



## **Effectiveness and Compliance of Long Lasting Insecticide Nets (LLINs) on Malaria Parasitemia among Pregnant Women attending Antenatal Clinics in Port Harcourt, Rivers State**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author MNW designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author FON managed the analyses of the study. Author MDW managed the literature search. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aim:** To determine the effectiveness and compliance of Long Lasting Insecticide Nets (LLINs) on malaria parasitaemia among pregnant women attending antenatal clinics.

**Study Design:** Cross sectional study.

**Place and Duration of Study:** Rivers State, Nigeria, between April and September 2011.

**Methodology:** Thick and thin blood films were made and stained using parasitological standard procedures to identify malaria parasites. Questionnaires were distributed to collect personal data of the pregnant women examined. Data gotten was analyzed with Chi-square test of significance.

**Results:** A total of 400 pregnant women were examined, 317(79%) used LLINs with 29(9.1%) positive for malaria parasites while 83(21%) did not use LLINs with 75(90.4%) positive for malaria parasites ( $P < 0.05$ ). Pregnant women in their first, second and third trimesters that used LLINs had prevalence rates of 5.3%, 12.2% and 11.5% respectively

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while those that did not use LLINs had prevalence rates of 89.1%, 94.1% and 90.9% respectively ( $P < 0.05$ ). Primigravidae, secundigravidae and multiparous women who used LLINs had prevalence rates of 10.3%, 8.7% and 5.9% while those who did not use LLINs had prevalence rates of 95.8%, 89.5% and 75% respectively ( $P < 0.05$ ).

**Conclusion:** The usage of LLINs in reducing malaria parasitaemia among pregnant women was statistically significant ( $P < 0.05$ ) irrespective of parity and gestation period.

**Keywords:** Prevalence; malaria; pregnancy; women; trimester; parity; LLINs.

## 1. INTRODUCTION

Malaria is a serious health burden of developing nations including Nigeria [1]. Malaria is transmitted by female *Anopheles* mosquitoes and the burden of malaria infection during pregnancy is caused mainly by *Plasmodium falciparum*. Pregnant women constitute the main adult risk group for malaria and 80% of deaths due to malaria in Africa occur in pregnant women and children below 5 years. Each year in sub-Saharan Africa (where 80 – 90% of the world's malaria cases occur), approximately 19 – 24 million women are at risk for malaria and its adverse consequences during pregnancy [2,3]. The protection of pregnant women living in malaria – endemic countries has been of particular interest to many National Malaria Control Programmes because of the reduced levels of immunity during pregnancy. In Rivers State, the general malaria prevalence rate has dropped from 60% to 43% [4]. Pregnant women and the unborn children are vulnerable to malaria, peri-natal mortality, low birth weight and maternal anaemia [5,6]. Bednets given to pregnant women have been found to be protective against malaria in both high and low malaria transmission areas [7]. Due to the severe complications associated with malaria in pregnancy, this study attempted to evaluate the efficacy of Long Lasting Insecticide Nets (LLINs) in reducing malaria parasitemia among pregnant women in relation to their parities and gestation periods.

## 2. MATERIALS AND METHODS

### 2.1 Study Site, Study Subjects and Criteria for Eligibility

Port Harcourt (capital of Rivers State) is located at latitude 4.75°N and longitude 7.00°E and lies along Bonny River in the Niger Delta. Population of the area is about 1, 620,214 [8]. The geography and infrastructure of Port Harcourt is highly congested because building codes and zoning regulations are not properly enforced. This adds to flooding and sanitation problems of the area, since there is no proper drainage or sewage disposal system, and most parts of the city get flooded during very heavy rains that fall for half of the year [8]. The ecology of Port Harcourt provides suitable breeding habitats for biological multiplication, development and high survival rate of female *Anopheles* mosquito vectors for the transmission of malaria parasite to the human population.

