

Original Article

Pulmonary tuberculosis screening and quality of life among migrant workers, Northern Thailand

Palita Charoensook¹, Panupong Upala², Amornrat Anuwatnonthakate¹, Thapakorn Ruanjai¹, Tawatchai Apidechkul^{1,2}

¹ School of Health Science, Mae Fah Luang University, Chiang Rai, Thailand

² Center of Excellence for the Hill tribe Health Research, Mae Fah Luang University, Thailand

Abstract

Introduction: The study aimed to estimate the prevalence of tuberculosis (TB) and to assess the quality of life and depression among the migrant workers in northern Thailand.

Methodology: A cross-sectional study was conducted to elicit information among migrant workers in Chiang Rai and Pha Yao provinces, northern Thailand. Several standard forms including GeneXpert were used for data collection. A simple random sampling was used to select the companies and the study sample. Interview was conducted in a confidential room. Chi-square was used to detect the association between variables at the significant level $\alpha = 0.05$.

Results: Totally 467 migrant workers were recruited into the study, 97.9% were Myanmar national, 55.7% were males, and 51.4% were aged > 32 years. Only 2.1% were living in Thailand illegally, 23.8% had no health insurance, and 92.1% had monthly income at < 20,000 baht. Eight cases (1.71%) were at risk of TB disease from the screening, only one case was positive for TB disease from GeneXpert, and no multi-drug resistant detected. 47.5% had a low level of knowledge and 28.7% had a negative attitude on TB prevention and care. 10.7% were in a moderate to severe stage of depression. Six variables were found the significant associated with quality of life; ethnicity, sex, marital status, income, length of working in Thailand, and insurance.

Conclusions: Besides active TB surveillance system, inter-country public health policy should be developed to cope with depression problem and improve quality of life among the migrant in Thailand

Key words: Tuberculosis; quality of life; depression; migrant workers; knowledge; attitude.

J Infect Dev Ctries 2018; 12(12):1052-1061. doi:10.3855/jidc.10596

(Received 30 May 2018 – Accepted 17 October 2018)

Copyright © 2018 Charoensook *et al.* This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction

Tuberculosis (TB) is a major cause of human infectious diseases especially in developing countries [1]. TB leads to one of the public health problems in the area of the epidemic of HIV/AIDS [1,2]. A number of TB cases have been detected yearly [1]. A large amount of money was spent for health care system and health utilization regarding TB treatment and prevention programs [3]. Even though many public health interventions were implemented in the past years throughout many organizations, TB is still ranked as one of the top threats to human health [4]. Beside HIV/AIDS patients, migrant workers are one of the most vulnerable for TB infection [5].

In 2018, more than 2 million migrant workers in Thailand [6]. Majority are Myanmar, Cambodia, and Lao PDR [6]. Chiang Rai and Pha Yao are located in northernmost of Thailand and are defined as significant border areas in the aspect of international trade and

economic activities in the northern region of Thailand [7]. There is a large economic growth in previous years in these areas in both agricultural and industrial areas [7]. Therefore, there was need to add a number of workers to the economic development plan. Since these two provinces share a border with Myanmar and Lao PDR, many workers from these two countries favor to work in Chiang Rai and Pha Yao province. Chiang Rai and Pha Yao Provincial Department of Labor Protection and Welfares reported 21,447 and 866 workers working in Chiang Rai and Pha Yao provinces respectively [6]. Most migrant workers are allowed to work in Thailand legally, but some of them are working illegally [6,8].

Quality of life and depression are good indicators used to predict the standard of living [9-11]. It also can be used as one of the key performance indicators of the development in various areas including economic and health care system developments [12]. Assessing the

quality of life among some vulnerable populations such as migrant workers is important in order to understand the situation and standardize relevant systems to improve public service as a whole particularly among those with limited access to public services [13].

There is few information available in TB prevalence and also the level of quality of life of migrant workers in northern Thailand. Therefore, the study aimed to investigate the prevalence of TB and also the quality of life among migrant workers in northern Thailand. The information could be used for policy development according to TB care and prevention among the migrant workers, and also used for health care system development to provide a proper health care service to them. Ultimately, could be support the goal of world health organization (WHO) in elimination of TB burden globally [14].

Methodology

Study design

A cross-sectional study design was used to elicit the information from the participants.

Study setting

The study was conducted in Chiang Rai and Pha Yao provinces. In 2017, Department of Labor Protection and Welfare [8] reported that totally 242 companies in Chiang Rai province, and 111 companies in Pha Yao province employed non-Thai workers in their company. All targeted companies were private businesses.

Department of Labor, Chiang Rai Provincial was contacted to get the list of the companies that having non-Thai employees. A simple random method was used to select 13 companies in Chiang Rai, and 5 companies in Pha Yao provinces. After selecting the companies, it was found that the total number of migrant workers were met the requirement of the study. Appointment was made after verbally contacting in all accepted companies. After reaching the selected companies, a short meeting with the manager was initiated to provide all essential information regarding the study.

Study population

Non-Thai workers in companies in Chiang Rai and Pha Yao provinces were the study populations. There were 9,624 workers in 2016 who were non Thai-nationals (Myanmar and Lao PDR) in these two provinces.

