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Malaria perception among pregnant women in Chhattisgarh, India

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MALARIA PERCEPTION AMONG PREGNANT WOMEN IN CHHATTISGARH, INDIA

by

PHILIP APRAKU BONDZIE

Ph.D., Boston University School of Medicine, 2014
B.Sc. Kwame Nkrumah University of Science and Technology, Kumasi, Ghana 2007

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Approved by

First Reader

Lora Sabin, M.A., Ph.D.
Associate Professor of Global Health

Second Reader

Mary L. Warner, M.MS.c, PA-C
Assistant Professor of Medicine

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ABSTRACT

Background: Malaria in pregnant women continues to be a public health problem in India. The prevalence of malaria in pregnancy is particularly high in the tribal conflict areas of India such as Chhattisgarh. Pregnant women have less acquired immunity protecting them against malaria than non-pregnant women of child bearing age. The decreased immunity results in a much more severe presentation of malaria symptoms, and potential death of both mother and fetus during malaria in pregnancy. Recognizing the need for effective malaria interventions in pregnant women, global and national malaria prevention and treatment guidelines have been established. Practice of these guidelines has been found to be inadequate in the Asian Pacific Region.

Literature review findings: Qualitative studies on the knowledge, attitudes and practices of malaria interventions have demonstrated that meeting communities at their level of understanding is essential in circumventing malaria spread. In an effort to create a synergy between health care workers, national and global malaria control strategies and pregnant women, there is the need to identify pregnant women's knowledge, attitudes and practices of malaria interventions. Currently, there is no data on the knowledge, attitudes and practices of pregnant women in the conflict districts of Chhattisgarh, India, where malaria prevalence and related symptoms have been identified to be significantly high.

Proposed project: This study seeks to assess the knowledge, attitudes and practices of malaria prevention and treatment in pregnant women in the conflict areas of Chhattisgarh, India, using a cross-sectional qualitative research design. This study will highlight the understanding of malaria transmission, perceptions of cause, recognition of signs and symptoms, treatment-seeking behaviors, preventive measures and practices of pregnant women who visit the antenatal clinic and those who do not.

Conclusion: If this study demonstrates knowledge and attitudes that favor customary or unproven methods of malaria interventions as shown in previous studies, then this may explain the present rate of MIP in these districts and hence the need for specific mediations for controlling and preventing malaria in this populace.

Significance: Findings from this study will help inform malaria education programs, health policies and practices that are tailored or targeted towards pregnant women in Chhattisgarh, India.

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LIST OF ABBREVIATIONS

ANC ..... Antenatal clinic

APR ..... Asian Pacific Region

IPTp ..... Intermittent preventive treatment in pregnancy

IRS ..... Indoor Residual Spraying

ITN ..... Insecticide-treated nets

KAP ..... Knowledge, attitudes and practices

LLIN ..... Long-lasting insecticidal nets

MC ..... Mobile clinic

MIP ..... Malaria in pregnancy

WHO ..... World Health Organization

INTRODUCTION

Background

Despite a decline in global cases from 262 million in 2000 to 214 million in 2015, malaria continues to cause more deaths worldwide than any other parasitic disease. In the Asia Pacific Region (APR), India is home to 75% of all malaria cases and deaths[1]. India alone recorded 1 million to 1.3 million malaria cases each year from 2010 to 2014, with 95% of the country's population at risk of infection[2]. True numbers are thought to be even higher than those reported, due to ineffective surveillance systems, inadequate diagnostic testing, and patients not seeking treatment [3–5]. Malaria poses an enormous financial burden of US$ 1940 million annually in India mostly stemming from lost earnings[6]. However, India represents one of the countries in the world still with limited malaria investment[7]. India's slow pace in preventing malaria may result in a potential challenge to eliminating malaria worldwide[8].

An estimated 91% of India's documented malaria cases are found in people living in tribal and rural areas, as well as in urban dwellers with poor sanitary and housing conditions. Children and pregnant women in these populations face the most risk[9–12] associated with adverse outcomes such as maternal anemia, preterm labor, still births and low birth weight[13–18]. Studies have shown that pregnant women have a three-fold increased risk of malaria infection compared to non-pregnant women who harbor lower levels of the disease causing parasite[19–22]. In the APR, pregnant women are also found to have less acquired immunity against malaria than pregnant women in Africa[23,24]. As a result, pregnant women with malaria in the APR experience more severe presentations of malaria

symptoms[25]. It stands to reason that pregnant women with malaria in the APR have an increased potential for maternal and fetal death compared to their African counterparts.

To prevent malaria morbidity and mortality in pregnant women and their babies, several guidelines and preventive measures have been put in place worldwide [26–28]. These guidelines and preventive measures are successfully being implemented in Africa but their application in the APR is confounded by several factors[29,30]. For example, although basic preventive measures such as indoor residual spray (IRS) and bed nets are effective and inexpensive, only about 20% of the at-risk Indian population uses them[31].

To gain a better understanding of the views and practices of pregnant women regarding malaria, several qualitative studies assessing the knowledge, attitudes and practices (KAP) of this population in Africa have been studied[32–35]. These studies have provided insight into interventions that are being utilized by various communities and subjects, as well as the factors that motivate a community's decision to implement specific malaria prevention methods[32,36,37]. Other studies have shown that interventions that target communities through education have significantly improved KAP over time, which has decreased disease burden[38,39]. Minimal qualitative studies on this topic have however been conducted in some states in India[40–42]. Given the prevalence of malaria in India and the adverse implications of the disease in pregnant women, it is imperative that further qualitative research is conducted in this malaria endemic country.

Statement of the Problem

Malaria continues to pose a significant threat in India. On top of other malaria-related challenges, forested tribal areas of India such as Chhattisgarh, Andhra Pradesh and Telangana, have had ongoing conflicts, significantly jeopardizing their healthcare[43].

Despite the establishment of mobile clinics and regular malaria preventive activities in the above conflict regions, there is persistent malaria transmission, especially in pregnant women. Data from mobile clinics established in these states showed that in a population of 575 pregnant women, 30% had malaria, with 21% of those diagnosed asymptomatic[44].

Malaria remains endemic in Chhattisgarh, particularly in the southern districts of the state where insurgency persists. In 2016, Chhattisgarh reported the second highest number of malaria cases among Indian states[45]. A draft report of community-based monitoring in Chhattisgarh for 2012 to 2013 identified malaria as the most common cause of death in the state[46]. In another study, estimates of malaria in pregnancy cases were as high as 220,000 per year, with an estimated 95,000 still births and miscarriages, and a thousand maternal births yearly[47]. Malaria continues to pose a significant threat to pregnant women and their babies in Chhattisgarh. In a recent study performed in Chhattisgarh, eighteen percent of children previously born to malaria-infected women died in their first year[44].

It is unclear why the high rates of malaria persist. The ongoing transmission of malaria could be associated with inadequate knowledge, and poor attitudes and practices relating to malaria prevention and treatment. A recent qualitative study performed in the Jharkhand state, a malaria endemic region in India, demonstrated poor understanding of

malaria transmission and utilization of effective malaria prevention methods among pregnant women[40]. In that study, pregnant women expressed concerns about the cost and side effects of drugs as limitations to utilizing malaria interventions. Practices such as the use of traditional remedies (69%) or untreated bed nets (89%) were not uncommon. At this time, nothing is known about the KAP of pregnant women towards malaria interventions in the conflict areas of Chhattisgarh state. Cases of malaria in pregnancy remain quite high there, additionally, with adverse effects on pregnant mothers and babies.

