KNOWLEDGE AND BEHAVIOR RELATING TO MALARIA IN MALARIA ENDEMIC VILLAGES OF KHAMMOUANE PROVINCE, LAO PDR

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Abstract. In order to provide basic data for evaluation of malaria control measures, a study on the knowledge and behavior of people regarding prevention of malaria was carried out in 8 malaria endemic villages in Khammouane Province of Lao PDR from 1999 to 2000. The total valid questionnaire respondents were 932, with a mean age of 32.3±14.9. 43.7% of the respondents were illiterate. About 44% of the respondents suffered from malaria in the past. About 55% of the illiterate group slept in mosquito nets, compared to 75.4% for the educated group. About 29% of the illiterate respondents had knowledge of malaria transmission by mosquito bites, compared to 48.8% for the educated groups. Out of 167 non-impregnated mosquito nets examined in two villages, 13 were in bad condition having holes or leaks and 39 female mosquitos including *Anopheles* spp were collected in these nets by early morning catches.

Knowledge of malaria and behavior in relation to the prevention of malaria were significantly related to educational level. Health education as well as general education must be taken into account for communities in malaria endemic areas to become more involved in malaria control strategies.

INTRODUCTION

Malaria is one of the most serious diseases affecting people in developing Asian countries with tropical and subtropical climates. Those in the Indo-Chinese Peninsula still encounter many of the malaria problems. In Lao PDR, a landlocked and the innermost country of the peninsula, malaria is a major public health problem. According to data collected from all provinces by the Epidemiological Department of the Center of Malariology, Parasitology and Entomology (CMPE), which is responsible for developing and maintaining the objectives and strategies of the National Malaria Control Program, there are approximately 300,000 confirmed and suspected malaria cases every year. Among them, about 10% are hospitalized and 300 to 500 deaths are officially registered at different health services (Phestosouvanh *et al*, 2000). In accord with the government policy on primary health care declared in 1999, the National Malaria Control Program (NMCP) is considered to be the top priority among health care programs. It is the overall objective of the NMCP to control malaria, *ie* to reduce the morbidity and mortality due to malaria by controlling the vector by impregnated bed nets, or other methods

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and offer early diagnosis and treatment supported by health education as an integrated program in all communities. Thus, malaria control is the most important health program and is beginning to take shape throughout the country as well as other malaria endemic countries (Ittiravivongs *et al*, 1992; Alikins *et al*, 1994; Ettling *et al*, 1994; Klein *et al*, 1995; Kobayashi *et al*, 1998; Tanner and Vlassot, 1998; Rashed *et al*, 1999).

Since 1995, a pilot study to establish a malaria surveillance system has been carried out in Khammouane Province, as an activity of Lao/JICA/WHO PHC Project, under the supervision of CMPE staff and Japanese participants. The prevalence rates of malaria in this province gradually decreased after introduction of the control program, indicating positive effect of these control measures (Kobayashi and Sato, 2000). The study, however, has not reported the extent of knowledge and behavior of inhabitants in relation to malaria control. Malaria control programs have often overlooked the role that attitudes, beliefs and behavior in communities might play in the transmission, treatment and control of disease (Ahorlu *et al*, 1997).

In order to accumulate the baseline data for evaluation of malaria control measures, a questionnaire study on knowledge and behavior on the prevention of malaria was carried out among the inhabitants in malaria endemic villages of Khammouane Province.

MATERIALS AND METHODS

Study area

Khammouane Province (about 16,315 km^2) is situated in the center of the country, about 350 km southeast of the capital, Vientiane. It is mountainous and comprises mostly of forested areas with many high plateaus. There are few plains along the Mekong River. The province had a population of about 270,000 in 1995. There are 9 districts, 76 communes and 882 villages (Kobayashi *et al*, 1998). Thakhek is the capital of the province and is the fifth largest city in this country.

Eight villages - Xiengvenh of Thakhek City, Bounghouana south and Thamlay of Xebangfay district, Nongcen of Ngommalat, and Napoung, Koutboun, Nalouang and Thapachon of Boualaopha district - were chosen for the study (Fig 1). Xiengvenh and two villages of Xebangfay district are surrounded by paddy fields, situated 20 to 25 km from Thakhek City and easily accessible by jeep in the dry season. The villages of Boualaopha district are remote and mountainous, situated about 100 km northeast of Thakhek, and 100 m above sea level. It takes about 10 hours from Thakhek by small boat in the rainy season.

