ASSESSMENT OF FACTORS ASSOCIATED WITH FEVER AMONG MIGRANTS IN YALA PROVINCE, SOUTHERN THAILAND

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Abstract. Cross-border migration is one of the factors contributing to the spread of malaria. Malaria is a public health problem in Yala Province, southern Thailand. Fever is a symptom suggestive of malaria in malaria endemic areas. In this study, we aimed to determine the incidence of fever among migrants during the previous three months, the proportion of migrants who sought healthcare for fever and were tested for malaria, and the factors associated with seeking healthcare when having a fever in order to inform malaria elimination programs in the study area. We conducted a cross-sectional survey of migrants in thirty malaria transmission villages/hamlets in four districts of Yala Province, Thailand during July to October 2019. Subjects were chosen by targeted sampling at each selected village/hamlet based on an established quota. The number of study subjects was chosen using the proportion of migrants who had fever during the previous two weeks (3.5%) reported in a previous survey in Thailand. Each subject was interviewed face-to-face by a trained volunteer using a pilot-tested questionnaire to obtain data regarding history of fever during the previous three months, types of healthcare services they chose, whether they got tested for malaria, their knowledge about malaria and insecticide-treated net use, socio-demographics and movement characteristics. After data collection, questionnaire results were coded and quantified. The socio-demographic and knowledge factors associated with seeking healthcare service for fever were assessed using logistic regression analyses. A total of 414 subjects were included in the study, 71.5% males. The mean (± standard deviation) age of study subjects was 29.9 (±9.3) years. Thirty-six point five percent of subjects had fever during the previous three months; 18.7% sought healthcare services for fever and 16.4% were tested for malaria. Of the subjects who sought healthcare services for fever, 46.5% went to a village health volunteer, 34.8% visited a malaria post in the village and 18.0% went to a private clinic. Of those who did not seek health care, 45.7% self-treated. Twenty-six point eight percent of the total study subjects received malaria-related health education. On multivariable analysis, factors significantly associated with seeking healthcare service were: knowing that malaria required treatment (odds ratio (OR): 4.03; 95% confidence interval (CI): 1.52-10.65; p=0.020), and working in or spending the night in the forest (OR: 4.86; 95%CI: 2.01-11.78; p=0.011). In our study, about one third of subjects had fever during the previous 3 months, about half of whom sought healthcare and most of these were tested for malaria. Factors significantly associated with seeking healthcare for fever were having a knowledge that malaria needed treatment and working overnight in the forest. Healthcare seeking among

study subjects with fever was inadequate and self-medication was a common practice. Further studies are needed to determine if educating the population in the study area regarding malaria will increase treatment seeking behavior and decrease the incidence of malaria in the study area.

Keywords: Migrants, Malaria, Yala, Thailand.

INTRODUCTION

Nearly one billion people worldwide are migrants (Bell and Charles-Edwards, 2013). Developing countries are affected more commonly by migration than developed countries (Borkowska *et al*, 2018). The highest rates of migration are within and between developing countries in Asia and Africa (IOM, 2018). The lifestyles of migrants change dramatically when they migrate (Naing *et al*, 2012). Migration can affect transmission of vector-borne diseases (WHO/EUROPE, 2018), such as malaria (Wangroongsarb *et al*, 2016). Migration can increase the risk of malaria transmission and re-introduce malaria to areas where it had been previously eradicated (Tipmontree *et al*, 2009).

In the Greater Mekong Subregion, *Plasmodium falciparum* has become resistant to artemisinin-based combination therapy, which has been the most commonly used treatment for malaria in several countries of the region, including Thailand (Edwards *et al*, 2015). There is a fear these resistant parasites will spread to other parts of the world, resulting in malaria epidemics that hamper malaria control (Bloland, 2001). To prevent this, all patients with suspected malaria should be diagnosed and treated as early as possible to reduce the risk of spread (WHO SEARO, 2015). In malaria-endemic areas, malaria should be suspected in any patient presenting with a history of fever ($\geq$37.5°C) and no other obvious cause (WHO, 2015). Cross-border migration, delays in seeking healthcare for fever and use of substandard drugs can contribute to malaria epidemics and spread of resistant parasites (Jacobson *et al*, 2017).