Inclusion criteria

a) non-Thai workers, b) aged ≥ 18 years old, c) worked at a study setting at least one year at the date of data collection.

Exclusion criteria

a) participants who could not provide essential information regarding the study protocols, and b) could not identify her/his nationality.

Sample size calculation

The study sample was calculated by the following formula [15]:

$$n = \frac{Z^2PQ}{e^2}$$

Where: n is the sample size (persons); Z is the critical value at 95% CI which was 1.96; P is the prevalence of pulmonary tuberculosis among migrant workers, which was 0.27% [16]; Q is 1- P = 0.73; e is the acceptable error (5%). As a result $n = [(1.96)^2 \times (0.27) \times (0.73)] / (0.05)^2 = 302$.

From the calculation, at least 302 participants were needed for the analysis. Adding 10% (30 participants) for any errors in the study, therefore, 332 participants were required. All migrant employees who were working at the selected companies and met the selection criteria were invited to participate the study.

Research instruments

Questionnaire, a 5-item TB screening form, SF-12 [10], PHQ-9 [17], and GeneXpert (Cepheid GeneXpert IV) [18] were used as the research instruments. Questionnaire was developed from the literature review and consultation with experts in relevant field. There were 6 parts. Part I consisted of 18 questions regarding the general characteristics such as nationality, age, sex, religion, income, number of family members, ability to use Thai, etc. In item of “income”, it was classified into category; $\leq 20,000$ baht, and $> 20,000$ baht per month, which was based on the average income of Akha hill tribe in Thailand who had similar characteristics to the migrant workers, at 20,000 baht/family/month [19]. In the item of “length of working in Thailand”, it was classified into two categories; ≤ 7 years, and > 7 years, due to the average working time in Thailand of the migrant workers at 7 years [8].

Part II consisted of 4 main questions regarding the information of work place such as type of company, number of workers, registration status of the company, etc. Part III consisted of 11 questions regarding the medical history and rights to access health care system such as history of TB, history of TB in their family, HIV

testing, diabetes mellitus (DM) and hypertension (HT), etc. Part IV consisted of 5 questions regarding risk behaviors such as smoking, alcohol use, methamphetamine, etc. Part V consisted of 10 questions to detect the level of knowledge regarding TB prevention and control. Part VI consisted of 10 questions to detect the level of attitude regarding TB prevention and control. Part VII was the standard form assessing quality of life (SF-12). Part VIII was the standard form assessing depression (PHQ-9). Part IX was for the laboratory.

Questions regarding knowledge were tested using Kuder-Richardson (KR) [20], only question that gained ≥ 0.75 were pooled into the study. Questions related to both knowledge and attitudes were tested for reliability by pilot test with 20 selected samples from one of the companies in Muang District, Chiang Rai province. In this process, feasibility and reliability were detected by Alpha Cronbrash coefficient [21]. The overall questionnaire score was 0.77.

5-Item TB screening form

A 5-item TB screening form is standard form for screening TB disease by its symptoms [22]. It consisted of 5-items; 1) having chronic cough more than two weeks (if yes = 3 scores, no = 0 score), 2) coughing up blood (if yes = 3 scores, no = 0 score), 3) chronic fever (if yes = 1 score, no = 0 score), 4) weight loss (if yes = 1 score, no = 0 score), and 5) nights sweats (if yes = 1 score, no = 0 score). Interpretation, any case that obtained ≥ 3 scores means positive.

Quality and interpretation of SF-12

The SF-12 is used for assessing health related quality of life (HRQOL) which consisted of 12 questions. Question no.1-5, and 8 were used to detect the physical health status or physical component score (PCS). The Internal consistency coefficients were $> 70\%$, and reliability was 83% [10]. Question no. 6-7, 9-12 were used to detect the mental health status or mental component score (MCS). Before interpretation, the raw scores were converted to the transformed scale which is shown on 0-100 scales. Interpretation; having SF-12 a score of ≤ 50 means low quality of life, and a score of > 50 means high quality of life.

Quality and interpretation of PHQ-9

The PHQ-9 is a multipurpose instrument for screening, diagnosing, monitoring and measuring the severity of depression. It has 84% sensitivity and 93% specificity for major depression [17]. It composes of 9 questions with 4 answer scales: “Not at all”, “Several

days”, “More than half the day”, and “Nearly every day”. Then, the total score is 27. Those who have > 9 score are in a normal group, 10-14 scores are in a mild group, 15-19 scores are in a moderate group, and > 20 scores are in a severe group.

Process of questionnaire development

The questions in part I-VI were developed from the literature review and consultation the experts in the field. After the first draft, researchers came up with discussions in terms of possibility, feasibility, and covered the content according to the objectives of the study. The questionnaire was tested for validity by the Index Objective Congruence (IOC) [23], which was assessed by three external experts who were working in the relevant field. Questions that gained >0.7 were included in the final form. Whereas questions with a score 0.5-0.7 were developed before they were included in the final form.

Data gathering procedures

After getting 18 companies as the target study settings, in Chiang Rai and Pha Yao province, all employees who met the inclusion criteria were invited to participate in the project. Before starting the interview, all participants were asked to obtain the informed consent form.

