

## RESEARCH ARTICLE

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# Knowledge and Behaviors toward Human Papillomavirus and Cervical Cancer in the Women of Reproductive Age in Thailand-Myanmar Border Areas

Patumrat Sripan<sup>1</sup>, Arunrat Tangmunkongvorakul<sup>1</sup>, Linda Aurbibul<sup>1</sup>, Hathairat Thongkiao<sup>2</sup>, Nuntisa Chotirosniramit<sup>1</sup>, Kriengkrai Srithanaviboonchai<sup>1,3\*</sup>

### Abstract

**Background:** Infectious disease is an important health problem in border areas as there is a possibility that the migrants may carry the disease into the area. The purpose of this study is to evaluate the knowledge and behaviors toward human papillomavirus (HPV) and cervical cancer in the women of reproductive age in the Thailand-Myanmar border area. **Methods:** A survey study in a population of 418 women of reproductive age in Mae Hong Son Province in the Thailand-Myanmar border area. Knowledge and risk behaviors of HPV and cervical cancer were described using descriptive statistics. **Results:** Fifty percent of the participants had sexual debut at age less than 20 years, 27% had more than one lifetime sexual partner and only 3% had sex outside a monogamous relationship during the past 12 months. In term of knowledge, 62.5% knew about HPV. The proportion of correct answers about HPV and cervical cancer questions ranged from 14–95% and 52–94%, respectively. Among the cervical cancer screening target, 69.4% accessed the screening. The factors associated with better knowledge about HPV and cervical cancer were education level higher than high school and sexual debut. **Conclusion:** The women of reproductive age in the Thailand-Myanmar border areas showed relatively low sexually risk behaviors for HPV infection. More than one-third of the participants did not know about HPV. The percentage of correct answer to questions about cervical cancer were low. We encourage the Thai Ministry of Public Health to increase health promotion and health literacy on prevention of HPV and cervical cancer in the women of pre- and reproductive age in the Thailand-Myanmar border area.

**Keywords:** Thailand-Myanmar border- HPV- cervical cancer- knowledge- risk behavior

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### Introduction

Human papillomavirus (HPV) is the most common cancer-related virus, especially in low- and middle-income countries [1]. The HPV genotype 16 and 18 cause the highest risk of cancers [2]. This virus can be transmitted or contracted through oral, vaginal, and anal sex. HPV infection can cause several types of cancer, including cervical, anal, oropharyngeal, vulvar, vaginal and penile cancers [3]. The most common HPV-related cancer is cervical cancer which is the second most common type of cancer in women in Southeast Asia [4]. The rates of sexually transmitted diseases (STD), including HPV infection, in the upper Northern region tend to increase. From 2009 to 2016, STD rates tended to increase, with disease rates of 25.96, 27.79, 28.86, 37.01, 30.82, 33.02, 39.93, and 41.86 per 100,000 people, respectively [5].

HPV can be prevented by avoiding risk factors, but the best protection against HPV infection is vaccination.

However, in Thailand, access to vaccines is still limited. Currently, it has been found that vaccination against HPV virus is the most effective and cost-effective way to prevent cervical cancer in Thailand [6]. Thailand launched a pilot project to use the HPV vaccine in 2014-2016 among girls in grade 5. It was expanded the service nationwide and included as a routine vaccine in the immunization program in 2017 [7]. Universal access to vaccines for particular group of populations is limited, especially in remote border areas. In addition, cervical cancer screening, which is secondary prevention, has limited access.

The upper Northern region has borders with two neighboring countries: Myanmar and Laos. Mae Hong Son, Chiang Mai, Chiang Rai, Phayao, and Nan are the five provinces that share a border with these two nations. Every district of Mae Hong Son Province, which is situated in Thailand's upper north, borders Myanmar [8]. The incidence of cervical cancer in some areas bordering Myanmar was found to be higher than the overall

<sup>1</sup>Research Institute for Health Sciences, Chiang Mai University, Chiang Mai, Thailand. <sup>2</sup>Mae Hong Son Public Health Office, Ministry of Public Health, Thailand. <sup>3</sup>Department of Community Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand. \*For Correspondence: kriengkrai.s@cmu.ac.th

incidence in the Northern region [9, 10]. In Myanmar, the most frequent cancer among women is cervical cancer. Myanmar has the second-highest incidence of cervical cancer in Southeast Asia only after Indonesia [11]. Cross-border travel has led to population movement in the international border area, making it difficult to control HPV infection and led to the increase of HPV and other STD, especially AIDS. This occurred on both sides of the Thailand-Myanmar border [12].

