

# SMOKING, ALCOHOL CONSUMPTION AND BETAL-QUID CHEWING AMONG YOUNG ADULT MYANMAR LABORERS IN THAILAND

Kyaw Htin<sup>1</sup>, Nopporn Howteerakul<sup>1</sup>, Nawarat Suwannapong<sup>2</sup>  
and Mathuros Tipayamongkholgul<sup>1</sup>

<sup>1</sup>Department of Epidemiology, <sup>2</sup>Department of Public Health Administration,  
Faculty of Public Health, Mahidol University, Bangkok, Thailand

**Abstract.** Health-risk behaviors among young adults are a serious public health problem. This cross sectional study aimed to estimate the prevalence of single and concurrent multiple health-risk behaviors: smoking tobacco, consuming alcohol, and chewing betel quid among young adult Myanmar laborers in Mae Sot District, Tak Province, Thailand. Three hundred Myanmar laborers, aged 18-24 years, were interviewed using a structured questionnaire. About 33.6% reported no risk behaviors, 24.7% had one, and 41.7% had two or three risk behaviors. Multinomial logistic regression analysis showed six variables were significantly associated with health-risk behaviors: male gender, high/moderate custom/traditional influences, friends who smoked/consumed alcohol/chewed betel quid, and exposure to betel-quid chewing by other family members.

**Keywords:** migrants, laborers, job stress, multiple health-risk behaviors, social influences, young adults, Thailand

## INTRODUCTION

Thailand is a developing middle-income country in Southeast Asia. It has become the most developed country in the Greater Mekong Sub-region (GMS), offering more employment opportunities and higher wages than neighboring countries (Hall, 2011; McGann, 2014). This is one reason why large numbers of migrant workers from Cambodia, the

Lao People's Democratic Republic (Lao PDR), and Myanmar have been residing and working in Thailand for many years. In 2009, about 1,078,767 registered migrant workers from Myanmar, 124,761 from Cambodia, and 110,854 from Lao PDR were working in Thailand (Office of Foreign Workers Administration, 2010). The majority of migrant workers were hired in agriculture and husbandry, construction, fishery-related, domestic work, and factories (Chantavanich and Vungsiriphisal, 2012). As the numbers of migrants increase, so do concerns about their health status.

Migrants may be exposed to health risks before, during, and after leaving their country of origin. Migration-related factors may influence perceptions of risk and risk behaviors; psychosocial stress

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Correspondence: Dr Nopporn Howteerakul, Department of Epidemiology, Faculty of Public Health, Mahidol University, 420/1 Ratchawithi Road, Bangkok 10400, Thailand.

Tel: +66 (0) 2354 8541; Fax: +66 (0) 2354 8567  
E-mail: npp92432@yahoo.com

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due to perceived lower social position, unemployment, and being a member of a minority group, may mean migrants have to cope with acute and immediate issues rather than the potential negative health effects later in life of current health behaviors (Kristiansen *et al*, 2007; Calderon *et al*, 2012; Lehane and Ditton, 2012). For most young adult Myanmar workers, life in Thailand limits their opportunities for normative behaviors, such as going out during holidays and socializing with friends. Most are employed in unskilled jobs with long hours, low wages, and poor working conditions. Often they live in congested factory dormitories, with poor quality food provided by their employers. They suffer from homesickness and stress due to their poor physical and psychosocial working environments (Latt, 2012). In addition, some are faced with communication and language barriers that impede access to health services (Power and Pratt, 2012). These factors are catalysts for many young Myanmar laborers to engage in health-risk behaviors, such as using recreational substances: smoking, drinking alcohol, and chewing betel quid.

A study of Myanmar laborers aged 15–24 years in Samut Sakhon Province (central Thailand), in 2000, found the prevalence of smoking to be 21.5%, and alcohol consumption 25.4%. However, no female young adults reported these health-risk behaviors. The results also revealed that high-to-moderate job stress was a factor related to alcohol consumption among these migrant laborers (Howteerakul *et al*, 2005).

