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OCCURRENCE OF MALARIA PARASITE AMID MATERNAL ATTENDANTS OF ANTENATAL AT THE PRIMARY HEALTH CENTRE IN RUMUOLUMENI, OBIO/AKPOR LOCAL GOVERNMENT AREA OF RIVERS STATE, NIGERIA

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Abstract
The occurrence of malaria parasites among maternal attendants (pregnant women) of antenatal care in Primary Health Centre Rumuolumeni, Obio/Akpor Local Government Area of Rivers State, Nigeria was studied over 12 weeks from February to April 2021. Venous blood samples were collected randomly from 92 pregnant women into Ethylene-Diamine Tetra Acetic (EDTA) bottles and properly labelled. The samples were transported to the Research Laboratory of the Department of Biology, Ignatius Ajuru University of Education, Rumuolumeni for microscopy. Thick and thin films were made to examine each blood sample stained with Giemsa stain following standard parasitological methods. Data obtained were analysed using chi-square statistics in SPSS version 23 to determine the association between variables. The result showed that 76(82.6%) were positive for the malaria parasite (*Plasmodium falciparum*) of the total blood samples examined. Age-related prevalence showed that 29–38 years had the highest prevalence of 33.7% while the 49 and above age group had the least prevalence of 10.9%. The difference was statistically non-significant ($p>0.05$). The multigravidae had the greatest infection rate (52.1%), with the lowest occurring in the secundigravidae (9.8%). The difference in parity was statistically significant ($p=0.005$). Maternal attendants in the 3rd trimester showed the highest infection rate, 44.5%, while those in the 1st trimester were least infected, 17.4%. Statistically, there was no significant difference concerning gestational age (trimester) ($p = 0.305$). This investigation has revealed the high burden of malaria among maternal attendants of ante-natal care in the study area and establishes that it remains a public health problem. Intensified ante-natal care, health education, and primarily the distribution of insecticide-treated nets (ITNs) are strongly recommended to combat and avoid complications associated with malaria parasite infection during pregnancy.

Keywords: Malaria. Parasite, Maternal attendants, Antenatal, Primary Healthcare

Introduction
Malaria is a mosquito-borne haematologic infectious illness that can be fatal, but it can also be prevented and treated. Plasmodium breeds are the causal agents; they are parasitic, intracellular, and unicellular protozoa (Rowe, 2017; WHO, 2021). Disease-endemic nations face a challenge to their economic and social progress (Ahuru & Omon, 2018). More than a century following its discovery, it is still the most prominent parasitic infection and a major health concern worldwide. In 2019, malaria was responsible for an estimated 409,000 fatalities and 228 million cases (WHO, 2021). Expectant mothers and children below 5 years old are particularly vulnerable because of their compromised immune systems. Its distribution spans the globe, but sub-Saharan Africa is where it's at its most abundant. 94% of all reported cases worldwide are concentrated in one area (WHO, 2021). When it comes to malaria, Nigeria has the worst problem of any country in the world. The deadliest form of the parasite, *Plasmodium falciparum*, is found there; it's responsible for 99.7% of all cases in Africa (WHO, 2021). *Plasmodium vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi* are four more malaria-causing species (Sato, 2021). Female Anopheles mosquitoes transmit the infection to humans by their bites, therefore environmental conditions like temperature, humidity, and rainfall can have an impact on malaria prevalence. Malaria is the second most deadly infectious disease in the world, after TB. The number of victims each year is estimated to be between 350 million and 500 million. More than 90% of all malaria deaths in the world happen in sub-Saharan Africa. The World Health Organization (WHO) says that malaria kills more than 10,000 mothers and 200,000 babies each

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year, putting the lives of 25 million pregnant women at risk (Global Malaria Programme, WHO, 2009). Malaria is caused by *Plasmodium falciparum* and *Plasmodium vivax* protozoan parasites, and it is estimated that 515 million clinical cases and 1-3 million fatalities occur each year in tropical countries (Sachs, 2002). The parasite *Plasmodium vivax*, which is present in much of Asia and Latin America, causes the majority of human malaria infections (Baird, 2007).Malaria is responsible for 11% of yearly maternal fatalities in Nigeria, making it a significant public health concern (WHO, 2010; Amoran et al., 2012). At 45%, Nigeria has the highest prevalence rate in Africa, according to Adefioye et al., (2007), the National Census of 2006, and the Federal Ministry of Health (FMH) in 2000. Considering the population, this is expected.