An interview was conducted in a private and confidential room by a researcher. Those who were found positive of TB screening were asked to obtain sputum specimen and it was stored in a specific media before sending it to the laboratory for detection by GeneXpert technique at Chiang Rai Provincial hospital. All the processes in the fieldwork lasted 30 minutes each.

Statistical analysis

Data were double entered into excel sheet. Data was analyzed by SPSS version 24; (IBM, Armonk, NY). Both descriptive and inferential statistics were used for data analysis. General characteristics were explained by means, standard deviations, and percentage. Chi-square and Fisher exact test were used to detect the association between variables at the significant level $\alpha = 0.05$. Fisher exact test was used in the place of chi-square, in case of having a small number of expected frequencies in a cell.

Ethical considerations

The study including its materials was approved by both the Human Research Ethics Committee of Mae Fah Laung University, Chiang Rai, Thailand (No. REH

600-18), and Human Research Ethic Committee of Chiang Rai Public Health Provincial Office (No. 25/2560) before commences. An interview was conducted in a confidential and private room at their working place. A small gift was provided to appreciate their participation. All completed questionnaires were immediately destroyed after coding and entering into the excel sheet. Data were kept in personal computer with security code.

Results

Totally 467 participants were included in the analysis. Four selected companied refused to participate the study. All migrant workers who met the criteria participated the study. Majority were Myanmar nationals (97.9%). Proportion between sexes was mostly equal, and a half of participants were aged > 32 years (51.4%). Majority were Buddhist (98.9%), and married (80.3%). Six persons had a history of detention. A few persons were living in Thailand illegally (2.1%). One-fourth had no health insurance (23.8%), and 92.1% had monthly income less than 20,000 baht.

Only three persons had previous TB diagnosis, and 6.8% had been tested for HIV/AIDS. One-third had no history of BCG vaccination (Table 1).

Only one-fourth were able to speak Thai (28.8%), able to read Thai (29.5%), and a few were able to write Thai (3.6%). Regarding health behaviors; 19.3% smoked, 25.9% used alcohol, and nobody reported on use of amphetamine, heroin, and opium. Majority were working in industrial sectors (69.6%), lived at work place (86.7%) which was prepared by the company, and 71.1% had two or more people living together. However, most of them lived in places with poor ventilation (70.0%).

Regarding TB screening, eight persons (1.71%) had a positive for at risk of TB disease. On a closer look, it was found that six cases were Myanmar nationals, and two cases were Laos nationals (six were males and two were females). However, after detection by GeneXpert, only one person was positive for TB (12.5%), and no multi-drug resistant.

The average level of knowledge in TB prevention and care was low (47.5%). Four variables were found to be statistically different in level of knowledge of TB prevention and care; ethnicity (p-value < 0.001), income (p-value = 0.03), status of working in Thailand (p-value = 0.028), and length of working in Thailand (p-value = 0.018) (Table 2).

Table 1. General characteristics.

Characteristics	Number	Percent
Nationality		
Myanmar	457	97.9
Lao PDR	10	2.1
Ethnicity		
Myanmar	364	78.0
Other	103	22.0
Gender		
Male	260	55.7
Female	207	44.3
Age (years)		
≤ 32	227	48.6
> 32	240	51.4
Median = 33, IQR1-3=26-38, Range = 38.		
Religion		
Buddhism	462	98.9
Christian	5	1.1
Marital status		
Married	375	80.3
Other	92	19.7
Income (baht/month)		
≤ 20,000	430	92.1
≥ 20,000	37	7.9
History of prisoner		
Ever	6	1.3
No	461	98.7
Working status in Thailand		
Legal	457	97.9
Illegal	10	2.1
Length of working in Thailand (years)		
≤ 7	310	66.4
> 7	157	33.6
Health insurance		
Yes	356	76.2
No	111	23.8
BMI		
Underweight	38	8.2
Normal	228	48.8
Overweight	67	14.3
Obese	134	28.7
History of TB diagnosis		
Yes	3	0.6
No	464	99.4
History of TB in a family member		
Yes	3	0.6
No	464	99.4
HIV testing		
Yes	32	6.8
No	435	93.2
Diabetes		
Yes	2	0.4
No	465	99.6
Hypertension		
Yes	7	1.5
No	460	98.5
BCG vaccination		
Yes	315	67.5
No	152	32.5
BCG scar		
Yes	284	60.8
No	183	39.2
Screening TB		
At risk	8	1.7
Not at risk	459	98.3
Total	467	100.0

BMI: Body Mass Index, IQR: Interquartile range, TB: Tuberculosis, HIV: Human immunodeficiency virus, BCG: Bacille Calmette-Guerin.

Table 2. Comparisons of knowledge in TB prevention and care among the participants.