There are two prevailing seasons, the rainy season usually from May to October and the dry season from November to April. Relative humidity in the dry season is more than 90% and temperature varies between 15ºC-35ºC. It is quite cool, being very often 13ºC-15ºC before dawn in December and January night at the study area.

A descriptive cross-survey pertaining to malaria was carried out from July to August 1999. In this study, we applied a structured interview that included questions on knowledge of malaria (causes of malaria, prevention of malaria), health behavior (using mosquito net) related to malaria. There were 430 households with a total population of 2,383 inhabitants in the study villages. The population ≥10 years was 1,518. The valid questionnaire came from 932 respondents. Active case detection for malaria in communities was made concurrently with this study. A total of 621 inhabitants was examined for malaria parasites by Dipstick (ICT malaria: AMRAD Australia) and by microscopy. Identification of malaria species using biological microscope was performed by well-trained microscopists in CMPE. The result of the Dipstick method was re-confirmed by Lao or Japanese specialist.

In order to know the condition of the mosquito nets used by householders and their

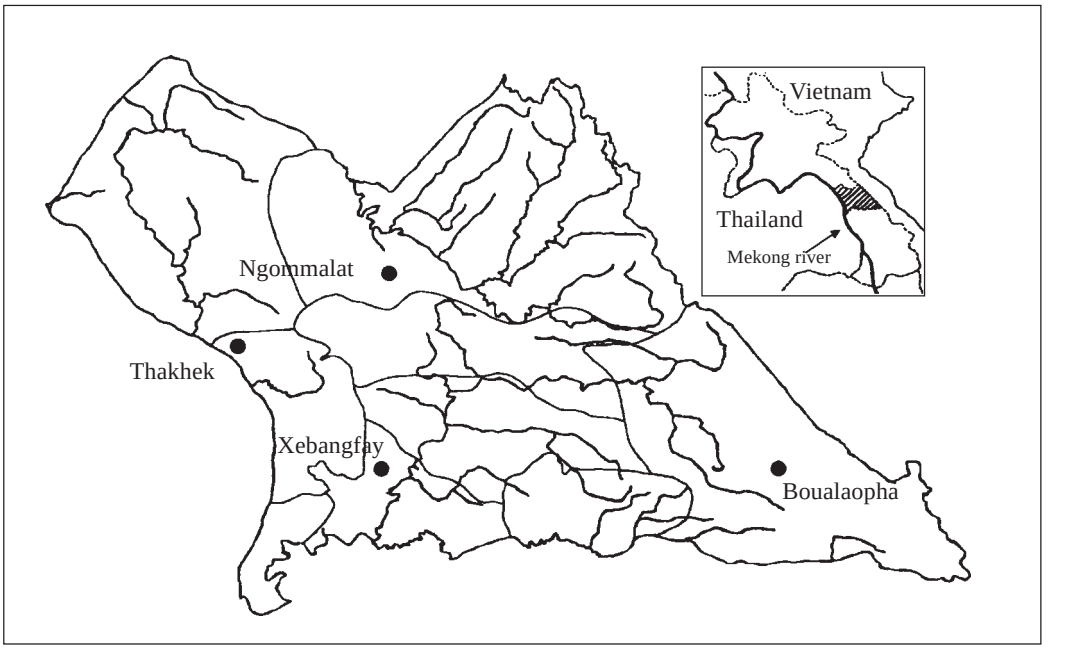

Fig 1–Study districts in Khammouane Province, Lao PDR.

families, an additional survey was made from 5 August to 28 September 2000 in 4 villages (Thapachon, Koutboun, Napoung and Thamlay). Two instructors visited each house and examined the number of persons accommodated and the condition of mosquito net at night. These nets were classified into 3 groups by condition as excellent (clean without hole and leak), normal (not so clean but without holes) and poor (dirty with hole or leak).

The data collected were classified according to education level, and compared to the knowledge of malaria and health behavior, using computer statistical software (SPSS). Chi-square test was used for comparison of groups and p-values less than 0.01 were defined to be statistically significant.

RESULTS

As shown in Table 1, the valid questionnaire was 932 respondents, comprising 402 (43.1%) males and 530 (56.9%) females. By

Table 1
Distribution of sociodemographic characteristics.