Southern Thailand shares a border with Malaysia; 7.1% of Thailand's malaria cases in 2012 occurred in Thailand's southern provinces (Thailand Malaria Elimination Program, 2019). The proportion of malaria cases in Thailand's southern provinces increased to 51.7% by 2016 (Thailand Malaria Elimination Program, 2019) due to malaria outbreaks in Yala Province, one of the southern provinces of Thailand. Forty percent of malaria cases in Thailand were from Yala Province in 2016 (Thailand Malaria Elimination Program, 2019). The Department of Disease Control, Ministry of Public Health of Thailand changed malaria control strategies to malaria elimination strategies in 2016 (Bureau of Vector Borne Diseases, 2016) and the result was that by 2019, malaria cases in the southern provinces of Thailand comprised 30.3% of the total cases nation-wide (Thailand Malaria Elimination Program, 2019). However, Yala Province still had the second highest number of malaria cases nation-wide in 2019 (25.2% of Thailand's

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total cases) (Thailand Malaria Elimination Program, 2019).

Southern Thailand has the fastest growing migrant population in Thailand, more than doubling from 2015 to 2019, adding an additional 229,712 migrants during that period (UN Working Group on Migration, 2019). Migration studies along the Thai-Cambodia and Thai-Myanmar borders conclude undocumented workers in those areas who do not access malaria health services and do not use protective measures are probably the origin of active malaria transmission along those borders (Wangroongsarb *et al*, 2011).

It is important to assess malaria risk among migrant populations since they may be a reservoir for malaria infections (Guyant *et al*, 2015). There are no prior studies of malaria among migrants in Yala Province. In this study, we aimed to determine the incidence of fever in the study population during the previous 3 months, the proportion of subjects who sought healthcare for their fever and the sources they sought, the proportion that were tested for malaria and the factors associated with seeking healthcare when having a fever. The information obtained from this study can inform efforts to develop effective malaria elimination interventions among migrant populations in Yala Province to eliminate transmission of malaria.

MATERIALS AND METHODS

Study design and setting

We conducted a cross-sectional survey among migrants aged ≥18 years who were willing to participate in the study in four malaria transmission districts of Yala Province, southern Thailand. Exclusion criterion was being unable to communicate verbally.

Sample size

The sample size was calculated to give a precision of that fell within a 95% confidence interval (CI) and was based on an estimated proportion of migrants who experienced fever in the previous 2 weeks of 3.5% among the study population (Malaria Consortium, 2016). Since the proportion of subjects who experienced fever during the previous 2 weeks is expected to be lower than the proportion of subjects who experienced fever during the previous 3 months, the proportion used for the calculation (3.5%) then the minimum number of subjects required based on this calculation should be more than adequate. The minimum sample size calculated to be needed for the study was 412 subjects.

Sampling approach

Two-stage cluster sampling was used in this study. Districts having the greatest number of reported malaria cases were chosen as the primary sampling units and in these areas the foci (villages/hamlets) where malaria was reported to be transmitted were chosen as the secondary sampling units. Of the eight districts in Yala Province, four were chosen as study areas based on the cluster sampling method described above. The number of subjects sampled at each of the four study sites was based on the minimum necessary sample size. People living within malaria transmission foci areas were recruited until the required minimum number of subjects was obtained. We identified the main sites, occupations, workplaces, residences, populations, and lifestyles of migrants in the study area using the help of informants in this migrant population. A preliminary mapping of migrant sites was also done in the selected villages/hamlets.

Study instrument and data collection

We held group discussions with selected migrants in order to develop a questionnaire for the cross-sectional study. The questionnaire consisting of 4 sections was pilot tested on 30 study subjects at one of the migrant sites in the study area. Modification of the pilot tested questionnaire was made based on the feedback obtained.

