Knowledge and beliefs about malaria transmission and practices for vector control in Southern Mexico

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Abstract

Objective. To investigate the knowledge and beliefs about malaria transmission and practices for vector control in eight villages on the coastal plain of Chiapas, Mexico. **Material and Methods.** A cross-sectional survey was conducted during May and June 1995 in Chiapas, Mexico. A questionnaire to investigate family structure, knowledge on malaria transmission, preventive measures and attitudes towards seeking treatment was applied to both family heads of a sample of households. Associations were analyzed by estimating odds ratios with confidence intervals and *p* values, using bivariate and multivariate logistic regression methods. **Results.** Malaria knowledge was poor and only 48% associated malaria with mosquito bites. The perceived benefit of indoor residual spraying was associated to a reduction of mosquitoes, a reduction in the numbers of cockroaches and rats, but only 3% associated it directly with the prevention of malaria transmission. Most villagers (97.6%) agreed with the indoor residual spraying of insecticides. Ninety nine percent of villagers had mosquito bednets, 75.7% used them all year round. Other measures used by villagers to prevent mosquito bites were smoke and mosquito coils. Above 40% of villagers self-medicated when any member of the family had a fever episode, but 51% attended proper

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Resumen

Objetivo. Investigar el conocimiento, las creencias sobre paludismo y las prácticas para el control de vectores en ocho localidades de la costa de Chiapas, México. **Material y métodos.** Durante mayo y junio de 1995, en un estudio transversal, se aplicó un cuestionario a ambos jefes de familia de una muestra de hogares de ocho localidades rurales del estado de Chiapas, México, para investigar la estructura familiar, el conocimiento acerca de la transmisión del paludismo, actividades de prevención y actitudes para la búsqueda de tratamiento. El análisis estadístico consistió en la estimación de razones de momios con intervalos de confianza y valores *p* usando métodos de regresión logística bivariada y multivariada. **Resultados.** El conocimiento sobre el paludismo fue pobre y sólo 48% lo asociaron con picaduras de mosquitos. Los beneficios percibidos del rociado intradomiciliar de insecticidas se asociaron con la reducción de mosquitos, cucarachas y ratas, pero sólo 3% asoció el rociado con la prevención de la malaria. La mayoría (97.6%) estuvo de acuerdo con el rociado intradomiciliar con insecticida. Noventa y nueve por ciento poseían mosquiteros y 75.7% los usaban todo el año. Otras medidas empleadas para prevenir las picaduras de mosquitos fueron el humo y espirales antimosquito. Por arriba de 40%

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health services (community dispensary, private physician, health worker). About 61% used pesticides for agricultural or livestock purposes and 55% applied them themselves. Women had a greater participation as family health promoters, with 70% of the housewives being in charge of the application of self-protection preventive measures. **Conclusions.** Educational programs aimed at increasing awareness on the participation of mosquitoes on malaria transmission could promote community participation in malaria control in the region. The English version of this paper is available too at: http://www.insp.mx/salud/index.html

Key words: malaria; knowledge, attitudes, practice; *culicidae*; Mexico

indicó que se automedicaba en caso de fiebre en algún miembro de la familia, 38% acudía al centro de salud oficial y11% visitaba a un médico privado. Cerca de 61% usaba pesticidas agrícolas y 55% lo aplicaban ellos mismos. Las mujeres tuvieron mayor participación como promotoras de la salud y cerca de 70% de las amas de casa estaban a cargo de la implantación de medidas preventivas. **Conclusiones.** Con el propósito de incrementar el conocimiento sobre la participación de los mosquitos en la transmisión del paludismo programas educacionales podrían ayudar a la inducción de la participación de la comunidad en las actividades para su control en la región. El texto completo en inglés de este artículo también está disponible en: http://www.insp.mx/salud/index.html

Palabras clave: paludismo; conocimientos, actitudes y práctica; creencias, *culicidae*; México