Plasmodium infections are more prevalent among female birth workers (maternal attendants) than among male or non-pregnant women. In places with limited or unstable transmission, the risk of developing these diseases may be similar for women of different gestations (Rogerson et al., 2007; Menendez, 2006). Pregnant women, often known as "maternal attendants," are three times as likely as non-pregnant women to contract a severe form of malaria. A critical illness has a mortality rate of > 50%. (Monif & Baker, 2004; WHO, 2006). *Plasmodium falciparum* infection endangers the lives of over 30 million pregnant women in malaria-endemic countries like Nigeria each year. As a result, pregnant women are at a greater risk of malaria parasite transmission and sickness development (Adefioye et al., 2007). This rising burden, mostly driven by drug resistance to frequently used chemotherapeutics, falls disproportionately on children and maternal caregivers (pregnant women). Malaria, a preventable and treatable disease, poses a larger risk to pregnant women and their unborn children. There are approximately 125 million pregnant women around the globe, and an estimated 200,000 babies die each year as a result of malaria exposure during pregnancy (MIP) (Steketee et al., 2001). Starting in the late 19th Century, when the malaria parasite was first discovered, people have been working to find a solution to the disease. Insecticide-treated nets, rapid diagnostics, microscopy, and man-made drugs are all part of these efforts. Chloroquine, a vital antimalarial drug developed in the 1940s, is a direct product of these investigations. Since then, the number of malaria-related deaths has dropped dramatically. However, medication resistance might reverse these positive developments. When a person is given medicine at a dose that is at least as high as is usually suggested but still within the patient's tolerance, the parasite strain is still deemed resistant (Popovic et al., 2019). When a pregnant woman takes a foetal allograft into her uterus and enters the gestational period, she experiences an immunologic tolerance event that leaves her susceptible to malaria infection. Mother attendants (pregnant women) with low pre-existing malaria immunity are more likely to have cerebral malaria, severe malaria anaemia, abortions, early deliveries, stillbirths, and maternal and infant mortality (Steketee et al., 2001; Cot & Deloron, 2003; Kalilnani-Phiri et al., 2013).

Plasmodium sporozoites, the malaria parasite, are carried in the mosquito's saliva and are delivered to the host's capillaries when the insect feeds on human blood. A few hours later, the parasite is released back into the host's circulatory system after completing more cycles and replications in the liver. The study was conducted by Monif and Baker (2004). Seven to thirty days post-mosquito bite is the incubation phase. Some of the symptoms include high body temperature, headache, nausea, vomiting, and muscle pain. Bloodstream parasitaemia causes symptoms that often recur every two to three days, however, this might change depending on the strain of Plasmodium the patient has (White & Breman, 2008). Malaria was eliminated in the United States due to widespread usage of DDT in the South during the 1940s (Williams, 1963). Despite progress made in Europe and other countries of Central and South America, Sub-Saharan Africa continues to experience the highest incidence of malaria (Schantz-Dunn & Nour, 2009). Malaria has been studied by medical practitioners from the beginning of time. Malaria is most prevalent in Africa, where it mostly affects pregnant women, young children, and individuals with compromised immune systems (Abe & Olusi, 2014).Malaria prevention in pregnant women is a high priority for the malaria partnership. According to the roll-back malaria partnership, in countries with high transmission rates, such as Nigeria, a combination of an effective case management strategy, insecticide-treated nets (ITNS), and intermittent preventative treatment can help pregnant women reduce their risk of contracting malaria. Because of this advice, malaria protection during pregnancy has altered substantially since the early 2000s, when weekly or biweekly chemoprophylaxis was the standard. This finding was reached by several researchers (Ojong et al., 2013). Malaria endangers the health of pregnant women, their unborn children, and their babies, while this risk may be considerably decreased by implementing initiatives or receiving effective therapy following an early and comprehensive diagnosis (Ter Kuile & Steketee, 2007; Menendez et al., 2007; Ter Kuile & Rogerson, 2008).