Chewing betel quid is another common health-risk behavior among Myanmar laborers in Thailand (Latt, 2012) and adults in Southeast Asia (Gupta and Warnakulasuriya, 2002; Gupta and Ray, 2004; Flora *et al*, 2012). The estimated pre-

valence among Southeast Asian adults was between 25%–50%, with peaks of 80%–90% in some areas and among some rural ethnic groups, with few differences in consumption between males and females. Betel quid is a mixture of substances; it usually contains betel leaf, areca nut, tobacco, and slaked lime. Many chewers use tobacco in betel quid, but some do not (Williams *et al*, 2002). Betel quid is also a socio-cultural practice, used as a recreational substance or for its stimulant effects, and to diminish hunger and as recreation (Gupta and Warnakulasuriya, 2002).

To our knowledge, no literature on the prevalence of betel-quid chewing among young adult Myanmar laborers in Thailand has thus far been published. In addition, most previous studies have focused on a single health-risk behavior (Ho and Gee, 2002; Wang *et al*, 2003; Howteerakul *et al*, 2005; The, 2006; Dorji *et al*, 2012), whereas young migrant laborers tend to practice multiple risk behaviors concurrently. This study focused on three major health-risk behaviors—smoking tobacco, consuming alcohol, and chewing betel quid—because they are highly interrelated.

Those who smoke also tend to consume alcohol and use other substances, such as betel quid. Moreover, habitual alcohol consumers, smokers, and betel-quid chewers are at higher risk of oral cancers (IARC, 2004; Lee *et al*, 2005; Ariyawardana *et al*, 2006; Muwonge *et al*, 2008; Yen *et al*, 2008; Lin *et al*, 2011; Loyha *et al*, 2012; Guo *et al*, 2013; Petti *et al*, 2013). In Myanmar, oral cancer ranks 6<sup>th</sup> in males and 10<sup>th</sup> in females and accounted for 3.5% of whole body cancers. About 90% of male and 44% of female patients had habitual backgrounds of chewing and smoking for >15 years. This suggested that long-term betel-quid chewing and smoking tobacco are risk factors for oral cancer (Oo *et al*, 2011).

In Thailand, data on the incidence of oral cancer among Myanmar laborers are unavailable. However, the use of recreational substances, such as alcohol consumption, tobacco smoking, and betel-quid chewing, is common among Myanmar laborers in Thailand (Howteerakul *et al*, 2005; The, 2006; Latt, 2012).

Therefore, this study aimed to estimate the prevalence of single and concurrent multiple health-risk behaviors (smoking tobacco, consuming alcohol, chewing betel quid) among young adult Myanmar laborers in Mae Sot District, Tak Province, Thailand. The study results will help provide baseline information for relevant government authorities and allied organizations and other interested persons to help understand the health behaviors of migrants and to describe baseline data for further studies.

## MATERIALS AND METHODS

### Study site and population

This cross sectional study was conducted in Mae Sot District, Tak Province, about 436 km northwest of Bangkok. The province shares a 560 km border with Myanmar to the west. Clusters of documented and undocumented Myanmar migrants reside in these border areas (Kongsin *et al*, 2008). In 2009, the population of Mae Sot District was 119,125 (Hall, 2011). Over 6,000 Myanmar migrants resided in the municipal area of Mae Sot District (Kongsin *et al*, 2008).

The inclusion criteria were: 1) Myanmar migrant laborer aged 18-24 years, either documented or undocumented; 2) able to speak the Myanmar language and stayed in the study area for at least three months, and 3) willing to participate in the study. Myanmar migrant laborers who

were too ill or too cognitively impaired to participate in the study, or were absent from the community during the data-collection period, were excluded.