Vector control programs are more effective with the involvement of the community, and prompter results are obtained from community-based programs compared with government-supported activities alone.[1,2] An advanced knowledge of the community beliefs and practices with respect to the disease in question is required to obtain and maintain its participation in surveillance and control activities.[3] Accordingly, it is important to identify family members that are more sensitive and/or aware of the benefits that will accrue to the community from a vector control program. It is also necessary to understand who in the family is in charge of prophylactic activities, as this will help in directing health workers' efforts. The participation of women in malaria control has been noted,[4] indicating a need to understand how women influence their environment, particularly the family habits, hygiene, and the interaction as a family unit with local health and education systems.

This paper presents the results of a survey to investigate the knowledge, beliefs, and practices about malaria transmission and vector control, by interviewing both parents from families in eight villages in Southern Mexico, where insecticide resistance management strategies were to undergo evaluation.

Material and Methods

The study took place before an insecticide resistance management project was carried out in 24 villages on the coastal plain of Chiapas, Mexico.[5] A questionnaire was applied in eight randomly selected villages (Figure 1, Table I) during May and June 1995, before the insecticide application began. Malaria is endemic in the area, but, except for one case reported in 1993, no malaria cases were recorded in the area during the five previous years. *Anopheles albimanus* abundance was similarly high in all villages included in the study. No current malaria transmission and high mosquito abundance were conditions that ethically allowed the insecticide resistance management trial.

To validate and adjust the questionnaire to the understanding of the population, a preliminary version was applied to 15 family heads of a village in the study area. The questionnaire was applied separately to both the mother and the father of each family to approximately 30% of the families per village. Previous to each interview, the purpose of the questionnaire was explained, indicating our interest in collecting information to aid in planning future health programs. The same interviewers examined each household to assess their construction materials.

The questionnaire included three sections; the first part was designed to obtain information on the family structure, including number of members, and their occupation and schooling. The second section investigated previous malaria episodes among family members, their knowledge about malaria transmission, and their attitudes towards the disease, including medication and use of health services. To investigate family heads' knowledge about malaria transmission, four optional answers were given: by mosquito bite, by water, by food, and by other means. These options were selected as the most cited by villagers during the validation of the questionnaire, where this question was in open format. To investigate the use of health services they were asked to whom they usually turn in case of a fever episode in family members, including: the