Characteristic	No.	%
Gender (n=932)		
Male	402	43.1
Female	530	56.9
Age (n=932)		
10 - l9 years	221	23.7
20 - 29 years	239	25.7
30 - 39 years	211	22.6
40 - 49 years	126	13.5
≥50 years	135	14.5
Occupation (n=900)		
Farmer	761	84.6
Personnel	13	1.4
Student	86	9.6
Others	40	4.4
Education (n=929)		
Illiterate	406	43.7
1-3 years	236	25.4
4-6 years	205	22.1
≥7 years	82	8.8

Table 2
Education level of respondents in study villages.

	No. of people	Illaterate		1-3 years		4-6 years		7 or more years	
		No.	%	No.	%	No.	%	No.	%
Thakhek									
Xiengvenh	82	30	36.1	25	30.1	18	22	10	12.0
Xebangfay									
Bounghouana south	241	132	54.8	34	14.1	63	26	12	5.0
Thamlay	195	72	36.9	42	21.5	54	28	27	13.8
Ngommalat									
Nongceng	135	59	43.7	50	37.0	22	16	4	3.0
Boualapha									
Napoung	131	45	34.4	37	28.2	25	19	24	18.3
Koutboun	67	29	43.3	23	34.3	13	19	2	3.0
Nalouang	32	19	59.4	10	31.3	3	9.4	0	0.0
Thapachon	45	20	44.4	15	33.3	7	16	3	6.7
Total	929	406	43.7	236	25.4	205	22	82	8.8
Gender									
Male	400	103	25.8	123	30.8	110	27.5	64	16.0
Female	529	303	57.3	113	21.4	95	18.0	18	3.4
Total	929	406	43.7	236	25.4	205	22.1	82	8.8
Age									
l0-l9 years	221	46	20.8	64	29.0	90	40.7	21	9.5
20-29 years	238	101	42.4	53	22.3	51	21.4	33	13.9
30-39 years	211	91	43.1	65	30.8	39	18.5	16	7.6
40-49 years	126	73	57.9	34	27.0	14	11.1	5	4.0
≥50 years	133	95	71.5	20	15.0	11	8.3	7	5.3
Total	929	406	43.7	236	25.4	205	22.0	82	8.8

age groups, the number of respondents in the age group 10-19 was 221 (23.7%), that in 22-29 was 239 (25.7%), 30-39 was 211 (22.6%), 40-49 was 126 (13.5%) and over 50 was 135 (14.5%). The mean age of the respondents was 32.3±14.9. Farmer (84.6%) was the most common occupation in all the villages. With regards to education, the rate of illiteracy was high (43.7%) and that with high education (for 7 years or more) was 8.8%. The rates differed among the villages. The percentage of illiterates in Nalouang (59.4%) and Bounghouana south (54.8%) was high; the group with high education in Nalouang was 0%, and in Koutboun and Nongceng it was 3.0%. By gender, illiteracy was high in the females, 57.3%. By age, illiteracy was high in older persons (Table 2).

To the question "Have you suffered malaria before?" 44.2% of the respondents answered "yes", and 92.1% of them took medicine (Table 3). From the results of the ICT and Giemsa malaria surveillance of 621 respondents, malaria prevalence differed among the villages. Positive rate was apparently low in Xiengvenh (5.6% of peoples examined); it was high in Nalouang (35.5%) and Thapachon (35.7%) (Table 4). In Nalouang and Thapachon, the rates of the responders with malaria were high, 61.3% and 70.5% respectively.

On malaria transmission, 378 (40.6%) respondents answered that mosquito transmits malaria, 496 (53.2%) respondents did not know how malaria was transmitted, 595 (63.8%)

Table 3
Number and percentage of the respondents who suffered malaria and took malaria medicine.

Characteristic	No.	%
Suffered malaria		
Yes	406	44.2
No	513	55.8
Total	919	100
Took medicine for malaria		
Yes	374	92.1
No	11	2.7
No answer	21	5.2
Total	406	100

Table 4
ICT malaria surveillance in study villages, Khammouane Province, Lao PDR, l999.

	No. of people examined	No. positive	Parasite positive rate %
Thakhek			
Xiengvenh	54	3	5.6
Xebangfay			
Bounghouana south	135	16	11.9
Thamlay	152	29	19.1
Ngommalat			
Nongceng	56	9	16.1
Boualapha			
Napoung	97	18	18.6
Koutboun	54	10	18.5
Nalouang	31	11	35.5
Thapachon	42	15	35.7
Total	621	111	17.9

respondents answered that sleeping under mosquito net at night was the best way to prevent malaria infection, 24.8% of the respondents did not know how to prevent malaria infection and 73.5% of the respondents used mosquito net at night (Table 5).

