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Research Article

Malaria in Pregnancy and the Utilization of Preventive Interventions among Pregnant Women in Uyo, Nigeria

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Abstract

Background and Objectives: Pregnancy-associated malaria remains a major risk to pregnant woman and her foetus in sub-Saharan Africa. Intermittent Preventive Treatment (IPT) and insecticide treated nets (ITNs) are the recommended malaria in pregnancy preventive interventions in the region. This cross-sectional study examined the prevalence of malaria in pregnant women. We also aimed to determine the use of these pregnant women regarding the recommended prevention interventions to understand barriers to uptake and help to improve their effectiveness.

Methods: Blood screening for malaria parasite was conducted on 405 pregnant women from Uyo in southern Nigeria. Information the on use of preventive measures were also obtained using questionnaires

Results: Our findings show that 105/405 (25.9%) women were infected with malaria. On the use of preventive measures for malaria control, there was an above average compliance by the study population. For the use of the recommended IPT drug, 73.8% of the women had taken a complete dose, while 25.9% failed to take the drug. Results also revealed that 68.3% of the women always slept under a Long-lasting Insecticide-treated Nets (LLINs) while 19.2% did not use the nets.

Interpretation and Conclusion: Our study indicates that malaria in pregnancy is still a problem in the study area. Therefore. advocacy on knowledge and behavior change practices should be strengthened to effectively prevent malaria for improved quality of life during and after pregnancy.

Keywords: Malaria; Pregnancy; IPT; LLIN

Introduction

Malaria, a mosquito-borne febrile illness, caused by the parasite *Plasmodium* parasite, continues to constitute a major source of morbidity and mortality globally. Although much progress has been made towards reducing malaria morbidity and mortality over the last century, an estimated 228 million cases occurred worldwide in 2018, leading to 405,000 deaths [1]. Most of the malaria morbidity were in the African region (93%) followed by the South-East Asia region (3.4%) and Eastern Mediterranean region (2.1%) [1]. In malaria endemic areas, pregnant women are particularly susceptible to malaria [2] and is a major public health concern in tropical and subtropical countries. The high vulnerability of pregnant women to malaria infection is the result of the reduced immune response associated with pregnancy, coupled with the

unique ability of a subset of *P. falciparum* infected erythrocytes to sequester in the placenta [3]. Infection of malaria during pregnancy poses a particular threat to pregnant women, with adverse outcomes such as malaria maternal anaemia, stillbirths, preterm labour, low birthweight and reduced intrauterine fetal growth [4].

In areas with stable malaria transmission, the prevalence of malaria in pregnancy ranges from 10% to 65% [5]. Outside Africa, ***P. vivax*** infections are predominant, and every year about 90 million pregnant women are exposed to the risk of infection mostly in the Asia–Pacific region only, and about three million in Latin America [3]. Every year, approximately 50 million women living in malaria endemic areas become pregnant, and in sub-Saharan Africa, malaria affects an estimated 24 million pregnant women and hence this region records the greatest severity of malaria, accounting for 90% of all the deaths [6]. It has been reported that in sub-Saharan Africa, malaria can cause as many as 10,000 cases of malaria-related deaths in pregnancy per year, usually due to severe maternal anaemia [7]. Moreover, each year, malaria in pregnancy is responsible for 20% of stillbirths, and 11% of all newborn deaths in sub-Saharan Africa [8].

Malaria in pregnancy remains a major public health challenge in Nigeria, with a quarter of the burden in Africa occurring in the country [9]. Moreover, over 12.0% of the gross domestic product (GDP) is expended on malaria annually in the country [10]. Current estimates of malaria parasitaemia in Nigerian pregnant women show great disparity and vary considerably among geographic regions. Hospital-based prevalence ranges from 5% in the northwestern region [11], 19.7% to 40.2% in the southwestern region [12,13], 66.4% to 95% in the southeastern region [14,15]. In south-west Nigeria, past studies reported malaria parasite prevalence in pregnancy to be of the range of 7.7% [16] to 60%-72% [17,18]. Bassey., *et al*. [19] in a study done in Port Harcourt, southern Nigeria, estimated that the prevalence of placental malaria was 65.2%. In a community-based study to estimate the burden of malaria in pregnancy in Enugu, southeast Nigeria, Gunn., *et al.* [20] noted that of the 2069 pregnant women examined, over 99% were positive for malaria parasitaemia. In north-western Nigeria, Fana., *et al*. [21] estimated a malaria prevalence rate of 41.6% out of 255 pregnant women.