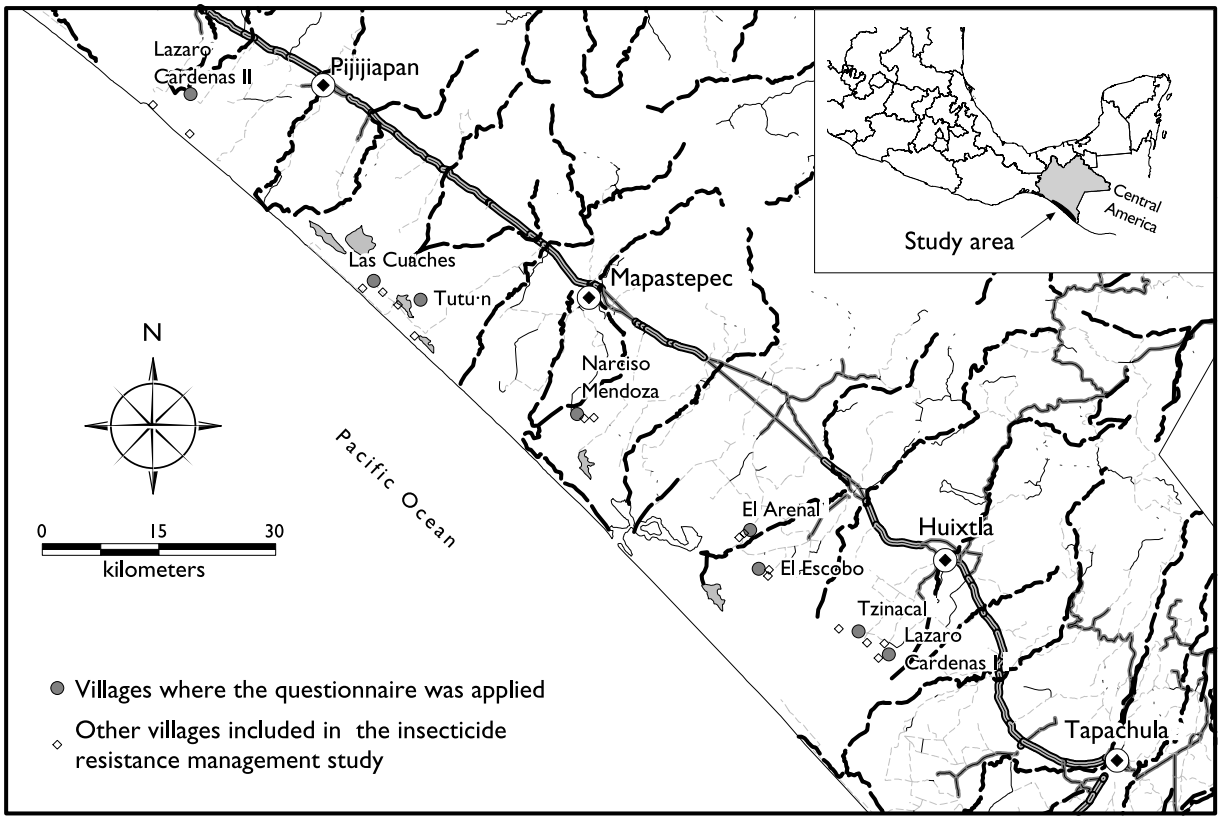

FIGURE 1. MAP OF HE COASTAL PLAIN OF CHIAPAS, MEXICO, INDICATING THE VILLAGES INCLUDED IN THE STUDY

Table I
INHABITANTS AND NUMBER OF QUESTIONNAIRES APPLIED PER VILLAGE. CHIAPAS, MÉXICO, 1995

Village name	*Pop.*	*Total families*	*Families interviewed*	*Questionnaires applied*
Las Coaches	330	56	12	24
Tutuán	539	90	33	66
Lázaro Cárdenas II	728	115	38	76
Narciso Mendoza	616	112	34	68
Arenal	1227	253	37*	74
El Escobo	490	110	31	62
Tzinacal	588	108	37	74
Lázaro Cárdenas I	348	75	23	46

* The 30% of families could not be reached

community dispensary, a private physician, a community health worker, self medication, a pharmacy, and a traditional health practitioner. In the third section, the understanding and application of preventive practices were investigated. In this section, questions addressed the family heads' perceived effect of indoor insecticide spraying, the preferred spraying frequency, the use of other preventive methods (bednets, smoke-fumigation and repellents), and who in the family was in charge of the application of preventive measures.

Chi-squared analysis[6] was used to test the hypothesis that schooling was independent of gender. Logistic regression analysis[7] was used to explore the possible associations between schooling and knowledge of malaria transmission, measures used to prevent mosquito bites, the perceived benefits of the spraying, and utilization of health services. All statistical analyses were carried out using the Stata statistical package.

Results

A total of 498 people were interviewed, 251 females and 247 males, comprising 277 families in the 8 villages (Table I). Surfaces of walls of houses were made of

wood (34.7%), plaster (24.9%), brick and cement block (17.1%), palm leaves (12.9%), and bamboo stems (8%). There were on average 5.53 ± 2.22 (SD) inhabitants per family, with a minimum of 2 and a maximum of 12 per household. Ninety-seven per cent of females were housewives and 77% of males were farmers. Family heads' schooling ranged from illiterate to high school or above; however, 43% of females and 36.8% of males had incomplete elementary education, and 28.3% of females and 19.8% of males were illiterate. Overall, males had higher education than females (χ^2= 16.0, DF= 6, *p*= 0.01).