Identifying the knowledge and perceptions pregnant women have regarding malaria risk, preventive methods, traditional healers versus modern healthcare providers, drug cost, drug safety and drug availability will help inform policy makers on the factors influencing malaria prevention and treatment. It will also help them devise potential ways of improving these measures for the Chhattisgarh population.

Hypothesis

Levels of malaria knowledge vary among pregnant women in Chhattisgarh, with many displaying knowledge and practices that are influenced by both modern methods and belief in traditional practices.

Objectives and specific aims

Substantial research has been done on the African continent to assess individual and community perceptions of malaria interventions. Results from such research have impacted policies and practices of communities, as well as how health care workers operate. The main objective of this study is to assess the knowledge, attitudes and practices

of pregnant women in relation to malaria prevention in the conflict areas of Chhattisgarh state, India.

The specific aims include

1. To describe or identify the local perceptions of malaria prevention and treatment among pregnant women;
2. To identify the factors that hinder or promote effective malaria prevention and treatment in pregnancy;
3. To examine the relationship between knowledge and practice of pregnant women who visit the antenatal clinic (ANC) compared with those who do not visit the ANC.

REVIEW OF THE LITERATURE

Overview

Malaria Burden

Malaria continues to pose a public health problem worldwide. More than half of the world's population is at risk of malaria, with children under 5 facing the greatest threat[48]. In 2016, governments of malaria endemic countries and international agencies spent almost US$ 2.7 billion in malaria control and prevention methods. However, this investment was less than half the amount needed to eliminate 40% of malaria cases and deaths worldwide [49].

But there are some hopeful signs. Malaria cases declined 14% from 2010 to 2015, down to 212 million infections (95% CI: 192–257 million)[50]. Deaths also fell 22% in the same period[50]. Of the 91 countries assessed by the WHO, India and 14 Sub-Saharan countries contributed to 80% of the global malaria burden. Despite the overall decline in malaria cases, the APR has seen a marginal increase in case incidence[49].

Over the years, decreased malaria mortality (particularly in children under 5) resulted in an increased life expectancy at birth of 1.2 years in the WHO African Region. This trend accounted for nearly 20% increase in total life expectancy, from 50.6 years in 2000 to 60 years in 2015 (a gain of 9.4 years)[50]. Between 2000 and 2015, 17 countries successfully eliminated malaria. About 70% of malaria cases averted were due to successful implementation of malaria control efforts[50]. This outcome shows the need and possibility of eradicating malaria in malaria endemic countries.

Malaria Parasite and Immunity

The word malaria, previously associated with marshy areas, comes from Italian for "bad air". In the latter years of the 19th century, Ronald Ross, the first British Nobel Laureate, discovered that malaria was transmitted by mosquitoes. Later, Giovanni Battista Grassi showed that the female *Anopheles* mosquito acted as the vector for the parasite causing malaria. Today, scientists and health professionals know that the malaria parasite can also be transmitted by infected blood transfusion or through vertical transmission. There are more than 100 species of *Plasmodium* that cause malaria. Among them, six identified *Plasmodium* species infect humans. These species include: *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale curtis, Plasmodium ovale wallikeri, Plasmodium malariae* and *Plasmodium knowlesi*[51]. Each *Plasmodium* species varies in morphology, geographical locations, impact on the human immune system and response to drugs. Adequate knowledge and understanding of the species differences are required to direct effective malaria prevention, diagnosis and treatment.

Individuals with repeated malaria infections acquire some level of immunity[52–55]. Upon reinfection, these immune individuals exhibit decreased levels of parasitemia and severity of symptom presentation[56,57]. This acquired immunity is transient and diminishes when there is no continuous exposure to the malaria parasite[56]. Infants <6 months old are protected from malaria due to transferred maternal antibodies and the presence of fetal hemoglobin[58]. This phenomenon of modified acquired immunity is recognized in sub-Saharan Africa[59]. In low endemic regions, such as Latin America and Asia, age and patient immune status play little role in malaria parasite incubation time and onset of symptoms[59]. The risk of severe malaria disease is thus higher in Asians and Caucasians compared to Blacks[60]

Malaria Biology

An understanding of malaria biology is instrumental in developing needed tools for malaria prevention, control and treatment. Knowledge on the part of the community will help ensure adherence to any policies, management methods or treatments available for eliminating malaria.

As stated above, malaria is caused by malaria parasites. Within infected humans, malaria parasites flow through the bloodstream as motile sporozites. The sporozites seek out and invade liver cells, an important step for the life cycle of the parasite[61] . Within the liver cells, the sporozites undergo asexual reproduction, known as exo-erythrocytic schizogony, with each sporozite producing tens of thousands of daughter merozoites. The merozites alter the liver cell to ensure safe exit into the bloodstream[62]. Upon exit into the bloodstream, the merozoites enter the erythrocytes within which schizogony occurs[63]. Matured merozoites (trophozoites and schizonts) then exit the erythrocytes, causing destruction of the red blood cells. The merozoites then infect other RBCs, continuing the asexual blood stage life cycle.

For every cycle, the parasite multiplies 6-20 times[64]. Clinically, malaria parasites can be detected once they reach high numbers in the bloodstream (>100 million parasites) using standard diagnostic tools.

Clinical features

Malaria symptoms are associated with other diseases, as well as with pregnancy. It is important for individuals and communities to be knowledgeable about these symptoms so they can seek early medical care. The at-risk population, particularly infants and

pregnant mothers, stand to benefit most from being able to identify potential symptoms and present to the healthcare center for further care.

Malaria symptoms can be classified into two groups, uncomplicated malaria and severe malaria. After infection, a patient may recover, remain asymptomatic with parasitemia, progress to uncomplicated disease, or further progress to severe malaria and (if not treated) death.

Uncomplicated Malaria

Most symptoms associated with uncomplicated malaria are non-specific. These symptoms are either gradual or fulminant across all the *Plasmodium* species. The symptoms may present early or late in the disease process. Initial symptoms include flu-like symptoms such as headache, arthralgia, myalgia, shivering, diaphoresis, abdominal discomfort and fatigue[59]. Other symptoms include dizziness, lassitude, anorexia, and chills[65]. This is sometimes followed by nausea, convulsions, watery diarrhea and orthostatic hypertension. The cardinal presentation of malaria is fever. Among the different *Plasmodium* species, febrile conditions tend to be most prevalent in *P. falciparum* infections. Using in vitro conditions, it is hypothesized that fever may play a role in helping fight malaria. In a study by Long *et al*., 2001, malaria parasite growth was observed to be inhibited at high temperatures *in vitro*[66].

Other symptoms, including hepatosplenomegaly, anemia and thrombocytopenia, are more prevalent in children in malaria endemic regions[67–71].

The various parasitic species do have some unique presentations. *P. falciparum* and *P. vivax* are the two most prevalent malaria species in India. *P. vivax* typically presents

with a sudden onset of a cold phase, followed by a hot phase and a sweating phase. The cold phase is characterized by pallor, chills and cutis anserina[65,72,73]. Patients may try to stay warm using blankets, with little success. The hot stage ensues with patients feeling very hot and vomiting. Headaches, altered awareness, dry throat, and diarrhea are not uncommon. Children may sometimes convulse. After about 2-6 hours, the patient enters the sweating phase. The patient begins to sweat profusely followed by a rapid decline in temperature. At this point, the patient begins to feel better, albeit with some degree of tiredness and the desire to sleep[59]. Hepatosplenomegaly may later be seen in the disease process in these patients.