Successful control of malaria which involves preventing the infection as well as treatment in pregnant women is a major step in curbing the burden of malaria in Africa [22]. In view of this, preventive measures recommended by World Health Organization for Africa include maintaining a clean environment, use of insecticide treated nets (ITN), intermittent preventive treatment in pregnancy and effective case management of both complicated and uncomplicated cases [23]. The Nigeria National Malaria Control Programme [24] exclusively recommends 2 doses of Sulphadoxine-pyrimethamine for chemoprevention of malaria during normal pregnancy. Another current effort to address malaria illness in pregnancy is the use of Long-lasting Insecticide-treated bednets (LLINs) to prevent contact with the mosquito vector [25]. Sleeping under insecticide-treated bednets has not only remained one of the most important of all measures of protecting pregnant women against malaria, it has become the single most dependable intervention when used properly and efficacious in reducing maternal anaemia, placental infection, and low birth weight [26].

Despite the impressive reductions in malaria incidence recorded in Nigeria over the past 15 years as a result of the aforementioned intervention strategies, as seen in the 2015 World Malaria Report [6], malaria mortality reduction rate has also slowed since 2015 as reflected in the same report released in 2018 [8]. However, the management and control of malaria in pregnancy in Nigeria is impaired by the inconsistency of local prevalence statistics. It therefore remains of critical importance to determine the prevalence of malaria as well as to better understand the prevention practices among pregnant women in the study population. Results from this study would provide baseline data which could be integrated into the existing State and National data on malaria in pregnancy control programme. The data will allow for the improvement and development of strategies targeting malaria prevention and treatment in this population. Such control measures may also possibly lead to reduction in prevalence, which is geared towards achieving malaria elimination in Nigeria.

Materials and Methods

Ethical statement

Ethical approval was granted by the Health Research Ethics Committee of the Akwa-Ibom State Ministry of Health. Verbal informed and free consent was obtained from the participants. The participants were informed that participation in the research was voluntary. The pre-tested questionnaires were administered by trained interviewers who interpreted the contents and the consent forms to those with poor understanding of English in local dialects. Those below the age of 18 years had their accompanying husband or older relatives consent for them.

Study site

The study was carried out in Uyo Local Government Area of Akwa Ibom State in South-south Nigeria. Malaria is holoendemic in

Akwa Ibom State. Uyo is characterised by a tropical humid climate without distinct seasonal variation. It has annual precipitation of about 1000 mm, though December to February has considerably low rainfall, and little variability in temperature [27]. Uyo Local Government Area is made up of four communities namely: Offot, Etoi, Oku and Ikono. Four hospitals were selected to represent each of these communities and cover private and public facilities. The hospitals were: St. Luke's hospital Anua, Offot, Primary Health Care Center Ikono, Primary Health Care Center Oku, and Dan-Abia Specialist Hospital Etoi.

Study population

The study was carried out over a period of November 2017 to May 2018. Pregnant women who attended antenatal care and consented to participate in the study during this period were included. It is important to state that only the female population of reproductive age (15 - 49 years) who make up 49% of the total female population were involved in the study. Questionnaires were administered to the participants to obtain information about their socio-demographic characteristics, ITN usage, IPT usage and pregnancy history.

Sample size

A total of 405 (greater than the determined sample size, by 5) pregnant women were sampled for prevalence of malaria in pregnancy, IPT, and use of ITNs. The population of the study community was based on the 2006 Nigerian Census as updated up to 2016 and was used to determine the sample size of this study. Within the study population, only 5% of the women of reproductive age are considered pregnant.

The sample size (n) was determined from the total population of Uyo: 429,900 using Taro Yamane's formula [28] for determining a sample size from a finite population.