Characteristics	Knowledge			χ^2	p-value
	Low	Moderate	High		
Ethnicity					
Myanmar	168 (46.2)	150 (41.2)	46 (12.6)	116.63	< 0.001 ^{*a}
Other	54 (52.4)	2 (22.3)	26 (25.2)		
Gender					
Male	118 (45.4)	107 (41.2)	35 (13.5)	4.70	0.095
Female	104 (50.2)	66 (31.9)	37 (17.9)		
Age (years)					
≤ 32	108 (47.6)	81 (35.7)	38 (16.7)	0.72	0.697
> 32	114 (47.5)	92 (38.3)	34 (14.2)		
Marital status					
Married	181 (48.3)	137 (36.5)	57 (15.2)	0.41	0.816
Others	41 (44.6)	36 (39.1)	15 (16.3)		
Income (bath/month)					
≤ 20,000	214 (49.8)	151 (35.1)	65 (15.1)	11.45	0.003 [*]
> 20,000	8 (21.6)	22 (59.5)	7 (18.8)		
Working status in Thailand					
Legal	220 (48.1)	165 (36.1)	72 (15.4)	6.77	0.028 ^{*a}
Illegal	2 (20.0)	8 (80.0)	0 (0.00)		
Length of working in Thailand (years)					
≤ 7	151 (48.7)	103 (33.2)	56 (18.1)	8.09	0.018 [*]
> 7	71 (45.2)	70 (44.6)	16 (10.2)		
Total	222 (47.5)	173 (37.0)	72(15.5)	N/A	N/A

* Significant level at $\alpha = 0.05$; ^a Fisher exact test.**Table 3.** Comparisons of attitude in TB prevention and care among the participants

Characteristics	Attitude			χ^2	p-value
	Bad	Neutral	Good		
Ethnicity					
Myanmar	111 (30.5)	210 (42.3)	114 (27.2)	7.26	0.027 ^{*a}
Other	23 (22.3)	3 (57.3)	6 (20.4)		
Gender					
Male	75 (28.8)	121 (46.5)	64 (24.6)	0.38	0.826
Female	59 (28.5)	92 (44.4)	56 (27.1)		
Age (years)					
≤ 32	56 (24.7)	107 (47.1)	64 (28.2)	3.79	0.150
> 32	78 (32.5)	106 (44.2)	56 (23.3)		
Marital status					
Married	112 (29.9)	174 (46.4)	89 (23.7)	4.03	0.134
Other	22 (23.9)	39 (42.4)	31 (33.7)		
Income (bath/month)					
≤ 20,000	130 (30.2)	198 (46.0)	102 (23.7)	12.94	0.002 [*]
> 20,000	4 (10.8)	15 (40.5)	18 (48.6)		
Working status in Thailand					
Legal	133 (29.1)	212 (46.4)	112 (24.5)	12.25	0.001 ^{*a}
Illegal	1 (10.0)	1 (10.0)	8 (80.0)		
Length of working in Thailand (years)					
≤ 7	103 (33.2)	146 (47.1)	61 (19.7)	20.05	< 0.001 [*]
> 7	31 (19.7)	67 (42.7)	59 (37.6)		
Total	134 (28.7)	213 (45.6)	120 (15.4)	N/A	N/A

* Significant level at $\alpha = 0.05$; ^a Fisher exact test.

In comparison of level attitude regarding TB prevention and care and the general characteristics, three variables were statistically different; income (p -value = 0.02), working status in Thailand (p -value = 0.001), and length of working in Thailand (p -value = 0.001) (Table 3).

Twenty-six persons had a moderate level of depression (5.6%), and another 24 persons had a severe stage of depression (5.1%). In a comparison of depression among the participants by characteristics, three variables were statistical different; ethnicity (p -value = 0.01), length of working in Thailand (p -value < 0.001), and health insurance (p -value = 0.001) (Table 4).

According to the quality of life indifferent characteristics of the participants, six variables were found the significant associated with quality of life; ethnicity, sex, marital status, income, length of working in Thailand, and insurance (Table 5).

Discussion

The prevalence of pulmonary TB among the participants was 0.21%. It coincides with the study conducted in Samut Sakhon province in 2015 which reported the prevalence at 0.20% among the Myanmar migrant workers [24]. In 2017, World Health Organization (WHO) reported Thailand was ranked the 22nd country in the world with the highest TB burden, and approximately 93,000 new cases yearly, 16% of whom were also HIV positive [25]. Thailand is defined as one of the countries with the highest burden of TB and HIV/AIDS problem particularly in northern region [25].

Under the regulations of Thailand, all legal migrant workers must be certified free of TB disease; therefore, most legal migrant workers in Thailand are free of TB disease at the date of entry into Thailand. Those detected with TB disease during entry into Thailand were sent back to their home country for treatment [26]. In our study, one case was detected in an illegal migrant worker. In fact, illegal migrant workers are facing double vulnerabilities in both burden of access to care and avoiding being charged by the police.

Table 4. Comparisons of depression in participants by characteristics.