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Intermittent preventative therapy during pregnancy (IPTp) is the most widely used method for reducing the risk of maternal malaria infection. This medication is designed to cure any current malaria infection even at beginning of the test and prevent reinfection for several weeks following administration. There is a growing need for novel and improved malaria therapies because of the spread of resistance to existing drugs (Bardaji et al., 2012; Duffy & Fried, 2005). Malaria diagnosis during pregnancy is complicated by factors such as the patient's changing immune status, the complexity of the pregnancy's stages, the risk of obstetric complications, the parasites' sequestration in the spleen and placenta, the different types of anaemia that can occur, and the individual's presentation. Diagnostic tools that are both quick and accurate are a major focus of MIP research. Malaria poses a grave health risk to more than 588 million people in 45 African nations (WHO, 2008). An increase in the risk of LBW, abortion, or early delivery for both mother and child is associated with maternal malaria infection. High levels of parasitaemia, anaemia, and altered placental integrity throughout the second and third trimesters increase these dangers and reduce the baby's nutritional support (Kakkikaya, 2015). Previous studies have shown that between 60% and 70% of pregnant women in Nigeria are parasitized by malaria (Akinleye et al., 2009). Pregnancy-related malaria kills as many as 10,000 women annually, mostly young moms giving birth for the first time (Adefioye et al., 2007).Studies have shown that malaria contributes to 3–5% of maternal anaemia, 12–14% of low birth weight, and 3–8% of infant mortality globally (Sarbin et al., 2010). Most pregnant women in regions with consistent malaria infection can carry healthy babies through their first and second pregnancies without major complications (Enato et al., 2007). The study by Sarki et al. (2019) examined malaria infection among maternal attendants (pregnant women) in Gombe Metropolis, northeast Nigeria, and found that 76% of 400 samples were positive for the parasite. At a comprehensive health centre in Dutsin-Ma LGA, Katsina State, Nigeria, 108 of 150 blood samples evaluated from maternal attendants (pregnant women) were positive for malaria, as reported by Abdullahi et al. (2020).Statistics from health care facilities in Rivers State and throughout Nigeria reveal that malaria occurrence in pregnancy remains high despite improvements in prenatal care services and health education as part of these services. That's why it's crucial to regularly examine the occurrence of malaria parasites among pregnant women who get prenatal treatment at Primary Health Centre Rumuolumeni in Obio/Akpor LGA, Rivers State, Nigeria.

Materials and Methods

Study Area: The Rumuolumeni village, where the research took place, is located at 4.8115º N, 6.94780 E. This location is inside the Obio/Akpor LGA of the Rivers State of Nigeria. The community's secondary school and primary health centre are both quite close to one another. In addition to being home to the Ignatius Ajuru University of Education (IAUE) Rumuolumeni, Port Harcourt, the area is home to several multi-national oil corporations.

Collection of Blood Samples: After obtaining informed permission, 92 pregnant women that are attending the prenatal clinic at the Primary Health Centre Rumuolumeni had blood drawn at random. This is a rundown of the steps involved in taking a blood sample: Each donor's upper arm was secured with a soft tubing tourniquet to make a vein look larger and more accessible. Methanol (mentholated spirit) was used to sterilise the puncture site before a venal puncture was done with a needle and 5 ml syringe. A sample of 2ml of blood was taken when the tourniquet was released and labelled appropriately by Cheesbrough's instructions (2009).

Preparation and Examination of Slides: The results were available less than two hours after the blood was drawn. Blood films of varying thicknesses were prepared on properly labelled, grease-free slides as per Chesbrough's (2009) directions. Here is the summary of what you should expect from the process: Once the blood sample was collected in the EDTA bottle, a drop was placed in the middle of a slide and spread out with the corner of another slide to cover an area of about four times its original size. The back of the slide was then cleaned with cotton wool and left to air-dry for at least 30 minutes at 37°C. The slides were stained by being submerged in 20 volumes of buffered water and 1 volume of Giemsa Stain for 25-30 minutes (PH 7.2). After that, the slides were washed in P.H-buffered water for three minutes. Then, after washing, they were placed on a rack to dry before being examined further. The final step was seeing the parasites using a binocular microscope equipped with an x100 objective lens and immersion oil placed on the prepared slides (Cheesbrough, 2009). Separate slides were used to make thin and thick films. The thick films were not fixed before being stained with Giemsa, whereas the thin films were fixed with methanol.