### Sampling

Migrants are frequently a hard-to-reach group, and a sampling frame is not available. The use of traditional household survey sampling methods to select the study samples is inappropriate (Agadjanian and Zotova, 2012). In this study, a systematic sampling technique was used to select six of fourteen communities, or clusters, from the study area. In each community, a probability proportional to size technique was used to select 40-50 samples. The study samples were also drawn according to workplace, unit of work, or function of job in each community.

Sample size was estimated using the single proportion formula, with 95% confidence interval. Sample size calculation was based on a previous study, which found 63.1% of young adult Myanmar laborers in Mae Sot smoked (The, 2006). Precision was set at 5.5%, and sample size was calculated to be at least 296 young adult Myanmar laborers.

### Ethical considerations

The Ethics Committee of the Faculty of Public Health, Mahidol University, approved the research protocol (COA No. MUPH 2013-042; 2013 Jan 22). All participants were clearly informed of their rights and any risks associated with their participation. Verbal consent was obtained from all participants before interview. At all times, the researchers respected the participants' dignity and personal privacy.

### Measurements

**Baseline characteristics.** There were nine questions, including age, gender, marital

status, education, occupation, income, duration of stay in Thailand, documentation status while living in Thailand and whether stay alone or with others.

**Job stress.** Job stress was evaluated with 20 questions (Howteerakul *et al*, 2005). It assessed workload (three items), feelings at work (three items), workplace (four items), colleagues (three items) and supervisor/boss at work (three items), and their role in the workplace (four items).

All questions were positive statements, and responses followed a Likert-type rating system, ranging from 5=Strongly Agree, 4=Agree, 3=Uncertain, 2=Disagree, and 1=Strongly Disagree. Of the possible total score, a range of 20-59 (<60% of the total score) was classified as 'High job stress', 60-79 (60%-79% of the total score) as 'Moderate,' and 80-100 ( $\geq 80\%$ ) as 'Low.' The Cronbach's alpha coefficient was 0.89.

**Social influences.** Social influences were evaluated with 33 questions (Howteerakul *et al*, 2005; The, 2006; Dorji *et al*, 2012). It measured financial problems (six items), peer pressure (three items for each health risk), family influences (three items for each health risk) and customs/traditional influences (three items for each health risk).

**Financial problems.** Financial problems were measured by the affordability of six household expenditure categories: accommodation, clothing, furniture or household equipment, food, medical care, and leisure. For examples, one has enough money to rent the type of accommodation one likes; one has enough money to afford the kind of clothing one wants; and one has enough money to afford the kind of food one need. Responses were rated on a three-point rating scale: 2=Always, 1=Sometimes, and 0=Never. Of the possible total score, a range of 0-6 (<60% of

the total score) signified 'High financial problems', 7-9 (60%-79%) 'Moderate,' and 10-12 ( $\geq 80\%$ ) 'Low.' The Cronbach's alpha coefficient was 0.74.

**Peer pressure.** Peer pressure was assessed by three questions: "Do you have any friends who smoke? If yes, how many of your friends are smokers? Does the friend who smokes persuade you to smoke? Family influence was assessed by three questions: Do you have any family members who smoke? If yes, who is/are the smokers in your family? Did your family members' smoking status have any influence on you to start smoking?

**Customs/traditional influences.** These measurements were assessed by three questions, with a dichotomous format: "Offering a cigarette (smoking) is a must in social gatherings, such as weddings, funerals, annual religious festivals, etc." "Refusal to accept a cigarette (smoking) in a social gathering shows disrespect for the host." "(Smoking) can facilitate hospitality and friendship among people." A score of 1 was assigned for "Yes" and 0 for "No". Of the possible total score for the three health risk behaviors (smoking, drinking, chewing betel), a range of 7-9 ( $\geq 80\%$ ) meant High customs/traditional influences, 5-6 (60%-79%) Moderate, and 0-4 (<60%) Low. The Cronbach's alpha coefficient was 0.75.

