

**Socio-behavioral study on malaria prevention and control among forest related workers in hard-to-reach areas**

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This study was done to determine the socio-behavioral factors on malaria prevention and control among the forest related workers in hard-to-reach areas of Pyin Oo Lwin Township. Community-based cross-sectional survey was carried out by collecting data on socio-demographic characteristics, knowledge, practice and behaviors of forest related workers using both quantitative and qualitative approaches. Study population consisted of people who were working at the forest related jobs in hard-to-reach areas of the township. A total of 204 workers were interviewed using pre-tested, closed-ended questionnaire. Twenty males and ten females of forest related workers were discussed at three focus group discussion (FGD) sessions. Among 204 interviewees, 149 (73%) had history of malaria and only 55 (27%) were free from malaria during the last two years. A total of 141 workers did not use the bed net. The old aged persons of frequent living in the forest without using bed net were having greater risks for getting malaria infection than the bed net users ( $p=0.001$ ). Their reasons for not using bed nets were unaffordable condition and inconvenience for hanging of bed nets in the forest. According to the recommendations, the forest related workers should be supplied with specific kind of bed nets which are convenient for using in the forested sites.

## INTRODUCTION

In Myanmar, malaria is the major health problem, like other developing countries in the world. About 20% of the people in Myanmar live in the malaria endemic forested areas. Moreover, migrating workers are gathered in the developmental projects located in forested sites, like construction of road and dam, mining of gold and gem and so on [1]. The migrant population needs to use preventive activities, such as carrying and using of bed nets. The most common reason for not having a bed net is the lack of money to buy one [2]. Many migrant workers sleep in the forest without bed nets. Only small, thin blankets, such as sarongs, are used to protect their bodies from mosquitoes and cold weather [3]. Migratory populations prevent against mosquito bites and cool weather by making fires. They use

cotton blankets because of their inability to afford bed nets [4].

Pyin Oo Lwin Township has been supplied with adequate rapid diagnostic test (RDT) kits and artemisinin-based combine therapy (ACT) at rural sub-health center level without interruption by vector borne disease control (VBDC) program since 2003. There has been also free provision of insecticide treated nets by non-government organization and international non-government organization for special activity sites since 2002. According to the yearly report by Pyin Oo Lwin Township, malaria morbidity and mortality rates become decreased along with these malaria control actions [5]. Although malaria prevalence was reduced, malaria was still endemic in the forested areas. This study was done to determine the socio-behavioral factors on malaria prevention and control among the forest

related workers in hard-to-reach areas of PyinOoLwin Township.

## MATERIALS AND METHODS

Community-based cross-sectional survey method was carried out by collecting data using both quantitative and qualitative approaches. Study population consisted of people who were working at the forest related jobs such as, distant farming, fire-wood making, wood cutting, fishing, working at special activities like road and dam construction in the forested areas. The study was done at the forests, forested foot hill and special project sites located at hard-to-reach areas which are more than two hours walking distance away from health centers of Wat Won, Pyin Sar and Kyar Twin Yae village tracts. A total of 204 number of forest related workers were interviewed with pre-tested, closed ended questionnaire. Three focus group discussion (FGD) sessions were done for qualitative approach. Environmental risk factors were investigated using check-list to assess the factors relating vector breeding places in one mile distance from the houses of the respondents.

The responses in the questionnaires were compiled, coded, entered into computer using SPSS 11.5 software and analyzed by R 2.9.0 software. The associations between the determinants of malaria and disease occurrence were analyzed. The crude odds ratios (OR) with 95% confidence intervals (CI) were calculated. The education of the respondents was categorized as illiterate, primary, middle, high school, university and graduate level according to their levels at which they had attended. Education levels were given with marks from 0 to 5 according to their levels. The occupations of the respondents were also categorized as distant farmers, laborers, mechanic workers, job owners and government staff. In the same way, occupation levels were also given score from 1 to 5. Personal income of the respondents was also divided into three

groups with, income of less than 60000 kyats a month, 60001 to 100000 kyats a month and more than 100000 kyats a month. Similarly, income levels were given marks with score 1 to 3 according to their increasing amount of income.

