

《 特別寄稿 》

The Need for Culture-Friendly Mosquito Bed-Nets in Rural Lao PDR

Eiko KANEDA

Co-author: Tiengkham PONGVONGSA (Savannakhet Malaria Centre, Lao PDR)

Summary

The mosquito bed-net is considered one of the most effective preventive measures against malaria. Although the World Bank offered loans for mosquito bed-nets worldwide, there has been no data on the usage of bed-nets in Laos. Most villagers in Laos use mosquito bed-nets; however, the size of the houses in this region is too small to allow for the use of mosquito bed-nets. Moreover, the maintenance of the mosquito bed-nets is insufficient. This paper highlights the importance of providing villagers with mosquito bed-nets as well imparting health education customized according to the culture of the region.

Background

The effectiveness of mosquito bed-nets, especially insecticide-treated bed-nets, is proven. For example, the bed-net has decreased the mortality rate of children under five in Gambia, Kenya, and Solomon Islands.⁽¹⁾⁽²⁾⁽³⁾ However, bed-nets have been misused

(1) D'Alessandro U, Olaleye BO, McGuire W, Langerock P, Bennett S, Aikins MK, Thomson MC, Cham MK, Cham BA, Greenwood BM. Mortality and morbidity from malaria in Gambian children after introduction of an impregnated bednet programme. *Lancet*. 1995;345 (8948):479-83.

(2) Beach RF, Ruebush TK 2nd, Sexton JD, Bright PL, Hightower AW, Breman JG, Mount DL, Oloo AJ. Effectiveness of permethrin-impregnated bed nets and curtains for malaria control in a holoendemic area of western Kenya. *Am J Trop Med Hyg*. 1993;49 (3):290-300.

in some communities in Asia and Africa. In Lao PDR, for example, the nets are sometimes used for capturing frogs and in vegetable cultivation. The nets are even sold in the market. According to demographic and health survey reports in Uganda, ensuring that 60% of the households have at least one mosquito bed-net will not necessarily protect children under the age of five from malaria.⁽⁴⁾

In Lao PDR, the World Bank offered loans for the distribution of mosquito bed-nets from 1999 to 2003, and the Global Fund has taken over this effort since 2005. As a result, the slide positive rate for malaria observed in Sepon district hospital decreased from 28.1% in 1997 to 11.2% in 2005.⁽⁵⁾ Although malaria has been effectively prevented in most regions in Lao PDR, hot spots still remain in some parts of country. This paper describes the usage of mosquito bed-nets by the ethnic minority in the Sepon district of Lao PDR and the need for these nets to be more culturally friendly.

Materials and Methods

Study site

A satellite image was used to predict the malaria endemic area in three Lao Theung minority villages, Kalouk-mai, Kalouk-kao, and Kaleng-kang, in Sepon district in the Savannakhet province. These three villages are located within 1.2 km of each other inside the forest. Since these villages cannot be easily accessed because of poor transportation services and bad road conditions, especially during the rains, these villages are almost isolated from other Laotian villages. Subsistence farming; slash-and-burn agriculture for self sufficiency; sale of iron scrap left from the Vietnam War to Viet-

(3) Yohannes K, Dulhunty JM, Kourleoutov C, Manuopangai VT, Polyn MK, Parks WJ, Williams GM, Bryan JH. Malaria control in central Malaita, Solomon Islands. 1. The use of insecticide-impregnated bed nets. *Acta Trop.* 2000;75 (2):173-83.

(4) Mugisha F, Arinaitwe J. Sleeping arrangements and mosquito bed-net use among under-fives: results from the Uganda Demographic and Health Survey. *Malar J.* 2003;2 (1):40.

(5) Malaria Station in Savannakhet province. Malaria Situation in Savannakhet 1997-2005. *Annual Malaria Report in Malaria Station, Savannakhet Province* 2006. (unpublished).

namese, who regularly visit the area; and stock animals constitute the major sources of income.

Large mosquito bed-nets without borders (190 × 180 × 150 cm) were distributed to all villagers in 2004 (insecticide-treated mosquito bed-nets) and 2006 (long-lasting nets) for 8,000 Kip (about 1 USD) each under the National Malaria Control Program.

Data collection

Accompanied by a village chief, a survey of households using observation, measurements, and interviews was conducted during the dry season from October to March. Data concerning mosquito bed-net use in households in Kalouk-mai and Kalouk-kae were gathered at the end of November 2006, and in Kaleng-kang at the end of February 2007. In order to get an impression of the prevalence of malaria, a malariometric survey of the inhabitants in the three villages was also conducted at the end of February 2007.

Observations and Measurements

To identify the nature of mosquito bed-net use, housing conditions were observed: the kind of material used for the walls and the floor, and the location of cooking area were noted. Then, all household mosquito bed-nets were counted, including unused ones.