Characteristics	Depression				χ^2	p-value
	Normal	Mild	Moderate	Severe		
Ethnicity						
Myanmar	73 (20.1)	251 (69.0)	19 (5.2)	21 (5.8)	15.69	0.001*
Other	39 (37.9)	54 (52.4)	7 (6.8)	3 (2.9)		
Age (years)						
≤ 32	62 (27.3)	137(60.4)	13 (5.7)	15 (6.6)	5.57	0.134
> 32	50 (20.8)	168 (70.0)	13 (5.4)	9 (3.8)		
Gender						
Male	53 (20.4)	178 (68.5)	13 (5.0)	16 (6.2)	5.57	0.134
Female	59 (28.5)	127 (61.4)	13 (6.3)	8 (3.9)		
BMI						
Underweight	9 (23.7)	28 (73.7)	0 (0.0)	1 (2.6)	13.7	0.314
Normal	63 (27.6)	139 (61.0)	12 (5.3)	14 (6.1)		
Overweight	20 (29.9)	40 (59.7)	4 (6.0)	3 (4.5)		
Obese	20 (14.9)	98 (73.1)	10 (7.5)	6 (4.5)		
Marital status						
Married	92 (24.5)	244 (65.1)	23 (6.1)	16 (4.3)	4.17	0.243
Other	20 (21.7)	61 (66.3)	3 (3.3)	8 (8.7)		
Income (bath/month)						
≤ 20,000	101 (23.5)	284 (66.0)	24 (5.6)	21 (4.9)	1.69	0.638
> 20,000	11 (29.7)	21 (56.8)	2 (5.4)	3 (8.1)		
Years working in Thailand						
≤ 7	53 (17.1)	217 (70.0)	21 (6.8)	19 (6.1)	25.56	<0.001*
> 7	59 (37.6)	88 (56.1)	5 (3.2)	5 (3.2)		
Health insurance						
Yes	102 (28.7)	228 (64.0)	13 (3.7)	13 (3.7)	30.30	0.001*
No	10 (9.0)	77 (69.4)	13 (11.7)	11 (9.9)		
Total	112 (24.0)	305 (65.3)	26 (5.6)	24 (5.1)	N/A	N/A

* Significant level at $\alpha = 0.05$.

Table 5. Quality of life among the participants.

Component	Characteristics	QOL		χ^2	p-value
		Low	High		
PCS	Ethnicity				
	Myanmar	31 (8.5)	333 (91.5)	5.28	0.002*
	Other	2 (1.9)	101 (98.1)		
MCS	Myanmar	98 (26.9)	266 (73.1)	0.02	0.886
		Other	27 (26.2)		
Overall	Myanmar	29 (8.0)	335 (92.0)	4.70	0.030*
		Other	2 (1.9)		
PCS	Gender				
	Male	25 (9.6)	235 (90.4)	5.80	0.016*
	Female	8 (3.9)	199 (96.1)		
MCS	Male	75 (28.8)	185 (71.2)	1.29	0.255
		Female	50 (24.2)		
Overall	Male	20 (7.7)	240 (92.3)	1.05	0.305
		Female	11 (5.3)		
PCS	Age (years)				
	≤ 32	15 (6.6)	212 (93.4)	0.14	0.707
	> 32	18 (7.5)	222 (92.5)		
MCS	≤ 32	56 (24.7)	171 (75.3)	0.99	0.320
		> 32	69 (28.8)		
Overall	≤ 32	15 (6.6)	212 (93.4)	0.01	0.980
		> 32	16 (6.7)		
PCS	Religion				
	Buddhism	32 (6.9)	430 (93.1)	1.28	0.308
	Christianity	1 (20.0)	4 (80.0)		
MCS	Buddhism	125 (27.1)	337 (72.9)	1.84	0.331
		Christianity	0 (0.0)		
Overall	Buddhism	31 (6.7)	431 (93.3)	0.35	1.000
		Christianity	0 (0.0)		
PCS	Marital status				
	Married	23 (6.1)	352 (93.9)	2.52	0.112
	Other	10 (10.9)	82 (89.1)		
MCS	Married	99 (26.4)	276 (73.6)	0.13	0.718
		Other	26 (28.3)		
Overall	Married	19 (5.1)	356 (94.9)	7.58	0.006*
		Other	12 (13.0)		
PCS	Income (baht/month)				
	≤ 20,000	32 (7.4)	398 (92.6)	1.16	0.280
	> 20,000	1 (2.7)	36 (97.3)		
MCS	≤ 20,000	121 (28.1)	309 (71.9)	5.21	0.022*
		> 20,000	4 (10.8)		
Overall	≤ 20,000	31 (7.2)	339 (92.8)	2.85	0.158
		> 20,000	0 (0.0)		
PCS	Status of working in Thailand				
	Legal	33 (7.2)	424 (92.8)	0.77	0.378
	Illegal	0 (0.0)	10 (100.0)		
MCS	Legal	125 (27.4)	332 (72.6)	3.75	0.053
		Illegal	0 (0.0)		
Overall	Legal	31 (6.8)	426 (93.2)	0.72	0.394
		Illegal	0 (0.0)		
PCS	Years working in Thailand				
	≥ 7	26 (8.4)	284 (91.6)	2.44	0.118
	> 7	7 (4.5)	150 (95.5)		
MCS	≥ 7	92 (29.7)	218 (70.3)	3.98	0.046*
		> 7	33 (6.4)		
Overall	≥ 7	25 (8.1)	285 (91.9)	3.02	0.082
		> 7	6 (3.8)		
PCS	Health insurance				
	Yes	21 (5.9)	335 (94.1)	3.19	0.078
	No	12 (10.8)	99 (89.2)		
MCS	Yes	87 (24.4)	269 (75.6)	4.14	0.042*
		No	38 (34.2)		
Overall	Yes	19 (5.3)	337 (94.7)	4.09	0.043*
		No	12 (10.8)		

* Significant level at $\alpha = 0.05$, QOF: Quality of Life, PCS: Physical Component Summary, MCS: Mental Component Summary.