According to the composite scale of the education, occupation and income of the respondents, the forest related workers were classified as skilled workers if the scale was 6 and above and classified as unskilled workers if the scale was less than 6. The disease occurrence was investigated using history of malaria in forest workers. Persons with history of malaria were defined as any workers who had history of confirmed malaria within two years according to diagnosis with RDT or microscopy at any health center or who had ever taken antimalarial treatment either for infection due to falciparum and vivax. Persons with no history of malaria were defined as workers who had no history of confirmed malaria according to diagnosis with RDT or microscopy at any health center and who had no history of taking antimalarial treatment within two years.

## RESULTS

### *Characteristics of forest related workers*

According to the interviews, age, sex, marital status, educational status, kinds of occupation in the forest and monthly income of studied population were described in Table 1. Among the workers, 88.7% of them worked in the day time. However, 11.3% worked their jobs both in the day and night time. About two thirds of the studied populations were working in the forest for two to three years. However, 38% of the workers had been working in the forest for longer duration, i.e. more than three years. More than half, i.e. 57% of the studied workers were working in the forested areas located within 8 miles distance from health centers. The rest were working in the areas located over 8 miles far from health centers. Among the forest related workers,

149 (73%) had history of malaria and only 55 (27%) were free from malaria in the last two years.

Table 1. Background characteristics of forest related workers (n=204)

Factors	Frequency	Percent
<i>Age (in completed years)</i>		
15 – 24	45	22.1
25 – 34	54	26.5
35 – 44	38	18.6
Above 44	67	32.8
<i>Gender</i>		
Male	130	63.7
Female	74	36.3
<i>Marital status</i>		
Unmarried	55	27
Married	149	73
<i>Education</i>		
Illiterate	19	9.3
Primary level	130	63.7
Middle level	36	17.6
High level	15	7.4
University level	3	1.5
Graduate	1	0.5
<i>Occupation</i>		
Distant farmer	160	78.3
Laborer, firewood maker, wood cutter	21	10.3
Mechanic	14	6.9
Job owner	5	2.5
Government servants	4	2
<i>Day/ night worker</i>		
Day time worker	181	88.7
Day & night time worker	23	11.3
<i>Monthly income</i>		
10000 kyat to 60000 kyat	164	80.4
60001 kyat to 100000 kyat	29	14.2
100001 kyat and above	11	5.4
<i>Working duration in forest</i>		
2 to 3 years	126	61.8
More than 3 years	78	38.2
<i>Distance between forest and health centers</i>		
8 miles and less	118	57.8
More than 8 miles	86	42.2
<i>Socio-economic status of the workers</i>		
Upper or skilled workers	62	30.4
Lower or unskilled workers	142	69.6
<i>History of malaria among the workers within two years</i>		
Yes	149	73
No	55	27

### Knowledge on malaria

This study also assessed their knowledge on malaria concerning about cause of malaria, biting time of malaria vector, signs and

symptoms of malaria, diagnosis of malaria, treatment seeking places and sources of bed net impregnation. These results are shown in Table 2. Among the workers, 55.4% knew the cause of malaria (i.e. mosquito bite). However, 13.3% of forest workers misunderstood the cause of malaria and the rest did not give any comment.

Table 2. Knowledge on malaria (n=204)

Factors	Frequency	Percent
<i>Cause of malaria</i>		
Mosquito bite	113	55.4
Drinking stream water	19	9.4
Swimming or bathing in forest	8	3.9
Don't know	64	31.3
<i>Biting time of malaria mosquito</i>		
Night time	99	48.5
Day time	15	7.4
Don't know	90	44.1
<i>Knowledge on signs &amp; symptoms of malaria</i>		
Know more than 3 symptoms	25	12.3
Know 1 to 3 symptoms	153	75
Don't know	26	12.7
<i>Knowledge on diagnosis of malaria</i>		
Rapid diagnostic test	30	14.8
Microscopy	122	57.4
Clinically	24	11.8
Don't know	41	20.1
<i>Knowing the treatment seeking places for malaria</i>		
Know the places (health center, clinic, hospital)	185	90.7
Don't know	19	9.3
<i>Knowing the persons who are malaria care providers</i>		
Know the providers (basic health staff etc.)	130	63.7
Don't know	74	36.3
<i>Knowing the sources of impregnating the bed net</i>		
Know the sources (when, where, who)	95	46.6
Don't know	109	53.4
<i>Knowledge on course of antimalarial treatment</i>		
Know the full course	99	48.5
Don't know	105	51.5

About half (48%) of the studied populations knew the biting time of mosquito causing malaria (i.e. night time). The correct time, place and person relating sources of impregnation of the bed nets in the community areas, were mentioned properly by about half of the studied populations (i.e. 46.6%). Half of the studied populations could mention about the full course of antimalarial treatment according to national guideline.