**Health risk behaviors.** Health risk behaviors were evaluated with four questions for each health risk (Howteerakul *et al*, 2005; The, 2006; Dorji *et al*, 2012), including starting age, duration of behavior, and intention to quit each health-risk behavior in the future.

#### Data analysis

Data entry and analysis were conducted using SPSS for Windows® (version 18.0; IBM, Armonk, NY). Baseline

characteristics and study variables were described by frequency, mean, standard deviation, and range. Health-risk behaviors were grouped into three categorical outcomes, no risk, one risk, and two or three risks. Multinomial logistic regression analysis was used to assess the association between all independent variables and concurrent multiple health-risk behaviors. This method is an extension of binary logistic regression; however, it allows for more than two categorical outcomes (Chan, 2005).

In the univariate analysis, each individual study variable was analyzed separately by simple multinomial logistic regression. In the multivariate analysis, checking the standard errors for the regression coefficients assessed the multicollinearity problem in the logistic regression analyses. A standard error  $>2.0$  indicated numerical problems, such as multicollinearity among the independent variables, requiring the variable to be omitted from the model (Chan, 2004). All variables with  $p$ -value  $\leq 0.25$  by univariate analysis, and no multicollinearity problems, were entered simultaneously for multinomial logistic regression analysis. Significance was set at  $p \leq 0.05$ .

The questionnaire was formulated in English and translated into Burmese. The first author and four trained research assistants who were working in a non-governmental organization in Mae Sot District, who were experienced in data collection interviewed the participants in the community during the afternoon and evening after work, which was the laborers' leisure-time. The study data were collected during February 2013.

## RESULTS

Of the 300 young adult Myanmar

Table 1  
Baseline characteristics of young adult  
Myanmar laborers ( $N=300$ ).

Variable	n	%
Age (yrs)		
18-20	112	37.3
21-24	188	62.7
Mean $\pm$ SD = $21.6 \pm 2.2$ , range=18-24		
Gender		
Male	168	56.0
Female	132	44.0
Marital status		
Single/widowed/divorced	161	53.7
Married	139	46.3
Education		
Primary school or lower	84	28.0
Secondary school or higher	216	78.0
Occupation		
Laborer: factory	185	61.7
Laborer: non-factory	115	38.3
Monthly income (THB) (USD 1 =THB31.5)		
$\leq 3,500$	142	47.3
$>3,500$	152	52.7
Mean $\pm$ SD = $3,691.3 \pm 1,061.6$ , range = 1,500-6,000		
Duration of stay in Thailand (yrs)		
$\leq 3$	173	57.7
$>3$	127	42.3
Mean $\pm$ SD = $3.7 \pm 3.0$ , range = 0.42-17		
Documentation status in Thailand		
No	212	70.7
Yes	88	29.3
Living in Thailand		
Alone/with friend	108	36.0
With family	192	64.0

laborers, 62.7% were aged 21-24 years, 56.0% were male, 46.3% were married, 78.0% finished secondary school or above, 61.7% were factory laborers, 52.7% had incomes  $>$ THB3,500 (USD1=THB31.5), 57.7% had stayed in Thailand for  $\leq 3$  years, 70.7% were undocumented immigrants, and 64.0% lived with their families (Table 1).

Table 2  
Prevalence of health-risk behaviors among young adult Myanmar laborers (N=300).