Section 1 of the questionnaire asked about socio-demographic variables: age, gender, ethnicity, occupation, education level, duration of having lived in Thailand, Thai language skill and if they had any migration-related documents.

Section 2 asked about movement characteristics: their residence prior to current locations, reasons for migration, how they migrated into Thailand and if they had any plan to move in the next 6 months.

Section 3 asked about whether they experienced fever during the previous three months, sought any healthcare services for their fever, if they had been tested for malaria, what the test results revealed and if they received any anti-malarial treatment if they tested positive. In this section, their choices of healthcare services, reasons for their choices and barriers to access the healthcare services were also asked.

Section 4 asked if migrants had previously received any malaria-related health education. If the subject had, then their knowledge about malaria and the use of insecticide treated nets (ITNs) were assessed.

Face-to-face interviews were conducted in the migrant's own language by trained volunteers during July-October 2019.

Data management and analysis

Questionnaires were checked, coded, rechecked, and paper-based data were entered independently by two data entry clerks with unique identifiers (IDs) using Open Data Kit open-source software 2016 (https://getodk.org). The data were then exported in .csv format into Microsoft Excel application 2016 (MicrosoftCorp, Redmond, WA), compared for discordant entries and subsequent correction of the erroneous entries, and transferred into Stata format. Stata, version 13.0 (StataCorp LLC, College Station, TX) was used to clean and analyze the data. Survey analysis was applied to account for clustering. We used descriptive statistics to describe the socio-demographic characteristics of the study subjects. Means and standard deviations were used to describe continuous variables, such as age, while numbers and weighted percentages were used to describe categorical variables, such as gender, ethnicity, and occupation. To evaluate the association between seeking healthcare services for fever and independent factors, we used logistic regression analyses. Occupational types were re-categorized as forest goers (rubber tappers) and non-forest goers (other occupational groups), and migration-related documents into having health insurance and not having health insurance, to facilitate statistical analysis. Variables with a p-value<0.2 on bivariate analysis were included in multiple logistic regression analysis. Forward stepwise multiple logistic regression analysis was used to select variables to be included in the final model. The probabilities for removal and entry of variables in the final model were set at 0.10 and 0.05, respectively. On logistic regression analysis, we calculated odds ratios (ORs) and 95% confidence intervals

(95%CIs). A p-value <0.05 was considered significant. Socio-demographic and migration characteristics and knowledge factors were compared between forest goers and non-forest goers using the Rao-Scott chi squared test (Wald statistic).

Ethical approval

This study was approved by the Institutional Review Board (IRB), Faculty of Medicine, Chulalongkorn University (COA No. 777/2019). Each subject gave written informed consent prior to inclusion in the study and were notified they could withdraw at any time.

RESULTS

A total of 414 subjects were included in the study, 71.5% males, giving a male:female sex ratio in our study of 2:1. Thirty-nine point five percent subjects were from Myanmar. The mean (±SD) age of study subjects was 29.9 (±9.3) years. Thirty-eight point six percent of subjects had a primary school education level and 30.4% had a middle school education level. Fifty point four percent of subjects could speak Thai. Twenty-six point four percent of subjects were laborers; 61.3% have been living in Thailand for more than six months. Fifty-two point nine percent of subjects held migrant health insurance and 21.7% had no migration-related documents (Table 1).

Fifty-nine point nine percent of subjects had been living in the study province prior to moving to the study area; 38.7% had been living outside Thailand prior to moving to the study area. Fifty-nine point six percent of study subjects had migrated to Thailand seeking work and 9.4% were in transit to another country. Of the subjects who arrived in Thailand during the previous 6 months, 57.4% had crossed the border via a regular checkpoint and 30.7% had crossed into Thailand at an unofficial crossing point (river/forest) (Table 2).