The size of each bed-net was noted, and the number of holes in the net was counted. The length and width of each sleeping area was measured and plotted on a layout. Finally, the number of individuals in a household that used the mosquito bed-net was determined. After the field survey, the distance between the mosquito bed-net and the wall was calculated. The average numbers of individuals that use a single bed-net in Lao PDR is up to five people, including a child. Moreover, the distance between the mosquito bed-net being used and the wall should be one meter or more. According to this national guideline, the data was divided into two categories: 'small' means the size of the mosquito bed-net was larger than that of the sleeping space, exactly the

same as the sleeping space, or the distance between the bed-net and the wall was less than one meter; and 'acceptable' means that the space between the mosquito bed-net and the walls on all four sides or other furniture was more than one meter.

Interview

Trained fieldworkers conducted interviews with household heads. If the household head was not available, the family was asked to nominate the next most appropriate person. The following questions were asked of all householders by means of a semi-structured interview: the place and the time at which the net was purchased and the interval between insecticide treatment of the nets. The effectiveness of the mosquito bed-nets was ascertained with regard to the following factors: preventing illness, protection against mosquitoes, and protection against other insects. In addition, interviewees were also asked about the purpose of mosquito bed-net use.

Malariometric surveys

Malaria diagnosis was based on two methods: microscopy and rapid diagnostic test. For microscopy, a finger-prick blood specimen of about 25 μl was collected by using a sterile lancet. Thick and thin blood films were prepared and examined under a microscope to detect the presence of malarial parasites.

For the rapid diagnostic test, OptiMAL (manufactured by DiaMed AG in Switzerland) was used. A finger-prick blood specimen of 5 μl was collected by using a sterile lancet through a microcapillary tube. The one to see the line of positive clearly and the one slightly seen were judged to be positive.

Statistical analysis

The data obtained were entered into Excel (Microsoft XP) and transferred to SPSS Releases 11.5 (SPSS, Inc., Chicago, IL) for further analysis. The chi-square test was used to compare the year of purchase with the number of net holes, and space between

the mosquito bed-net and wall and the number of net holes. A p value of <0.05 was considered statistically significant.

Ethical considerations

The Ministry of Health in the Savannakhet province approved the project at the district level. The project was also approved by the Health Development Study Project team and the ethical committee of the Institute of Tropical Medicine, Nagasaki University. The study was discussed with the chief of the villages who also accompanied us during the house visits. An informed consent form was read and signed by each participant before blood samples were obtained. Individuals with positive blood test results were administered Plasmotrim or chloroquine, according to the standard of the national drug policy in Lao PDR.

Results

The demographic characteristics and housing conditions

Table 1 shows the demographic characteristics of the subjects, house conditions, and possession of mosquito bed-net in three villages: Kalouk-mai, Kalouk-kaio, and Kaleng-kang. The total study population included 328 individuals (female: 173) and 51 children under the age of five years. Of the 60 households studied, bamboo was used for flooring in approximately 78% of the households and for making walls in 87% of the households. The houses are mainly constructed using local materials, and the floor of the house is generally raised to a high level. Only two houses were accessible without using a ladder. The kitchen was found to be located in the same place as the sleeping area in 31 (52%) households, and this was a characteristic feature of these villages. All households used firewood as their fuel. The possession of mosquito bed-nets in three villages was 147 with 51 unused. None of the nets has ever been re-impregnated with insecticide. All mosquito bed-nets were used for the intended purpose.

Table 1: Demographic characteristics and conditions of houses in three villages

Variable	study village		
	Kalouk-mai	Kalouk-kao	Kaleng-kang
Demographic			
population	78	118	132
female	42	60	71
undersr 5	12	20	19
household	17	21	25
Mediam age	24.1	20.7	20.2
Type of housing * (n=)			
floor: bamboo	(17)	(20)	(23)
wood	16	14	17
wood	1	6	6
wall: bamboo	17	15	20
wood	0	5	3
Cooking place with bedroom	10	11	10
Bed-net possession			
corrently used	29	34	33
not used	16	15	20

* One house in Kalouk-kao was under construction and two houses in Kaleng-kang were away.

Table 2: purcher year and number of holes of used mosquito bed-net

Purchase year (n=91)	Number of holes		
	no hole (%)	1-9 (%)	>= 10 (%)
2004	14 (37.8)	14 (37.8)	9 (24.3)
2006	45 (83.3)	6 (11.1)	3 (7.1)

Condition of mosquito bed-net

Table 2 presents the use of bed-nets by year 2004 and 2006. The number of households using a punctured mosquito bed-net was 35% and the number of holes was influenced

Table 3: The relationship between sleeping space and number of holes of used mosquito bed-net

House size *	Number of holes		
	no hole (%)	1-9 (%)	>= 10 (%)
small	40 (57.1)	19 (27.1)	11 (15.7)
acceptable	14 (73.7)	3 (15.8)	2 (10.5)

* small: the size of the mosquito bed-net was larger than that of the sleeping space, the size of the mosquito bed-net was exactly the same as the sleeping space, and the distance between bed-net and the wall less than one meter

acceptable: the spaces between the mosquito bed-net and the walls on all four sides or other furniture were more than one meter.

by the purchase year ($X^2 = 15.5$; $p < 0.001$). Fifty-four new nets had been used since July 2006, and 18.2% of these nets had holes after 5 months.