Malaria knowledge. Eighty six percent of interviewees (*n*= 430) indicated no malaria experience, 1.6% (*n*= 8) indicated that at least one member of their family had had malaria during the previous year, and the remainder recalled bouts of malaria in the previous 2-5 years or more than 10 years. No significant differences in answers were detected between sexes and among localities.

Forty-eight percent of interviewed villagers indicated that malaria was transmitted by mosquito bites (*n*= 229), 2.8 % answered that it was by water (*n*= 14), 47.8% did not know (*n*= 238), and 1.4% gave other answers (*n*= 7). Forty-seven percent of people with complete elementary education knew more about malaria transmission than tose with less education. According to the sex-adjusted logistic model, malaria transmission knowledge was similar between males and females who completed elementary school (*p*= 0.13, OR= 1.47, 90% CI 1.02-2.1) (Table II), but women who completed elementary school knew more than less educated women (*p*= 0.01, OR= 2.24% CI= 1.28-3.47).

When knowledge about the reason for spraying was investigated, 63.9% (*n*= 281) of the villagers associated it with a reduction of mosquitoes inside houses, 29.1% (*n*= 128) responded that it helped to reduce cockroach numbers, 1.8% (n= 8) associated it with a reduction of rats in the houses, 2.3% (*n*= 19) indicated other benefits, but only 3% (*n*= 13) related insecticide indoor spraying with prevention of malaria transmission. Sixty to 87% of villagers from any schooling group recognized that the spraying reduced mosquito numbers, 10%-32% from all groups associated it with a reduction in cockroach numbers, while 0-7.7% from all groups acknowledged that spraying helps to prevent malaria. Neither of the two more literate groups acknowledged the benefits of spraying in malaria prevention. No significant differences were detected in the responses among schooling groups in the logistic regression analysis adjusted by sex (*p*= 0.21, OR= 1.32,

Table II

RESULTS OF THE LOGISTIC MODEL ANALYSIS OF KNOWLEDGE ABOUT MALARIA AND VECTOR CONTROL PRACTICES. CHIAPAS, MEXICO, 1995

Dependent variables	*Elementary education*	*OR Adjusted by sex (Confidence Interval)*
Knowledge that malaria is transmitted by mosquitoes	Incomplete	1.0
	Complete	1.47
		(1.02, 2.11)*
Perceived benefit that insecticide spraying reduces malaria or mosquitoes	Incomplete	1.0
	Complete	1.32
		(0.91, 1.93)*
Use of fans as preventive measure	Incomplete	1.0
	Complete	3.44
		(1.35, 8.74)‡
Proper use of health services	Incomplete	1.0
	Complete	1.63
		(1.05, 2.54)‡

* 90% Confidence interval
‡ 95% Confidence interval

90% CI 0.91-1.93) (Table II), but women, regardless of their education level, reported less often that spraying diminished indoor mosquitoes or malaria occurrence (p= 0.07, OR= 2.12, 90% CI= 0.53-0.98).

To the question of wheter they agreed with indoor residual spraying, 97.6% responded positively and only 12 persons aswered negatively. Among the reasons given for refusing spraying were that the insecticide kills their livestock, stains the walls, or is ineffective. Also, some people reported having physical impediments to remove the furniture out of the house. More than 30% (n= 158) indicated that they would prefer their houses sprayed every two months, 29.3% (n= 146) preferred it at six months intervals, as it is customary with DDT, and 22.75 (n= 113) preferred spraying every three monts.

Preventive practices. Ninety-nine percent of interviewed villagers indicated that they had mosquito bednets, but only 76.5% (n= 377) use them all year round; 10.8% (n= 53) during the high mosquito abundance season, and 12.2% (n= 60) only during the wet season. There were no significant differences in the responses given by spouses.

