control measure was intermittent preventive treatment (20.00%) and Antenatal Care/Health education (13.75%). **Conclusions:** Malaria still exerts heavy public health and socioeconomic burden on pregnant women in the study area. This calls for concerted effort to scale up and sustain control strategies especially intermittent preventive treatment and health education during antenatal visits.

1. Introduction

Malaria remains one of the most important diseases of the tropics despite several years of concerted effort towards control. A lot of times the actual statistics is not clear in so many regions due to paucity of data and this leads to neglect of the disease and the devastation. Hundreds of millions of people are affected and pregnant women are more susceptible together with little children[1-3]. It is dangerous to both the mother and the foetus. The pregnant women are at greater risk of malaria infection and of symptomatic malaria disease than non-pregnant adults[1]. According to Lindsay *et al.* pregnant women are more attractive to mosquitoes and the malaria-parasite densities are also higher in them[4]. Malaria which is caused mainly by four *Plasmodium* species namely *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae* and *Plasmodium ovale*, which is, according to Arora and Arora, the most important of all the tropical diseases in terms of morbidity and mortality[5]. They opined that more than 300-500 million individuals throughout the World are infected with the disease and 1.5-2.7 million people die of it yearly. Each year, 25-30 million women become pregnant in malaria endemic area of Africa, and similar numbers are exposed to malaria in Asia, Oceania, and South America[6]. According to Nigeria's Federal Ministry of Health[7], malaria is associated with 11.0% of all maternal deaths and 70.5% of morbidity in pregnancy. It accounts for up to 15% maternal anaemia, 5%-14% of low birth weight (LBW), and 30% of "preventable LBW; 300 million cases (90%) occur in Africa. It is reported one person in Africa dies of malaria every 10 seconds, and pregnant women and children under five are most of risk. It equally indicated that other burdens associated with malaria during pregnancy include but not restricted to spontaneous

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abortion and miscarriage, still birth, socio-economic status of the family is affected in terms of using scarce resources on preventable conditions. Malaria is an important cause of severe anemia in pregnant African women, and by this mechanism malaria causes an estimated 10 000 maternal deaths each year[8]. Moreover, malaria infections result in 75 000 - 200 000 LBW each year due to combinations of preterm delivery and fetal growth restriction[8].

To tackle this enormous burden there are two proven tools, first, insecticide treated nets (ITNs) which decrease parasite prevalence in all gravidities (pregnant women), decrease LBW and still birth in first to four pregnancy, and show trends towards benefits against anaemia and clinical malaria[9]. Secondly, intermittent preventive treatment in pregnancy (IPT), which involves athemisin based combination therapies in various forms. It has been shown to decrease peripheral and placental parasitemia and also increase maternal hemoglobin and infant birth weight especially in primi- and secundigravidea[6]. FMOH indicated in her new policy for malaria in pregnancy include focused antennal care with health education, early detection and prompt appropriate case management of women with symptoms and signs of malaria[7]. Furthermore it was pointed out that integrated vector management including environmental management should be taken into consideration and that adequate health education should be observed.

This study was therefore carried out as part of a comprehensive approach to ascertain the epidemiology and burden of malaria among pregnant women in parts of the Niger Delta Area of Nigeria to determine areas of priority for quick and rapid intervention.

2. Materials and methods

2.1. Study area

The study was carried out in Andoni Local Government Area in Rivers state which is located in the Niger Delta Area of Nigeria. The Andoni territory lies between Bonny to the West, Ibibio to the East and North-East, Ogoni to the North-west and the Atlantic Ocean to the South. The territory is divided by the estuary of the Imo River to the Atlantic Ocean into Eastern and Western Andoni (areas of interest). The area consists of six political districts and one urban being Ngo the Local government headquarters with an estimated population of 450 000. Andoni bounded by water becomes a perfect habitat for breeding of mosquitoes and malaria transmission is stable throughout the year. The majority of these component communities are rural in nature. These predominant occupations such as fishing exposes them more to the bite of mosquitoes. Similarly, environmental factors like presence of swamps, overgrown grasses, stagnant water around the vicinities *etc* greatly influence the transmission of malaria in the area. This area is very important because it harbors large deposits of crude oil in Nigeria, and plays a major role in the national economy. And there are high level of oil prospecting and mining activities.