P. vivax may remain in a latent stage in untreated patients. Weeks, months or even years after the primary infection, the disease can relapse with manifestation of clinical symptoms. Relapses usually last for a shorter time and are often less severe[59].

In *P. falciparum* malaria, flu-like symptoms are present in the prodromal phase. Patients may experience dry cough and tachypnea insinuating acute respiratory disease. Similar to *P. vivax* malaria, patients may have hepatosplenomegaly, jaundice and orthostatic hypertension. *P. falciparum* malaria is likely to progress to severe illness if not treated. On the other hand, the disease can be quickly treated with the right medications. *P. falciparum* can recur due to existing erythrocytic forms of the parasites.

Severe malaria

Severe malaria mostly stems from *P. falciparum*. It is present in both children and adults in low malaria endemic areas, but much more prevalent in young children in high malaria endemic areas. Other symptoms associated with severe falciparum malaria include

hypoglycemia, impaired consciousness, shock, pulmonary edema, jaundice, and renal impairment. Acidosis and hyperparasitemia with or without bleeding also occurs in all age groups. These symptoms can develop rapidly and can lead to death within hours or days[59].

The most prevalent finding in *P. vivax* malaria is severe anemia, particularly in pregnant women. This is usually not associated with the high parasite levels seen in severe *P. falciparum*. That is, *P. vivax* is able to cause severe anemia at lower parasitemias. Several studies have reported other severe symptoms associated with *vivax* malaria. These include kidney failure, severe jaundice, metabolic acidosis, splenic rupture, hypoglycemia, abnormal bleeding and hemodynamic shock. *Vivax* malaria can also cause low birth weight.

Severe malaria is associated with high mortality; it is therefore important to recognize it to prevent death

Malaria Control

To eradicate malaria worldwide, populations need to have universal access to and implementation of preventive measures, with proper treatment of malaria cases that develop. Additionally, communities must be aware of these control measures and be able to implement them. Countries like the United States were able to eliminate malaria through practices aimed at modifying mosquito habitat[74]. Other countries such as Turkey saw a decline in malaria due to the emergence and use of Dichlorodiphenyltrichloroethane (DDT)[75]. Between 1950-1970, extensive use of DDT resulted in more than a 50% decline in malaria infections in many countries (reviewed in Shiff 2002)[75]. There are currently several methods in place to help prevent malaria, though over time mosquito vectors

develop means to circumvent those methods if they are used ineffectively or in isolation. WHO recommends an integrated vector management approach that emphasizes linkages between the environment and health, optimizing benefits to both. An effective vector control method reduces vector population, which can result in a decrease in malaria morbidity and mortality. To effectively control malaria, both healthcare workers and the community need a combination of tools and approaches.

Methods used for malaria vector elimination include aerial spraying (ultra-low volume); larvicide use (cupric arsetoarsenite, temephos or insect growth regulators); biological control of the mosquito ovum (fish, bacteria or fungi feeding); and male mosquito sterilization[76]. Mount *et al.,* showed that ultra-low volume spray resulted in 89-100% mortality of different mosquito species[77]. Environmental management has also proved beneficial in wetlands, coastlands, forest areas and non-agricultural man-made habitats, particularly in rural areas[76]. Research by Keiser *et al.,* showed that environmental management can lead to an 88% reduction malaria transmission risk[78].

Long-life insecticide-treated nets (LLITN) are another way of preventing mosquito bites. LLITNs are an effective, cheap and easy to use method of malaria prevention. However, they only effective during sleep when slept under[76]. Traps have also been developed based on odors released by mosquito targets. Several studies have been performed to identify the target odors that will attract more mosquitos to the traps[79–81]. Further, a careful design of human settlements reduces malaria transmission by about 96%[82] . This approach involves covering windows and doors with net screens, blocking eaves, and installing ceilings.

Malaria in India

India is the second-most populated country in the world, with more than 1.3 billion people. Its population is tremendously diverse, including various religious groups, ethnic groups, socioeconomic statuses and educational backgrounds. The country is made up of 29 states and 7 union territories and occupies a large footprint (nearly 1.3 million mi^2). Its terrain consists of wide desert areas, vast plains, hills and tall mountains, rain forests, rivers, waterfalls, beaches and two groups of islands.

India has one of the fastest growing economies in the world[83], yet it struggles with poverty and poor health[84]. In 2015, infant mortality was recorded at 38 deaths per 1,000 live births, mortality for children under 5 at 48 per 1,000 live births and maternal mortality at 174 deaths per 100,000 live births[85,86]. Most of these deaths are recorded in malaria endemic districts. Despite these numbers, malaria control programs in India have paid little to no attention to malaria in pregnant women and their babies[87].

Malaria has posed a threat to India for centuries. In 1852, a recorded malaria epidemic wiped out the entire population of Ula in West Bengal state while causing havoc to nearby communities[88]. Railway introduction to India seems to have been both a blessing and a curse. While it provided a major opportunity for travel and business, the embankments used in railway construction served as breeding grounds for malaria parasites. Furthermore, the railway workers most likely (and unwittingly) helped spread the parasites as they moved from one area to the next. World War II also saw a significant increase in malaria-related cases and deaths in India[88].

India first established malaria control programs in the 1900s, around railway and military areas. Following that, the National Malaria Control Programme (NMCP) was started in 1953. The NMCP focused on insecticidal residual spray use with DDT, the monitoring and surveillance of cases, and treatment of patients. Following the launch of NMCP, malaria-associated illnesses and deaths were significantly reduced over the following years (75 million malaria cases in 1953 to 2 million malaria cases 1958)[89]. During this period, India became a model for malaria control for developing countries worldwide[90]. Other control programs have been established since, including: The National Malaria Eradication Programme (1958), the Urban Malaria Scheme (1971), and the Modified Plan of Operations (1977), among others. Each program saw a decline in malaria cases after its establishment, though cases eventually rose again. The resurgence in cases was linked to poverty, lack of adequate health infrastructure for surveillance and logistical challenges in various parts of the country. Inadequate KAP may have interfered with the effectiveness of malaria control measures over the years[91,92].

India's current focus is to eliminate malaria and to maintain a malaria-free zone by 2030. To accomplish this goal, the country launched the National Framework for Malaria Elimination (NFME) in India 2016-2030 in February 2016.

Indian tribal populations account for the greatest share of reported malaria cases (91%) and deaths (99%). The tribal populations live in certain states: Orissa, West Bengal, Andhra, Karnataka, Jharkhand, Madhya Pradesh, Chhattisgarh, Maharashtra, Meghalaya, Mizoram, Odisha, Telegana and Tripura. These states are mostly forested, made up of foothills and located in conflict areas. [93].

Indian malaria transmission is largely seasonal-based and is termed "unstable transmission[94]." This transmission is most prevalent before the monsoon rains and prevalent in all age groups, with pregnant women particularly at risk during epidemics[95]. People in unstable transmission regions are usually slow to develop natural immunity to malaria, leaving the majority of Indians at high risk of malaria infection[96]. The situation differs from Africa, where there is high and stable malaria transmission. As a result, Africans are able to develop incomplete immunity albeit the development of immunity requires several years of malaria exposure[53,55,97,98]. It should be noted that there are areas of stable transmission in India as well[99].

