Attitudes, Knowledge, and Practices Regarding Malaria Prevention and Treatment among Pregnant Women in Eastern India

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Abstract. We explored views toward and use of malaria prevention and treatment measures among pregnant women in Jharkhand, India. We conducted 32 in-depth interviews and six focus group discussions (total = 73 respondents) with pregnant women in urban, semi-urban, and rural locations in a region with moderate intensity malaria transmission. Most respondents ranked malaria as an important health issue affecting pregnant women, had partially correct understanding of malaria transmission and prevention, and reported using potentially effective prevention methods, usually untreated bed nets. However, most conveyed misinformation and described using unproven prevention and/or treatment methods. Many described using different ineffective traditional malaria remedies. The majority also showed willingness to try new prevention methods and take medications if doctor-prescribed. Misconceptions and use of unproven prevention and treatment methods are common among pregnant women in eastern India. Policy makers should focus on improving knowledge and availability of effective malaria control strategies in this population.

INTRODUCTION

Malaria is endemic in India and constitutes a major public health challenge. An estimated 2–3 million malaria cases resulting in 500–800 deaths are reported annually nationwide, with 95% of India's population at risk of infection.^{1,2} As has been demonstrated in sub-Saharan Africa and Thailand,^{2–5} the few available epidemiologic studies of malaria in pregnancy (MIP) in India found that malaria was associated with adverse maternal and neonatal outcomes including maternal anemia, preterm labor, stillbirths, and low birth weight.^{3–10}

India's government has initiated measures to improve malaria prevention and treatment, including among pregnant women, although actual implementation has been inconsistent. Some states have benefited from the Enhanced Malaria Control Project, funded by the World Bank, in which vector control using larvicides and indoor residual spraying (IRS), distribution of insecticide-treated bed nets (ITNs), and early case detection and treatment of malaria with chloroquine (pregnant women) plus primaquine (non-pregnant women) have been used.^{11,12} In some districts, a comprehensive malaria strategy exists on paper, but control measures are limited in availability or practice.^{13,14}

Several studies conducted in malaria-endemic areas of Africa regarding attitudes and practices toward malaria control measures among pregnant women indicate that malaria is perceived as a serious illness, knowledge of malaria risks during pregnancy is relatively high, and contact with traditional healers and self-medication with local remedies is common.^{15–20} In addition, pregnant women have limited confidence in the effectiveness of ITNs and intermittent preventive therapy for protection from malaria.

In India, a survey conducted in 21 states on malaria knowledge found that male sex and college education were posi-

tively associated with correct knowledge of malaria etiology and clinical features, and female sex, illiteracy, and tribal population were predictors of poor malaria knowledge.²¹ Recent research in Orissa State indicated relatively high knowledge of malaria transmission and widespread acquisition of subsidized ITNs.^{12,22} Surveys of pregnant women in eastern India showed that bed nets were widely available and used, although other prevention measures, such as chemoprophylaxis and ITNs, were underused.^{14,23} In central India, sociocultural barriers to acceptance of malaria chemoprophylaxis among pregnant women were found to include fear of mixing medications, concerns about medications not prescribed by antenatal clinics, and infertility conspiracies.²⁴

Given the mixed record on implementation of malaria prevention and treatment measures, and the need for greater understanding of barriers to implementation among pregnant women, we conducted a qualitative study among pregnant women in the state of Jharkhand, India, as one component of a large cross-sectional study of the burden of MIP. This primary study found relatively low rates of malaria among pregnant women receiving antenatal care at three hospitals in Jharkhand (approximately 2%, $n = 3,089$), possibly the result of earlier efforts of the Enhanced Malaria Control Project (the project ended in 2005).¹⁴ Additional related research suggest that government malaria prevention efforts in Jharkhand were largely limited to widespread IRS and efforts to increase bed net use. Pregnant women often used untreated nets whereas chemoprophylaxis was rarely used.²³ To our knowledge, this is the first report that uses qualitative methods to examine these issues among pregnant women in India.