The international labor organization reported that there were 3.3 million migrant workers in Thailand (51% were Myanmar nationals, 37% were Cambodians, and 12% were Lao PDR nationals), approximately 8.5% of country's labour force in low-skilled jobs [27]. More than half of the migrant workers are in Thailand illegally [28].

Most migrant workers in Ching Rai and Pha Yao earn less than 20,000 baht per family per month. This number is greater than those who are working in Myanmar with approximately 3,744 baht per month per family [29]. Many people from Myanmar and Lao PDR favor to work in Thailand for better income. Many studies reported on the association of poverty and the risk of TB infection [30-32]. It could be assumed that migrant workers in Thailand are vulnerable for TB infection especially in the era of HIV/AIDS which is a major influencing factor of TB epidemic in Thailand [33].

Under the universal coverage, all Thai nationals have been provided free health care on almost all health problems while accessing public hospitals [34]. It covers 99.87% of Thai population [35]. However, this does not cover migrant workers. Therefore, this might be a barrier to access healthcare and getting proper medical checkup for migrant workers while being suspected of TB infection. This is supported by the study of Tchirhart, *et al.* [36] which reported that insurance, and access to free or low-cost services were major factors affecting access to health care system among migrant TB patients. Moreover, migrant TB patients are in serious need of health system response along the Thailand-Myanmar border [37]. Therefore, migrant workers particularly those who are living in Thailand illegally are insecure regarding access to health care system.

Besides working status and right of free access to health care system of migrant workers, quality of life and depression are also significant problems. The study among the migrant workers in Singapore reported that females were living in low quality of life compared to the general population [38]. The study among nurse migrant workers in the United States found that they have a low quality of life compared to native nurses [39]. Moreover, the study among the migrant workers in Germany found that migrant workers were associated with low quality of life particularly in mental aspect [40]. In our study, it was found that males had a significantly lower quality of life than females.

In our study, it was found that more than 10% of the migrant workers are in the mild and severe stage of depression but no difference between sex and age

categories. Janssen-Kallenberg, *et al.* [41] reported that older age and low socioeconomic status are associated with severe depression among the Turkish migrant workers. More than 50% were positive for depression among the Moroccan-Dutch migrants [42].

There are some limitations in the study. A cross-sectional study design is a powerful design to estimate the prevalence of health problem particularly where there is high prevalence. However, in our study, only 8 cases were positive for the screening test, and one case was found positive for TB disease. It is less powerful to detect factors associated with TB among the migrant workers. Moreover, adjusting all potential confounder factors may not be possible in a cross-sectional study.

Another limitation is only workers who are working in a registered company were recruited into the study. There are many other illegal migrant workers working in other unregistered companies such as small agricultural farms, and some other small service businesses. Therefore, the participants in the study somehow did not represent all migrant workers. Those workers are more vulnerable for TB infection because they are working illegally and it could be assumed that they were not certified free of TB before entry to Thailand.

In the study, 4 companies declined to participate in the study after first contact. The main reason was time availability. However, it might be due to having many illegal workers in their companies.

Conclusion

Most migrant workers are legally working in Thailand. Only one-fourth have health insurance. Majority are Myanmar nationals working less than 7 years, and receiving low monthly income. A few cases have a positive screening of TB and only one case was found with TB disease with none MDR-TB detected. A half of them have low level of knowledge in TB prevention and care, and one-third have low level of attitude in TB prevention and care. Ten percent are in moderate and severe stages of depression and one-third are on low quality of life. Even though there were few participants with TB infection among the migrant workers, collaborations between countries are still needed for effective TB surveillance and control. Moreover, improving quality of life and solving depression problems among the migrant workers in Thailand should be intended from national and international relevant agencies.

Acknowledgements

We would like to thank The National Research Council of Thailand, Mae Fah Luang University, and The Center of Excellence for The Hill tribe Health Research for support in form of grants. We also would like to thank all the company managers for their assistance to get access and recruit participants. The authors are also grateful to all participants for participation the project.