Determination of malaria parasitaemia

About 2 mls of venous blood was obtained from a peripheral vein of each participant and transferred into an EDTA bottle. Each sample was labelled correctly with the patient's personal data to avoid any mix up. A total of 405 samples of blood specimens were collected. Thick and thin film microscopy of the peripheral blood for the confirmation of the presence or absence of malaria parasite followed the methods of Cheesbrough [29] and Sood [30]. The prepared blood smears were air dried and subsequently stained with freshly prepared Giemsa stain at pH 7.2. The stained smears were examined under ×100 oil immersion lens of a light microscope. Malaria diagnosis was based on identification of asexual stages of *Plasmodium* species on the thick blood film while thin smears were used for species identification. Parasite density was determined by counting the number of parasites per high power field and ranged from + (1 - 10 parasites per 100 high power fields), ++ (> 10 parasite per 100 high power fields), +++ (1 - 10 parasites in one high power field), and ++++ (> 10 parasites in one high power field). The slides were reported as negative if no parasite was identified per 100 power fields.

Determination of preventive measures among pregnant women

Structured questionnaire (405) designed to elicit information on the use of ITNs, intake of IPT, reasons for not complying with the usage, and frequency of use was issued to pregnant women on their ante-natal care (ANC) visits. The questionnaire was administered to pregnant women who could read and write and self-administered to pregnant women who could neither read nor write.

Analysis of data

IBM SPSS Version 26 Statistical software was used to analyze the data. Prevalence and use of preventive measures were analyzed using the frequency and percentage, while χ^2 (Chi-square) to determine any statistical differences between the variables at 5% and 1% levels of significance, and at specified degrees of freedom.

Results

Prevalence of malaria parasites of pregnant women by age

A total of 405 pregnant women between the ages of 16 - 46 years participated in the study. Malaria prevalence among this population was 25.9% (105/405). Highest prevalence of 80.0% was observed in the age group 16 - 20 years and the least prevalence of 14.2% was recorded for the age group 41-46 years. Age was significantly associated with malaria prevalence (p = 0.001) (Figure 1).

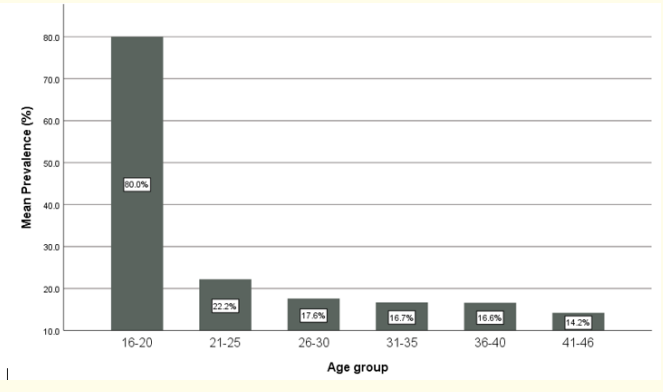

Figure 1: Prevalence of malaria among pregnant women in relation to age.

Frequency of ITN use by respondents

A total of 277 (68.3%) respondents use LLINs daily to prevent mosquito bites. Conversely, 19.2% reported that they do not use LLINs (Table 1).

Frequency	No.	%
Used daily	277	68.3
Occasionally	50	12.3
Never	78	19.2
Total	405	100

Table 1: Use of LLIN by pregnant women in Uyo, Akwa Ibom State.

Of the 128 who reported they either used LLINs occasionally or were not using it at all, 46.0% (59/128) reported that LLIN generates heat, 28.9% (37/128) opined that they had difficulty setting it up, 15.6% (20/128) claimed they use insecticides instead of LLINs and 9.3% (12/128) claimed there was no mosquitoes in their houses as shown in table 2.

Reasons for non-usage/sometimes usage	No.	%
Heat generation	59	46.0
Difficulty in setting up	37	28.9
Use of Insecticide	20	15.6
No mosquito in my house	12	9.3
Total	128	

Table 2: Reasons for non-usage of LLINs by pregnant women.