### *Practice and behaviors of forest related workers*

A total of 204 forest related workers were interviewed to investigate their behavior and practice on personal protection against malaria. These are described in Table 3.

Table 3. Practice and behaviours of forest related workers

Factors	Frequency	Percent	
<i>Sleeping with personal protection</i>			
Without any protection	102	50.0	
With long sleeve	1	0.5	
With repito application	1	0.5	
Beside smoky fire	3	1.5	
With blanket	34	16.7	
With bed net	63	30.8	
<i>Reasons for not using bed net (n=141)</i>			
Not habitual to	42	29.8	
No mosquito and no bite	35	24.8	
Not afford to buy	19	13.5	
Hot	18	12.8	
Not get enough air	15	10.6	
No relevant reason	12	8.6	
<i>Regular impregnation among bed net user (n = 63)</i>			
Impregnate the bed net regularly	6	9.5	
Not impregnate the bed net	57	90.5	
<i>Reasons for not impregnating the bed net (n = 57)</i>			
Not habitual to	2	3.5	
No mosquito and no bite	1	1.8	
Not afford to go	1	1.8	
Not accessible	10	17.5	
Not know sources (where, when, who)	35	61.4	
No relevant reason	8	14	
<i>Taking full course of drug among persons with malaria (n = 149)</i>			
No	29	19.5	
Yes	120	80.5	
<i>Reasons for not taking the full course of drug (n = 29)</i>			
Recovery from fever	11	37.9	
Nausea, vomiting and dizziness	8	27.6	
Kept the drug to take for the next malaria attack	4	13.8	
Not afford to go	3	10.3	
Change to another health provider	2	6.9	
Not accessible	1	3.4	
<i>Health seeking behavior</i>			
	1 <sup>st</sup> action n=149(%)	2 <sup>nd</sup> action n=55(%)	3 <sup>rd</sup> action n=15(%)
Self-medication	23(15.4)	2(3.6)	1(6.7)
Family member	4(2.7)	-	-
Drug seller	4(2.7)	-	-
Traditional healer	5(3.4)	1(1.8)	-
Quack	6(4.0)	4(7.2)	-
Volunteer health worker	7(4.7)	3(5.4)	1(6.7)
Basic health staff	41(27.5)	22(40)	7(46.6)
Doctor	21(14.1)	17(30.9)	3(20.0)
Hospital	38(25.5)	6(10.9)	3(20.0)

Half of the studied workers did not sleep with any personal protection such as bed net, blanket, repito application, mosquito coils or sleeping beside smoky fire. Only 63 of them (31%) had behavior of sleeping with bed net in the forest. A total of 141 workers did not use the bed nets. The main reason for not using the bed nets was that they were not habitual to use the bed nets in the forest. Another foremost reason was that there was no mosquito in the forest. Third reason was that they were not affordable to buy the bed nets. Among the bed net users, only 9.5% impregnated their bed net regularly and 90.5% did not impregnate their bed nets regularly. The major reason for not impregnating the bed nets was that they did not know the time of impregnation, the place of impregnation and the persons who are conducting the impregnation of the bed nets in the community. Among 149 of the respondents who had history of malaria, 80% took the full course of anti-malarial treatments. The rests took partial treatments. The majority of them stopped the course as soon as they recovered from fever.

The second leading reason for not taking full course was because of fear of side effects of drug. According to health seeking pattern stated by the respondents, the majority of workers took the treatment from the health staffs at the first action. However, 15% of them took self-medication at home in the first action and some of them took self-medication at home even in the second and third actions for malaria episodes.