References

- World Health Organization (2017) Global tuberculosis report 2017. WHO Report. Available: http://www.who.int/tb/publications/global_report/gtbr2017_main_text.pdf. Accessed: 25 May 2018.
- Fernandez D, Salami I, Davis J, Mbah F, Kazeem A, Ash A, Babino J, Carter L, Salemi JL, Spooner KK, Olaleye OA, Salihu HM (2018) HIV-TB coinfection among 57 million pregnant women, obstetric complications, alcohol use, drug abuse, and depression. *J Pregnancy* 2018: 5896901
- Chimbindi N, Bor J, Newell ML, Tanser F, Baltusen R, Hontelez J, Vlas SD, Lurie M, Pillay D, Barnighausen T (2015) Time and money: the true costs of health care utilization for patients receiving 'free' HIV/TB care and treatment in rural KwaZulu-Natal. *J Acquir Immune Defic Syndr* 70: e52-60.
- Nahid P, Dorman SE, Alipanah N, Barry PM, Brozek JL, Cattamanchi A, Chaisson LH, Chaisson RE, Daley CL, Higashi MGJM, Ho CS, Hopewell PC, Keshavjee SA, Lienhardt C, Menzies R, Merrifield C, Narita M, O'Brien R, Peloquin CA, Raftery A, Saukkonen J, Schaaf HS, Sotgiu G, Starke JR, Migliori GB, Vernon A (2016) Clinical practice guidelines: treatment of drug-susceptible tuberculosis. *Clin Infect Dis* 63: e147-195.
- Tawatchai A (2016) A 20-year retrospective cohort study of TB infection among the hill tribe HIV/AIDS population, Thailand. *BMC Infect Dis* 16: 72
- Foreign Workers Administration Office (2018) Statistic of migrant worker -Thailand, January 2018. FWAO statistic document. Available: https://www.doe.go.th/prd/assets/upload/files/alien_th/5f3479f4e58d958f20d607c457bc89bd.pdf. Accessed: 25 May 2018.
- Ramingwong S, Sopadang A, Tippayawong KY (2016) Supply chain redesign strategies for agro-industry in Chiang Rai special economic zone. *Sci Int* 29: 201-204.
- Ministry of Labour (2018) The performance of the responsibility of the Ministry of Labour- Thailand, 2018. MOF document. Available: http://www.mol.go.th/sites/default/files/downloads/pdf/aebbk_hwaammankhngeduen_16_-_31_m.kh_.611.pdf. Accessed: 25 May 2018.
- Flores-Mir C, Brandelli J, Pacheco-Pereira C (2018) Patient satisfaction and quality of life status after 2 treatment modalities: Invisalign and conventional fixed appliances. *Am J Orthod Dentofacial Orthop*. 154: 639-644.
- Chariyalertsak S, Wansom T, Kawichai S, Ruangyuttikarna C, Kemerer VF, Wu AW (2011) Reliability and validity of Thai versions of the MOS-HIV and SF-12 quality of life questionnaires in people living with HIV/AIDS. *Heath Qual Life Outcomes* 15: 1-9.
- Sakthong P, Kasemsup V, Watjana WW (2015) Assessment of health-relates quality of life in Thai patients after heart surgery. *Asian Biomed* 9: 203-210.
- Apidechkul T (2011) Comparison of quality of life and mental health among elderly people in rural and suburban areas, Thailand. *Southeast Asian J Trop Med Public Health* 42: 1282-1292.
- Apidechkul T, Laingoen O, Suwanaporn S (2016) Inequity in accessing health care service in Thailand in 2015: A case study of the hill tribe people in Mae Fah Luang District, Chiang Rai, Thailand. *J Health Res* 30: 67-71.
- World Health Organization (2017) Global Tuberculosis Report 2017, 2017. WHO Report. Available: http://www.who.int/tb/publications/global_report/gtbr2017_main_text.pdf. Accessed: 25 May 2018.
- Kasiulevicius V, Sapoka V, Filipaviciute (2006) Sample size calculation in epidemiological studies. *Gerontologia* 7: 225-231.
- Wongkongdech R, Srisaenpang S, Tungsawat S (2015) Pulmonary TB among Myanmar migrants in Samut Sakhon province, Thailand: A problem or not for the TB control program. *Southeast Asia J Trop Med Public Health* 46: 296-305.
- Wu SF (2014) Rapid screening of psychological well-being of patients with chronic illness: reliability and validity on WHO-5 and PHQ-9 scales. *Depress Res Treat* 2014: 239490.
- World Health Organization (WHO) (2014) Xpert MTB/RIF implementation manual technical and operation 'how to': practical considerations. Available: http://apps.who.int/iris/bitstream/handle/10665/112469/9789241506700_eng.pdf;jsessionid=F1EC65D197715539134AA5497A8BF837?sequence=1. Accessed: 25 May 2018.
- Apidechkul T (2018) Prevalence and factors associated with type 2 diabetes mellitus and hypertension among the hill tribe elderly populations in northern Thailand. *BMC Public Health* 18: 694.
- Shoemaker DM (1969) Note on the attenuating effect of zero-variance items on KR-20. *J Educ Meas* 6: 255-256.
- Tavakol M, Dennick R (2011) Making sense of cronbach's alpha. *Int J Med Educ* 2: 53-55.
- World Health Organization (WHO) (2017) Tuberculosis: Systematic screening for active tuberculosis principles and recommendations. Available: <http://www.who.int/tb/screening/en/>. Accessed: 25 May 2018.
- Pérez-Rojo G, Noriega C, Velasco C, López J (2018) Development and assessment of the content validity of the professional good practices scale in nursing homes. *Int Psychogeriatr Dec* 7: 1-5.
- Wongkongdech R, Srisaenpang S, Tungsawat S (2015) Pulmonary TB among Myanmar migrant workers in Samut Sakhon province, Thailand: A problem or not for the TB control program? *Southeast Asian J Trop Med Public Health* 46: 296-305.
- World Health Organization (2017) Thailand: Tuberculosis. Available: <http://www.searo.who.int/thailand/areas/tuberculosis/en/>. Accessed: 25 May 2018.
- Tschirhart N, Sein T, Nosten F, Foster AM (2016) Migrant and refugee patient perspective on travel and tuberculosis along the Thailand-Myanmar border: A qualitative study. *Plos One* 11: e0160222.
- International Labor Organization (2017) Migrant workers in Thailand. Available: <https://www.ilo.org/global/statistics-and-databases/lang--en/index.htm>. Accessed: 25 May 2018.