METHODS

Study sites and population. The sites included urban (Ranchi District Hospital), semi-urban (Gumla District Hospital), and rural (Konbir Mission Hospital) locations. All three sites are characterized by a mixture of populations including 1) general caste, comprised of traditionally higher castes and all persons not otherwise classified, and traditionally disadvantaged

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populations now given administrative recognition; 2) scheduled tribes, originally indigenous persons who are now largely integrated with mainstream society; 3) scheduled castes, primarily the historically lower castes; and 4) other backward castes, diverse groups considered socially and educationally behind other castes.

Respondents for the present study were sampled from among pregnant women receiving antenatal care at one of the three hospitals or living in a semi-rural community within the catchment area of Ranchi District Hospital. Women were eligible for participation if they were 1) pregnant, 2) willing to provide informed consent, and 3) ≥ 15 years of age. Respondents participated in an in-depth interview (IDI) or a focus group discussion (FGD).

Procedures. Prior to data collection, members of the Boston-based team and Indian collaborators held a training workshop in Ranchi for eight local interviewers that focused on malaria, qualitative research methods, and research ethics. We also reviewed the English and Hindi versions of the question guides to ensure clarity and accuracy. Extensive role-playing was undertaken to sensitize the local team to issues that might arise during data collection.

We used IDIs and FGDs because the two techniques are complementary, yet may yield different responses. At each site, all pregnant women presenting for an antenatal check-up during the 2–3 weeks that the team was on site were invited to participate in an IDI or an FGD, depending on the woman's preference. However, in Ranchi, because of difficulties enrolling a sufficient number of respondents for a pre-arranged FGD at the District Hospital, United Nations Children's Fund-supported health workers assisted us in identifying potential respondents among pregnant women living in Ranchi's outskirts, but within the District Hospital catchment area.

Interviewers worked in teams of two or three, with one person conducting the IDI/FGD and the other person(s) taking notes. The IDIs and FGDs were carried out at one of the hospitals or, in the case of Ranchi, at the home of a community health worker. They were conducted in Hindi by using semi-structured question guides that covered specific topics and enabled open-ended exchanges and probing when unexpected responses emerged. We audio-recorded each IDI and FGD, a practice acceptable in India; the recordings did not appear to inhibit recruitment or in-depth discussion. The IDIs took 60–90 minutes to complete, and the FGDs each lasted 90–120 minutes. We gave each respondent a bed net for her participation.*

Questions focused on health concerns and knowledge, attitudes, and behaviors regarding malaria prevention and treatment. Interviewers asked about traditional and modern approaches to malaria prevention and treatment, with follow-up questions on the availability and affordability of modern methods. The IDIs focused on individual behaviors; the FGDs asked more broadly about community actions. The IDI queries included 1) What do you do to protect yourself against malaria during pregnancy? and 2) Have you been sick with malaria during this or any other pregnancy? If yes, what did you do? Questions for FGDs included 1) How do pregnant

women in this community protect themselves against malaria? And 2) Which of these methods do they use often?

The study was reviewed and approved by the Boston University Institutional Review Board, the Ethics Committee of the National Institute of Malaria Research in India, the Scientific Advisory Committee of the National Institute of Malaria Research, and the Health Ministry Screening Committee of the Indian Council of Medical Research. All respondents provided written informed consent prior to engaging in an IDI or FGD.

Data analysis. Daily during data collection, teams comprised of a bilingual study member and the interviewer/note-taker group that had conducted each IDI or FGD convened to confirm the accuracy of the Hindi language notes using the relevant recording and highlight notable statements. These notes and embedded quotations were then translated into English. Another bilingual study member verified the English language notes by comparing them with the audio recordings. One Boston-based analyst coded these notes using grounded theory²⁵ and analyzed resulting themes using Microsoft (Redmond, WA) Excel 2003. Questions of interpretation were discussed with members of the Boston-based and India-based teams. The analysis included comparing IDI and FGD responses; we also examined differences by caste, education, and site. We prioritized responses by the frequency with which they were mentioned; the extent and nature of divergent views were also explored. A response was included in the frequency analysis if a respondent mentioned it spontaneously or in reply to a follow-up question.