Malaria in pregnancy

Studies by Lindsay et al., 2000, showed that malaria vectors predominant in Africa are highly attracted to pregnant women (mean, 6.33 per night [95% CI 4.5-8.7) than non-pregnant women (3.1 [2.1-4.5]; p = 0.0002)[100]. The increased attraction has been attributed to physiological changes in pregnant women, such as increased carbon dioxide exhalation and greater skin emission of volatile substances and heat[100,101]. Pregnancy itself modifies the immune system resulting in a differential response to infection compared to non-pregnant women[102], making pregnant women more vulnerable to serious malaria illness upon infection[103]. The risk of infection and disease manifestation is additionally increased in primigravidas and in HIV-infected pregnant women[104] as immunity further decreases. Upon malaria infection, pregnant women have a greater propensity to develop complications and ultimately death. Mortality rate in pregnant women with severe malaria approaches 50%[22]. Severe anemia represents a particular problem during malaria in

pregnancy. Generally, malaria-infected red blood cells get sequestered by the spleen, leading to increased erythroid hyperplasia, folic acid depletion and megaloblastic anemia[105]. In addition, infected erythrocytes are sequestered in the placenta of pregnant women[106,107]. These actions result in a higher rate of severe anemia in infected pregnant women. Such findings have highly been reported in malaria endemic regions, with 25% of severe anemia cases in pregnancy stemming from malaria[104]. Finally, children born to women with malaria during pregnancy and acute placental malaria infection are more susceptible to malaria infection during infancy and are at a high risk of infant death.[108]

Some malaria-infected pregnant women remain asymptomatic due to the sequestration of the parasites in the placenta. These women sometimes have a high level of immunity, protecting them but putting their fetus at risk of malaria infection[22]. The placental sequestration of red blood cells alters oxygen and nutrient transfer to the fetus. Additionally, placental sequestration of infected erythrocytes, elicits a local monocyte inflammatory response[109]. Although the mechanisms are still unclear, these events in the placenta potentially result in spontaneous abortion, still birth, pre-term birth, or low-birth-weight babies[110]. Low-birth-weight babies face an even high risk of death[111].

Both the mother and the baby are at risk of severe malaria infection. The levels of parasites are high in this cohort, causing hypoglycemia, severe anemia and acute pulmonary edema in the mothers. Fetuses could once again be aborted due to fetal distress, and stillbirth is not uncommon. *P. vivax* infection leads to about a 107g reduction in birth weight, versus a 170g reduction in in *P. falciparum* infection[112].

Malaria in pregnancy is an overlooked health crisis in India. Studies carried out in Central India by Singh *et al*., in 1999 showed that parasitemia, maternal mortality, and severe anemia, were predominant in pregnant women compared to non-pregnant women infected with either *falciparum* or *vivax* malaria[14]. In earlier studies in northwestern India, Kochar *et al*., had also showed a similar trend in pregnant women and their neonates[113]. The mortality rate in pregnant women with *falciparum* malaria infection was significantly higher (38%%) than in non-pregnant women (15%) with *falciparum* infection ($p<0.001$).

A number of studies have been performed to estimate the burden of malaria in pregnancy in India. Dellicour *et al*., showed that among the world's countries, India had the most pregnancies at risk of both *falciparum* and *vivax* malaria infection[114]. A study conducted in India's Madhya Pradesh state, malaria prevalence in pregnant women was 12.6% (OR of 7.61 at 95% CI (2.1 - 27.4)) vs 6.6% (OR of 1.73 at 95% CI (0.5 - 6.2)) in non-pregnant women of child-bearing age. Additionally, anemia was the predominant side effect in pregnant women with malaria (62.6%), as compared to non-pregnant women of child-bearing age (53.2%)[115]. Another study performed in Jharkhand state between 2006 and 2007 showed that about 2% of women who attended antenatal clinics had malaria. In that same study, 4% of women in the delivery units had malaria infection, with 2% of that population having placental infection. *P. falciparum* accounted for 84% of in-patient diagnosed malaria in pregnancy, while *P. vivax* accounted for 8%[16] .

A recent study of malaria-infected women performed in a tertiary level medical college hospital in Kolkata, India, identified 77% of the malaria cases as caused by *P. vivax*. The remaining 23% were *falciparum* malaria cases. The complications identified in the

study were mostly caused by *P. falciparum* infection. The most common symptom present was anemia (84% of all cases), followed by 61% of women with affected placentas. Low birth weights and perinatal births were also reported in this study. Although disease prevalence was higher in primigravidas, disease severity was higher in multigravidas[116].

Moore *et al.*, showed that out of 50,060 pregnant women followed in India, 16% (8,221) had malaria during their pregnancy. About 21% of the babies born to these women were small for their gestational age[117].

Several other studies in India have shown high prevalence of *P. falciparum* or *P. vivax* malaria and discussed their impact on pregnant women or their neonates[44,118,119]. The prevalence of malaria in this vulnerable population and the resulting impact also mean that both pregnant women and the children born to them are an important source of malaria transmission.

Again, these various findings point to the focal nature of malaria prevalence in the country, a varied geoparasitological distribution nationwide and the need for focused malaria interventional methods.

Malaria Prevention in Pregnancy

Malaria is a preventable and treatable disease. There has been a reduction in malaria transmission worldwide, particularly in Africa. As already highlighted, some countries have also experienced total malaria elimination.

Although there is little to no information on the specific impact of malaria preventive measures on pregnant women, overall the WHO reported significant cost

savings of U.S. $900 million from malaria control practices in Sub-Saharan Africa between 2001-2014[120].

Most of these successes have been due to significant investments in and implementation of malaria control programs, in addition to the use of effective drug treatments[121].

Malaria prevention was one of the Millennium Development Goals[122], with the aim of;

1. Preventing malaria with long-lasting insecticidal nets and indoor residual spraying
2. Testing and diagnosing with accuracy and treating with quality-assured anti-malarial medicines
3. Providing preventive therapies for infants, children and pregnant women
4. Tracking every malaria case in a surveillance system
5. Scaling up the fight against emerging drug and insecticide resistance

The use of insecticide-treated bed nets (ITNs), including long-lasting insecticidal nets (LLINs), and intermittent preventive treatment in pregnancy (IPTP) have been the mainstay of malaria prevention methods. LLINs have been designed to kill mosquitoes for 3 years and have been recommended by the WHO. ITN use has resulted in a reduction in malaria mortality and morbidity in pregnant women and children. It has also led to decreased maternal anemia, parasitemia, and low birth weight[123,124]. Despite the significant impact of ITN use, 47% of the world's population at risk of malaria failed to sleep under mosquito nets in 2015[120]. Within the South-East Asia region, Stewart and Marchand showed that ITN use could serve as an efficient way of controlling malaria[125]. There is the

need for effective education, behavior change, and active participation on the part of individuals and communities for further progress. Past studies have shown that it has been easy to persuade traditional highland communities in India to commit to ITN use once they had been educated about the benefits and experienced them[126]. This indicates the possibility of modifying KAP of communities through education[125] leading to effective use of ITNs.

Indoor residual spraying (IRS) has been another successful malaria preventive method. It is a very effective way of reducing malaria transmission by directly killing mosquitoes. It involves spraying insecticides on potential dwelling areas for mosquitoes. In 2015, about 106 million people worldwide were protected from malaria by IRS[120].

