KNOWLEDGE AND USE OF PREVENTIVE MEASURES AGAINST MALARIA IN ENDEMIC AND NON-ENDEMIC VILLAGES IN NORTHERN THAILAND

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Abstract. The objective of this study was to determine the frequency and determinants of knowledge of malaria in four sites in northern Thailand, and to compare the use of prevention measures between people with and without a knowledge of malaria. An epidemiological survey was conducted in January 2002 among 857 persons living in four sites in northern Thailand. Of the 857 persons, 53% had a knowledge of malaria, ranging from 38% and 51% in non-endemic to 76% and 77% in endemic sites. Headache (89%), shivering (83%) and fever (79%) were the most frequently mentioned symptoms. Younger persons had more knowledge of malaria than older persons; adjusted Odds Ratio (aOR): 3.91 [95% confidence interval (CI): 2.32-6.56] for the 15-29 age group compared to persons 60 years and older. In comparison to men, knowledge of malaria was significantly lower among women (aOR: 2.00, 95%-CI: 1.47-2.70). Persons with knowledge reported a significantly higher use of prevention measures than persons without knowledge of malaria.

INTRODUCTION

In Thailand, malaria is forest-related and prevalent along the international borders with Myanmar and Cambodia, which are countries highly endemic for malaria. Malaria transmission in forested areas is intense, due to the presence of efficient vectors and the frequency of population movement (MOPH, 2002). The unstable political situation and recurring conflicts along the Thai-Myanmar border have increased the numbers of displaced persons in areas with poor health facilities and high malaria transmission. Joint efforts between governments have not materialized (Chareonviriyaphap *et al*, 2000).

In the central plain area of Thailand, malaria transmission has been eliminated for more than two decades. Apart from vector control using DDT residual spraying, one reason for this elimination of malaria is change in land use, such as clearing of forest to cultivate cash crops. Another possible reason may be people's awareness of the disease, which has changed as a result of prevention programs. Although knowledge often increases through prevention programs (Kroeger *et al*, 1996), it is well known that changing risk behavior remains difficult to accomplish. Knowledge of malaria and the use of measures to prevent malaria are important factors for planning sustainable malaria control programs, because they may enhance or interfere with the effectiveness of control measures (Klein *et al*, 1995). However, the effects of attitudes, beliefs and behavior on the transmission, treatment and control of the disease have often been overlooked (Ahorlu *et al*, 1997).

The malaria control program of Thailand started in 1949 with mainly indoor residual spraying with DDT. At present, vector control does not rely on indoor residual spraying alone as in the past, but also includes fogging, the use of impregnated bed nets and mosquito repellent (MOPH, 2002). Evaluation of this control program

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takes place on a regular basis, but figures on the malaria knowledge and the use of prevention measures are scarce. Health education and community participation have been an integral part of the Thai malaria control program since a decade (Malaria Division, 1996).

A large epidemiological survey on malaria is currently ongoing as part of a multidisciplinary project called RISKMODEL. The aim of this epidemiological survey is to determine risk factors for malaria infection among inhabitants of four different study sites in northern Thailand. One of these potential risk factors may be ignorance of malaria. To gain insight into knowledge of malaria at the start of our project, we determined the frequency and determinants of knowledge, and compared the practice of prevention measures between people with and without knowledge of the disease.

MATERIAL AND METHODS

Study design

RISKMODEL is a research project which aims to investigate the relationship between changes in land use and the occurrence of malaria and dengue in northern Thailand (van Benthem *et al*, 2002). For the prospective malaria study, 4 study sites with changes in land cover, or a high incidence of malaria, were selected. Site 1, Nong Khao Klang, presents a typical pattern of slash and burn agriculture for growing upland rice. Site 2 and site 3, Huai Pong Khan Nai and Huai Chang Kham, respectively, present narrow irrigated valley schemes for the cultivation of rice and garlic. All these three sites are inhabited by the Karen hill-tribe and located in Mae Hong Son Province. Site 4, Huai Ngu, located in Chiang Mai Province, consists of 2 villages, of which the main village is located in an irrigated valley. In addition, Lisu village orchards are located on hill slopes. Sites 1 and 4 are villages with a low incidence of malaria in the last 10 years, whereas sites 2 and 3 have a high incidence of malaria.

