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Malaria in asymptomatic migrant workers and symptomatic patients in Thamaka District, Kanchanaburi Province, Thailand

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ABSTRACT

Objective: To investigate malaria infections in asymptomatic legal migrant workers and symptomatic patients in Thamaka, Kanchanaburi Province. **Methods:** This study was conducted during April 26–29, 2008 using thick and thin blood Giemsa's stained. A total of 671 samples were collected in asymptomatic migrant workers and 38 samples in symptomatic patients in the same period. **Results:** The results showed the prevalence rate was 1.64% (11 out of 671 samples) in asymptomatic migrant workers and *P. vivax* infections were found to be dominant (81.8%). Age group of infections showed between 16–42 years as a high risk of infection. Female: Male ratio was 1: 1.3. The infection rate was 35.7% (10 out of 38 samples) in symptomatic patients with the highest infection being *P. falciparum* (80.0%). Age group of infections between 13–36 years. **Male:** Female ratio was 1: 1.4. About 43% of malarial infections came from Muhlumyai area, Myanmar. **Conclusions:** The high rate of malarial infections in Thamaka District still need surveillance, especially as migrant workers may spread malaria to the people living in this area if vector present.

1. Introduction

Malaria is still a major public health problem in Thailand along the border area with Myanmar. [1–3]. Kanchanaburi Province is one of the ten leading provinces with the highest malaria cases. There are mass migrations from Myanmar natives migrating to work in Thailand. Thamaka District, Kanchanaburi Province is one spot for many Myanmar workers to work in many factories and live in this area. The Thai–Myanmar border showed the highest number of malaria cases from non–Thai people; in 2006, 91% of these cases were reported from this area [3–5]. The primary vector reported in Kanchanaburi are *Anopheles dirus*, *An. minimus* and *An. maculates* [6–8].

Most of the studies reported malaria in Thong Pha Phoom and Sangkhla Buri District of Kanchanaburi where the area is close to Myanmar and migrants work at wood cutting and gathering forest products. A previous study showed 60.8% of the cases were infected by *falciparum* malaria, 36.4% by *vivax* and 2.8% by mixed infection of both species along the

border of Thai–Myanmar. 74.2% of the subjects were Thai–Yai and Myanmar [9]. Chuckpaiwong (1999) reported that the prevalence of *P. falciparum* vs *P. vivax* in Bongtee, Saiyok, Kanchanaburi in July 1999 and February 2000 was 8.4% vs 2.8% and 1.6% vs 2.3%, respectively [9].

We are interested in investigating malarial infections in asymptomatic legal migrant workers and symptomatic patients in Thamaka, Kanchanaburi Province where the area is close to Suphan buri, Ratchaburi Province of Thailand. This is a high risk area but it is hard to gather information due to the focus being directed to more populous areas.

2. Materials and methods

2.1 Study area and population

A cross-sectional survey was conducted at Thamaka District (13°55'15"N, 99°45'56"E), Kanchanaburi Province, Thailand (Figure 1). The District is a factory area, located about 97 km Northwest of Bangkok and 30 km away from Muang Kanchanaburi. About 10% of Thais work in factories [10]. A large community of Myanmar migrants work and live in Thamaka.

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Figure 1. Thamaka District, Kanchanaburi Province of Thailand (red)

This study was approved by the Ethic Committee of Rangsit University, Pathum Thani, Thailand (RSEC 02/51). This project was carried out with the cooperation of the hospital in the area. 671 out of 1,500 (44.3%) asymptomatic legal Myanmar workers were recruited when renewing work permits to determine the presence of controlled disease, including filaria and malaria during April, 2008. In the same period, we also investigated malaria infection in 38 patients who were present in the hospital in this area with fever and chills.

2.2 Blood examination

Blood smears from Myanmar workers were collected after the participants took DEC 45 min (for filarial diagnosis), thick and thin blood smears were prepared from venous blood. One hundred sixty two rapid test for *P. falciparum* malaria (paracheck) were randomly tested in parallel using the principle of two site sandwich immunoassay for the determination of *P. falciparum* specific histidine rich protein-2 (*Pf*.HRP-2) in whole blood samples. (200 rapid tests were sponsored by a company in Thailand).