Knowledge about HPV and perceived risk of having diseases that associate with HPV infection is associated with a reduction in behaviors at risk for HPV infection [13]. The results about the evaluation of knowledge and understanding about HPV and diseases caused by HPV infection in various groups of people may help provide basic information for planning to raise awareness to reduce the risk of HPV infection in order to prevent cervical cancer. This may also reduce disparity in cervical cancer incidence and mortality. The knowledge and risk behavior of HPV infection and cervical cancer in women of reproductive age in Thailand-Myanmar border has not been reported. This study aimed to evaluate knowledge and behaviors toward human papillomavirus and cervical cancer in the women of reproductive age in the Thailand-Myanmar border area.

## Materials and Methods

### *Study design and participants*

This is a cross-sectional study. The eligible criteria were Thai women with national ID card who live in Mueang, Pai, and Khun Yuam districts in Mae Hong Son province, aged 18-49 years, stayed in the study areas (Supplementary Figure 1) at least 1 year, understood Thai language, and were interested and willing to participate by giving informed consent. The estimated sample size based on theory of probability for the survey study was 394. Previous study in this population found that about 6.3 percent refused to be interviewed about sexual behavior. The study team considered adding 24 women, resulting in a sample size of 418 women. The eligible participants were recruited from June 2021 to August 2021 and interviewed by the trained interviewer based on the questionnaire at the district hospitals of study area (Mueang, Pai, and Khun Yuam districts).

### *Measurements*

An anonymous questionnaire consisted of four parts including 1) demographics, 2) behaviors 3) knowledge about HPV (7 items) 4) knowledge about cervical cancer (8 items). The questionnaire was validated by three experts on molecular and infectious agents of HPV, health behavior and public health epidemiology. For Part 3 and Part 4, the answers were “true,” “false,” or “do not know”. The number of correct answers was counted and “do not know” was considered as an incorrect answer. The knowledge about HPV and cervical cancer screening was described and categorized into 3 level including low, medium, and high.

### *Statistical analysis*

Descriptive statistics were used to describe the demographic characteristics and health behavior of the participants as a number and percentage. All the information was described and compared by ethnic group which are Northern lowland Thai and hill tribes using Fisher’s exact test. Binary logistic regression was used to determine factor associated with knowing HPV and low knowledge about cervical cancer.

### *Ethical statement*

The study was approved by the Human Experimentation Committee of Research Institute for Health Sciences, Chiang Mai University.

## Results

The data collected from 418 women of reproductive age (18-49 year) in 3 districts in Mae Hong Son Province, Northern Thailand. These included 99 (24%) in Khun Yuam, 186 (44%) in Mueang Mae Hong Son, and 133 (32%) in Pai. The characteristics of participants in this study are shown in Table 1. The median age was 36 years old, most of them were high school/vocational or higher education holders 315 (75%), agricultural workers 137 (33%), married 302 (72%), Buddhist 316 (76%), hill tribes 214 (51%), living with spouse/partner 300 (72%), not having enough income for spending 186 (44%), and using Universal Health Coverage 275 (66%). Among the women aged 18-49 years, 21 (5%) received the HPV vaccine and 279 (67%) had done cervical cancer screening. Among them, 17 (6%) had an interval screening time of more than 5 years.

In terms of sexual behavior, among 389 (93%) who have debuted sexual activity, 50% were < 20 years at the first sexual debut (median age (IQR): 19 (17–22)), 104 (27%) had more than one lifetime partner, 96% had sexual intercourse within 12 months, 75% never used a condom with their own partners, and 9 (3%) had sex outside a monogamous relationship. The proportion of more than one lifetime sexual partner was significantly higher in the Northern lowland Thai and the hill tribes ( $p=0.030$ ) (Table 2).