The status of the knowledge of malaria transmission (mosquito bite), prevention measure (sleeping in net) and use of net in each study village are shown in Table 6. By villages, only 12.5%, 23.4% and 26.7% of the respondents in Nalouang, Koutboun and Thapachon respectively answered that malaria was transmitted by mosquitos. Among the respondents in Xiengvenh, Thamlay and Napoung more than 50% of them knew how malaria was transmitted. On sleeping under net, many respondents in Thamlay (84.9%), Napoung (70.8%) and Xienvenh (84.2%) answered that sleeping under net was the best way to prevent malaria transmission. However, in Bounghouana, the usage of net was apparently low, being 22%. With regards to recognition of transmission, and prevention, the percentage for the illiterate group (28.6% and 54.9% respectively) was significantly different from the percentage for the group with education (48.8% and 75.4% respectively). Fig 2 shows the differences in knowledge of malaria transmission, prevention and use of net among the respondents with different education status.

Table 5
Summary of knowledge and health behavior regarding malaria.

Characteristic	No.	%
Knowledge		
Transmission (n=932)		
Mosquito bite	378	40.6
Unknown	496	53.2
Drinking unboiled water	30	3.2
Drinking river water	12	1.3
Eat raw fish	5	0.5
Others	46	4.9
Prevention measures (n=932)		
Sleep in mosquito net	595	63.8
Unknown	231	24.8
Clean the house	91	9.8
Take a medicine	70	7.5
Others	66	7.1
Behavior		
Using mosquito net (n=931)	684	73.5

In an additional survey, 37 houses with 92 nets in Thapachon, 24 houses with 75 nets in Koutboun, 24 houses with 62 nets in Napoung

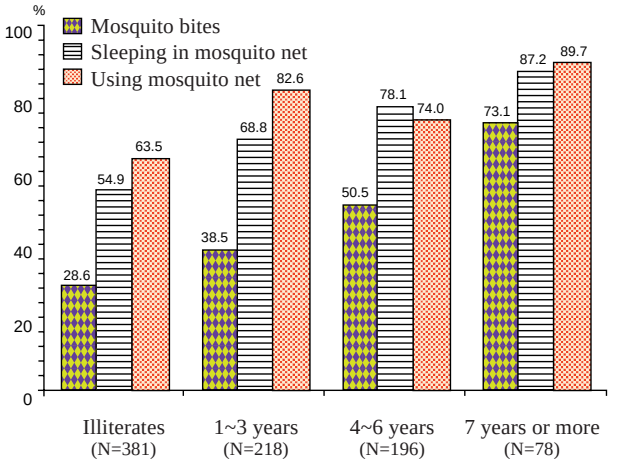

Fig 2–Comparison of knowledge of malaria transmission (mosquito bites), prevention (sleeping in net) and using net among respondents with different education status.

and 19 houses with 47 nets in Thamlay were examined for mosquitos invading into these nets. A total of 39 female mosquitos including *Anopheles* spp was collected in 13 nets out of 167 non-impregnated mosquito nets in Thapachon and Koutboun by early morning catches. Ten of the nets harboring mosquitos had more than one hole of various size, and 5 of them housed more than the prescribed number of persons (Tables 7, 8).

DISCUSSION

Malaria was seen as one of the main health problems, especially among mountainous dwellers of Boualapha district where it was ranked first in this country. The purpose of this study was to identify the knowledge

Table 6
Knowledge of malaria transmission (mosquito bites), prevention measure (sleeping in net) and using net among respondents in different villages and education level.

	No. of people	Mosquito bite		Sleeping in mosquito net		Using mosquito net	
		No.	%	No.	%	No.	%
Thakhek							
Xiengvenh	57	29	50.9	48	84.2	47	82.5
Xebangfay							
Bounghouana south	234	52	22.2	122	52.1	52	22.2
Thamlay	192	119	62.0	163	84.9	176	91.7
Ngommalat							
Nongceng	121	46	38.0	78	64.5	101	83.5
Boualapha							
Napoung	130	73	56.2	92	70.8	129	99.2
Koutboun	64	15	23.4	41	64.1	62	96.9
Nalouang	32	4	12.5	14	43.8	27	84.4
Thapachon	45	12	26.7	22	48.9	45	100.0
Total	875	350	40.0	580	66.3	639	73.0
Education level							
Illiterate	381	109	28.6[a]	209	54.9[a]	242	63.5[a]
Received education	492	240	48.8	371	75.4	395	80.3
Total	873	349	40.0	580	66.4	637	73.0

[a]$p<0.001$

Table 7
Number of mosquitos collected in bed nets at study villages, August 2000.