Villagers indicated that they usually apply their own measures to prevent mosquito bites; 69.3% (n= 345) responded that they produce smoke by burning flammable material, which varied from weeds to dry cattle dung. Only 19.5% (n= 97) used the mosquito bednets as the principal means for preventing bites, and the remainder used electric fans, other measures, or no measures at all. In the logistic model, the use of electric fans was associated with people that had completed elementary education (p= 0.009, OR= 3.44, 95% CI= 1.35-8.74), (Table II).

A total of 98.4% responded that they bought at least one product for protection against mosquito bites within the previous year. The most common products purchased by villagers were mosquito nets (98.2%, n= 489) and insecticides for home use (22.3%, n= 111), although 10.4% (n= 52) bought mosquito coils and only 0.8% (n= 4) bought mosquito repellents. On average 3.3 ± 1.4 (SD) (n= 448) mosquito nets were purchased per family during the previous year, and no difference in the answer was found between sexes. Families bought, on average, 6.4 ± 6.6 (SD) (n= 111) insecticide products during the previous year, and again no difference was found between the answers given by sex. On average, 8.4 ± 9.7 (*SD*) (n= 52) mosquito coils were bought per family during the previous year and no difference between sexes was found. Finally, the 4 males who bought repellents averaged 5.5 ± 4.2 (*SD*) repellent purchases per person during the previous year.

When asked which family member applied prevention measures, 70.2% answered that the mother was in charge. When this question was analyzed by sex, 71.7% of females and 68.7% of males answered that the mother was in charge. The father was in charge of applying the prevention measures in 13.5% of cases. However, when analyzed by sex, only 11.6% of the answers given by females involved males, while 15.4% of the answers given by males involved themselves. The involvement of the eldest son in applying prevention measures was reported in 7.4% of the answers (7.2% of females and 7.7% of males).

Use of health services. Villagers were asked what they did when any member of the family had a fever episode. Fifty one percent of the respondents indicated that in the case of fever in any family member, they attended to an adequate health service: the community dispensary, a private physician, or a voluntary health worker. In the logistic model, adjusted by sex, there was a positive association of this behavior and complete elementary or higher education levels (p= 0.02, OR= 1.63, 95% CI= 1.05-2.54), (Table II). Only 1% (n= 5) responded positively to the specific question of using anti-malarial drugs when a fever episode occurred.

Discussion

In Mexico, a national malaria control program began in 1955, with excellent success. However, epidemic outbreaks occurred when control activities decreased. A long-term control strategy was then adopted in 1982.[8] In 1990, at the peak of the last epidemic, an intensive control program was launched, which included indoor spraying of DDT and anti-malaria drugs during the high transmission season. Therefore, it would be expected that frequent contact of villagers with the malaria program personnel, as well as the permanent presence of community health promoters, would result in better awareness about malaria transmission. However, a poor understanding of this and other related issues was documented in this survey. This situation coincides with that reported in Kenya, where only 58.5% of interviewed householders associated malaria with mosquitoes.[9] Although malaria knowledge was marginally better at higher education levels, it is possible that the small number of villagers with previous malaria experience may explain the little awareness about malaria in our study area.

Conversely, 63.9% of villagers recognized the benefits of indoor insecticide spraying in the reduction

of mosquito abundance, but again, only 3% related this directly with a reduction in malaria transmission. It is clear that villagers seldom have any appreciation of malaria control *per se*. Nevertheless, the acceptability of the spraying, in terms of house-spraying coverage, is sufficient to prevent human-vector contact and to control malaria in the region. Malaria control based on indoor house spraying heavily depends on this acceptance. In India, vector control is still based on DDT indoor spraying, but the coverage is poor as the general opinion of the people does not favor this intervention.[10] On the other hand, in Sri Lanka, high acceptance levels of malathion, resulted in more than 90% of sprayed houses.[11] The acceptability of spraying is linked to whether householders perceive residual spraying as beneficial. In our study area, none of the interviewees regarded spraying as detrimental, and 97.6% agreed with it, although no predisposition was found in the frequency they would like their houses treated.