RESULTS

Characteristics of respondents. We conducted six FGDs (two per site), each with 5–10 respondents, and 32 IDIs (11 each in Gumla and Konbir; 10 in Ranchi), with a total of 73 persons in April–May 2007 (Table 1). Most IDI and FGD respondents were 20–29 years of age with a few greater than 34 years of age. Two-fifths had no schooling, another 15% had completed primary school, and 2–3% had attended post-secondary school. Most were either scheduled tribes (56%) or other backward castes (27%). Most were engaged in housework; others worked in agriculture, construction and other unskilled labor jobs, or commercial activities. Monthly household income ranged from less than 1,000 Indian Rupees (INR) (\$25) to greater than 5,000 INR (\$125), with most respondents reporting 1,001–3,000 INR (\$25–\$75). All but two respondents were primarily supported by their husbands, although 15 (21%) contributed $\geq 10\%$ of total household income. The only major differences in characteristics across sites were 1) by income because average household income was 20% lower among Konbir respondents than among those elsewhere and 2) by caste because a relatively high proportion of total respondents in Gumla were of other backward caste, and those in Konbir and Ranchi were disproportionately of scheduled caste background.

Below we provide the main results by theme. Although stratified analyses showed no major patterns by caste or education, certain differences emerged by IDI/FGD and site; these are highlighted where relevant.

Attitudes toward malaria. Most respondents viewed malaria as one of the most important health issues affecting pregnant women in their area. Nearly three-fourths (72%) of

*We intended to provide insecticide-treated bed nets, but after failing repeatedly to obtain them in Ranchi and in New Delhi, we were obliged to provide untreated bed nets instead.

TABLE 1
Characteristics of respondents*

Characteristic	IDs (n = 32), no. (%)	FGDs (6) (n = 41), no. (%)	IDs and FGDs (n = 73), no. (%)
Age, years			
15–19	2 (6.3)	4 (9.8)	6 (8.2)
20–24	16 (50.0)	21 (51.2)	37 (50.7)
25–29	9 (28.1)	11 (26.8)	20 (27.4)
30–34	4 (12.5)	2 (4.9)	6 (8.2)
35–39	1 (3.1)	3 (7.3)	4 (5.5)
Education			
None	8 (25.0)	23 (56.1)	31 (42.5)
Primary	6 (18.8)	3 (7.3)	9 (12.3)
Middle	4 (12.5)	7 (17.1)	11 (15.1)
Lower secondary	10 (31.3)	5 (12.2)	15 (20.5)
Senior secondary	3 (9.4)	2 (4.9)	5 (6.8)
Graduate	1 (3.1)	1 (2.4)	2 (2.7)
Caste			
General	3 (9.4)	4 (9.8)	7 (9.6)
Other backward castes	10 (31.3)	10 (24.4)	20 (27.4)
Scheduled caste	5 (15.6)	0 (0.0)	5 (6.8)
Scheduled tribals	14 (43.8)	27 (65.9)	41 (56.2)
Main daily activity			
Housework	25 (78.1)	31 (75.6)	56 (76.7)
Petty job	3 (9.4)	0 (0.0)	3 (4.1)
Labor	3 (9.4)	6 (14.6)	9 (12.3)
Agriculture	1 (3.1)	4 (9.8)	5 (6.8)
Household monthly income, INR†			
≤ 1,000	1 (3.1)	2 (4.9)	3 (4.1)
1,001–2,000	12 (37.5)	16 (39.0)	28 (38.4)
2,001–3,000	8 (25.0)	15 (36.6)	23 (31.5)
3,001–4,000	4 (12.5)	5 (12.2)	9 (12.3)
4,001–5,000	3 (9.4)	2 (4.9)	5 (6.8)
≥ 5,001	4 (12.5)	1 (2.4)	5 (6.8)

* IDs = in-depth interviews; FGDs = focus group discussions.