IPTP entails administration of therapeutic doses of an effective antimalarial drug, currently sulfadoxine-pyrimethamine (SP), at least twice to all pregnant women. IPTP is offered as part of antenatal care services during the second and third trimesters, irrespective of the status of malaria infection. IPTP is recommended by the WHO and is well-established in most stable malaria transmission settings. (The WHO also recommends that pregnant women receive both iron and folic acid supplements.) There has been significant success in IPTP preventing adverse outcomes from malaria infection during pregnancy[127–131]. For example, Menendez *et al.*, IPTP use during pregnancy resulted in 40% reduction (95% CI, 7.40–61.20]; p=0.020) in the incidence of clinical malaria, and a 13% reduction of actively infected placentas (p=0.002) But despite the positive results from using IPTP, about 30% of pregnant women in Africa receiving antenatal care did not receive IPTP, while others did not complete the course as recommended by the WHO[120].

Other practices that could limit malaria transmission include controlling malaria mosquito larvae with larvicides and using window screens, window curtains, insecticide treated blankets and protective outfits, among others. With the exception of larvicides, however, these additional practices have not been recommended by the WHO.

Malaria Treatment in Pregnancy

If malaria prevention fails, pregnant women infected with malaria can still take the necessary steps to protect both themselves and their unborn children. However, the right diagnosis is essential to prevent unnecessary exposure to antimalarials and the development of drug-resistant malaria. The following medications can be used for malaria treatment in pregnant women: quinine, chloroquine, artemisinins, atovaquone-proguanil, and clindamycin[26]. Women in their second or third trimester with uncomplicated *falciparum* malaria are treated with artemisinin-based combination therapy[26]. Within the first three days of treatment, the short-acting artemisinin derivative causes a significant reduction in parasite numbers. The remaining parasites are eliminated by the long-acting partner drug which also acts as a prophylactic agent, thereby preventing new infections when serum drug levels are beyond the minimum inhibitory concentrations of the parasite[132]. Women in their first semester are treated with quinine[26]. In India, chloroquine is recommended for *P. vivax* malaria[133]. The development of severe malaria is an emergency and therefore calls for immediate treatment. Quinine or artemisinin derivatives should be provided parenterally, preferably using the intravenous route.

Knowledge about malaria treatment and therapeutic dose options is essential for effective management of malaria, especially among pregnant women and their unborn children.

Existing research

Knowledge attitudes and practices of malaria prevention/treatment

Globally, several studies have been conducted to identify the knowledge, attitudes and practices towards malaria prevention and treatment. The effectiveness of the various malaria preventive and treatment methods depend on the attitudes and knowledge of both individuals and the community as a whole. These attitudes and knowledge are shaped by social and cultural factors[32].A study by Chapman in 2003 demonstrated the need for extensive qualitative research for providing a comprehensive understanding of pregnancy care[134]. Other studies have also demonstrated the need for recurring qualitative research on trends in thought, knowledge and beliefs towards malaria, as these seem to change with time[135,136].

A systematic review by Pell *et al.,* was performed to examine KAP in MIP in Africa. The study found that pregnant women underestimated the seriousness of MIP due to locally defined reasons. First, malarial symptoms, because they are somewhat generic, can be attributed to other local illnesses. Pregnant women confused malaria symptoms with pregnancy symptoms, too. They further blamed their malarial symptoms on heat, cold, diet and/or physically strenuous work. Some pregnant women believe that malaria is a threat caused by witchcraft rather than by a parasite infection[32].

The WHO recommends at least eight antenatal care visits to reduce perinatal deaths and improve care during pregnancy[138]. These visits help ensure successful implementation of MIP interventions by providing timely and relevant information during pregnancy and also providing comprehensive and high-quality medical care, and support system where

necessary[139]. Thus antenatal clinics (ANCs) serve as important places to improve patient KAP towards malaria interventions. In a systematic study of developing countries by Simkhada *et al*., a pregnant woman's education, travel costs and distance to an ANC influenced the likelihood that she would visit the ANC. Younger women also avoided ANC visits to hide their pregnancies, while older women indicated they had enough experience with pregnancy and therefore did not need ANC visits[140,141]. Some women thought ANCs were there just for pregnant women who are ill, failing to understand ANCS were also for well-pregnancy visits and preventive visits[32]. Failure to visit an ANC may explain the high negative impact of malaria in pregnancy in India and globally. Studies examining KAP in pregnant women who visit the ANC and those who do not are warranted to help ensure that pregnant women are receiving the benefit of preventing and treating malaria during ANC visits.

In India, most studies on malaria KAP have focused on the general population. For example, Vijaykumar *et al*., showed that 63% of respondents acknowledged mosquito bites as the cause of malaria[142]. Nevertheless, people from remote villages with malaria preferred to consult traditional healers. Among people who did not know the cause of malaria, 10% attributed the cause to dirty drinking water, hard work, tiredness or long exposure to the sun. Although 65% of the respondents recognized malaria as a serious disease, they described it that way because malaria infection hampered their day-to-day work, resulted in more money being invested in treatment and caused physical suffering[142]. Individuals in this setting may be amenable to malaria education that centers around the prevention and treatment of malaria to avoid falling sick and not being able to go to work. Others (27%)

did not consider malaria a serious disease, with the reason given that treatment was easily attainable. Furthermore, the authors found that 67% of people knew that malaria infection can be reduced through (insecticide-impregnated) mosquito net use, while 30% did not know how to reduce the risk of malaria infection[142]. Factors that have influenced seeking care for malaria have included the proximity of healthcare facilities to the homes of patients. Patients preferred to go to care providers — whether traditional healers, community health workers or qualified doctors — whose care centers were situated in close proximity to their homes[142,143].

Similarly, studies in the Odisha state of India showed that patients were more likely to seek care from traditional healers or unqualified providers even when they had awareness of malaria-related symptoms[144]. The Odisha studies also showed that malaria patients were more likely to avoid treatment when it was offered by trained community health workers. The patients lacked trust in the health workers for the following reasons: drugs frequently out of stock[144], drug side effects, doubts about drug quality and inappropriate provider behavior (some providers provide quick symptom relief through expensive antibiotic injections)[143].

Another study performed in malaria-endemic areas of India showed a lack of knowledge about malaria etiology and symptoms among tribal populations. In association with the lack of knowledge, patients presented to traditional healers or unqualified providers who lacked knowledge about malaria infection. The use of antimalarials and malaria preventive methods such as ITNs were reported to be low (50% of the tribal population). As in other studies, community health workers identified lack of transport as

a hindrance to malaria surveillance and proper prevention and treatment[145]. In another study, health facilities in the Terai region of West Bengal, India, lacked the necessary infrastructure (such as blood testing units and antimalarial drugs) for malaria treatment, despite frequent outbreaks of malaria[146] .

In a study conducted in 200 households in urban regions of India, 92% of the people reported knowledge of malaria, but only 53% knew it was preventable. As a result, the use of ITNs and DDT spraying was very low[147]. Similar studies in parts of India have shown awareness of mosquitoes as transmitters of malaria, but low adoption of preventive measures[148]. A national study in India (n=1,000) showed a disconnect between knowledge of malaria prevention and prevention practices[149].

A recent cross-sectional survey in India showed 56% of the population had some knowledge about malaria but only 16% practiced good malaria preventive measures. As many as 82% of the respondents used self-medications[150]. Unlike the above studies, Sood *et al*., showed that good knowledge of LLINs positively impacted their use, which reduced malaria incidence. Knowledge of LLINs also positively influenced the purchase of LLINs. This study emphasized the need for and importance of effective malaria education that translates people's knowledge of malaria into effective prevention methods[151]. As patients gained knowledge and experienced reduced malaria cases from LLIN use with minimal side effects, the use of LLINs became widely accepted.