Before the start of the study, permission and collaboration of the head of the village was obtained. The study was conducted on the weekends to increase the possibility of meeting people at home. The interviewers received interview training for one day. The staff consisted of 7 interview teams, each responsible for a number of households in the village. A supervising team visited each interview team during their work to check their performance and questionnaires on inconsistencies. When correction was deemed necessary, the interview team visited the study participant again on the same day to gather the missing information.

Study population

All inhabitants of a study site were asked to participate in the study. In total, 1,208 persons have been included since January 2002. They were followed for three consecutive years, once per year in January after the second peak of malaria transmission. In northern Thailand, two annual peaks of malaria occur: the early rainy season (June-July) and the cold dry season (November-December)(based on data from the Office of Disease Prevention in Chiang Mai). Written informed consent was obtained (those who could not write gave a fingerprint). Persons were asked about their knowledge of malaria, the use of preventive measures, movement history and other risk factors, by means of a structured questionnaire. Knowledge of malaria was measured by asking questions related to disease symptoms, mode of disease transmission, breeding places of mosquitoes and preventive measures. Persons with a knowledge of malaria were defined as persons who reported to know the disease and who were able to mention at least one disease symptom. All questions related to knowledge were open questions and were asked to persons 15 years and older. Questions related to knowledge were asked before the questions concerning preventive measures to avoid bias. The prevention measures were mentioned one by one to investigate the practice of persons.

Ethical approval

Ethical approval was obtained from the medical ethical committee of Chiang Mai University.

Statistical analysis

The frequency of knowledge was measured during the first survey in January 2002. Differences between the four study sites concerning

knowledge of malaria and differences in the use of prevention measures between persons with and without knowledge of malaria were calculated by chi-square tests and a p-value of <0.05 was considered as statistically significant. Logistic regression was used to identify determinants of knowledge of malaria. Determinants significantly associated with knowledge of malaria on univariate analyses (p-value<0.05) were selected for multivariate analyses. Interaction between determinants included in the multivariate model were tested (p-value<0.05) and all non-significant factors were added once more to the final model to investigate possible confounding factors.

RESULTS

Questions related to knowledge of malaria were asked to persons aged 15 years or older (N=857). The male:female ratio was equally distributed in all four study sites (Table 1). In site 4, a higher percentage of older persons were included (24%) compared to sites 1, 2 and 3. In these three sites, 85 to 91% of the interviewed population were farmers, but was only 51% at site 4. Overall, 53% had knowledge of malaria but large differences were observed between sites (p<0.0001). In the malaria endemic sites 2 and 3, 76 and 77% of the population had knowledge of malaria, whereas only 38 and 51% of the population in non-endemic sites 1 and 4 had a knowledge of malaria.

Of the 857 persons, 459 reported having a knowledge of the disease malaria. However, 6 of them could not mention any of the acknowledged symptoms, resulting in 453 persons (53%) with a knowledge of malaria. Of these, 92% knew that malaria is transmitted via mosquitoes and 80% mentioned that malaria vectors bite between dusk and dawn. Among the persons with knowledge of malaria, headache (89%), shivering (83%) and fever (79%) were most frequently mentioned as disease symptoms (Table 2). Overall, people with a knowledge of malaria and living in sites 1, 2 and 3 could mention more symptoms than people with a knowledge of malaria living in site 4. The use of mosquito nets (87%) and special clothes (66%) were the best-known preventive measures.

Overall, persons with a knowledge of ma-

Table 1
Characteristics of the 857 persons older than 14 years in the 4 villages of the malaria study.

	Site 1	Site 2	Site 3	Site 4	Total	
	n	n	n	n	N	%
Total	103	137	150	467	857	100
Sex						
Male	51	64	78	227	420	49
Female	52	73	72	240	437	51
Age (years)						
15-29	25	38	47	85	195	23
30-44	45	53	56	170	324	38
45-59	20	25	26	143	214	25
> 59	13	21	21	69	124	14
Profession						
Farmer	94	116	132	240	582	68
Other [a]	9	21	18	227	275	32
Knowledge of malaria[b]						
Yes	57	104	115	177	453	53
No	46	33	35	290	404	47

[a] Other includes traders, students, housewives, monks, nuns, laborers and forest workers, office and factory employees, and unemployed.