Table 3 shows knowledge about HPV and cervical cancer. Among the participant, 261 (63%) have heard about HPV. The proportion of correct answers about HPV range from 9%–60%. Almost half of the participants answered the question about HPV incorrectly. The lowest percent of correct answers was found for the question “All types of HPV infections can be prevented by using vaccines” in which only 9% answered correctly. The proportion of correct answers on the questions evaluating knowledge about cervical cancer ranged from 52%–94%. The proportion was highest on the question about whether cervical cancer is treatable when detected in its early stages (94%), followed by the question about whether cervical cancer screening can prevent morbidity and mortality from cervical cancer (88%), and whether having multiple sexual partners increases the risk of cervical cancer (84%). The participants answering correctly that cervical cancer screening is an essential healthcare practice only for

Table 1. Characteristics of Women of Reproductive Age in Thailand-Myanmar Border Areas

Characteristics	n, (%)			P-value <sup>b</sup>
	Total	Lowland Thai	Hill tribes <sup>a</sup>	
Age, year				0.02
<30	116 (28)	58 (29)	58 (27)	
30-39	150 (36)	60 (29)	90 (42)	
40-49	152 (36)	85 (42)	67 (31)	
Mean (IQR)	36 (29-43)	37 (28-44)	36 (29-41)	
Education				<0.001
Never went to school	17 (4)	8 (4)	9 (4)	
Primary school	86 (21)	36 (18)	50 (23)	
High school	184 (44)	66 (32)	118 (55)	
Higher than high school	131 (31)	93 (46)	38 (18)	
Occupation				<0.001
Owned business	39 (9)	31 (15)	8 (4)	
General employment	61 (15)	31 (15)	30 (14)	
Permanent employees	98 (24)	67 (33)	31 (14)	
Agriculturist	137 (33)	39 (19)	98 (46)	
Jobless	81 (19)	34 (17)	47 (22)	
Marital status				<0.001
Single	65 (16)	47 (23)	18 (8)	
Married	302 (72)	137 (67)	182 (85)	
Divorced/Widowed	34 (8)	19 (9)	15 (7)	
Religion				<0.001
Buddhism	316 (76)	193 (95)	123 (57)	
Christianity	100 (24)	8 (4)	92 (43)	
No religion	2 (<1)	2 (1)	0 (0)	
Living with spouse/partner	300 (72)	129 (64)	171 (80)	<0.001
House expense given income				0.001
Enough to save	40 (10)	27 (13)	13 (6)	
Enough to spend	191 (46)	103 (51)	88 (41)	
Not enough to spend	186 (44)	73 (36)	113 (53)	
Health Insurance				<0.001
UHC	275 (66)	116 (57)	159 (74)	
SSS	69 (16)	37 (18)	32 (15)	
CSMBS	57 (14)	42 (21)	15 (7)	
Others	16 (4)	7 (4)	9 (4)	

<sup>a</sup> Karen, Leesu, Mong, Thai-Chinese Yunnan and Lahu; <sup>b</sup>Fisher's exact test; UHC, Universal Health Coverage, SSS, Social Security Scheme; CSMBS, Civil Service Medical Benefits Scheme

women with vaginal discharge or bleeding had the lowest proportion (52%). A lower proportion of correct answers in hill tribes compared to lowland Thai were found for the question about whether cervical cancer screening is an essential healthcare practice only for women with vaginal discharge or bleeding (45% versus 59%), and whether single women should not go for screening (64% versus 75%), while, the proportion was higher in hill tribes compared to lowland Thai for the question about whether smoking increases the risk of cervical cancer (72% versus 56%). Regarding to level of knowledge, the levels of knowledge were low in 21 (5%), medium in 128 (31%), and high in 269 (64%).

The factors associated with knowing about HPV is shown in Table 4. For univariable analysis, factors which were significantly associated with knowing HPV was education, occupation, and health insurance. Only education level higher than high school and sexual debut significantly associated with knowing about HPV in multivariable analyses. Table 5 shows similar results that education level higher than high school and sexual debut significantly associated with higher knowledge.