However, malaria KAP in healthcare workers as it relates to pregnant women is also essential, especially in situations where healthcare workers are the only source of accurate information for the general populace. Studies by Wylie *et al*., in two Indian states,

Jharkhand and Chhattisgarh, showed that the use of efficient malaria preventive methods like ITNs were low. Health workers in Jharkhand did not recommend ITN use during antenatal visits, though more than 90% of the pregnant women owned bed nets. In the same study, only 14% of health workers in Chhattisgarh recommended bed net use to pregnant women. The use of chloroquine as chemoprophylaxis or IPTP therapy was prescribed in only 0.7% and 0.1% of ANC visits, respectively[99]. In addition to the above published studies, several other studies performed in India reinforce these mixed findings[152–158].

Several studies point to the focal nature of factors influencing knowledge, attitudes and practices of malaria prevention and treatment worldwide. The impact and perceived value of KAP of malaria interventions varies with geographical location, respondent education level, gender, and socioeconomic status, as well as between pregnant women and non-pregnant women. A recent meta-analysis highlighted some factors that influence malaria prevention and treatment among pregnant women. These factors included poor knowledge of drug safety, self-medication practices, education, past miscarriages, antenatal care, adherence to treatment policies, patient preference for particular drugs, and drug availability and cost[159].

In general, women in some regions exhibit poor knowledge in malaria prevention and treatment practices. A cross sectional study by Sahoo *et al*., among residents in slum areas of India showed that awareness of malaria and other vector-borne diseases was significantly higher in males (65% in males vs. 46% in females), and literates (66% in literates with more than primary school education vs. 20% in people with primary or no

primary education)[137]. Females who were illiterate were especially likely to demonstrate poor malaria knowledge.

A few qualitative studies have examined KAP in pregnant women in India. One study involving 31 pregnant women in government-run maternity hospitals in Mumbai showed respondents' lack of concern about anemia during pregnancy. Anemia was seen as normal during pregnancy[41]. Although mild anemia is normal during pregnancy (50% increase in plasma volume expansion relative to 25% increase in erythrocytes)[160], severe anemia from malaria is detrimental to the pregnant woman and the fetus. Indeed, a number of studies have shown that malaria prevention leads to a reduction in anemia during pregnancy[161,162]. It is important for pregnant mothers and health workers to identify severe anemia as a serious complication during pregnancy and its link to malaria to help save both the pregnant mother and the fetus.

Another study conducted in some rural regions of India examined health information-seeking behaviors and perceived information support of low-income pregnant women. The data showed that lack of access to medical care negatively impacted the care and health practices of pregnant women. Patients resorted to knowledge from elderly women, friends and family to inform their decisions on disease prevention and treatment. All the women felt challenged by feelings of shame and embarrassment, including fear of repercussions from talking to their doctors about their pregnancies[42]. This psychological belief potentially hindered the women's ability to obtain the necessary health information particularly as it relates to malaria in pregnancy.

In 2010, studies in the urban and rural areas of Jharkhand state in India assessed KAP in pregnant mothers. Pregnant women endorsed the use of unconventional methods for malaria prevention. These methods ranged from mantra reading to ingestion of concoctions and were influenced by their traditional beliefs and practices. Most pregnant women were unaware of chemoprophylaxis and ITN use for malaria prevention. Pregnant women in this region preferred the use of untreated bed nets and non-modern methods for malaria prevention and treatment, though there was a desire to comply with instructions received from healthcare workers[163]. A more comprehensive study among pregnant women and caretakers in the urban and rural areas of Jharkhand and Chhattisgarh states has recently been performed. In this study, respondents from Chhattisgarh did not view malaria as a significant issue for pregnant women. Respondents from Jharkhand saw malaria as a threat to pregnant women, but they mostly resorted to traditional methods of malaria prevention. Interestingly, healthcare workers failed to effectively address malaria prevention and treatment methods during ANC visits [164].

Altogether, KAP studies performed on malaria in pregnancy worldwide and in India suggest a culturally and locally defined outlook on the disease. Pregnant women, traditional healers, healthcare workers, and members of the community are all stakeholders in malaria prevention and treatment. The availability of antenatal clinics and other health care centers, the distance to health facilities, and the cost of and accessibility to preventive methods and medications all contribute to the effectiveness of malaria intervention methods. The views and practices of stakeholders help to provide a structural framework

targeting each society's needs in curtailing malaria, particularly in vulnerable populations such as pregnant women.

KAP studies can serve as an evidence-based tool for planning, refining and evaluating malaria policies in various countries. KAP studies help to identify general perceptions and attitudes held by individuals. They also bring to bear the factors that influence behaviors in most people. In the process, KAP studies help to define the right communication process for planning effective messages and activities for malaria prevention and treatment. This ensures effective use of the limited resources available for producing the preferred behavioral change and practice. KAP studies can also provide insight into problems, needs and barriers in malaria interventions. This helps identify the solutions needed for improving access and quality of services. To some extent, KAP studies can be used to identify ways to involve health providers in preventing and treating malaria. All in all, KAP studies can positively impact individual and community change by 1) mobilizing government resources, 2) improving malaria prevention, case detection and treatment adherence, and 3) combating incorrect dogmas.

KAP could be improved by advocating, communicating and organizing activities for the community with the goal of educating them about malaria and its interventions[165]. Indeed, training programs to improve KAP on malaria prevention and control have successfully impacted the implementation of malaria prevention and treatment. For example, a study in Nigeria saw an increase in malaria knowledge of 66.7% after training. The training entailed organized lectures, health education and practical demonstration sessions[166]. Studies in some parts of India have shown the need to use culturally appropriate

health education materials, incorporate traditional healers into malaria control programs, and increase the availability of malaria prevention tools to communities, to increase KAP of malaria interventions[167].

To date, KAP in conflict areas of India have not been explored, though these are high malaria endemic areas. Assessing KAP in these regions has the potential to help improve the state of malaria among pregnant women.

METHODS

Study design

This study will be a cross-sectional qualitative study in Chhattisgarh, India, during which a question guide with open ended questions will be administered in a face-to-face interview approach to examine pregnant women's knowledge, attitudes and practices towards malaria prevention and treatment.

Study population and sampling

In India, Chhattisgarh is the state most affected by conflicts in tribal forested areas. These areas are burdened with illiteracy, poverty, overpopulation[168] and malaria. Mobile Clinics (MCs) have been established in open areas in the closest possible proximity to homes[169]. MCs are organized by Médecins Sans Frontières India as a way to bring healthcare to people who are apprehensive about attending government hospitals and clinics. Clinic sessions are organized once a week to provide general care, antenatal care and post-natal care consultations, laboratory tests, and drug dispensation. These services are free of charge, creating an environment that allows the natives to visit without concern for cost.

The study population will include pregnant women present in the conflict areas of Chhattisgarh. Eligibility includes women who are: 1) pregnant; 2) consent to taking part in the study; and 3) greater than 15 years of age.