Variable	n	%
Current smoker	118	39.3
Age started smoking (years), n=118		
8-20	98	83.1
21-24	20	16.9
Mean ± SD = 18.3 ± 3.0, range=8-24		
Days of smoking per week (days), n=118		
1-3	25	21.2
7	93	78.8
Mean ± SD = 6.3 ± 1.6, range=1-7		
Intention to quit smoking (n=118)		
Not ready to quit smoking within 6 months	77	65.3
Ready to quit smoking within 6 months	34	28.8
Ready to quit smoking now	7	5.9
Current drinker, n=110	110	36.7
Age started consuming alcohol (years), n=110		
13-20	88	80.0
21-24	22	20.0
Mean ± SD = 19.2 ± 2.4, range=13-24		
Days consuming alcohol per week (days), n=110		
1-6	105	95.5
7	5	4.5
Mean ± SD = 2.9 ± 1.8, range=1-7		
Intention to quit alcohol consumption (n=110)		
Not ready to quit alcohol consumption within 6 months	67	60.9
Ready to quit alcohol consumption within 6 months	39	35.5
Ready to quit alcohol consumption now	4	3.6
Current betel-quid chewer	160	53.3
Age started betel-quid chewing (years), n=160		
10-20	138	86.2
21-24	22	13.8
Mean ± SD = 18.2 ± 2.7, range=10-24		
Days of betel-quid chewing per week (days), n=160		
1-6	44	27.5
7	116	72.5
Mean ± SD = 5.6 ± 2.0, range=1-6		
Intention to quit betel-quid chewing (n=160)		
Not ready to quit betel-quid chewing within 6 months	129	81.1
Ready to quit betel-quid chewing within 6 months	19	11.9
Ready to quit betel-quid chewing now	11	6.9

#### Prevalence of health-risk behaviors

Concerning 39.3%(118/300) were current smokers. Of the 118 current smokers, 83.1% started smoking at age ≤20 years; 78.8% smoked 7 days per week; 65.3% of the current smokers were not ready to quit

smoking within the next 6 months.

In terms of alcohol consumption, 36.7% (110/300) were current alcohol drinkers. Of the 110 alcohol drinkers, 80.0% started drinking alcohol at age ≤20 years; 95.5% drank alcohol 1-6 days

Table 3  
Patterns of health-risk behaviors among young adult Myanmar laborers, by gender  
(N=300).

Variable	Male %(n=168)	Female %(n=132)	Total %(N=300)
No risk	18.8 (19)	81.2 (82)	33.6 (101)
One risk	18.5 (31)	32.5 (43)	24.7 (74)
Smoking	35.5 (11)	4.7 (2)	4.3 (13)
Alcohol consumption	25.8 (8)	0.0 (0)	2.7 (8)
Betel-quid chewing	38.7 (12)	95.3 (41)	17.7 (53)
Two or three risks	70.2 (118)	5.3 (7)	41.7 (125)
Smoking + alcohol consumption	15.3 (18)	0.0 (0)	6.0 (18)
Smoking + betel-quid chewing	16.1 (19)	57.1 (4)	7.7 (23)
Alcohol consumption + betel-quid chewing	16.1 (19)	14.3 (1)	6.7 (20)
Smoking+alcohol consumption+betel-quid chewing	52.5 (62)	28.6 (2)	21.3 (64)

Table 4  
Level of job stress, financial problems and customs/traditional influences among 300 young adult Myanmar laborers, by gender.

Variable	Male %(n=168)	Female %(n=132)	Total %(N=300)
Level of job stress			
Low	8.9 (15)	18.2 (24)	13.0 (39)
Moderate	64.3 (108)	67.4 (89)	65.7 (197)
High	26.8 (45)	14.4 (19)	21.3 (64)
Level of financial problems			
Low	3.0 (5)	1.5 (2)	2.3 (7)
Moderate	49.4 (83)	40.9 (54)	45.7 (137)
High	47.6 (80)	57.6 (76)	52.0 (156)
Level of customs/traditional influences			
Low	50.0 (84)	75.0 (99)	61.0 (183)
Moderate	35.7 (60)	17.4 (23)	27.7 (83)
High	14.3 (24)	7.6 (10)	11.3 (34)

a week; 60.9% of the current alcohol drinkers were not ready to cease alcohol consumption within the next 6 months.

Regarding betel-quid chewing, 53.3% (160/300) were current betel-quid chewers. Of the 160 betel-quid chewers, 86.2% started chewing betel quid at age  $\leq 20$

years; 81.1% of the current betel-quid chewers were not ready to quit within the next 6 months (Table 2).