2.2. Criteria for selection and study population

The study area was selected considering the endemic nature of the disease (malaria) in the area. Consequently, a total of 140 pregnant women were randomly selected from four communities of Andoni Local government Area between January and June, 2010. The sample population was selected irrespective of age, educational background, marital status, occupation, cultural and religious affiliation.

2.3. Ethical consideration

Consent was also obliged and obtained from the husbands and parents of the pregnant women. Informed consent was obtained from all study subjects. Ethical clearance was given by Ngo General Hospital in Andoni Local Government Area, Rivers State, Nigeria.

2.4. Blood collection, staining and microscopy

Two milliliter of blood was collected intravenously under a sterile condition. The blood samples were put in EDTA bottles, labeled and sent to Ngo General Hospital laboratory where thick and thin smears were prepared and stained with 10% Giemsa as previously described[10]. The blood films were examined microscopically using 40× and 100× objectives (with oil immersion) and 7× eye piece.

2.5. Malaria burden study

Pretested structured questionnaires were were administered to obtain vital information such as age, village, sex, occupation, level of education and to ascertain their level of health, *etc*. Focus group discussions and key informant interviews were performed to substantiate the results. Medical personnel (physicians) also examined the subjects to determine the malaria specific morbidity indicators they presented.

2.6. Statistical analysis

Chi-square (χ^2) was used to analyze data obtained in the study and a probability value (P-value) of $P<0.05$ was regarded as significant.

3. Results

Results of this study showed that 80 (57.1%) of the study subjects were positive for malaria while 60 (42.9%) were negative. A total of 35.0% were 15-20 years, 25.0% were

21-25 years, 22.5% were 26-30 years, 12.5% were 31-35 years and 5% were 36 years and above (χ^2=2.71, P<0.05). 43.70% respondents had just informal education, 25.00% had primary education, 18.75% had secondary education and 12.50% had tertiary education (χ^2=5.89, P<0.05). Overall, 25.00% respondents worked as fisher, 18.75% as farmer, 15.00% worked as businessman, 2.50% as civil servants, 8.75% as artisans and 10.00% as unemployed (χ^2=10.1, P<0.05).

Trimester played a significant role in malaria incidence among study subjects (Table 1). Women in the 1st trimester recorded 38.75% incidence, 32.50% in the 2nd trimester while 28.75% in the 3rd trimester (χ^2=8.38, df=11, P<0.05). Anaemia (20%) was the most common symptoms (χ^2=7.67, df=7, P<0.05) (Table 2). Table 3 shows 13.75% spent N7 000.00 for treating malaria while the least amount was N3 000.00 by 22.5% of respondents (χ^2=6.62, df=4, P<0.05). 25.0% women had low birth weight, 12.5% had still birth, and 22.5% had abortion. The mortality was 5.0%, and morbidity was 35.0% (χ^2=21.38, P<0.05). Table 4 shows predisposing factors of pregnant women to malaria in the study area (χ^2=9.56, df=5, P<0.05). About 25.00% agreed that the presence of stagnant water was a major predisposing factor. Table 5 indicates responses on the perceived preventive and control measures of malaria among pregnant women (χ^2=5.20, df=7, P<0.05). Antenatal care and health education (13.75%) and IPT with sulfadoxine-pyrimethamine (20.00%), were widely perceived to be most helpful.

Table 1
Incidence of malaria according to trimesters of pregnant women in the study area.

Location of residence	Total No screened	Total No. positive	No. Positive 1st trimester	No. Positive 2nd trimester	No. Positive 3rd trimester
Asarama	35	24	9	8	7
Unyeada	35	20	12	5	3
Ataba	35	22	8	6	8
Ngo	35	14	2	7	5
Total	140	80	31	26	23

Table 2
Signs and symptoms of malaria among pregnant women.