In this cross-sectional study, source population consisted of pregnant women attending five (two public and three private) antenatal clinics between April and September, 2011 (Wet/Rainy season). The study subjects (400 pregnant women) were selected randomly (systematic random sampling) without prior knowledge of their clinical and family health history. Selection was also proportionally selected from the antenatal clinics based on the average monthly antenatal clinic attendance. About 30-50 pregnant women attend ANC per

day (excluding Sunday) in the sampled private and public healthcare centres. Pregnant women were used in this study because they have a high risk of contracting malaria.

## 2.2 Data Collection

The oral consent of each pregnant woman was gotten before commencing this study. Questionnaires to determine age, parity and gestation period, were distributed to and completed by the pregnant women. Pregnant women who could not read or write were assisted in filling their questionnaires. Peripheral blood samples were collected using venous procedure. Standard and careful laboratory procedures were adopted in collecting blood samples from the pregnant women. Thick and thin blood films were made on clean slides and labeled accordingly as recommended by WHO [9].

## 2.3 Microscopic Examination

Thick blood films were stained using Field's staining method while thin blood films were stained using Leishman staining method. Stained slides were examined under the light microscope using x100 objective lens (immersion oil) [10]. Thick blood films were used to determine the parasite densities while thin blood films were used to identify the parasite species and infective stages. Slides were read by two trained microscopists using standard and quality-controlled procedures. Slides with malaria parasite <3 in a high power field was scored scanty; 3-10 as (+); 10-19 as (++); >20 as (+++) or more according to the degree of infection (parasitemia).

## 2.4 Statistical Analysis

The data collected from this study were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS) for windows (version 17.0). Comparisons were made using Chi-square test of significance. Significance level was set at 0.05.

## 3. RESULTS

### 3.1 Overall LLINs Compliance Rates

The compliance rates of LLINs usage by pregnant women is shown in Table 1. A total number of 400 pregnant women were examined with 317(79%) LLINs-compliant while 83 (21%) were not LLINs-compliant (P<0.05). LLINs-compliant pregnant women had a malaria prevalence rate of 9.1% (29 out of 317) while those who did not use LLINs had a prevalence rate of 90.4% (75 out of 83) (P<0.05). The odds ratio of LLINs compliance in relation to malaria prevalence was 93 (95% CI 41–212).

**Table 1. LLINs compliance among pregnant women examined**

LLINs usage	NNI (%)	NI (%)	Total
Used LLINs	288 (90.9%)	29 (9.1%)	317
Did not use LLINs	8 (9.6%)	75 (90.4%)	83
Total	296 (74%)	104 (26%)	400

*LLINs = Long Lasting Insecticide Nets; NNI = Number Not Infected; NI = Number Infected*

### 3.2 Effect of LLINs Compliance on Malaria Prevalence in relation to Trimester

The effect of LLINs compliance on malaria prevalence among pregnant women in relation to trimester is shown in Table 2. LLINs – compliant pregnant women in their first, second and third trimesters had malaria prevalence rates of 5.3%, 12.2% and 11.5% respectively while those that were not LLINs – compliant had prevalence rates of 89.1%, 94.1% and 90.9% respectively (P<0.05).

**Table 2. Effect of LLINs compliance on malaria prevalence among pregnant women in relation to trimester**

Trimester	Used LLINs		Did not use LLINs	
	NE	NI (%)	NE	NI (%)
First trimester	132	7 (5.3%)	55	49 (89.1%)
Second trimester	98	12 (12.2%)	17	16 (94.1%)
Third trimester	87	10 (11.5%)	11	10 (90.9%)
Total	317	29 (9.1%)	83	75 (90.4%)

*NE =Number Examined; NI = Number Infected; LLINs = Long Lasting Insecticide Nets*

### 3.3 Effect of LLINs Compliance on Malaria Prevalence in relation to Parity

The effect of LLINs compliance on malaria prevalence among pregnant women in relation to parity is shown in Table 3. Primigravidae, secundigravidae and multiparous women who were LLINs – compliant had malaria prevalence rates of 10.3%, 8.7% and 5.9% respectively while those who were not LLINs – compliant had prevalence rates of 95.8%, 89.5% and 75% respectively (P<0.05).