Administration of Questionnaire: Full consent of the attendees was obtained verbally before administering the questionnaire. The questionnaires were well structured, and the authors verified the contents to reflect the history

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of pregnancy, biodata, and other questions associated with this research. However, for confidentiality's sake, volunteer participants' identifiers (names, addresses, phone numbers, etc.) were not collected.

Data Analysis: This study's data were analysed using the chi-square statistic and simple percentages in IBM SPSS Statistics version 23 to ascertain a significance threshold of 0.05 for the relationship between variables.

Results

Overall Prevalence: Out of the 92 samples collected from maternal attendants of antenatal in the study environment and examined, a total of 76 (82.6%) tested positive for malaria parasite (*Plasmodium falciparum*) (Fig. 1).

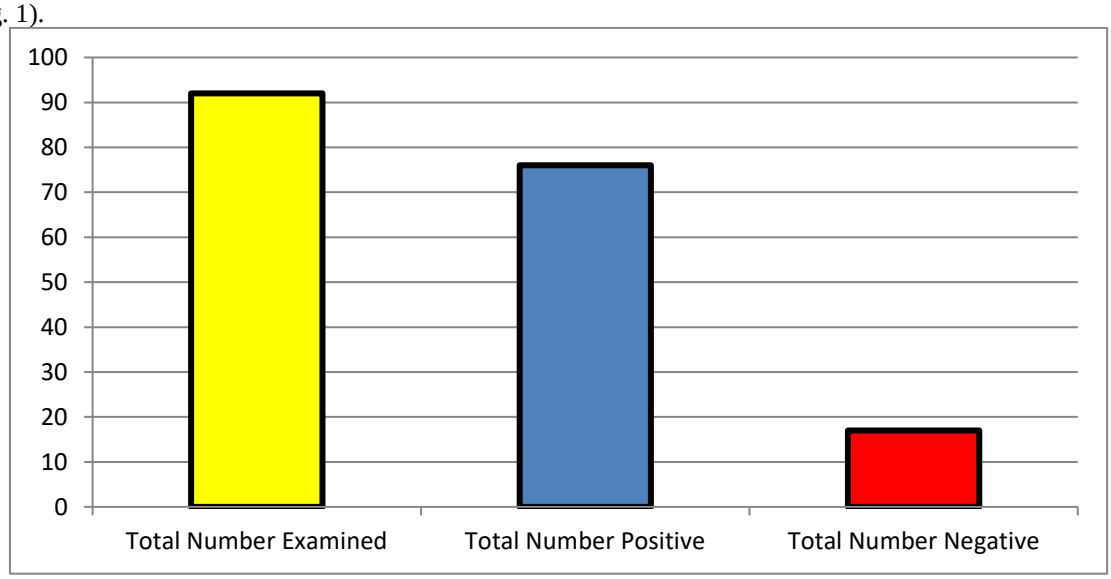

Fig. 1: Graphical representation of the overall occurrence of malaria infection among maternal attendants (pregnant women) in the study area.

Age-Related Occurrences: A common method of data analysis was dividing the research population into four equal age groups. As a result, the following data was compiled on the ages sampled, the total examined, the total tested positive, and the percentage of positive tests: 24 pregnant women (maternal attendants) between the ages of 19 and 28 were screened, and of them, 19 were positive for the malaria parasite. This corresponds to an incidence rate of 79.2%. 36 pregnant women were screened, and 31 (86.1%) tested positive for malaria parasites; these women were all between the ages of 29 and 38. Twenty pregnant women (maternal attendants) in the age range of 39–48 were tested, with 16 (80%) showing positive for malaria. Last but not least, only 12 maternal attendants (pregnant women) were investigated in the age category of 49 and up, and 10 (83.3%) of the total) tested positive for malaria parasites. However, there wasn't any statistically significant distinction in ages ($p>0.05$) (Table 1.).