Of the 414 study subjects, 36.5% experienced fever in the previous 3 months, 18.7% (51.3% of the 166 subjects who experienced fever) sought healthcare services for fever, 16.4% (44.9% of the 166 subjects who experienced fever) were tested for malaria, 7% (19.1% of the 166 subjects who experienced fever) stated they tested positive for malaria and 4.2% (11.5% of the 166 subjects who experienced fever) received anti-malarial treatment (Fig 1). Those who did not receive treatment were rubber tappers and had tested positive for malaria at a private clinic; received symptomatic treatment and were then referred to a government hospital since the clinics did not have anti-malarial medication. However, these subjects did not go to a government hospital to receive proper anti-malarial treatment. The numbers and proportions of those who self-treated or went to another clinic, and if the treatment they used relieved their symptoms were not collected.

Fifty-three point six percent of study subjects with fever sought healthcare; 46.5% from village health volunteers. Thirty-four point eight percent from malaria posts, which are community-based malaria services at the village level, 18.0% from private clinics and 0.7% from a drug store (Table 3). The reasons given for seeking healthcare at those places were: convenience (85.8%) and having health insurance (58.0%). Of the subjects who did not seek healthcare, 45.7% reported they self-medicated and 30.6% went to a traditional healer.

Twenty-six point eight percent of subjects reported that they had received

Table 1
Sociodemographic characteristics (n=414).

Socio-demographic characteristics	n (weighted %)	95% CI
Mean (±SD) age in years	29.9 (±9.3)	26.9 - 33.0
Male	278 (71.5)	50.1 - 86.2
Ethnicity		
Myanmar	183 (39.5)	26.0 - 54.9
Shan	52 (12.6)	3.5 - 36.2
Karen	84 (15.4)	5.9 - 34.7
Malaysian	47 (20.0)	3.4 - 64.3
Sakai	48 (12.5)	2.4 - 45.4
Education level		
Can read and write	101 (24.9)	12.2 - 44.2
Primary school	167 (38.6)	31.7 - 46.0
Middle school	131 (30.4)	19.3 - 44.4
High school	12 (5.3)	1.0 - 24.1
Higher education	3 (0.8)	0.1 - 4.6
Thai language ability		
Can speak Thai	232 (50.4)	29.2 - 71.4
Can read Thai	138 (27.8)	13.1 - 49.4
Occupation		
Vendor	17 (3.0)	0.5 - 17.0
Laborer	88 (26.4)	13.1 - 46.2
Paddy farmer	15 (2.6)	0.7 - 9.0
Construction worker	128 (23.4)	9.8 - 46.4
Rubber tapper	116 (24.0)	8.4 - 52.2
Undefined	50 (20.5)	3.7 - 63.3
Length of time in study province		12.2 - 74.3
<6 months	126 (38.7)	25.8 - 87.8
≥6 months	288 (61.3)	
Type of migration-related documents held		
Migrant health insurance/HICS	255 (52.9)	27.5 - 76.9
HIS-PCP	36 (9.6)	2.3 - 32.0
Passport	27 (15.9)	1.5 - 70.8
No document	96 (21.7)	15.8 - 29.0

95% CI: 95% confidence interval; SD: standard deviation; HICS: health insurance card scheme; HIS-PCP: health insurance for people with citizenship problems

malaria-related information: 20.1% knew that they could get sick from malaria; 12.5% knew staying overnight in the forest was a risk factor for malaria; 15.1% knew severe malaria can cause death; 15.2% knew malaria should be treated with appropriate therapy, and 8.5% knew using ITNs is better than using conventional nets to prevent malaria (Table 4).

Forest goers (rubber tappers who

Table 2
Study subject migration characteristics (n=414).