### *Environmental risk factors*

According to the checklist of environmental risk factors for mosquito breeding places such as streams, rice fields, swamp, hoof-marks, cowshed and outdoor shelters were predominantly found in the 94%, 90%, 68%, 95%, 79% and 85% of the environments of residues of the respondents, respectively. Bamboo cottages and huts without wall were the commonest housing type resided by 50% and 47% of the forest related workers, respectively.

### *Bivariate and multivariate analysis with logistic regression*

Forest related workers with the age of above 24 years, were 2.5 times more vulnerable to malaria infection compared to younger workers. Similarly, the workers who lived in the forest for more than 3 years were 2.2 times more susceptible to malaria infection than the workers who lived in the forest for shorter duration. The respondents who were living near the slow running streams were 4.9 times more likely to expose the infection than the others. In the same way, those living near the rice fields were 4.3 times more likely to expose to the infection than the others. The workers with the behaviors of sleeping without bed nets were 11 times more likely to get malaria infection than the bed net users.

Multivariate analysis with logistic regression was done with the variables which were significant in bivariate analysis. According to logistic regression, bed net non-users if they were old aged, living longer duration in the forest in presence of streams and rice fields near their houses were 13.5 times more liable to be transmitted by the infections than the others. These are explained in Table 4.

### *Focus group discussion*

Three sessions of FGD were conducted separately at three villages: Wat Won, Pyin Sar and Kyar Twin Yae. Discussions were done with twenty males and ten females of workers with the age of 15 to 60 years. Both males and females were consisted in each group. Thematic ideas concerning signs and symptoms of malaria, cause of malaria and their practice and behaviors malaria prevention and control were discussed.

### Theme concerning with signs and symptoms

The respondent from Kyar Twin Yae village said “*I had suffered from unconsciousness during malaria fever.*” The majority of respondents from each discussion said that “*We experienced with chilling, rigors and fevers during attack.*”

Table 4. Bivariate and multivariate analysis between risk factors and malaria occurrence

<b>Bivariate analysis</b>				
Factors	No malaria	Malaria	Crude OR (95%CI)	p value
<i>Age</i>				
15 to 24 years	19	26		
Above 24 years	36	123	2.5 (1.16-5.29)	0.013*
<i>Duration of stay (In forest)</i>				
2 to 3 years	41	85		
> 3 years	14	64	2.2 (1.06-4.75)	0.024*
<i>Streams (In environment)</i>				
Absence	8	5		
Presence	47	144	4.9 (1.33-19.83)	0.007*
<i>Rice fields (In environment)</i>				
Absence	12	9		
Presence	43	140	4.3 (1.55-12.42)	0.003*
<i>Knowledge</i>				
<i>Biting time of mosquito</i>				
Know	29	69		
Not know	26	80	1.3 (0.66-2.52)	0.4
<i>Behavior</i>				
<i>Sleep pattern</i>				
Sleep early	5	10		
Sleep lately	50	139	1.4 (0.35-4.72)	0.5
<i>Bed net using</i>				
User	38	25		
Non-user	17	124	11 (5.12-24.2)	0.000*
<b>Multivariate analysis with logistic regression</b>				
Factors	Crude OR (95%CI)	Adjusted OR (95%CI)	P (LR test)	
<i>Bed net</i>				
Non-user vs user	11.1 (5.42-22.67)	13.5 (6.06-30.2)	<0.001***	
<i>Duration of stay</i>				
>3 years vs 2 to 3 years	2.2 (1.11-4.39)	2.6 (1.11-6.09)	0.023*	
<i>Running streams</i>				
Presence vs absence	6.2 (1.78-21.42)	5.5 (1.13-26.94)	0.032*	
<i>Rice fields</i>				
Presence vs absence	4.3 (1.71-11)	3.0 (0.91-9.62)	0.073	
<i>Age</i>				
Above 24 years vs 15 to 24 years	2.5 (1.24-5.02)	1.9 (0.79-4.58)	0.156	

LR test = Logistic regression test

These discussions were practically same as the symptoms of malaria disease.