† 1,000 INR (India Rupees) was approximately \$25 at the time of the study.

IDI respondents and all FGDs listed malaria among the top three health issues of pregnant women. When asked why they ranked malaria so highly, most respondents, particularly those in Gumla and Konbir, replied that it would harm the health of the woman or the fetus. One of three IDI respondents believed that malaria would jeopardize the life of the woman or the fetus, a view voiced strongly in one Konbir FGD. As expressed by a Konbir IDI respondent: “I consider it dangerous because the mother becomes weak. Due to high fever from malaria, the mother might miscarry and may even die.”

When queried about willingness to try previously unused strategies to prevent malaria, more than two-thirds (69%) of IDI respondents (>80% of those in Konbir) responded affirmatively (Table 2). Several expressed interest in experimenting with anything effective or cheaper than what they were currently using. “If any are available, I will use them,” stated one IDI respondent in Ranchi. However, respondents were most enthusiastic about trying ITNs, about which most had known little prior to participating in this study. Of those who voiced wariness toward new approaches, most noted their lack of knowledge.

Most respondents articulated concerns regarding malaria treatment during pregnancy, including 50% of IDI respondents and most respondents in four FGDs. These ranged from general fear for the baby (“it will affect the baby in the womb”), to specific worries, including a heightened risk of miscarriage, stillbirth, birth defects, disabilities, jaundice, and death. However, most respondents volunteered that they would accept treatment if doctor-prescribed. Among those without concerns, many assumed that treatment would be doctor-prescribed. “If

one has medicines that the doctor prescribes then nothing will happen,” explained an IDI respondent in Konbir.

Most IDI respondents stated that malaria was inadequately addressed in antenatal care visits with health care workers. Of 25 IDI respondents (78% of the total) who reported routinely accessing prenatal care during their pregnancy, six stated that clinic staff had provided advice or counseling regarding malaria; none of these were in Ranchi. Most respondents (80%) concluded that malaria was not emphasized during prenatal visits.

Three-fourths of IDI respondents and most respondents in every FGD reported accessing one or more sources of malaria information, such as doctors, nurses, and traditional birth attendants; relatives, especially female relatives; community elders and educated people; United Nations Children’s Fund workers; and television, radio, and posters. Those persons who named no source typically explained, “I do not receive any information.” When asked about the most reliable source, most mentioned doctors; several noted nurses, female relatives or neighbors, and television and posters.

Knowledge of malaria transmission, prevention, and treatment. Nearly all respondents demonstrated some correct knowledge of malaria transmission and prevention. All but one IDI respondent and every FGD linked malaria transmission with a mosquito bite. However, most IDI respondents (59%) and four FGDs (both Ranchi FGDs, and a few respondents in Gumla/Konbir FGDs) also mentioned at least one incorrect cause of malaria transmission (Table 2). Most frequently, they connected malaria infection with an unclean living environment. Tainted food was commonly mentioned, including leftover food, decayed food, foods sold on a trolley, sweets, and food touched by a mosquito or fly. “If anyone eats leftover food, they will get a fever and maybe malaria,” explained a Gumla IDI respondent. Mosquitoes that had made contact with potentially unclean items such as drains, dirty water, bushes, or food, and mosquitoes born “due to dirtiness” or “in garbage” were listed as causes of malaria. Drinking water sullied by mosquito contact was also mentioned. A Ranchi-based IDI respondent explained: “If a mosquito defecates in water that is stored for household drinking then this can also cause malaria.”

When asked about prevention methods, every IDI respondent (except one who misunderstood the question) and every FGD named at least one proven method, bed nets (untreated). Most IDI respondents (88%) and most respondents in three FGDs (one in Gumla and both in Konbir) also cited a second prevention strategy such as mosquito coils or IRS. At the same time, knowledge of certain prevention strategies was poor. For example, no respondent mentioned ITNs or chloroquine prophylaxis, and only four IDI respondents noted insecticide spraying. Probing showed that, prior to this study, few had heard of ITNs (12%) or insecticide sprays (21%); none knew about chemoprophylaxis.