[b] People with a knowledge of malaria who could mention at least one symptom of the disease.

Table 2
Knowledge of malaria symptoms, and prevention measures in 453 persons older than 14 years of age.

	Site 1	Site 2	Site 3	Site 4	Total N	Total %	p-value
Disease symptoms							
Fever	70	77	70	90	359	79	[a]
Headache	95	98	94	79	404	89	[a]
Shivering	98	91	97	63	374	83	[a]
Muscular pain	67	66	76	17	225	50	[a]
Nausea/vomiting	58	52	63	4	167	37	[a]
Cerebral malaria	7	7	5	1	19	4	0.07
Prevention measures							
Mosquito nets	84	91	91	84	396	87	0.12
Cloths	77	73	75	53	297	66	[a]
Spraying	10	34	37	17	120	27	0.001
Repellent	21	18	10	13	65	14	0.12
Mosquito coils	25	29	14	67	178	39	[a]

[a] = p<0.0001

laria used preventive measures more often than persons without knowledge, except for the use of non-impregnated mosquito nets (p=0.13). Table 3 shows determinants for knowledge of malaria infection. On univariate analysis, sex, age, profession and site were significantly related with a knowledge of malaria and all determinants except profession remained statistically significant on multivariate analysis. Twice as many men than women had a knowledge of malaria [adjusted Odds Ratio (aOR): 2.00, 95% confidence interval (CI): 1.47-2.70]. The knowledge of malaria decreased with increasing age: younger persons had a higher knowledge of malaria compared to older persons (aOR: 3.91, 95% CI: 2.32-6.56 for persons 15 to 29 years of age compared to persons of 60 years and older). Persons living in malaria endemic sites 2 and 3 had a higher knowledge of malaria compared to persons living in non-endemic sites 1 and 4. On the final multivariate model, no statistically significant interaction existed between the determinants, and no confounding factors were found (p<0.05). Restricting risk factor analysis to one person per household did not substantially change the results. When repeating analysis for endemic and non-endemic sites separately, the same independent risk factors were found: sex and age. Therefore, the results for endemic and non-endemic sites were combined. To investigate whether increased knowledge resulted in more common use of preventive measures, differences in use were compared between persons with and without knowledge of malaria (Fig 1).

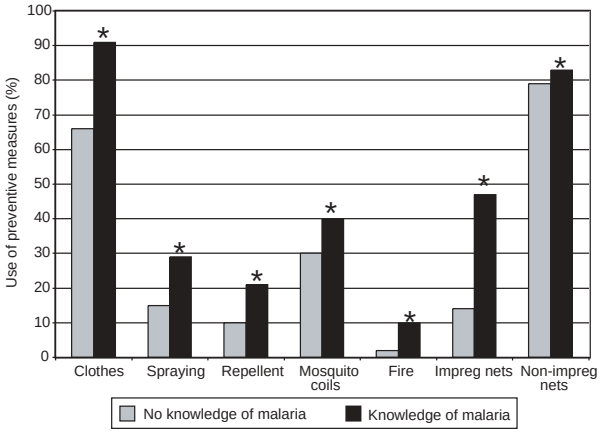

Fig 1–Differences in the use of preventive measures between persons with (n=453) and without (n=404) a knowledge of malaria (* indicates p<0.05).

Table 3
Logistic regression to identify determinants for a knowledge of malaria in four villages in northern Thailand.

	N	% with knowledge	Unadjusted		Adjusted	
			OR[a]	95% CI[a]	OR[a]	95% CI[a]
Sex						
Male	420	60	1.72	1.31-2.27	2.00	1.47-2.70
Female	437	46	1.0		1.0	
Age (years)						
> 59	124	35	1.0		1.0	
45-59	214	47	1.68	1.07-2.66	2.29	1.39-3.79
30-44	324	56	2.41	1.57-3.71	2.94	1.83-4.73
15-29	195	65	3.52	2.19-5.64	3.91	2.32-6.56
Profession						
Farmer	582	56	1.49	1.11-1.96		
Other[b]	275	46	1.0			
Site						
1	103	55	2.03	1.32-3.12	1.98	1.27-3.09
2	137	76	5.16	3.35-7.97	5.52	3.51-8.67
3	150	77	5.38	3.53-8.21	5.43	3.50-8.41
4	467	38	1.0		1.0	

[a] OR= Odds ratio; 95%-CI= 95% Confidence interval.
[b] Other includes traders, students, housewives, monks, nuns, laborers and forest workers, office and factory employees, and unemployed.