Table 1: Occurrence of malaria in the study area according to age group (n=92)

Age group (Yrs.)	No. Examined	No. Positive (% Occurrence)	No. Negative (%)
19 – 28	24	19 (20.6)	5 (5.4)
29 – 38	36	31 (33.7)	5 (5.4)
39 – 48	20	16 (17.4)	4 (4.3)
49 and above	12	10 (10.9)	2 (2.2)
Total	92	76 (82.6)	16 (17.4)

Chi-square (χ^2) = 0.604, df = 3, p=0.895

Parity (Gravid) Related Occurrence

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In addition to discussing the findings in terms of the gravidity that may be attained, this study also differentiates between the primigravidae, secundigravidae, and multigravidae. A total of 27 birth attendants (pregnant women) were located among the primigravidae, and 19 of them (70.4% of the total) were determined to be infected with the malaria parasite. There were 14 pregnant women and their attendants (maternal caretakers) evaluated from the secundigravidae group; 9 of these women tested positive for the malaria parasite, giving us a prevalence of 64.3%. Finally, 51 maternal attendants (pregnant women) were sampled from the multigravida group, and 48 of them (94,1%) tested positive for malaria parasites. However, the disparity in weight was statistically significant (p0.05) (Table 2.).

Table 2. Occurrence of malaria infection based on gravidity (parity) (n=92).

Gravidity	No. Examined	No. Positive (% Occurrence)	No. Negative (%)
Primigravidae	27	19 (20.7)	8 (8.7)
Secundigravidae	14	9 (9.8)	5 (5.4)
Multigravidae	51	48 (52.1)	3 (3.3)
Total	92	76 (82.6)	16 (17.4)

Chi-square (χ^2) = 10.8, df = 2, p=0.005

Gestational age (Trimester) Related Occurrence

Each of the pregnancy's three trimesters was accounted for in this study. The following data is documented for each trimester, including the number of exams performed, the number of positive results, and the associated percentage of occurrence: Sixteen out of nineteen (84%) pregnant women who were checked during the first trimester were found to have the malaria parasite. The second-trimester sample included 26 pregnant women and 19 of them (73.1% of the total) tested positive for malaria parasites when evaluated by a trained medical professional. In contrast, 47 maternal attendants (pregnant women) were screened in the third-trimester group, and 41 (87.2%) were found to have malaria parasites in their blood. There wasn't any significant statistical correlation between the change in the trimester of pregnancy and the newborn's weight (p>0.05) (Table 3.).

Table 3: Occurrence of malaria parasite in the study area based on a trimester (n=92)

Trimester	No. Examined	No. Positive (% Occurrence)	No. Negative (%)
1st Trimester	19	16 (17.4)	3 (3.3)
2nd Trimester	26	19 (20.7)	7 (7.6)
3rd Trimester	47	41 (44.5)	6 (6.5)
Total	92	76 (82.6)	16 (17.4)

Chi square (χ^2) = 2.38, df = 2, p=0.305

Discussion

This parasitological investigation found that there was a high occurrence of malaria infection (82.6%) among maternal attendants (pregnant women) receiving prenatal treatment at the Primary Health Centre Rumuolumeni in the Obio/Akpor Local Government Area in Rivers State, Nigeria. This number is somewhat higher than the 78.9% rate of malaria and anaemia among maternal attendants (pregnant women) in a traditional birth home in Benin City, Nigeria, reported by Bankole et al. (2012). Recent research by Abdullahi et al. (2020) in the Dutsin-Ma LGA, Katsina State, Nigeria, found an overall occurrence rate of 72%. This compares to reports of a 72% occurrence by Adefioye et al. (2004) in Osogbo, South West Nigeria, and a 57% occurrence rate by Marielle et al. (2003) in Gabon.

Okolo et al. (2017) in Grimard Catholic Hospital, Anyigba, Nigeria discovered that 41% of the population had the disease, but Igwe et al., (2007) reported that 11% of the population had the condition. Sarki et al. (2019) reported a prevalence of 91% in Gombe city, Gombe State, Northeast Nigeria; Yoriyo and Hafsat (2014) reported a prevalence of 92% in the same area, however, only 82.6% of pregnant women were infected with malaria. These researchers found a broad variety of occurrence rates based on the fact that mosquito vectors flourish, proliferate, and become more active in different places due to changes in climate, rainfall, and surface water (Okolo et al.,