Based on past qualitative studies, saturation is reached after interviewing 6-12 individuals with comparable backgrounds[170]. This study will enroll two groups of pregnant

women: those who visit the ANC clinics and those who do not. At least six women who have visited the ANC clinics and six women who have not visited the clinics will be recruited from each of the 7 districts (Bestar, Dantewda, Jashpur, Kanker, Kawarda, Rajnanadgaon, and Surguja) within the Chhattisgarh conflict region[171]. Interviews will be conducted in each district for 2-3 weeks. Pregnant women will be given a bed net for their participation, an incentive successfully used in the previous studies.

Data collection

Data collection will be similar to the method used by Sabin *et al*.,[163]. Qualitative data will be collected by two trained local interviewers, focusing on malaria knowledge, malaria prevention and local health beliefs using a pre-tested, semi-structured question guide (Appendix 1). One interviewer will focus on obtaining the information and the second interviewer will record the responses, an accepted and successful practice used in previous studies[40]. The interviews will be conducted in Hindi. All interviews will be recorded using a voice recorder, which is an acceptable practice in India.

The question guide will be structured to enable open-ended exchanges. Each interview should take between 90-120 minutes to complete. The question guide will contain specific topics focused on 1) What do you do to protect yourself against malaria during pregnancy? 2) Have you been sick with malaria during a previous pregnancy or during this one? 3) If yes, what did you do? Other questions will target socio-demographic data, health concerns, and knowledge, perception, and behaviors regarding malaria. Respondents will also be asked about their use of modern and traditional malaria intervention methods. Daily reviews of collected data and recordings will be done by a

bilingual study member to ensure accurate Hindi language notes. The notes will then be translated into English, with verification by a second bilingual study member.

Data analysis

An analyst will code the responses using grounded theory[172], analyze the resulting themes using Microsoft (Redmond, WA) Excel 2010, and perform a frequency analysis of the themes in relation to specific topics. Reponses made spontaneously or in reply to a follow-up question will be included in the frequency analysis. Responses will be prioritized based on the number of times they are mentioned. The analysis will also compare responses between districts, as well as by level of education and between pregnant women who visited the ANC and those who did not.

Timeline and resources

The study will be conducted over the course of one year (two to three weeks in each district).

Institutional Review Board

The study will be submitted for review by the Boston University Institutional Review Board and the MSF Ethical Review Board in Geneva, Switzerland. Patient information will be de-identified and data analyzed anonymously. Consent will be obtained from all respondents before participation.

CONCLUSION

Discussion

This study will be the first to examine the knowledge, attitudes and practices towards malaria prevention in pregnant women in the conflict forested areas of Chhattisgarh, India. Malaria in pregnancy (MIP) can cause severe anemia in the pregnant woman, with increased risk of post-partum bleeding and sometimes death[111,173]. MIP can also result in low birth weight or stillbirth. Despite ambitious goals and guidelines for malaria prevention in India, there is little attention paid to pregnant women and their unborn children. Additionally, insufficient progress has been made in controlling the disease nationwide. The success of MIP interventions in populations depends on understanding the impact of culture and tradition on the knowledge, perceptions and attitudes of the population, as well as on effective medication. This study will generate information that could help target policies for this vulnerable population with the goal of 1) developing culturally sensitive and appropriate malaria preventive and treatment tools; 2) improving cultural health beliefs through education; 3) encouraging healthcare workers to include examples from cultural backgrounds to help dispel myths and facilitate lifestyle changes in the context of where patients live and 4) providing easy access to modern methods of malaria prevention and treatment.

This study could potentially be limited by the number of women who visit the MC for ANC. The MCs were established to accommodate the fears and insecurities of the locals with the aim of encouraging clinic visits without any danger. Nevertheless, due to the conflict nature of these communities, patient visits to the MC may still be limited. It

has been estimated that only about 25% of pregnant women in the area access the MC ANC every year[15]. This means findings from our study potentially may not reflect the cultural views of all the pregnant women in the districts. However, the approach of also including women who do not visit the ANC ensures a diverse population and an adequate sample size reflecting the community.

This study is focused on conflict tribal areas of India and thus findings from this study may not be applicable to other regions of India or the world. Furthermore, respondents, knowing their knowledge and awareness about malaria is being assessed, may exaggerate their responses. This may mask other views or behaviors that may be relevant for improving malaria prevention and treatment.

Within the study population, patient knowledge and perceptions may be impacted by health workers influence. Since the MCs provide ANC and post-natal care consultations, access to these services may skew the knowledge and attitudes of pregnant women because they have received knowledge about malaria. On the other hand, if the knowledge of pregnant women who visit the ANC is found to be lacking, it may be a reflection of the kind of care and information being received from their care providers. Even if the ANC health workers were adequately trained, there is the need for a study that accesses the attitude and practice of these providers because several studies have shown health workers do not always recommend the necessary malaria interventions to their patients[164,174]. There are also obviously situations in which patients fail to follow recommendations provided by healthcare workers.

Correct knowledge of malaria etiology and interventions among women who visit the ANC may suggest a potential positive impact of the health worker education. If pregnant women who attend the ANC are well-informed, the study may identify ways to encourage pregnant women who do not visit the ANC to do so, if their level of malaria knowledge and practices is found to be inadequate.

Summary

This study will highlight a number of malaria data points among pregnant women in conflict areas of Chhattisgarh, India: what they understand about the disease's transmission, how they perceive its cause, whether they recognize its signs and symptoms, what treatment-seeking behaviors they exhibit, and what preventive measures and practices they employ.

If this study finds poor knowledge and attitudes favoring traditional or unproven methods of malaria interventions, as shown in previous studies, then that may explain the current rate of MIP in these areas and demonstrate the need for specific interventions targeted to this population for the control and prevention of malaria.

Since several policies and guidelines are being proposed in India and worldwide, there is the need to ensure that the general population is up-to-date on these guidelines and willing to embark on the measures needed to eliminate malaria. Knowledge gained from this study will help direct additional studies toward the neglected and vulnerable populations in India and help foster the country's fight to end malaria by 2030.

Clinical and/or public health significance

Malaria poses a significant health threat to pregnant women. If the data shows the need for improving KAP, governmental policies can be employed to help educate and implement malaria interventions, especially in conflict areas of India. Through this study, we will learn if pregnant women attending MCs in Chhattisgarh know more about malaria preventive measures and treatments than those who do not attend the clinics. Knowledge gained from this study could eventually help avoid the impact malaria has on pregnant women, such as severe anemia, and on their babies, such as low birth weight, preterm labor, and stillbirths. Indeed, studies in the Orissa state of India showed a correlation between high knowledge and malaria intervention utilization[143], pointing to the fact that findings from this study can go a long way toward identifying customs, local beliefs and practices that have obstructed malaria prevention in pregnant mothers. This will help inform policies in this region of India, furthering the expectations of decreased malaria morbidity and mortality and increased GDP growth, as well as eventual achievement of India's overarching goal of eliminating malaria by 2030.

APPENDIX 1

Malaria in Pregnancy in Chhattisgarh, India
IN-DEPTH INTERVIEW – Pregnant Women

INTRODUCTION: Introduce yourself and other team members who are present, describe your roles, and explain that you hope the participant is comfortable and happy to participate in this interview.

1. General Health Concerns:

1.1 What do you consider to be the important health problems among pregnant women in this area?
Possible probes:

If they only mention their own problems -- What about for pregnant women in general? Can you think about other pregnant women you know – your relatives, your neighbors?

If they only mention specific aches and pains -- What about any illnesses or diseases?

Which of these do you consider the **three** most important?
1.2 *if malaria is mentioned:*

Why do you consider malaria as an important health problem?
If malaria is not mentioned above:

How important is malaria as a problem among pregnant women? Why?