#### Theme relating with causes of malaria

The participants from Pyin Sar and Kyar Twin Yae villages talked about the causes of malaria with *“We got malaria when we had unsafe water and fruit in the forest.”*

However, most of the participants of three groups discussed similarly as those answered in the questionnaire with *“Mosquito bite might make malaria.”*

Some participants from Wat Won village also said that *“We suffered malaria if we had imbalanced body temperature and reduced resistance to disease.”*

Strangely, one participant from Wat Won village shared his experience with *“Surely, one would get malaria if he did taboo or wrong doing in the forest.”*

#### Theme relating practice and behavior

Some of the participants from Pyin Sar and Kyar Twin Yae villages talked about self-medication as responded in questionnaire with *“Malaria was cleared if we took self-medication orally with combination of dried viscera of porcupine, carbon of fire smoke and turmeric powder.”*

Majority of participants of three groups pointed out their practices with *“We were secured from malaria by drinking safe or boiled water, sleeping beside fire and eating safe food.”*

Some discussed as suitably as they answered in the questionnaire *“Sleeping under the bed net was good if we could do like that.”*

Unexpectedly, some participants from Kyar Twin Yae said their reason for not using bed net with *“Oh! hanging of bed net was inconvenient for sleeping sites in the forests.”*

Some participants of Wat Won also gave reason with *“We had no extra bed net to use in the forest. We possessed only one which was just enough for our family.”*

This discussion was the same as the responses in questionnaire.

## DISCUSSION

Majority of people in this study area expressed the inadequate understanding of malaria transmission and symptoms. On the contrary, a study in Indonesia found that 69% of people correctly responded with mosquito bite as causes of malaria. Incorrect responses included stagnant water, bad climate, unclean environment and unsafe food in that study [6]. Regarding symptoms of malaria, majority of respondents from both studies could state the correct symptoms. The present study found that only 55.4% of respondents had knowledge on cause of malaria with mosquito bite, 9.4% with drinking stream water and 3.9% with bathing or swimming in the forest.

Majority of the people in this study area had proper health care seeking practice for malaria. They took health care from health staffs of proper health centers with full course of antimalarial treatment. Only 20% of them did not take full course of treatment as they had misunderstanding in treatment completion course. Study in northern Sri Lanka found that the main reasons for not taking full course of treatment were side effects (57.6%) and clear of symptoms (16.7%) [7]. Similarly, the present study found that the reasons for not taking full course regime, were given by 37.9% and 27.6% of respondents with recovery from symptoms and fear of side effects, respectively. Survey of treatment seeking behavior in rural Ethiopia showed that community health workers were the source of the first action treatment seeking persons [8]. The majority of respondents in the present study took health care from basic health staff in every action for malaria episodes. However, fifteen percent of participants took self-medication in the first action. Therefore, most of people in this area had good health seeking behaviors although some took self-medication at home.

Risk factor survey in Thailand also detected that population movements, irregular use or non-use of mosquito nets, behavioral risk

factor such as delayed treatment, improper treatment seeking pattern were main risk factors for malaria infection [9]. Similarly, some risk factors for malaria appeared from this study. Older age, living longer duration in the forest, non-utilization of bed net and presence of environmental factors such as running stream and rice fields were significantly associated with disease occurrence in the present study.

Risk factors survey in the Philippines revealed that age greater than 30 and being a migrant were all found to be significant risk factors [10]. In the same way, the present study also found that the age older than 24 years and being a migrant were significant risk factors.

### Conclusion

The forest workers in the study area had inadequate knowledge on malaria. The majority of respondents had very risky behavior like non-utilization of bed net in the forest. Their reasons for not using bed nets were unaffordable condition and inconvenience for hanging of bed nets in the forest. This study also revealed another risk behaviors of non-impregnation of bed net regularly although there were availabilities of impregnation. Moreover, they had behavior of taking self-medication with traditional plants and animals' viscera. According to this study, bed net non-users if they were old aged, living longer duration in the forest in the presence of streams and rice fields near their house, had greater risks for getting malaria infection than the others.

### Recommendations

- (1) The forest related workers residing in the forested area should be educated with health issues concerning malaria prevention and control.
- (2) The forest related workers should be encouraged the practising the utilization of insecticide treated net and regular impregnation.
- (3) The forest related workers should be supplied with specific kind of bed nets

those are convenient for using in the forested sites.

- (4) They also should be given information on awareness of accurate sources of impregnation of bed net in the community.

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