Table 3 shows the relationship between the parity of the women and the usage of LLINs. Of the 63 malaria-positive primigravidae mothers, 4.7% (3/63) used LLINs daily while 61.9% (39/63) did not use at all. Also, out of 17 multigravidae mothers infected with malaria, 23.5% (4/17) used LLINs daily while 64.7% (11/17) did not use LLINs at all.

Of the 21 malaria-negative primigravidae mothers, 80.0% (17/21) used LLINs daily while 4.7% (1/21) did not use LLINs at all. Also, out of 103 malaria-negative multigravidae mothers, 86.4% (89/103) used LLINs daily and 4.9% (5/103) did not use at all LLINs at all, as shown in table 4. There was a statistical difference (P= 0.019) among pregnant women who used LLINs and those who did not make use of it.

On the use of IPT for malaria, the result showed that 73.8% (299/405) received of IPT, while 0.2% (1/405) took incomplete dosage and 25.9% (105/405) did not take IPT as shown in table 5.

Various reasons were given for not receiving IPT as shown on table 6. Among the study participants, 15.3% (62/105) opined that taking IPT may result in abortion, 0.2% (1/105) reported bleeding from the first dose and 10.3% (43/105) said they were not sick at the moment.

Associating malaria status of pregnant women with intake of IPT (Table 7), the result showed that of the 63 malaria-positive primigravidae mothers, 1.6% (1/63) took complete dose of IPT and 98.4% (62/63) did not take IPT. Also, of the 17 malaria-positive multigravidae mothers, 5.9% (1/17) took incomplete dose and 94.1% (16/17) did not take IPT.

On the pregnant women who tested negative for malaria parasite, all the 21 malaria negative primigravidae mothers took complete dose of IPT. Out of 103 malaria negative multigravidae mothers, 97.1% (100/103) took complete dose while 2.9% (3/103) did not take IPT as seen in table 8. There was a significant difference (P = 0.001) among pregnant women who took complete dosage, incomplete dosage and pregnant women who did not take.

Parity	No. Examined	No. +ve for malaria parasite	No. of women who used LLINs daily and tested positive	No. of women who used LLINs occasionally and are positive	No. of women who did not use LLINs and tested positive
Primigravidae	84	63	3 (4.7%)	21 (33.3%)	39 (61.9%)
Secundigravidae	201	25	2 (8.0%)	3 (12.0%)	20 (80.0%)
Multigravidae	120	17	4 (23.5%)	2 (11.8%)	11 (64.7%)
Total	405	105	9	26	70

Table 3: Relationship between parity and usage of LLIN among malaria infected respondents.

Parity	No. Examined	No. negative for malaria parasite	No. of women who used LLINs daily and tested negative	No. of women who used LLINs occasionally and are negative	No. of women who did not use LLINs and tested negative
Primigravidae	84	21	17 (80.0%)	3 (14.2%)	1 (4.7%)
Secundigravidae	201	176	162 (92.0%)	12 (6.8%)	2 (1.1%)
Multigravidae	120	103	89 (86.4%)	9 (8.7%)	5 (4.9%)
Total	405	105	268	24	8

Table 4: Relationship between parity and usage of LLIN among malaria negative respondents.

Receipt of IPT	No. of pregnant women	%
Completed dose	299	73.8
Incomplete dose	1	0.2
Not taken	105	25.9
Total	405	

Table 5: Use of IPT among pregnant women in Uyo, Akwa Ibom State.

Reason	No. of respondents	%
Fear of Abortion	62	59.0
Had bleeding from the first dose	1	0.95
Not sick at the moment	43	40.9
Total	105	

Table 6: Reasons for not taking IPT among pregnant women.

Parity	No. Examined	No. positive for malaria parasite	No. of women who took complete IPT and tested positive	No. of women who took incomplete IPT dose and tested positive	No. of women who did not use IPT and tested positive
Primigravidae	84	63	1 (1.6%)	0	62 (98.4%)
Secundigravidae	201	25	2 (8.0%)	0	23 (92.0%)
Multigravidae	120	17	0	1 (5.9%)	16 (94.1%)
Total	405	105	3	1	101

Table 7: Relationship between parity and intake of IPT among malaria infected respondents.