The results of Table 3 point out the relationship between the hung bed-net and the wall of the house. The results revealed that 78.7% ($n = 70$) of the mosquito bed-nets were not used properly.

Five people or more people can sleep per one mosquito bed-net, which is against the Laotian standard. On the other hand, a large (L) mosquito bed-net may sleep only one or two people. The numbers are 8% and 57% respectively.

In total, 158 people (79.8%) used mosquito bed-nets, including 35 children under five. Furthermore, 24 of people ($n = 203$) moved to other houses during night time only for sleep and 20 of them were teenagers, most of whom did not use a mosquito bed-net. In total, 23 people used one mosquito bed-net by themselves, and 14 of them were the head of a household.

Impression of mosquito bed-net

The impressions of the mosquito bed-nets were ascertained by interviews evaluating three criteria: preventing illness, preventing mosquitoes and preventing other insects (Table 4). The villagers believe that the use of mosquito bed-nets can prevent illness:

Table 4: Perceived effectiveness of mosquito bed-net

	Kalouk-mai (n=17)	Kalouk-kao (n=20)	Kaleng-khang (n=23)
Preventing illness			
very	14	17	15
somewhat	1	1	6
not at all	1	1	2
Priventing mosquitoes			
very	16	16	17
somewhat	0	1	6
not at all	0	1	0
Priventing other insects			
very	15	15	15
somewhat	1	2	7
not at all	0	1	1

responses were 14/17 in Kalouk-mai, 17/20 in Kalouk-kao and 15/23 in Kaleng-kang. Briefly, almost 100% of the villagers recognized the effectiveness of mosquito bed-net, especially with regard to repelling mosquitoes.

The prevalence of malaria

Table 5 presents the prevalence of malaria. Overall, 19.3% (n = 274) of the inhabitants suffered from malaria. The infection rate in the population over the age of five of each village, Kalouk-mai, Kalouk-kao and Kaleng-kang, was 16.7% (n = 60), 13.3% (n = 90) and 10.4% (n = 77), and in children under five was 76.9% (n = 13), 25.0% (n = 16) and 50.0% (n = 18), respectively; however, few people had malaria symptoms.

Discussion

Residents did use the mosquito bed-nets distributed by government; however, the malaria infection rate was still high. This finding suggests that the mosquito bed-nets were not appropriately used. We were unable to directly observe the population in this closed

Table 5: Malaria prevalence in three villages

village	n	Total	> 5 years	0-5 years
		cases (%)	cases (%)	cases (%)
Kalouk-may	73	20 (27.4)	10 (16.7)	10 (76.9)
Kalouk-kao	106	16 (15.1)	12 (13.3)	4 (25)
Kaleng kang	95	17 (17.9)	8 (10.4)	9 (50)
Total	274	53 (19.3)	30 (13.2)	23 (48.9)

society, and this is a limitation of this study.

Some of problems and their solutions are presented here. For instance, villagers continue to use nets even if they have holes.⁽⁶⁾ In addition, children in their teens who sleep in other houses at night rarely use a mosquito bed-net. Approximately >50% of the household heads used one mosquito bed-net (size L) for themselves. We found that the size of the distributed mosquito bed-nets (size L) is too large. The houses in these villages are small. The bamboo used for making walls and floors may easily tear the mosquito bed-nets. Moreover, the required re-impregnation of bed-nets with insecticide is not carried out. Most of these problems can be resolved by supervision and health education. However, problems arising due to the large size of the nets cannot be easily resolved.

On the basis of these findings, we make the following two proposals. First, although it is difficult to come to a consensus on the standard size, international organizations should consider the house sizes in the target countries and provide nets of a suitable size. Secondly, although distribution of bed-nets important, it is also important to educate villagers with regard to the use of mosquito bed-nets. Further, if the kitchen and sleeping areas are located in the same place, the nets would be in constant contact with smoke from the kitchen, and this might reduce the effect of the insecticide-treated mos-

(6) Carnevale P, Bitsindou P, Diomande L, Robert V. Insecticide impregnation can restore the efficiency of torn bed nets and reduce man-vector contact in malaria endemic areas. *Trans R Soc Trop Med Hyg.* 1992;86(4):362-4.

quito bed-nets.

Conclusion

In conclusion, there are many different types of ethnic groups in Lao PDR. It is important to know about their culture and behaviour and formulate health programmes, e.g. providing mosquito bed-nets to prevent malaria and other mosquito-related diseases, on the basis of this knowledge.

Acknowledgements

This survey was performed with funding from 'Environmental Changes and Infectious Disease in Tropical Asia project', the Research Institute for Humanity and Nature, Kyoto, Japan. We would like to thank Prof. Kazuhiko Moji (Project Chief) and Prof. Bounngong Bouppha (Director of the National Institute of Public Health, Lao PDR). We thank Prof. Masamine Jimba (the University of Tokyo) for his comments and suggestions on earlier versions of this manuscript. We also thank the villagers and the staff of the National Institute of Public Health, Lao PDR and Savannakhet Malaria Centre, Lao PDR.

—かねだ えいこ・法学部専任講師—
—ティエンカム・ボングボングサ・ラオスサバナケット県マラリアセンター・センター長—