In addition, most respondents (58% of IDs and four FGDs, including both in Ranchi) mentioned unproven prevention approaches. Keeping nearby areas and oneself clean were described in particularly adamant terms. A Ranchi FGD respondent stated, prompting group agreement: “malaria parasites may also be present on dirty hands, so we should clean our hands before cooking”. Others described applying karanj (Indian beech tree), neem (Margosa tree), or other herbal oils to skin; putting acid, phenol, or bleach in drains; eating fresh

TABLE 2
Illustrative statements by respondents*

Attitudes	Knowledge	Practices
<p><u>Willingness to try new methods of prevention</u></p> <p><i>I am interested to use any [new methods]... cream would be easy because we can apply it and sleep without any problem. Here there is a problem of electricity, so [we have] no fan to drive away mosquitoes and bed nets are not easily available.</i></p> <p>– IDI respondent in Ranchi</p> <p><i>We want something new so that we will use it and be protected from malaria.</i></p> <p>– IDI respondent in Ranchi</p> <p><i>Yes, I will try....insecticide-treated net, because mosquitoes will not come near this type of bed net.</i></p> <p>– IDI respondent in Gumla</p> <p><i>Yes—ITN, can spray, prophylaxis; if bed nets are not available, then I can take medications to protect myself....With ITNs, mosquitoes will not be able to sit or bite if they touch the bed net.... I will try other methods if I find out about them.</i></p> <p>– IDI respondent in Konbir</p> <p><u>Concerns regarding treatment</u></p> <p><i>I don't know about medicines, but [if I take them], the baby may be born disabled or weakened by the medicines. They may cause abortion.</i></p> <p>– IDI respondent in Gumla</p> <p><i>I have concerns about medicine. I worry that it may cause miscarriage, or stillbirth.</i></p> <p>– IDI respondent in Konbir</p> <p><i>I think about it seriously, but don't know anything about treatment. I worry that the baby will abort.</i></p> <p>– FGD respondent in Gumla, with general agreement from the group</p> <p><u>Most reliable malaria information source:</u></p> <p><i>The doctor is best, because whatever the doctor advises will be the correct treatment. I trust the doctor.</i></p> <p>– IDI respondent in Gumla</p> <p><i>The doctor [is most reliable], not the TV, because they do everything for advertisement so that their product can sell more.</i></p> <p>– IDI respondent in Ranchi</p> <p><i>Older women [are most reliable] because they give us the best information about prevention from mosquito bites.</i></p> <p>– IDI respondent in Konbir</p>	<p><u>Incorrect understanding of malaria transmission</u></p> <p><i>If a fly sits on utensils and defecates and then someone uses the utensil, this also causes malaria.</i></p> <p>– IDI respondent in Gumla</p> <p><i>If someone has malaria, pregnant women should not be near them because it spreads through touch and eating someone else's food.</i></p> <p>– IDI respondent in Ranchi</p> <p><i>[Malaria is] due to mosquitoes born in garbage, due to stagnation of dirty rain water entering the water table.... Insects, mosquitoes live in it [and] drinking this water may cause malaria.</i></p> <p>– FGD respondent in Konbir, with agreement from several other respondents</p> <p><u>Inaccurate ways to prevent malaria</u></p> <p><i>Eating fresh food, drinking boiled water [can prevent malaria]....</i></p> <p>– IDI respondent in Konbir</p> <p><i>Eat clean food and drink clean water so that dirty things don't get to your body and you don't get malaria.</i></p> <p>– FGD respondents in Ranchi, with general agreement from the group</p> <p><i>Mosquitoes will not wander around the house if cleanliness is maintained and will not be able to bite.</i></p> <p>– IDI respondent in Konbir</p> <p><i>[The best way to prevent malaria is to] keep area near house clean.</i></p> <p>– IDI respondent in Gumla</p> <p><u>Lack of understanding of malaria treatment</u></p> <p><i>[I have] no knowledge about malaria medicine, but I know that paracetamol is used for fever.</i></p> <p>– IDI respondent in Ranchi</p> <p><i>I don't know the name of any medicine, but it is provided by doctors at hospital.</i></p> <p>– IDI respondent in Gumla</p> <p><i>Taking medicines orally is less effective. We get better relief from injections due to their immediate effect....and we feel better.</i></p> <p>– IDI respondent in Konbir</p>	<p><u>Traditional prevention approaches</u></p> <p><i>Eating fresh food, drinking boiled water... applying karanj oil on the exposed parts of body....</i></p> <p>– IDI respondent in Konbir</p> <p><i>Mosquitoes don't bite if you apply mustard oil on skin.</i></p> <p>– FGD respondent in Gumla</p> <p><i>By burning used leaf plates (plates made of leaves that are used to serve food at important social gatherings), straw, grains, I make smoke and warm my hands and body to prevent malaria.</i></p> <p>– IDI respondent in Ranchi</p> <p><u>Traditional remedies for malaria: remedy used with last fever</u></p> <p><i>A: I drank turmeric in milk, because my mother-in-law told me it will cure me.</i></p> <p><i>B: I put cool oil on the head.</i></p> <p><i>C: [I] rubbed brass utensils on sole of foot... powder of barley mixed with turmeric also put on foot and fever came down.</i></p> <p>– IDI respondents in Ranchi</p> <p><i>[I ate] warm garlic and oil.</i></p> <p>– IDI respondent in Gumla</p> <p><i>I took water leftover after cooking rice... and drank it for 2-3 days....</i></p> <p>– IDI respondent in Konbir</p> <p><u>Traditional remedies for malaria: personal and community-wide approaches</u></p> <p><i>These days a cloth that is soaked in goat milk is put on head and navel, then fever immediately goes away.</i></p> <p>– IDI respondent in Ranchi</p> <p><i>I first of all go to Bhagat (witch doctor) and then I test to see if I have a spirit inside of me or not. If there is no spirit inside me then Bhagat will hold my hand to see if there is a "chitta" spirit.</i></p> <p>– IDI respondent in Konbir</p> <p><i>Traditional healers do witch doctoring. Rice that has been blessed after conducting prayers is given to a hen. If malaria is cured, then they sacrifice the blood of the hen to the god....</i></p> <p>– IDI respondent in Gumla</p>