#### Patterns of health-risk behaviors

Approximately one-fourth (24.7%, 74/300) of the young adult Myanmar laborers had one health-risk behavior,

and 17.7% were betel-quid chewers. The proportion of males with one risk factor was significantly lower than the females (18.5% vs 32.5%). However, on closer examination, the proportions of male smokers or alcohol drinkers were significantly higher than the females (35.5% vs 4.7%; 25.8% vs 0.0%, respectively), except for betel-quid chewing, where the proportion of female betel-quid chewers was significantly higher than the males (95.3% vs 38.7%).

Forty-two percent (125/300) reported two or three risk behaviors. The proportion of males having two or three risk behaviors was significantly higher than females (70.2% vs 5.3%), 21.3% (64/300) had three risk behaviors (smoking, alcohol consumption, and betel-quid chewing). The proportion of males with three risk behaviors was significantly higher than females (52.5% vs 28.6%) (Table 3).

#### **Levels of job stress, financial problems and customs/traditional influences**

Of the 300 young adult Myanmar laborers, 21.3% reported having high levels of job stress, the proportion of males was higher than females (26.8% vs 14.4%), 52.0% reported high levels of financial problems and the proportion of females was higher than males (57.6% vs 47.6%), 11.3% reported high levels of customs/traditional influence and the proportion of males was higher than females (14.3% vs 7.6%) (Table 4).

#### **Factors associated with health-risk behaviors**

In the univariate analysis, each study variable was analyzed separately by simple multinomial logistic regression. Eleven variables were significantly associated with health-risk behaviors: age 21-24 years, male, married, high/moderate job stress, high/moderate customs/traditional

influences, friends who smoke/consume alcohol/chew betel quid, exposure to family member smoking/drinking alcohol/chewing betel quid (data not shown).

In the multivariate analysis, all variables associated with health-risk behaviors at  $p \leq 0.25$  in the univariate analysis and with no multicollinearity problems, were simultaneously entered for multinomial logistic regression analysis. Six variables remained significantly associated with health-risk behaviors: male gender, high/moderate customs/traditional influences, having friends who smoke/consume alcohol/chew betel quid, and exposure to family member's betel-quid chewing (Table 5).

## **DISCUSSION**

The findings of this study indicated that the prevalence of health-risk behaviors among young adult Myanmar laborers in Mae Sot District was high for alcohol consumption (36.7%), smoking (39.3%), and betel-quid chewing (53.3%). Further examination of health-risk behavior patterns showed that the prevalence of young adult laborers with two or three health-risk behaviors was significantly higher than those with one risk (41.7% vs 24.7%). The results confirmed previous studies that found young adult laborers practiced concurrent multiple health risks, especially young adult male laborers; those who smoked also tended to consume alcohol and chew betel quid (Lee *et al.*, 2005; Yen *et al.*, 2008; Lin *et al.*, 2011; Guo *et al.*, 2013; Petti *et al.*, 2013).

This study found that, for one risk behavior (betel-quid chewing), the proportion of females was significantly higher than males (95.3% vs 38.7%). However, the female proportions for smoking and alcohol consumption were significantly

Table 5

Multinomial logistic regression analysis of associated factors for health-risk behaviors among 300 young adult Myanmar laborers.