## Discussion

This is the first study evaluated knowledge and risk

Table 2. Cervical Cancer Prevention and Sexual Behaviors of Women of Reproductive Age in Thailand-Myanmar Border Aareas

Behaviors	n, (%)			P-value <sup>a</sup>
	Total	Lowland Thai	Hill tribes	
Cervical cancer prevention behavior				
HPV Vaccine uptake	21 (5)	11 (5)	10 (5)	0.824
Screening uptake	279 (67)	135 (67)	144 (67)	1
Screening time of more than 5 years	17 (6)	11(8)	6 (4)	0.212
Sexual behavior				
Sexual debut	389 (94)	185 (92)	204 (95)	0.163
Age <20 year at first sexual debut	195 (50)	84 (46)	111 (54)	0.105
Median (IQR)	19 (17-22)	20 (18-22)	19 (17-22)	
Lifetime partners > 1 person	104 (27)	59 (32)	45 (22)	0.030
Condom use with partners				0.665
Every time	28 (8)	15 (10)	13 (7)	
Sometime	55 (16)	24(15)	31 (17)	
Never	254 (75)	117 (75)	137 (76)	
Sex outside a monogamous relationship within 12 months	9 (3)	5 (3)	4 (2)	0.738

<sup>a</sup>, Fisher's exact test

behaviors leading to HPV infection and cervical cancer of the population living in the Thailand-Myanmar border areas. The disparities were found in many aspects in different ethnic groups as reported in several countries. Although more than half of the participants had an education beyond high school level, a significantly lower proportion of hill tribe women went to college than that of the lowland Thai participants (18% vs 46%). There were still some women that had no chance to go to any school (4%). The proportion of insufficient income was higher

in hill tribes (53% vs 36%). Universal Health Coverage is the most common health insurance in the study population (66%), 57% in lowland Thai and 74% hill tribes.

To limit inequalities and support informed choice, it is important to understand the barrier of awareness and knowledge about cervical cancer prevention. Our study found the higher probability to know about HPV and higher level of knowledge about cervical cancer in the women who graduated higher than high school compare to lower level of education. Similarly, as in previous publications,

Table 3. Proportion of Correct Answer to Question about HPV and Cervical Cancer of Women of Reproductive Age in Thailand-Myanmar Border Areas

Sentence	Correct Answer, n(%)			P-value <sup>a</sup>
	Total	Lowland Thai	Hill tribes	
Knowledge about HPV				
1. HPV infection is sexual transmission (True).	242 (58)	117 (58)	125 (58)	1
2. People with HPV can transmit the virus to their sexual partners even if they have no symptoms of the infection (True).	215 (52)	109 (54)	106 (49)	0.378
3. Having multiple sexual partners increases the risk of HPV infection (True).	248 (60)	122 (60)	126 (59)	0.765
4. HPV infection can be prevented by using condoms (True).	219 (52)	107 (53)	112 (52)	0.922
5. All type of HPV infections can be prevented by using vaccines (False).	38 (9)	24 (12)	14 (6)	0.062
6. HPV infection increases the risk of cervical cancer (True).	228 (55)	109 (54)	119 (55)	0.844
Knowledge about cervical cancer				
1. Smoking increases the risk of cervical cancer (True).	268 (64)	113 (56)	155 (72)	0.001
2. Cervical cancer screening is an essential healthcare practice only for women with vaginal discharge or bleeding (False).	216 (52)	120 (59)	96 (45)	0.003
3. Single women should not go for screening (False)	291 (70)	153 (75)	138 (64)	0.014
4. Cervical cancer screening is not necessary for women who have been vaccinated (False).	251 (60)	129 (64)	122 (57)	0.163
5. Having multiple sexual partners increases the risk of cervical cancer (True).	350 (84)	167 (82)	183 (85)	0.508
6. Sexual debut at a young age increases the risk of cervical cancer (True).	302 (72)	142 (70)	160 (74)	0.327
7. Cervical cancer screening can prevent morbidity and mortality from cervical cancer (True).	367 (88)	177 (87)	190 (88)	0.766
8. Cervical cancer is treatable when detected in its early stages (True).	395 (94)	192 (95)	203 (94)	1