DISCUSSION

In the four research sites in Chiang Mai and Mae Hong Son provinces, Thailand, 53% of the study population had a knowledge of the disease malaria. However, large differences existed between villages where malaria transmission is still present and villages where malaria is rare or absent (76% and 77% compared to 53% and 38%). The percentages of the endemic sites were comparable with a study from Myanmar in which 72% of the study population knew the symptoms of malaria (Hla-Shein *et al*, 1998). Studies in Thailand among mobile populations revealed that knowledge of vectors for malaria was 25-58% (Aramarattana, 1993; Butraporn *et al*, 1995). In Lao PDR, knowledge of malaria transmission by mosquito bites ranged from 29% to 49% in illiterate and literate persons, respectively (Uza *et al*, 2001). Thus, knowledge of malaria may vary greatly between countries but also between villages or sub-populations within one country.

Other risk factors for ignorance of malaria in the present study were sex and age; women and older persons had a lower knowledge of malaria. Men are normally the head of the household and often participate in health education programs. Younger persons are more educated than the elderly due to a national policy of education. Other studies did not mention these factors, but often only one person per household was interviewed, whereas we asked all persons above 14 years of age. We did not determine the education level of the study participants. Other studies showed that knowledge of malaria and behavior in relation to the prevention of malaria were significantly related to education level and socio-economic status (Macintyre *et al*, 2002; Uza *et al*, 2002). Our study population was rather homogeneous socio-economically , since most persons were farmers.

Headache, shivering and fever were the most frequently mentioned disease symptoms, as was found in other studies (Konradsen *et al*,

1997; Nieto *et al*, 1999). Comparable to other studies, the use of mosquito nets was the most frequently mentioned preventive measure (Espino *et al*, 1997; Hla-Shein *et al*, 1998; Uza *et al*, 2002), followed by wearing preventive clothes and the use of mosquito coils. Even persons without a knowledge of malaria reported the use of mosquito nets, although these were mainly non-impregnated mosquito nets. In 85% of all households mosquito nets were available. The use of preventive measures was higher in persons with than in persons without a knowledge of malaria, similar to a study in rural Zimbabwe (Vendule and Mharakurwa, 1996). This indicates that knowledge of the disease increased the use of preventive measures in our four study sites in northern Thailand. However, the reported use of preventive measures by persons without a knowledge of malaria was also substantial. These figures could either accurately represent the actual practice or be partly the result of socially desirable answers. Knowledge of malaria was not necessarily a prerequisite for the use of preventive measures (Macintyre *et al*, 2002). Many persons tried to avoid mosquito bites, even if knowledge on malaria was lacking. The use of prevention measures was reported by the interviewee and could not be confirmed. However, the reported use of mosquito nets could be compared to the availability of mosquito nets in the house, because the interviewer counted the number of mosquito nets. In total, 96% of the study population had mosquito nets in their house, which was in line with the reported mosquito net use of 88%. Based on this, we assumed that also other prevention measures were reported honestly.

In conclusion, the majority of the study population had a knowledge of malaria, but the knowledge of malaria was much higher in the endemic than non-endemic sites. Preventive measures are more commonly used in areas with malaria than in areas without. This difference in use can be explained by the difference in the percentage of people with knowledge in endemic and non-endemic sites, since factors related to knowledge are comparable between endemic and non-endemic sites. Education programs for villagers in non-endemic areas should therefore be initiated as if malaria reappears or if there is a risk that this will happen, sush as with land use or political changes. We conclude that some groups need special attention in future health education programs: old persons and women. Persons with a knowledge of the disease more frequently reported the use of preventive measures in this study, indicating that education programs are an important tool in malaria prevention, at least until an effective vaccine is available. Whether increased knowledge and use of prevention measures really decreases the risk of malaria infection will be a subject of future investigations.

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