*IDIs = in-depth interviews; FGDs = focus group discussions.

food; and drinking clean water. Many respondents described traditional methods that may offer protective benefit, most typically the burning of various items (wood, green leaves, dried cow dung cake, karanj residue, paddy rice dust, small twigs, and neem leaves) whose smoke drives away mosquitoes.

Although most persons knew that treatment for malaria existed (50% of IDIs and most in each FGD), no respondents could name a medication used to treat malaria. As discussed earlier, most respondents also mistakenly believed that malaria treatment posed a danger to the pregnant woman, her fetus, or both.

Malaria prevention and treatment practices. When asked about personal protection measures, 97% of IDI respondents

reported using a modern method: 91% said that they slept under a bed net, of which all but two were untreated, and 63% used coils. Similarly, all FGDs listed bed nets (untreated), and most respondents in three FGDs (two in Ranchi and one in Konbir) mentioned coils, as broadly used prevention approaches. However, when probed, respondents revealed less consistent use of bed nets and coils than initially implied. One-third of IDI respondents who reported using bed nets and coils used them irregularly (or their homes lacked a bed net); only the Ranchi FGDs described regular bed net use among pregnant women in their communities. Although most IDI respondents stated that bed nets and coils were available for purchase (68% and 54%, respectively), several explained

that markets and shops that sold bed nets were far from their homes. Relatively few, and none in Konbir, said that bed nets and coils were affordable (25% and 31%, respectively). The FGDs confirmed this pattern (both Ranchi FGDs agreed that bed nets and coils were available but only one group described them as affordable), and Konbir-based FGD respondents asserted that neither was available or affordable. As a result, most respondents purchased a bed net or coil with difficulty. As a Ranchi-based IDI respondent explained, "I have to save money gradually to buy [a bed net]."