Parity	No. Examined	No. negative for malaria parasite	No. of women who took complete IPT dose and tested negative	No. of women who took incomplete IPT dose and tested positive	No. of women who did not use IPT and tested negative
Primigravidae	84	21	21	0	0
Secundigravidae	201	176	175 (99.4%)	0	1 (0.6%)
Multigravidae	120	103	100 (97.1%)	0	3 (2.9%)
Total	405	300	296	0	4

Table 8: Relationship between parity and intake of IPT among malaria-negative respondents.

Discussion

A prevalence of 25.9% for malaria in pregnancy was observed among the pregnant women. This rate represents a decrease in prevalence compared to 54.7% and 41.0% of maternal malaria infection earlier reported by Ikpeze., *et al.* [31] from the same study area. The observed reduction may be due to the improved use of malaria preventive measures including LLIN and IPT by pregnant women.

The highest prevalence of 40.0% observed in the age group 16-20 years agrees with the findings of Agomo., *et al.* [32] who reported that the highest malaria prevalence was seen in pregnant women < 20 years in Lagos [16]. This finding could be attributed to the fact that immunity to malaria is lower in younger age groups, but as age increases, frequent exposure to malaria creates a stronger immunity, hence resulting in lower prevalence among older age groups [33]. Eneanya [34] also noted that the people in the younger

age group had the highest prevalence of malaria because they have less knowledge on malaria prevention practices such as preventing exposure to bites of malaria vectors. As a consequence, this subset of the population exhibits a carefree lifestyle which includes exposing themselves to those vectors [35].

From this study, prevalence of malaria was found to be higher in primigravidae (72.6%) compared to secundigravidae (13.9%) and multigravidae (13.3%). This agrees with the works of Nwachukwu and Chinemerem [36], Aribodor., *et al*. [15] and Ikpeze., *et al*. [31], in which highest prevalence was found among pregnant women in the primigravidae followed by multigravidae and least in the control group. It has previously been documented that immunity is gradually acquired following consecutive pregnancies, and this plays an important role in controlling malaria infection during pregnancy [37]. Mbanefo., *et al.* [38] also reported that women in their first pregnancy are most vulnerable to malaria infection. Such immunity is thought to arise either from the priming of memory T-cells or from the production of antibodies against *P. falciparum* chondroitin sulfate A (PfCSA) that prevents parasite sequestration in the placenta [39,40].

On responses to the usage and reasons for non-usage of LLINs, 68.3% of the pregnant women opined that they used LLINs daily. Similarly, 73.8% of pregnant women took a complete dosage of IPT. This represents a remarkable improvement when compared with the study of Ikpeze., *et al*. [31] who reported 46.2% for LLINs usage and 48.1% for intake of IPT. This improvement could be attributed to improved public enlightenment on the use of these malaria preventive tools during pregnancy in Akwa-Ibom State as evidenced in the daily radio jingles in both local and English languages circulated in the state. The current ongoing public health campaign which involves free distribution of LLINs to pregnant women during antenatal visits could also account for the high rate of LLINs usage observed in this study. Gamble., *et al*. [41] and Adeyemi., *et al*. [42] have shown that LLIN use in pregnancy reduced the incidence of malaria in pregnancy, and hence the incidence of pregnancy-related complications such as premature deliveries, low birth-weight babies, maternal anaemia and intra-uterine foetal deaths.

Conclusion

Malaria prevalence at 25.9% among pregnant women, though a reduction from previous comparatives studies, is still high, as malaria prevalence takes into consideration population growth. This implies that as the population size rises, prevalence rate is likely to increase and as such needs to be addressed as Nigeria moves towards elimination. The implication of this fact is that malaria in pregnancy is still a public health problem in the study area. The usage of LLINs and IPT also recorded an improvement from past studies, but still falls below national target of 80%, thus emphasizing the need for intensified efforts. The findings of this study are an indication that malaria in pregnancy is still a major issue in Nigeria. Nigerians especially pregnant women should be enlightened on the effectiveness of the use of IPT and LLINs for prevention of malaria. Efforts should also be geared towards improving availability, affordability and adaptability of control measures especially in the resource-constrained settings. Political will, increased investment in interventions and a more intensified research in this area is strongly advocated.

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