**Table 3. Effect of LLINs compliance on malaria prevalence among pregnant women in relation to parity**

Parity	Used LLINs		Did not use LLINs	
	NE	NI (%)	NE	NI (%)
Primigravidae	174	18 (10.3%)	48	46 (95.8%)
Secundigravidae	92	8 (8.7%)	19	17 (89.5%)
Multiparous	51	3 (5.9%)	16	12 (75%)
Total	317	29 (9.1%)	83	75 (90.4%)

*NE =Number Examined; NI = Number Infected; LLINs = Long Lasting Insecticide Nets*

## 4. DISCUSSION

In this study, the overall compliance rate of pregnant women who used LLINs was 79% (317 out of 400) while those who did not use LLINs was 21% (83 out of 400). The results showed that pregnant women who were LLINs – compliant had lower malaria prevalence rates than those who were not LLIN –compliant. One major aim of the roll back malaria (RBM) campaign is to have 80% of pregnant women and children (between 0 – 5years) covered by LLINs by 2010 [11]. The Rivers State government (South-south Nigeria) distributed more than two million nets during the Immunization plus days and Stand alone campaigns, to meet its target of providing two nets to every household in the state. A 2009 survey conducted to assess this programme showed 43.5% ownership and 62.9% utilization rate, during the wet season (when mosquito activity is at the highest in Rivers State) [12]. The

compliance rate of 79% in this study is comparable to the RBM target of 80% compliance. The use of LLINs among pregnant women has been found to be increasing in many malaria endemic parts of Africa, particularly in areas where the RBM campaign and Global Fund are active. In a community survey of six African countries (Ethiopia, Ghana, Mali, Nigeria, Senegal and Zambia) in 2007, the use of LLINs by pregnant women of reproductive age varied from a low of 32% to a high of 69% [13]. In another study in Burkina Faso where pregnant women were interviewed in antenatal clinics and Delivery Units, 58% of women reported owning a LLIN in 2004 [14].

Among the LLIN – compliant pregnant women, malaria prevalence rates for those in first, second and third trimesters were 5.3%, 12.2% and 11.5% respectively while among those who were not LLIN – compliant, malaria prevalence rates for those in first, second and third trimesters were 83.6%, 94.1% and 90.9% respectively. This study showed that pregnant women in their second and third trimesters had the highest malaria parasitemia; this is probably because second trimester and early third trimester is the time of maximum malaria risk during pregnancy [15].

Among the examined LLIN – compliant pregnant women, malaria prevalence rates for primigravidae, secundigravidae and multiparous women were 10.3%, 8.7% and 5.9% respectively while among the pregnant women who were not LLIN –compliant, malaria prevalence rates for primigravidae, secundigravidae and multiparous women were 95.8%, 89.5% and 75% respectively. Primigravidae followed by secundigravidae had higher malaria rates (in both LLINs – compliant and non LLINs – compliant women) and this finding is similar to some other reported studies [15,16,17].

Some pregnant women did not use LLINs because they thought the chemicals used in treating the bednets could cause cancer and also complained that the bednets gave them heat/discomfort especially at night while a few said they lacked knowledge on how to effectively use LLINs. Others complained that they did not use LLINs because the bednets were too expensive for them and they could not get access to the free bednets promised by the Roll Back Malaria (RBM) campaign in Nigeria.

## **5. CONCLUSION**

From this study, pregnant women who were LLIN – compliant had better protection from malaria. It is recommended that more LLINs be made readily available and evenly distributed freely or at reduced prices among pregnant women [18], since the ultimate goal of malaria control is to prevent mortality and reduce socio – economic loss by reducing morbidity through progressive interventions.

## **CONSENT**

All authors have declared that written informed consent was obtained from the patients for publication of this case report and accompanying images.

## **ETHICAL APPROVAL**

Ethical approval was gotten from the ethical committee of the Rivers State Ministry of Health before the commencement of this research.

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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