Characteristics	n (weighted %)	95% CI
Residence prior to current location		
In the same district[a]	197 (43.2)	21.2 - 68.4
In the same province	283 (59.9)	26.0 - 86.4
Other provinces inside Thailand	5 (1.4)	2.6 - 7.4
Outside Thailand	126 (38.7)	12.2 - 74.3
Reasons for migration to the current location[b]		
Seeking work	277 (59.6)	30.1 - 83.5
Family reasons	12 (2.0)	0.6 - 6.7
Religious reasons	21 (9.6)	1.3 - 46.0
Leisure	13 (8.2)	1.1 - 42.3
In transit	43 (9.4)	4.7 - 18.0
No specific reasons	43 (11.2)	1.9 - 44.6
Have plans to move in the next 6 months[c]		26.7 - 60.7
No	182 (42.5)	15.8 - 40.8
Yes	104 (26.5)	23.8 - 38.6
Not sure	125 (30.7)	
Where entered Thailand, if within previous 6 months (n=126)[c]		
Crossed the border via:		
Regular checkpoint	49 (57.4)	15.0 - 91.2
Temporary checkpoint	18 (11.8)	7.4 - 18.5
Unofficial crossing point	58 (30.7)	4.6 - 80.3

95% CI: 95% confidence interval
[a]Subjects whose residence in the same district were a subset of those whose residence in the same province prior to current location
[b]Reasons for migration were not mutually exclusive
[c]Subjects with missing data were excluded from the analysis

worked in the forest at night) were 4.86 times more likely to seek healthcare services when they experienced fever (OR=4.86; 95%CI: 2.01-11.78; p=0.011) than non-forest goers (other occupational groups), and knowing that malaria requires treatment was significantly associated with seeking healthcare services for fever (OR=4.03; 95%CI: 1.52-10.65; p=0.020) (Table 5).

The Rao-Scott chi squared test (Wald statistic) showed the proportion of subjects having health insurance was significantly higher (p<0.001) among forest goers (35.3%, 95%CI: 28.4-43.0) than non-forest goers (17.5%, 95%CI: 13.5-22.3). There were no other significant differences between these two groups seen in this study.

DISCUSSION

In this study, more than half of the study subjects were aged 25-64 years and had been living in Thailand for more than 6 months. These findings are similar to reports in other surveys among migrant

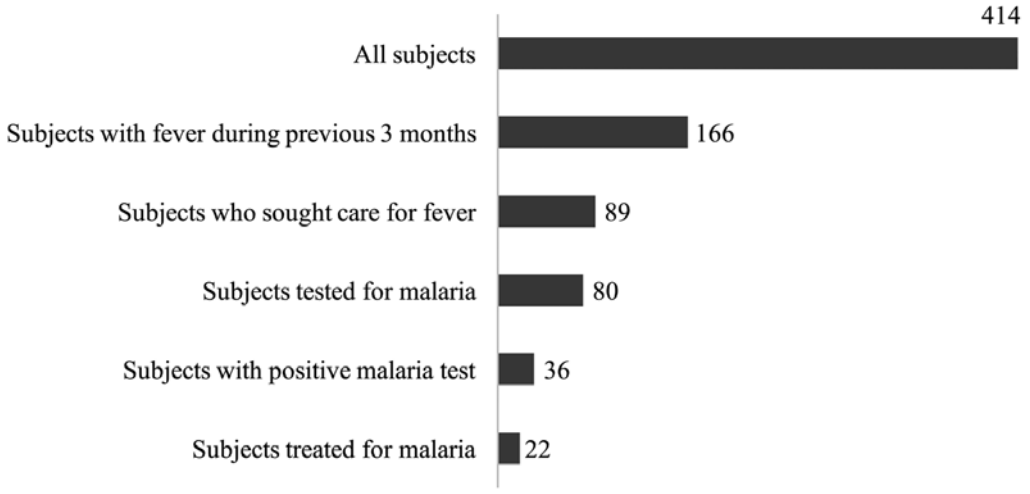

Fig 1-Numbers of subjects by fever related activities.

Table 3
Variables related to healthcare seeking behavior among study subjects with fever.