In addition, one in three IDI respondents and most of five FGDs (all but one in Konbir) described periodic IRS in their neighborhoods. Such spraying was welcomed, although FGD respondents in Konbir mentioned "some opposition because it produces bed bugs," and others in Gumla noted potential food contamination. Only two IDI respondents personally used insecticide sprays. None reported use of antimalarial prophylaxis during pregnancy.

Consistent with the beliefs described above, most IDI respondents (69%) and five FGDs described using a range of traditional prevention approaches. Most involved burning leaves, cow dung, paddy rice, or wood to repel mosquitoes; Ranchi FGD respondents also mentioned burning insects' nests. Some, including 41% of IDI respondents and five FGDs (all but one in Gumla), described popular local methods with unproven protective value. These included cleaning one's surroundings, using a fan, and rubbing mustard, neem, or karanj oil, or kerosene on one's body. An IDI respondent in Konbir told of drinking boiled neem leaves. The FGD respondents in Ranchi described a commonly used liquid mixture of roots and plants, as well as this local method: "mix live bed bugs with jaggery (unrefined sugar) and make a tablet that is eaten—then that person will never get malaria....the person eating it should not know there are live bed bugs inside."

When asked about malaria treatment, most respondents showed confidence in modern medicine, and also described the use of traditional approaches. Three-fourths of IDI respondents had experienced a fever or febrile episode during her current or a previous pregnancy. Of these persons, most (63%) were seen by a doctor or nurse, and 50% took a medication (typically unknown to the respondent). Of the nine who did not see a doctor or nurse, four took a medication on their own. Among all 24, five (two of whom also saw a clinician) used a traditional remedy. These included drinking turmeric in milk or rice-soaked water; rubbing utensils on the foot; and eating garlic and oil.

Regarding what they or pregnant women in their community "would do" in case of fever, one-fourth of IDI respondents, but most respondents in every FGD, said that they would go to a doctor or hospital and take medications, if doctor-recommended. Several mentioned that clinic visits or medications were sometimes unaffordable. A Konbir IDI respondent elaborated: "I would go to the doctor, but if my husband has no money, I would stay home."

When asked about traditional remedies, one-fourth of IDI respondents asserted they would not turn to such approaches, and a similar proportion said they would. The rest gave vague answers that could be interpreted either way. Most FGD respondents in five FGDs indicated that traditional remedies were common in their community. These remedies included the personal home-based techniques described above, as well as visits to traditional healers for mantra reading, worshipping,

and spirit cleansing, which typically involved feeding special items to, or sacrificing the blood of, a hen.

DISCUSSION

This study highlights the complex way that pregnant women in eastern India understand malaria transmission and prevention and simultaneously endorsed traditional beliefs and practices, including unproven prevention and treatment strategies. Most discussed mosquito bites and bed nets in the same breath in which they emphasized cleanliness and drinking boiled water. These findings are similar to those of other developing country studies, underscoring the way that traditional and modern beliefs and practices, both effective and ineffective, may coexist in developing societies.^{12,15,18–20} Similarly, our respondents exhibited faith in the capacity of clinicians and modern therapies to treat malaria, yet described the widespread use of traditional treatments ranging from mantra-reading to the ingestion of exotic concoctions. They also showed unawareness of ITNs and chemoprophylaxis, and highlighted issues of accessibility and affordability of major prevention measures.