Patients who were present in hospital with fever ($>37.5^{\circ}\text{C}$) and chills in this period were asked for blood collections for thick and thin smear and diagnosed using rapid test in all 38 cases. The thick and thin blood film were stained with 10% Giemsa in phosphate buffer (pH 7.2), following the standard WHO procedure (2010) [11]. and examined under an oil-immersion lens. The specific species of Plasmodium, stage of parasite and parasite densities were recorded. Blood films were double checked by 2 experienced parasitologists. The negative blood films were reported if no parasites were seen in 100 oil-fields. All participants found to be infected

with malaria were contacted personally and provided with standard curative treatment from hospital.

2.3 Data analysis

Data were interpreted by descriptive statistics and expressed as percentage (%). Parasite densities were determined by number of parasites per microliter from thick blood film compared with 500 white blood cells and calculated by formula

$$\text{Number of parasites per } \mu\text{l} = \frac{\text{no. of parasite counted} \times 8,000}{500}$$

3. Results

3.1 Malaria infection in asymptomatic migrant workers

A total of 671 blood samples out of 1,500 samples (44.7%) were collected in asymptomatic migrant workers. There were 352 (52.5%) male and 319 (47.5%) female. 43.9% age between 21–30 years and 43.4% came from the Muhlumyai area of Myanmar. The prevalence of malaria infection was 1.64% (11 out of 671 Myanmar migrant workers). *Plasmodium vivax* was the dominant species (81.8%) in asymptomatic migrant workers (9 out of 11 infected cases). Only asexual stage (ring form) was noted in 2 cases with *P. falciparum* infection. The parasite densities in this group were ranged between 112–720 parasites per μl . The demographic characteristics of the participants are summarized in Table 1.

Table 1.

Demographic characteristics of malaria infection in asymptomatic migrant workers at Thamaka, Kanchanaburi Province.

Demographic characteristics	No.	No. positive (%)
Age (years)		
1–10	0	0
10–20	203	3 (1.5)
21–30	294	3 (1.02)
31–40	125	4 (3.2)
41–50	47	1 (9.1)
51–60	2	0
Sex		
Male	320	6 (1.9)
Female	351	5 (1.4)
Female : Male ratio	1 : 1.3	

3.2 Malaria infection in 38 symptomatic patients

A total of 38 blood samples were collected in the patients who were present in hospital in that period with fever and chill. 10 cases (35.71%) were reported with malaria infections. *Plasmodium falciparum* was the dominant species in 8 of 10 cases of symptomatic patients (80.0%), 1 case was infected with *P. vivax* and also a mixed infection of *P. falciparum* and *P. vivax* was found in 1 case. The parasite densities in this group were ranged between 80–80,000 parasites per μl .

One case of infection with *P. vivax* also showed gametocyte in blood smear. The demographic characteristics of the symptomatic patients and infected cases are summarized in Table 2.

Table 2

Demographic characteristics of malaria infection in symptomatic patients in Thamaka, Kanchanaburi Province.

Demographic characteristics	No.	No. positive (%)
Age (years)		
1–10	3	0
10–20	10	5 (50.0)
21–30	11	4 (36.4)
31–40	8	1 (12.5)
41–50	4	0
51–60	0	0
>60	2	0
Sex		
Male	22	5 (22.7)
Female	16	5 (31.3)
Male : Female ratio		
Nationality		
Thai	19	1 (5.3)
Burmese	19	9 (47.4)

3.3 The result of rapid *Pf* test (paracheck)

Two hundred rapid tests for *P. falciparum* malaria (paracheck) were performed. One hundred sixty two tests were carried out on Burmese migrant workers and the results of all were negative which related to negative blood film results. 9 out of 10 (90.0%) of cases showed positive results using rapid *Pf* test and 100% of cases showed positive results using blood smear. The blood smear also revealed the species of malaria parasites as shown in table 3.

Table 3

Comparison between the result of positive cases by rapid *Pf* test and blood smear.