Variable	One risk (vs no risk)		Two or three risks (vs no risk)	
	OR <sup>a</sup>	95% CI	OR <sup>a</sup>	95% CI
Age (yrs)				
18-20	0.72	0.33-1.58	0.54	0.22-1.30
21-24	1.00		1.00	
Gender				
Male	2.65	1.15-6.11	42.37	15.22-117.93
Female	1.00		1.00	
Marital status				
Single/widowed/divorced	0.55	0.25-1.20	0.54	0.22-1.34
Married	1.00		1.00	
Job stress				
High and moderate	1.23	0.48-0.16	1.57	0.49-5.07
Low	1.00		1.00	
Financial problems				
High	1.65	0.77-3.56	1.22	0.52-2.87
Low and moderate	1.00		1.00	
Customs/traditional influences				
High and moderate	2.44	1.10-5.43	1.93	0.79-4.73
Low	1.00		1.00	
Friends who smoke				
Yes	0.85	0.37-2.00	2.89	1.03-8.16
No	1.00		1.00	
Friends who consume alcohol				
Yes	1.38	0.63-3.01	4.61	1.78-11.96
No	1.00		1.00	
Friends who chew betel quid				
Yes	4.42	1.75-11.19	3.37	1.12-10.14
No	1.00		1.00	
Exposure to family-member smoking				
Yes	0.55	0.24-1.27	1.09	0.40-2.95
No	1.00		1.00	
Exposure to family-member consuming alcohol				
Yes	1.71	0.77-3.76	1.02	0.41-2.52
No	1.00		1.00	
Exposure to family member chewing betel quid				
Yes	2.55	1.05-6.20	1.05	0.40-2.77
No	1.00		1.00	

<sup>a</sup>Odds ratio adjusted for age, gender, marital status, job stress, financial problems, customs/traditional influences, friends who smoke/consume alcohol/chew betel quid, exposure to family member smoking/consuming alcohol/chewing betel quid.

lower than for males (smoking 4.7% vs 35.5%; drinking alcohol 0.0% vs 100.0%). This may be because betel quid is quite inexpensive and easy to procure in Mae Sot, and its use is an accepted behavior among young adult Myanmar laborers. Males and females of all ages chew betel quid (*Kun-yar* in Burmese).

Betel-quid is offered to guests who come to offer their congratulations, good wishes, and gifts on special occasions, such as weddings, funerals, and annual religious festivals; however, elders and the general community consider smoking and alcohol consumption to be poor behavior.

The prevalence of smoking and alcohol consumption among young adult Myanmar laborers in this study was quite high, compared with Myanmar laborers aged 18–24 years in Samut Sakhon (smoking, 39.3% vs 21.5%; alcohol consumption, 36.7% vs 25.4%) (Howteerakul *et al*, 2005). This discrepancy might be due to differences in the sample population and the year of the study.

Most Myanmar laborers in Mae Sot crossed the Moei River, the border between Mae Sot and Myawaddy, both legally and illegally. Many of the young Myanmar adults worked in factories. Due to the large number of Myanmar immigrants, the Burmese language is spoken widely throughout Mae Sot. Burmese restaurants and food stalls are abundant. Signs are often written in Burmese. Migrants living in Mae Sot are more deeply imbued with Myanmar culture and lifestyle than young adult Myanmar laborers in Samut Sakhon, a province in central Thailand.

#### **Factors associated with health-risk behaviors**

Multinomial logistic regression analysis found four variables to be significantly

associated with health-risk behaviors, compared with 'one risk' vs 'no risk,' and 'two or three risks' vs 'no risk': male gender, friend who smokes/drinks alcohol/chews betel quid, exposure to family member's betel-quid chewing, and high/moderate customs/traditional influences.

One important finding was the significant difference in risk factors between the sexes for single and concurrent health-risk behaviors. The likelihood of males practicing two or three health-risk behaviors (vs 'no risk') was markedly higher than the likelihood of males practicing only 'one risk' (vs 'no risk') behavior, compared with females (42.37 times vs 2.65 times). The possible explanation was that, for 'two or three risk' behaviors, data from the gender-stratified analysis indicated that the proportions for all combinations of two and three health-risk patterns in females were significantly lower than males; however, for single health-risk patterns, the proportions of females who smoked or drank alcohol were significantly lower than for males, except for betel-quid chewing, which was significantly higher than for males. This reduced the overall likelihood that more males practiced one risk behavior than females.