Signs/Symptoms	Total No screened	No. positive	Percentage (%)
Anemia	18	16	20.00
Sweating	17	11	13.75
Fever	22	10	12.50
Shivering	24	10	12.50
Headache	14	9	11.25
Pains	13	9	11.25
Malaise	15	8	10.00
Others	17	7	8.75
Total	140	80	100.00

Table 3
Financial cost of malaria treatment.

Cost	No. of respondents	Percentage (%)
N3 000.00	18	22.50
N4 000.00	20	25.00
N5 000.00	21	26.25
N6 000.00	10	12.50
N7 000.00	11	13.75
Total	80	100.00

N1=USD 154.

Table 4
Predisposing factors of predisposes pregnant women to malaria.

Predisposing factors	No. of respondents	Percentage (%)
Presence of stagnant water	20	25.00
Overgrown weeds/bushes	15	18.75
Absence of mosquitoes nets	10	12.50
Much farming/fishing	18	22.50
Staying late night outside	8	10.00
Low immunity	9	11.25
Total	80	100.00

Table 5
Perceived control/preventive measures against malaria among pregnant women.

Control/Preventive measures	No. of respondents	Percentage (%)
Antenatal care and health education about malaria	11	
IPT	16	20.00
ITNs	10	12.50
Environmental sanitation of the surrounding	7	8.75
Use of personal clothing	8	10.00
Mechanical control (use of fan)	9	11.25
Screening windows and doors	9	11.25
Total	80	100.00

4. Discussion

The high incidence of malaria reckoned among pregnant women in this study is traceable to the terrain of the study area, riverine in nature which serves as potential habitat for the breeding of mosquitoes. Also poor environmental conditions occasioned by lack of effective sanitary practices favored constant presence and transmission of malaria. Lucas and Gilles had already observed four factors that determined the epidemiology of malaria in pregnancy: environmental, vectorial, parasite and host factors[11]. The significant difference in the incidence of malaria between the different locations of residence can be likened to the disparities in the level of environmental sanitation which can be affected by the socio-economic status of the pregnant women. Ngo which is the Local Government Headquarters and where a considerable level of environmental sanitation

is achieved had the lowest level of malaria incidence among the study communities. This agrees with the World malaria report. It is reported that approximately 40% of the world's populations living in the world's poorest localities are in lack of proper sanitation practices, and are at risk of malaria. Every year more than 50 million people living in such areas become severely ill with malaria[12].

The age specific incidence of malaria as recorded in this study is in accordance with previous report that age may be an independent risk factor, as younger pregnant women have been found to be more susceptible to malaria in some settings[13]. Furthermore, adolescent and young adult women have been observed to be have higher incidence of parasitemic than older adults; and this may reflect continuing development of malaria immunity[14]. It has also been reported that host factors including age, sex, health, status *etc* could contribute to one's susceptibility[15]. These findings show that age plays a dominant role in the susceptibility of pregnant women to malaria.

Pregnant women who had no formal education had the highest incidence of malaria in this study. Level of education has been previously reported to have influence on susceptibility to malaria disease. This is because educated people are more exposed to correct knowledge and better perceptions about the disease and are therefore equipped to control and manage it better. Lucas and Gilles identified behavior influenced by education among four factors that influence the epidemiology of malaria[11]. Others include genetic, immune and nutritional factors. Educational level could influence behavior towards malaria susceptibility and management/control.

Most of the pregnant women indulged in fishing and farming as means of livelihood. Others were involved in trading while a few were civil servants others were unemployed. The occupational environment of these women played a role in their susceptibility to the disease. This is because in fishing and farming, they were exposed to more frequent bites of infectious mosquitoes. This agrees with previous report that host-agent-environment interaction plays a dominant role in malaria transmission and its sustenance[16].