Variables	*n* (weighted %)	95% CI
Choice of healthcare provider(*n*=89)		
Village health volunteer	43 (46.5)	27.5 - 66.7
Malaria post	31 (34.8)	20.8 - 52.0
Private clinic	14 (18.0)	7.3 - 38.0
Drug store	1 (0.7)	0.1 - 9.0
Reasons for seeking healthcare at place of choice (*n*=89)[a]		
Convenience	76 (85.8)	70.1 - 94.0
Having insurance	54 (58.0)	38.9 - 74.3
Staff speaks same language	15 (15.7)	5.0 - 40.0
Friendly service	35 (42.6)	26.4 - 60.5
Others	7 (6.9)	2.3 - 19.1
Reasons for not accessing and barriers to accessing treatment (*n*=77)[a]		
Self-medicated	35 (45.7)	23.2 - 70.2
Treated by a traditional healer	23 (30.6)	9.8 - 64.0
Do not know where healthcare services are located	18 (24.6)	12.6 - 42.7
Live far from healthcare services	22 (28.2)	10.7 - 56.4
Not enough free time to seek healthcare	7 (7.6)	2.4 - 21.3
No health insurance	5 (4.4)	0.8 - 20.4
No migration -related documentation	5 (5.9)	1.1 - 26.3

95% CI: 95% confidence interval
[a] Reasons for seeking healthcare, reasons for not accessing and barriers to accessing treatment were not mutually exclusive.

Table 4
Knowledge about malaria and use of insecticide-treated nets (n=414).

Knowledge factors	n (weighted %)	95% CI
Received information about malaria	133 (26.8)	15.5 - 42.4
Can get sick from malaria	96 (20.1)	12.6 - 30.5
Staying overnight in the forest is a risk factor for malaria	60 (12.5)	7.7 - 19.8
Severe malaria can cause death	73 (15.1)	9.0 - 24.0
Malaria needs treatment	79 (15.2)	7.5 - 28.4
ITNs are better than convectional nets to prevent malaria	41 (8.5)	4.1 - 16.7

ITN: insecticide-treated net; 95% CI: 95% confidence interval

Table 5
Weighted logistic regression analysis of factors associated with seeking healthcare for fever.

Factors	Bivariable analysis[a]			Multivariable analysis		
	Crude OR	95% CI	p-value[b]	Adjusted OR	95% CI	p-value[b]
Study district						
Bannang Sata	1	reference	0.150	NA		
Yaha	0.92	0.22-3.76				
Kabang	2.04	1.20-3.45				
Than To	0.78	0.44-1.38				
Health insurance status						
No health insurance	1	reference	0.036	NA		
Having health insurance	1.73	1.07-2.78				
Risk assessment						
Non-forest goers	1	reference	0.019	1	Reference	0.011
Forest goers	4.52	1.62-12.63		4.86	2.01-11.78	
Received health information about malaria	2.33	1.20-4.50	0.027	NA		
Can get sick from malaria	2.12	1.13-3.98	0.032	NA		
Staying overnight in the forest is a risk factor for malaria	3.20	1.48-6.93	0.017	NA		
Severe malaria can cause death	2.53	1.21-5.32	0.028	NA		
Malaria needs treatment	3.61	1.05-12.45	0.046	0.03	1.52-10.65	0.020
ITNs are better than conventional nets	2.04	1.05-3.96	0.041			

[a]Variables with a p-value <0.2 on bivariable analysis were included in multivariable analysis; [b]Wald statistic; Rao-Scott chi squared test; OR: odds ratio; 95% CI: 95% confidence interval; NA: not applicable; ITN: insecticide-treated net.

populations in Thailand (Wangroongsarb *et al*, 2011; Naing *et al*, 2012). The sex ratio of males to females in our study was 2:1, similar to another study from Yala Province, Thailand who reported the overall sex ratio among migrants is 1.8:1 (Yala Provincial Labour Office, 2019).

In our study, more than half the subjects moved to the study province from another province in Thailand and more than half the subjects moved because they were seeking work. A study of migrants along the Thai-Cambodia border found migrant subjects preferred to move within the same district or province seeking work because there was adequate work in the same district or province but this required moving to find available work (Shafique *et al*, 2016).