An alternative reason is a social-acceptability reporting bias, where males may exaggerate and females underreport concurrent health-risk behaviors. A previous study in Lao PDR showed similar results, with males being more likely to report engaging in concurrent health-risk behaviors than females (Sychareun *et al*, 2011). Although females had a lower proportion of concurrent multiple health-risk behaviors than males did (5.3% vs 70.2%), the proportion of females chewing betel quid was quite high (95.3%, 41/43). Therefore, females were also at high risk of gum disease and oral cancers.

Young adult laborers with high/moderate customs/traditional influences were found to be more likely to practice one health-risk behavior than those with low customs/traditional influences (adjusted OR 2.42; 95%CI: 1.09-5.37). A possible explanation is that the highest proportion of single-risk behaviors was betel-quid chewing, which was an acceptable health risk to elders and members of the general community. By contrast, smoking and alcohol consumption were considered poor behaviors, deprecated by many Myanmar Buddhists, who interpret the fifth lay precept against intoxication very strictly. This finding was inconsistent with the finding in Bhutan, where customs/traditional influences were not significantly associated with betel-quid chewing behavior (Dorji *et al*, 2012).

Young adult laborers, who had friends who were smokers, alcohol drinkers, or betel-quid chewers, were more likely to practice multiple health-risk behaviors than those who did not have such friends. These results concur with previous findings, which suggested that adolescents who are connected with peers practicing negative behaviors were more likely to practice health risk-related behaviors (Hoffman *et al*, 2007; Huang *et al*, 2010; van der Vorst *et al*, 2010; Cruz *et al*, 2012). The results also agree with a study of adolescents in Lao PDR, which found that peer behaviors were associated with concurrent health-risk behaviors (Sychareun *et al*, 2011).

Regarding family influences, young adult laborers who were exposed to family members' betel-quid chewing were more likely to practice one health risk behavior than those who were not exposed (adjusted OR 2.56; 95%CI: 1.05-6.24). This result agreed with the findings of other studies (Wang *et al*, 2003; Dorji *et al*, 2012;

Velayudhan *et al*, nd) that suggest a family history of betel-quid chewing encourage other family members to use betel. Most Myanmar laborers live in an extended family with the older generation. It might be that their family members influenced their betel-quid chewing habits.

This study had some limitations: first, the sampling method used to select this hard-to-reach population was modified from a workplace-based stratified probability design, a variant of the time-location sampling approaches used to sample female labor migrants in Moscow, Russia (Agadjanian and Zotova, 2012). In this study, some respondents lived in dormitories; therefore, samples were also drawn according to workplace, unit of work, or function of job in each community. This may have affected the representativeness of the study samples.

The second limitation was the small sample size, which represented only the prevalence of health-risk behaviors (smoking, alcohol consumption, and betel-quid chewing) among young adult Myanmar laborers in the study locale. In addition, the sample size was too small to analyze the factors associated with health-risk behaviors by gender-stratified analysis using multinomial logistic regression analysis.

Third, this was a cross sectional study, and it determined associations rather than causal relationships between significant factors and the health-risk behaviors of young adult Myanmar laborers. Furthermore, health-risk behaviors are not static, and may change over time (Eaton *et al*, 2012; Mahalik *et al*, 2013). Therefore, further longitudinal studies are recommended, with a wider range of respondents, to examine the influence of family, friends and Myanmar culture in the community on betel quid chewing and the interaction

of the three concurrent health-risk behaviors on migrants' oral health.

In conclusion, the prevalences of single and concurrent multiple health-risk behaviors among Myanmar laborers aged 18-24 years were quite high. Approximately 21.3% concurrently practiced smoking, alcohol consumption, and betel-quid chewing. These behaviors put them at increased risk of a range of diseases. Longitudinal studies with larger sample groups are needed to evaluate any causal relationships between these health-risk behaviors and the associated factors identified in this study.

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