Samples	n	Positive cases (%)			
		Rapid <i>Pf</i> test	Blood film (10 cases)		
			<i>Pf</i>	<i>Pv</i>	<i>Pf+Pv</i>
Chill and fever	38	9	8	1	1
Asymptomatic	162	0	0	0	0
Total	200	9	8	1	1

4. Discussion

Thamaka is one district of Kanchanaburi Province which reported quite low incidence of malaria infections: there were 2 Thai cases and 15 foreign cases in year 2007[4]. However, this area has an abundance of migrants living and working in factories. The vectors of malaria such as *Anopheles dirus* complex [8], *Anopheles maculatus* [7] reported in Kanchanaburi and *Anopheles minimus* species A and C in western Thailand [6], and also the breeding habitats of *An.*

minimus C were present within a 30–40 km radius of the northern part of Sai Yok and this species was also found in the central and southern parts of Si Sawat District [6].

The prevalence of malaria infection in asymptomatic migrant Burmese workers was 1.64% in Thamaka district, Kanchanaburi Province. The prevalence rate in this study was higher than the year 2007 (0.49/1,000 population), which was reported by Ministry of Public Health (2007)[4]. However, the results were quiet similar to Kritsiriwuthinan and Ngrenngarmmlert (2011), which revealed malaria infections in blood film in asymptomatic foreign migrant workers from Bangkok and Samut Sakhon province of Thailand, and reported the infection rate was 1.36% in 294 subjects[12] and recently they revealed that the highest prevalence of malaria infection by molecular screening from Burmese migrants[13].

In our study, *P. vivax* was the dominant species (81.8%), higher than *P. falciparum* in asymptomatic migrant workers which was similar to the previous results in asymptomatic mobile Cambodians in Aranyaprathet, Sakaeo Province [13]. Approximately 10% of *P. vivax* infections were still asymptomatic. Age group more than 50 years have no reported malaria infection and male showed the higher ratio than female (1:1.3) similar to the previous studies [4,5,11,14,15]. The age and sex distribution of the malaria patients reflected the disease situation in the area. Most infected groups were working-aged males who laboured in forest areas along the border before moving to work in factories. In a retrospective study along Thailand's borders, increasing proportions of malaria cases were shown over 12 years among cross-border migratory foreign workers; these cases were especially concentrated in districts bordering Cambodia and Myanmar. This trend suggests that cross-border seasonal labour might play an important role in malaria transmission[16]. The history of malaria cases were noted: 5 cases from Mawlamye, 4 cases from Dawai and 2 cases from Rangoon, areas where malaria is a major public health problem in Myanmar.

Of the 35.7% reported malaria infections in patients with fever and chills, *Plasmodium falciparum* was the dominant species in symptomatic patients (80.0%), the same as a previous study by Chaveepojnkamjorn and Pichainarong (2004) [5]. This 2004 study showed that 60.8% of the cases were infected by falciparum malaria, 36.4% by vivax malaria and 2.8% by mixed infection of both types in migrant foreign nationals who lived in the endemic areas along the Thai–Myanmar border area. One case infected with *P. vivax* also noted gametocyte stage (sexual stage) which was found in blood smear. This could be the transmission stage for malaria. The age range that exhibited the majority of infections was 10–40 years. This finding is similar to previous studies by Chaveepojnkamjorn and Pichainarong (2004); Kritsiriwuthinan and Ngrenngarmmlert (2011) [5,12]. In our study of clinical symptomatic cases, females were more likely to get malaria than men which contrasted from previous studies [5,12,13] together with our results for asymptomatic migrants. However, 9 out of 10 cases were Burmese migrants living

and working around factories in Kanchanaburi. Reasons for malaria infection being higher in female than male are still unclear. The rapid *Pf* test (paracheck) determined that 162 asymptomatic migrants showed 100% negative results which corresponds with microscopic determination from thick and thin blood smear (100% specificity). The manufacture of this rapid test also reported 100% sensitivity and 100% specificity in *P. falciparum* endemic area. In 38 cases of patients present in hospital with clinical fever and chills, we were able to determine malaria parasites with rapid *Pf* test (paracheck) and blood smear. The positive results of blood smear showed the same results as rapid test for *P. falciparum* detection. However, the blood film showed more results to identify *P. vivax* and mixed infection between *P. falciparum* and *P. vivax*. So this study suggests that in the area which still varies in malaria species, the rapid *Pf* test (paracheck) should not be used alone to interpret the results of infection. It might be useful to use the rapid *Pf* and Pv test such as ICT Malaria *Pf*/*Pv* assay, which had a sensitivity of 96% for screening malaria parasites in Thailand, especially in migrants^[17].

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Conflict of interest statement

We declare that we have no conflict of interest.

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