Our analysis also suggested interesting differences across the study sites. First, respondents in Ranchi, the most urban setting, showed relatively poor knowledge of malaria, yet also appeared to have greater access to bed nets and coils, particularly relative to Konbir, the most rural setting. That pregnant women in Ranchi would be less knowledgeable than those in Konbir was somewhat surprising, but it might be caused by the lower malaria transmission in Ranchi.¹⁴ Pregnant women in Ranchi may also receive fewer focused malaria messages, which appears substantiated by the fact that no Ranchi respondent reported being given advice about malaria prevention during antenatal clinic visits. The difference in perceptions of availability and affordability of bed nets and coils reinforces evidence indicating uneven implementation of India's malaria control policy.^{13,14,23} Given the relative isolation and lower levels of income of Konbir, it was not surprising that respondents there reported greater difficulty obtaining prevention items.

Our results point to several areas where government action is needed to positively affect use of malaria prevention and treatment methods among pregnant women in eastern India. First, respondents' view that malaria was inadequately addressed by medical personnel, coupled with their respect for clinicians, suggests that improving communication about malaria prevention and treatment between health care workers and pregnant women is critical and could play a meaningful role in reinforcing correct knowledge and dispelling faith in unproven measures. Enhanced training of personnel to improve information sharing should go beyond conventional approaches to include activities such as communication workshops with role play. Second, our respondents described both physical (markets located far from homes) and financial barriers to use of prevention approaches such as bed nets and coils, whose cost (U.S. \$4–\$10 for an untreated bed net; U.S. \$0.03 per day for coils) is burdensome for low-income households. Improving access to ITNs, which are supposed to be provided at no charge to high-risk populations, including pregnant women, should be a priority, particularly in light of respondents' openness to trying new prevention approaches. Creative strategies that combine distribution of ITNs with other key services such as immunization days or antenatal

visits should be explored. Where resources are limited, distribution at a subsidized price should be considered, an approach successfully tried elsewhere in India.²² Third, knowledge of chloroquine prophylaxis and treatment was virtually nonexistent among respondents, although both were recommended in national guidelines at the time of the study. Educating communities about the safety of modern antimalarial drugs, adding this component to messages conveyed between medical personnel and pregnant women, and ensuring the supply of medications in clinics visited by pregnant women are essential to improving MIP control in India.

We recognize several study limitations. First, our respondents were recruited primarily among women attending antenatal clinics (a minority resided near Ranchi), and thus we likely failed to capture the views of women in comparatively marginalized, remote tribal populations. Second, respondents knew that the study team was engaged in a larger MIP assessment. Given the attention that such research undoubtedly generated, some respondents may have exaggerated the importance of malaria as a health issue for pregnant women. Third, relatively reticent FGD respondents might have hesitated to speak up in a group setting, thereby biasing results in favor of more forceful speakers. Fourth, we discovered during detailed data analysis that some questions were posed in potentially confusing ways, which may have led to possible misunderstanding of queries and/or misleading responses.

Although malaria prevalence appears to be relatively low among pregnant women living in Jharkhand State,¹⁴ it is nonetheless important to increase knowledge of effective malaria prevention and treatment methods in communities where misconceptions and use of unproven prevention and treatment methods are common. Improving knowledge and availability of effective malaria control strategies in these areas has the potential to build on a high degree of accurate knowledge, openness to trying new prevention and treatment approaches, and remarkable respect for clinicians practicing in these communities.

Received June 18, 2009. Accepted for publication January 11, 2010.

Acknowledgments: We thank Dr. Manoj K. Das and the interviewers for their efforts on behalf of the study; the chief medical officers at each of the district hospitals, the Jharkhand State health authorities, and the Indian Council of Medical Research for administrative and logistical support; and the pregnant women who participated in this study for generously sharing their personal views and experiences.

Financial support: This study was supported by the G/PHN/HN/CS, Global Bureau and the India Mission, and the U.S. Agency for International Development (USAID) under the terms of Cooperative Agreement GHS-A-00-03-00020-00.

Disclaimer: The opinions expressed in this paper are those of the authors and do not necessarily reflect those of the USAID.

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