	No. of houses examined	No. of mosquito nets examined	No. of mosquito net with mosquitos
Xebangfay			
Thamlay	19	47	0
Boualapha			
Napoung	24	62	0
Koutboun	24	75	4
Thapachon	37	92	9
Total	104	276	13

Table 8
Condition of net and number of mosquitos collected in bed nets.

Village and net no.	Net size[a]	No. of persons in net	Net condition[b]	No. of mosquito in net
Koutboun (n=4)				
1	L	4	poor	8
5	S	2	poor	7
4	S	1	poor	2
16	L	3	poor	1
Thapachon (n=9)				
16	S	2	poor	6
124-1	M	4	poor	4
103	M	4	poor	3
107	S	1	poor	2
124-2	L	1	normal	2
108	L	3	poor	1
1	M	3	poor	1
5	M	3	excellent	1
15	S	3	excellent	1
Total (N=13)		34		39

[a]L: large size (for 4-6 person); M: medium (for 2-3), Small (for one)
[b]poor: old with holes, normal: available, excellent: new

and behavior regarding malaria of people in high endemic area of Lao PDR and to design educational strategies for malaria control that could be used by community leaders, health volunteers and school teachers.

Results of the survey showed that even though most (73.0%) of the people in the villages kept and used mosquito nets, their knowledge of mosquito transmitting malaria was low (40.0%) and incidence of malaria was comparatively high in Boualapha. These results are quite similar to those of previous studies in Myanmar (Hla-Shein *et al*, 1998).

Most of the respondents in this study who answered that malaria was transmitted by mosquito bites, used without concern dirty bed nets with holes or leaks resulting in many engorged vector mosquitos being found in the

nets in the early morning. Mosquitos were collected even in the normal and excellent bed nets used by people at night. This shows that bed nets were not properly used. Most of the nets accommodated more than the prescribed number of people and due to their improper use at night, mosquitos often entered the nets through the opening of their skirts.

Klein *et al* (1995) emphasized the importance of understanding the beliefs and practices in the community for planning or evaluating vector control activities. They also pointed out the importance of methodology in the study on knowledge, belief and behavior, and mentioned that information could be collected despite of a limited number of interviews with key informants or focus groups in a community, instead of developing a standardized questionnaire.

Many (about 50%) of the people in the villages were illiterate and did not know that malaria is transmitted by mosquito bites. They also had incorrect knowledge about malaria transmission, such as drinking unboiled water or stream water. In addition, their knowledge and behavior were significantly different from the educated groups. This finding concurs with previous findings in Malawi (Ziba *et al*, 1994) that educational level of household head was strongly correlated with use of bed net to prevent malaria.

Most of the research and control strategies relating to malaria have focused on basic clinical aspects and vector control. WHO (1993) have stressed the necessity and importance of studies on socio-cultural and socio-economic factors. Many authors have reported recently KAP (knowledge, attitude and practice) study in different countries *viz* Myanmar (Hla-Shein *et al*, 1998), Colombia (Nieto *et al*, 1999) and Malawi (Slutsker *et al*, 1994). The KAP study is becoming more important to design and improve malaria control activities, to establish epidemiological and behavioral baselines and to identify indicators of monitoring programs (Schultz *et al*, 1994).

In the present study, the majority of the people in the study areas did not have a clear-cut knowledge on transmission of malaria. With regards to knowledge and behavior for protection measures of malaria, the illiterate group scored significantly lower than the educated group and their usage of bed nets was not proper. It is important to develop educational material oriented towards strengthening knowledge as well as giving new knowledge and sustaining practices that prevent malaria infection in different villages.

ACKNOWLEDGEMENTS

This study was supported by Grant-in-Aid for Scientific Research (B) (11691217) from the Japanese Ministry of Education, Science, Sports, and Culture, and performed under Lao/Japan Medical Cooperation Project by JICA (Japan International Cooperation Agency). We wish to thank Dr Yong Hoi Sen, Faculty of Science University of Malaya, for reading the manuscript and useful comments. We also would like to thank all staff members in CMPE and provincial Health Office, Khammouane Province for cooperation during the course of this study.

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