In our study, 36.5% of subjects reported fever during the previous 3 months, much higher than the 3.5% reported in a survey conducted previously in Thailand involving only a 2-week period (Malaria Consortium, 2016). However, the proportion of subjects in our study who sought healthcare services for fever (51.3%) was lower than that reported in 2016 survey mentioned above (67.5%) (Malaria Consortium, 2016). A probable reason for this was that our subjects were all migrants but in the 2016 survey, 96.3% of subjects were from the local population.

In our study, the majority of subjects who sought healthcare for fever, went to village health volunteers. This result is different from a previous study in Thailand where the majority of subjects with fever sought healthcare at a government hospital (Malaria Consortium, 2016). This again is because our subjects were migrants while their subjects were mostly locals. However, choosing village health volunteers by our subjects indicates the important role these volunteers have in helping people, including migrant populations.

In our study, among the subjects who did not seek healthcare services, 45.7% self-medicated and 30.6% went to traditional healers. Self-treatment of fever among this migrant population warrants further investigation to ascertain the kinds of medication these people are taking and where they are obtaining it to determine if there is misuse of antimalarial drugs, which may contribute to drug resistance (Guyant *et al*, 2015).

In our study, 26.8% of subjects had been exposed to health education messages about malaria. This proportion is much lower than the results reported in previous surveys from other malaria transmission provinces in Thailand, excluding southern provinces (96.4-98.0%) (Malaria Consortium, 2014; Malaria Consortium, 2016). These low levels of malaria knowledge highlight the need to improve health education regarding malaria in the migrant populations of southern Thailand.

In our study, we found receiving malaria-related health education was significantly associated with seeking treatment for fever. The education level of most subjects in this study was primarily middle and primary school level. Health education should be simple, in an appropriate language, culturally appropriate and easily understood. Malaria control and prevention programs at the community level should include migrant populations to be successful. These programs require close collaboration with and support from employers, who should be included in health promotion activities and who can provide advice regarding seeking healthcare (Penchansky and Thomas, 1981; Saurman, 2015).

In our study, working at night in the forest was also associated with seeking treatment for fever. This may be because a greater proportion of forest workers had health insurance in our study than other occupational groups. A study of Shan migrants in Chiang Mai Province, Thailand reported migrants were more likely to seek healthcare if they had health insurance (Nwi *et al*, 2018). All the subjects in our study who did not receive anti-malarial treatment at the place they had tested positive were rubber tappers. They were primarily diagnosed at private clinics and then referred for treatment to government hospitals since anti-malarial medications are only available at hospitals. However, some did not go to the hospital. Reasons reported for not going to the government hospital were not having health insurance, not having migration-related documents, thinking their fever was not severe enough to need treatment. Data on whether these people self-medicated or visited another clinic, which drugs were used for self-treatment or whether they took any antimalarial drugs were not collected. Our results suggest malaria elimination programs in the study area need to adopt a public-private mixed (PPM) strategy for malaria diagnosis and treatment. This could be done by building partnerships between private clinics and government public hospitals and developing an efficient referral and follow-up system.

Our study has some limitations. Although targeted sampling allowed us to include many migrants in our study, it did not include many mobile migrants, especially those who might be participating in illegal activities, such as logging, hunting, and sex work. This was mainly due to a lack of information about these hidden groups and limited time for data collection at each migrant site because of security reasons in Yala Province, which is one of the three provinces in southern Thailand experiencing conflicts and violence. Including these populations in a study or in malaria control activities would require more time and different approaches.

This is the first survey of fever and healthcare seeking behavior among migrants in Yala Province, southern Thailand. Our data will inform malaria control programs about malaria knowledge, attitudes and activities in the migrant population in order to develop appropriate malaria control strategies for this population.

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CONFLICTS OF INTEREST

The authors declare no competing interests.

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