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2017). Potential causes include inadequate waste management or transportation options in the region. Malaria and its consequences are more common among city dwellers because of the city's poor environmental conditions (Ukibe et al., 2008). In highly endemic areas, where semi-immune adults have established substantial tolerance to local strains of plasmodia, maternal attendants (pregnant women) are more likely to get clinical malaria. The increased susceptibility of pregnant women to malaria infection has been linked to pregnancy-induced decreases in cellular and humoral immunity (Ukibe et al., 2016). Ukibe et al. (2006) stated that the high occurrence of malaria transmission in this research might be attributable to the lack of or insufficient use of preventative measures like insecticide-treated bed nets by maternal attendants (pregnant women) (ITNs). Malaria parasite infection was more common in those seen between the ages of 29 and 38, affecting 33.7% (31/36) of this age group. Contrary to these findings, Sarki et al. (2019) found that the highest rates of malaria parasite infection were seen in young women between the ages of 15 and 24. However, this study agrees with a previous one by Abdullahi et al. (2020) that reported the highest malaria prevalence among maternal attendants (pregnant women) seen between the ages of 25 and 29.

Malaria was more common among younger maternal attendants (pregnant women) than among those of older ages, according to research by Keating et al. (2004). Therefore, younger maternal attendants (pregnant women) are at a higher likelihood of contracting malaria than their more senior counterparts. Age-related differences in malaria prevalence are again attributed to maturing natural immunity to infection (Bouyou-Akotet et al., 2003; Mbanugo & Okoroudo, 2005). There may be protection against malaria infection owing to acquired immunity, as reported by Rogerson et al. (2003), which may explain why there is an age-related variation in prevalence.
The greatest infection occurrence by gravidity was seen among the multigravida (those with three or more pregnancies) in this research (52.1%). Our findings are congruent with those of Abdullahi et al., (2020), who found a maximum infection rate of 58.6% in multigravida. This study's results are consistent with those of Sarki et al. (2019), who likewise identified a 54% infection rate in multigravida. The findings of Okolo et al. (2017) and Mofolorunsho et al., (2018). Contrary to our findings, Maureen et al. (2016) demonstrated that the incidence of the malaria parasite was highest in primigravidae (71.0%). (first-time pregnancy). The incidence of malaria in pregnancy is higher for primigravidae because they lack malaria-specific immunity. Still, the high number of maternal attendants (pregnant women) (48/51) in this sampling group may account for the increased occurrence of malaria in multigravida seen in this study (Elliot et al., 2005). Another possible cause is that most women that have gotten pregnant multiple times are not protecting themselves against malaria with insecticide-treated nets (ITNs).

Maternal attendants (pregnant women) in their 3rd trimester had a higher parasite count compared to those in their 1st and 2nd trimesters. This contrasts with the research of Ukibe et al. (2016), who discovered that such likelihood of contracting malaria was greatest during the 2nd trimester of pregnancy. Maternal attendants (pregnant women) in their 3rd trimester had the greatest risk of depression (79.2%), according to research by Maureen et al. (2016). Since most cases of malaria are asymptomatic within the 1st trimester of pregnancy, Agomo et al. (2009) hypothesised that many pregnant women do not seek medical attention until later in their pregnancies, explaining the steady decline in infection rates observed during the 2nd and 3rd trimesters (Agomo et al., 2009). According to Ter Kuile et al. (2003), P. falciparum infection is most common between 9 and 16 weeks of pregnancy.

Conclusion

Researchers found that 82.6% of pregnant women and their attendants were infected with malaria in the study location. The results of this study show that malaria is a significant threat to public health in the examined area. Additionally, studies have revealed that pregnant women (maternal attendants) are especially vulnerable to contracting the malaria parasite due to several different, yet interconnected risk factors. Despite this research, malaria is still a problem in the study region, threatening the health of maternity attendants (women who care for pregnant mothers).

Recommendations

1. It was determined that pregnant women and their families in the research area would benefit from receiving insecticide-treated bed nets (ITNs).
2. Pregnant women should always sleep under insecticide-treated nets to prevent the spread of malaria (ITNs).

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3. The community's local health centres should offer on-going health education and comprehensive prenatal care.
4. Clinicians of various specialities should be educated in preventive care and chemoprophylaxis. However, primary care physicians still require instruction in the theories, concepts, and methods of these therapies.

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Conflict of interest
The authors state that they have nothing to gain or lose by publishing this article.

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