2. Malaria Knowledge:

2.1 (A) What do you think causes malaria?
Possible probes:

(B) If mosquito bite is not mentioned -- What about a mosquito bite?

2.2 Can you describe some symptoms of malaria?
If fever is not mentioned – What about fever?

2.3 Can you name any treatments and/or specific medicines used in the treatment of malaria?

2.4 How do you think malaria affects the health of pregnant women?

2.5 If a pregnant woman has malaria, do you think it will affect the baby? If yes, how?

2.6 Can you tell me some things you can do to prevent malaria in pregnancy?

2.7 Which of the method(s) for preventing malaria in pregnancy do you think work(s) best?

2.8 Why?

3. Prevention: Personal Knowledge, Attitudes, and Behaviors:

3.1 What do you do to protect yourself against malaria during pregnancy?

Possible probes:
What about protecting yourself from mosquito bites?
Anything else?

3.2 What traditional remedies do you use to protect yourself from malaria?
Anything else?

3.3 What newer (modern) methods do you use to protect yourself from malaria?
Probes for modern methods:

- *Mosquito Coils / Mat / Liquidator*

- *Insecticide Sprays*

- *Regular Bed nets*

- *Insecticide-treated Bed nets*

- *Malaria prophylaxis (Drugs to prevent malaria)*

Ask for each, if one or more of the above is mentioned:

3.4 Can you tell me more about that?

(a) How often do you use xx?

(b) Is there anywhere that you can get it for free?

(c What is the availability?

(d) How much do they/does it cost?

(e) How affordable are they/is it?

(f) Do you like use it?

3.5 For each of the newer (modern) methods not mentioned, ask specifically about each one. For those that are used, ask the following:

(a) How often do you use xx?

(b) Is there anywhere that you can get for free?

(c) What is the availability?

(d) How much do they/does it cost?

(e) How affordable are they/is it?

(f) Do you like to use it?

3.6 For each of the modern methods that are not being used:

(a) Why not?

(b) Do you know if there is anywhere that you can get it for free?

(c) Do you know if it is available in this community?

(d) Do you know how much it costs?

(e) Do you know how affordable it is?

(f) Do you like to use it?

3.7 Would you be willing to try a different method?

Which one? For each one mentioned: why?

3.8 Is there a bed net in your house?

(If participant already mentioned using a bed net, change to: You already told me about using a bed net. Can you tell me more about bed nets? And go to (a) below.

3.9 If Yes:

(a) Who sleeps under bed nets?

(b) Who decides who sleeps under bed nets?

(c) What benefit is there from sleeping under a bed net?

4. Prevention: Antenatal Care Emphasis on Malaria

4.1 Do you routinely go to the clinic for antenatal care?

4.2 *If yes: (If no, skip to 5 below)*

(a) What advice or counseling on malaria have you been given by your health worker during your antenatal visits?

(b) Was malaria emphasized as a major concern for pregnant women?

5. Treatment of Malaria During Pregnancy:

5.1 Have you been sick with fever or had a febrile episode during this pregnancy or any other pregnancy? (if no, skip to 5.3 below)

5.2 If *yes*, was it due to malaria?

If yes:

(a) what did you do?

(b) Where did you go?

(c) Why did you go there?

(d) Did you take any medicines? If yes, which ones? How did you get them? Were they affordable?

(e) How did you take them? (Refers to oral vs. injection)

If no, please tell me about the last time you had a fever:

(a) what did you do?

(b) Where did you go?

(c) Why did you go there?

(d) Did you take any medicines? If yes, which ones? How did you get them? Were they affordable?

(e) How did you take them?

(f) If she didn't take any medicines, why not?

(g) What traditional remedies did you take? Why did you take/use that one/those?

5.3 *If she has not been sick with fever and/or malaria*;

(a) What would you do if you get sick with fever or malaria during this pregnancy?

(b) Where will you go? Why there?

(c) What medicines will you take? How will you get them? How will you take them?

(d)If she will not take any medicines, why not?

(e) What traditional remedies will you take? Why that one/those?

5.4 Do you have concerns (or worries) regarding malaria treatments during pregnancy?

(a) What are they?

(b) Are you concerned that the medicines are dangerous for the baby?

(c) *If yes*, what are your concerns?

6. Others:

6.1 How do you get information about malaria during pregnancy?

6.2 *If no*, do you know where to get information about malaria?

6.3 *If yes*, which of these sources do you believe is/are the most reliable source(s) of information?

6.4 (A) Can you tell me about traditional rituals related to pregnancy and malaria in this area?

(B) Do you practice them?

6.5 Is there anything else you would like to share?

Check that you have collected:

- A RANKING OF THE IMPORTANCE OF THE HEALTH PROBLEMS NAMED **(1.1)**
- THE MAIN WAYS THAT PREGNANT WOMEN IN THIS AREA PROTECT THEMSELVES AGAINST MALARIA **(3.1 - 3.3)**
- WHY/WHY NOT PREGNANT WOMEN USE CERTAIN STRATEGIES TO PROTECT THEMSELVES AGAINST MALARIA **(3.4 - 3.6)**
- WHETHER THEY WOULD TAKE MEDICINES IF PREGNANT AND IF NOT, WHY NOT **(5.2, 5.3)**

THANK THE PARTICIPANT FOR HER TIME AND ASK IF SHE HAS ANY QUESTIONS

LIST OF JOURNAL ABBREVIATIONS

Acta Trop	Acta Tropica
Am J Public Heal Res	American Journal of Public Health Research
Am J Trop Med Hyg	The American Journal of Tropical Medicine and Hygiene
Ann Top Med Parasitol	Annals of Tropical Medicine and Parasitology
Anthropol Med	Anthropology and Medicine
Biomed Res Int	Biomed Research International
BMC Med	BMC Medicine
Bull World Health Organ	Bulletin of the World Health Organization
Clin Infect Dis	Clinical Infectious Diseases
Confl Health	Conflict and Health
Curr Sci	Current Science
Dengue Bull	Dengue Bulletin
Indian J Malariol	Indian Journal of Malariology
Indian J Med Res	Indian Journal of Medical Research
Indian J Pediatr	Indian Journal Of Pediatrics
Infect Immun	Infection and Immunity
Int J Confl Violence	International Journal of Conflict and Violence
Int J Med Sci Public Heal	International Journal of Medical Science and Public Health

Int J Mosq Res	International Journal of Mosquito Research
J Adv Nurs	Journal of Advanced Nursing
J Biosci	Journal of Bioscience
J Clin Diagn Res	Journal of Clinical and Diagnostic Research
J Fam Med Prim care	Journal of Family Medicine and Primary Care
J Infect Dis	Journal of Infectious Diseases
J Vector Borne Dis	Journal of Vector Borne Diseases
Lancet Infect Dis	Lancet Infectious Diseases
Malar J	Malaria Journal
Matern Child Health J	Maternal Child Health Journal
Mem Inst Oswaldo Cruz	Memorias do Instituto Oswaldo Cruz
Parasit Vectors	Parasites and Vectors
PLoS Med	PLoS Medicine
Soc Sci Med	Social Science and Medicine
Trans R Soc Trop Med Hyg	Transactions of the Royal Society of Tropical Medicine and Hygiene
Trends Parasitol	Trends in Parasitology
Trop med In Health	Tropical Medicine and International Health
Yale J Biol Med	Yale Journal of Biology and Medicine

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