Stage of pregnancy otherwise known as trimesters was also observed to play a role in malaria incidence in this study as women in the 1st trimester were more infected than those in the 2nd and 3rd trimesters. This corroborates previous findings that malaria is most frequent in pregnancy, peaking between 13 and 16 weeks and declining towards term[17].

Malaria infections are usually accompanied by such symptoms as malaise, high fever, headache, pains, sweating and shivering, coagulation defects, shock renal failure, aneamia, *etc*. The symptoms of the four types of malaria are difficult to differentiate without laboratory studies and virulence depends on which species of the parasite involved. FMOH had indicated that fever, headache, joint and body pains, weakness, loss of appetite, nausea with or without vomiting are some of the common symptoms of uncomplicated falciparum malaria[7]. Axillary temperature of 37.5 °C or higher, anaemia (pallor of the mucus membrane or palm), spleen and /or liver enlargement are also some of the commons signs of malaria. In this study the symptoms observed include anaemia, sweating, fever, shivering, headache, pains, *etc*.

Malaria places a huge financial burden on pregnant women as observed in this study. As much as N7 000 (USD45.45) is spent on treatment alone and at least N3 000 (USD19.48) each one month they have malaria. These are monies that could be used to adequately feed the family, pay for children's school fees, clothings or other things. Therefore the disease also indirectly affects effective running of the family. This corroborates the FMOH views on the economic burden of malaria under direct and indirect costs[7]. Some of which are frequent school absenteeism, missed work and wages reduced productivity and use of scarce resources on preventable conditions.

The study reveals the prevalence of malaria based on burden of abnormalities. Morbidity had the highest prevalence followed by low birth weight, abortion, still birth and mortality. These findings are in consonance with previous reports[2,12,18]. Furthermore FMOH had documented the association of malaria with 11.0% of all maternal deaths and 70.5% of morbidity in pregnant women in Nigeria[18]. Another study had also shown that malaria in pregnancy caused increase in abortion, premature labor, intrauterine hypoxia, and decrease in maternal resistance to infection which may lead to puerperal sepsis[19]. The report further indicated that malaria parasites hide in the placenta and interfere with transfer of oxygen and nutrients to the baby, increasing the risk of spontaneous abortion, still birth and preterm birth.

Most of the respondents agreed that the presence of stagnant water, overgrown weeds/bushes, late night outdoor activities and absence of mosquito nets (ITNs) predisposed them to the disease. Similarly, environmental and host factors have previously been implicated in the incidence of the disease[16]. Introduction of electricity in rural areas had also been observed to promote late night, outdoor human activities and this has increased biting opportunity for mosquitoes[11].

Responses on perceived preventive and control measures of malaria among pregnant women in the study area suggested that antenatal care and health education, IPT with sulfadoxine pyrimethamine, constant use of insecticide nets, environmental sanitation, use of personal protective clothing and other mechanical control methods (use of fan) would all be effective in controlling malaria. FMOH recommended the following in the new policy of malaria in pregnancy:

Constant use of ITNs, IPT with sulfadoxine pyrimethamine, early detection and prompt appropriate case management of women with symptoms and signs of malaria[7]. Similarly, two proven tools had been suggested: ITN combined with antimalarial sulphadoxine pyrimethamine which have been shown to decrease peripheral and placental parasitemia[20,21]. World Health Organization however recommends administration of two or more doses of a safe, effective anti-malarial after the end of the first trimester to all pregnant women[22].

It is expedient to conclude from the findings of this study that malaria continues to exert significant public health and economic burden among pregnant women in parts of the Niger Delta of Nigeria. And this will continue unless urgent and proactive steps are taken. Community health officers should be trained, empowered and equipped to reach rural people on malaria issues. Pregnant women should be encouraged to attend antenatal care where malaria education should be carried out frequently. Early detection and prompt appropriate case management of pregnant women with symptoms and signs of malaria should also be improved.

Conflict of interest statement

We declare that we have no conflict of interest.

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