28. Nattaya S (2016) Migrant labours in Thailand: An analysis of current situation affected by Thai government policies. Available: <https://www.ucm.es/data/cont/docs/119-2018-04-10-Natthaya%20Sattayaphongphan.pdf>. Accessed: 25 May 2018.
29. United Nations Development Program (2017) Myanmar: Country statistics. Available: <http://www.mm.undp.org/content/myanmar/en/home/countryinfo.html>. Accessed: 28 May 2018.
30. Bhat J, Rao VG, Sharma RK, Muniyandi M, Yadav R, Bhondley MK (2017) Investigation of the risk factors for pulmonary tuberculosis: A case - control study among Saharia tribe in Gwalior district, Madhya Pradesh, India. *Indian J Med Res* 146: 97-104.
31. Verguet S, Riumallo-Herl C, Gomez GB, Menzies NA, Houben RMGJ, Sumner T, Lalli M, White RG, Salomon JA, Cohen T, Foster N, Chatterjee S, Sweeney S, Baena IG, Lönnroth K, Weil DE, Vassall A (2017) Catastrophic costs potentially averted by tuberculosis control in India and South Africa: a modelling study. *The Lancet* 5: e1123-32.
32. Rendon A, Centis R, Zellweger JP, Solovic I, Torres-Duque CA, Cordeiro CR, Mello FC, Manissero D, Sotgiu G (2018) Migration, TB control and elimination: Whom to screen and treat. *Pulmonary* 24: 99-105.
33. Junya D, Somyot K, Sriprapa N, Suthapa P, Virat K, Nuapun M, Yongyut M, Eric P, Sara W, Apiratee K, Panama M, Michael M (2017) Implementing an isoniazid preventive therapy program for people living with HIV in Thailand. *PLoS One* 12: e0184986.
34. Center for Global Department (2017) Thailand's Universal Coverage Scheme. Available: <http://millionssaved.cgdev.org/case-studies/thailands-universal-coverage-scheme>. Accessed: 25 May 2018.
35. Ministry of Foreign Affairs (2017) Thailand's voluntary national review on the implementation of the 2030 agenda for sustainable development. Available: <http://www.mfa.go.th/sep4sdgs/contents/filemanager/images/sep/VNR%20English.pdf>. Accessed: 29 May 2018.
36. Tschirhart N, Nosten F, Foster AM (2016) Access to free or low -cost tuberculosis treatment for migrants and refugees along the Thailand-Myanmar border in Tak province, Thailand. *Int J Equity Health* 15: 100.
37. Tschirhart N, Nosten F, Foster AM (2017) Migrant tuberculosis patient needs and health system response along the Thailand-Myanmar border. *Health Policy Plan* 32: 1212-1219.
38. Anjara SG, Nellums LB, Bonetto C, Van BT (2017) Stress, health and quality of life of female migrant domestic workers in Singapore: a cross-sectional study. *BMC Women Health* 17: 98.
39. Schilgen B, Niehaus A, Handtke O, Schulz H, Mosko M (2017) Health situation of migrant and minority nurse: A systematic review. *PLoS One* 12: e0179183.
40. Brad T, Samkange-Zeeb F, Ellert U, Keil T, Krist L, Dragano N, Jockel KH, Razum O, Reiss K, Greiser KH, Zimmerman H, Becher H, Zeeb H (2017) Acculturation and health-related quality of life: results from the German National Cohort migrant feasibility study. *Int J Public Health* 62: 521-529.
41. Janssen-Kallenberg H, Schulz H, Kluge U, Strehle J, Wittchen HU, Wolfardt U, Koch-Gromus U, Heinz A, Mosko M, Dingoyan D (2017) *BMC Psychiatry* 17: 264
41. van de Beek MH, van der Krieke L, Schoevers RA, Veling W (2017) Social exclusion and psychopathology in an online cohort of Moroccan-Dutch migrants: Results of the MEDINA-study. *PLoS One* 12: e0179827.

Corresponding author

Dr. Tawatchai Apidechkul
 School of Health Science, Mae Fah Luang University
 333 Mo.1 Tasud Sub-district, Muang District
 Chiang Rai, Thailand, 57100
 Tel: +66 (0) 53 916914;
 Fax: +66 (0) 53 916821
 E-mail: tawatchai.api@mfu.ac.th

Conflict of interests: No conflict of interests is declared.