Bednets are among the most recognized methods of personal protection against mosquitoes and nuisance insects,[12] and many trials have evaluated the benefits of insecticide impregnated bednets.[13-15] Impregnated bednets were easily accepted and used by villagers, even in areas with no previous experience or low usage.[16] The dissemination and effectiveness of bednets in Ghana was influenced by seasonal factors, patterns of use, and cost.[17] In our study area, these were the products for personal protection most frequently purchased during the previous year. Bednets were present in 99% households, most of them (76%) were in use all year round and the others during the high mosquito season. However, villagers regarded bednets as protecting against mosquito bites, and they did not associate them with malaria prevention. It is interesting that when asked about self-protection practice, only 19% listed bednets.

Practices recognized as self-protecting measures were identified as those applied as soon as mosquito biting activity starts, while villagers are still active before going to bed, after which bednets were used. A study on the behaviour of the local malaria vector *An. albimanus* with the use of pyrethroid impregnated bednets, documented that this method may be an alternative to house-spraying.[18] Therefore, the extended use of bednets in the area supports their inclusion (impregnated with insecticide) as an additional malaria control measure in the coastal area of Chiapas.

Alternative self-protection practices against mosquito bites included using a range of products and methods, from the burning of any material to produce smoke, to the use of mosquito coils. Besides relief from the heat, locals are aware that electric fans also prevent mosquito biting. Nevertheless, this measure was limited to the better educated people. Although the questionnaire did not provide elements to construct a socioeconomic index of the population, the presence of electric fans was associated to concrete floor (p= 0.002, OR= 25.54, 95% CI= 3.92-192.5), indicating that this facility was limited to the more well off families.

The historical position of women, placed at a lower social level than men, is still clearly observed in the communities we studied. Most of the women interviewed were housewives and a significantly higher percent were illiterate as compared with males. Women in the area were in general socially, culturally and economically at a disadvantage to men. Despite these inequalities, there were no differences in their beliefs and practices about malaria. Women had a greater potential impact as family health promoters, with 70% of the housewives being in charge of the application of the self-protection preventive measures.

Use of health services by the community depends on several factors; such as the availability of service providers. In some instances, private physicians are preferred over public health facilities, because they are perceived as more reliable, although they are highly expensive and usually located at long distances from rural areas, which deters utilization of their services.[19] In some regions, villagers rely on the pharmacist or use local shops for treatment, claiming that they receive prompt consultation and treatment, and because these are their nearest source of care.[20] A high percentage of the villagers from our study area used self-medication when family members had fever, but most of them attended proper health service providers. This contrasts with other malarious areas of Mexico, where 55% of fever cases self-medicated at home, and only 16.4% attended primary health care services (equivalent to the community dispensaries) for treatment.[21] This seems to be influenced mainly by the availability of primary health care services and the severity of the fever. In our study area, proper health services are either available in each village or at close distance. Concerning the severity of the fever, as malaria transmission is very low and there were no cases reported during the previous four years, fever was more likely to be associated with other infectious diseases, as has been reported elsewhere.[22] This lack of recent experience with malaria, which made villagers to confuse any fever episode with malaria, is reflected in the difference between the malaria cases officially reported and those reported by villagers in the questionnaires.

In summary, although malaria knowledge in the coastal plain of Chiapas was poor, knowing the benefit of indoor residual spraying was associated with a

reduction of mosquitoes and other pests in the houses, and most of villagers agreed with this control measure. People in the communities apply their own preventive measures to avoid mosquito bites and the use of bednets is widespread, which makes bednets a viable alternative for malaria control. The participation of women from these communities in the application of these measures was important. These results indicate the need for educational programs aimed at the induction of community participation for malaria control. These programs should be directed at increasing the awareness of the community about the participation of mosquitoes on malaria transmission and the different strategies devised to abate mosquito abundance and deter human-vector contact. The participation of women in malaria prevention activities within households should be taken into account in these educational programs.

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