<sup>a</sup>Fisher's exact test

Table 4. Factors associated with Knowing about HPV

Factors	Odd Ratios (OR)	95%CI OR	p-value	aOR	95%CI aOR	p-value
Ethnic groups						
Lowland	1					
Hilltribes	1.02	0.68-1.51	0.93			
Age group						
<30	1					
30-39	1.33	0.81-2.19	0.257			
40-49	1.47	0.89-2.40	0.138			
Education						
Never went to school/ Primary school	1			1		
High school	1.41	0.86-2.30	0.169	1.5	0.92-2.47	0.105
Higher than high school	2.14	1.24-3.67	0.006	2.29	1.32-3.99	0.003
Occupation						
Jobless	1					
Owned business	1.99	0.89-4.46	0.095			
General employment	1.81	0.91-3.61	0.091			
Permanent employees	2.21	1.19-4.10	0.012			
Agriculturist	1.26	0.72-2.20	0.41			
Living with spouse/partner	1.04	0.67-1.62	0.847			
House expense given income						
Enough to save	1					
Enough to spend	0.85	0.41-1.78	0.668			
Not enough to spend	0.56	0.27-1.17	0.126			
Health Insurance						
UHC	1					
SSS	0.98	0.57-1.68	0.948			
CSMBS	2.52	1.27-4.97	0.008			
Others	1.48	0.50-4.36	0.482			
Sexual debut	1.87	0.85-4.08	0.118	2.28	1.02-5.07	0.044
Lifetime partners > 1 person	1.4	0.88-2.22	0.152			

aOR, Adjusted Odd Ratios; UHC, Universal Health Coverage; SSS, Social Security Scheme

lower education and socioeconomic status may lead to less access to HPV health education through all media. Women with undergraduate or higher educational level had more knowledge of cervical cancer and HPV [14-17]. Language could also be one of the barriers to accessing health information about cervical cancer and HPV in the minority groups [18]. The health education and literacy program tailored to this population should for example provide HPV and cervical cancer education to the health village volunteers who speak the tribal languages in order to convey the knowledge to people in their village. The accessibility of HPV and cervical cancer could also be increased by educating the hill tribe people in their own language when they visit a hospital for any reason.

The percentage of HPV vaccination, HPV screening uptake and sexual risk behavior were not different between lowland Thai and hill tribes, except the proportion of having more than one lifetime partner was higher in lowland Thai (78% vs 68%). Most of the women did not use condom with partner. A very small proportion of the study population (3%) reported sexual intercourse outside the monogamous relationship within 12 months.

Risk behaviors in the study population were different to what is found in the female students aged 18-24 year in several universities in Chiang Mai Province which had high sexual risk behavior towards HPV infection, 40% of students had had sexual intercourse and the youngest was 13 years of age at sexual debut. The proportion of condoms used every time when having sex was only 18.1% [11].

It has been shown that the knowledge about HPV and cervical cancer among the reproductive age in resource-limited countries is low. The respondents with the correct answer about HPV as a causative agent of cervical cancer were low at 11% in India, 19% in Ethiopia, 40% in Kenya, and 55% in our study. Only 44.70% had heard of HPV in Kenya, and 63% in our study. The correct response that smoking is a risk factor of cervical cancer was 68% in Ethiopia, 12.7 in India, 53.39% in Kenya and 64% in our study. However, a high percentage of people in these countries knew that screening helps in prevention of cervical cancer: 84% in Kenya and 88% Thailand [19-21].

Few studies have reported about the knowledge, risk behaviors of HPV infection and cervical cancer in the Northern Thai population. A study evaluated knowledge

Table 5. Factors Associated with Low Knowledge about Cervical Cancer

Factors	Odd Ratios (OR)	95%CI OR	p-value	aOR	95%CI aOR	p-value
Ethnic groups						
Lowland	1					
Hilltribes	1.57	0.64-3.87	0.328			
Age group						
<30	1					
30-39	0.9	0.29-2.75	0.85			
40-49	1.02	0.34-3.02	0.974			
Education						
Never went to school/ Primary school	1			1		
High school	0.6	0.24-1.53	0.285	0.44	0.16-1.20	0.109
Higher than high school	0.16	0.03-0.77	0.022	0.1	0.02-0.55	0.008
Occupation						
Jobless	1					
Owned business	1.4	0.22-8.77	0.716			
General employment	0.43	0.04-4.27	0.474			
Permanent employees	0.82	0.16-4.18	0.812			
Agriculturist	2.5	0.68-9.12	0.167			
Living with spouse/partner	0.62	0.25-1.54	0.307			
House expense given income						
Enough to save	1					
Enough to spend	0.47	0.12-1.90	0.289			
Not enough to spend	0.78	0.21-2.92	0.706			
Health Insurance						
UHC	1					
SSS	0.4	0.09-1.77	0.228			
Sexual debut	0.26	0.08-0.84	0.025	0.14	0.04-0.53	0.004
Lifetime partners > 1 person	1.44	0.54-3.87	0.466			

aOR, Adjusted Odd Ratios; UHC, Universal Health Coverage; SSS, Social Security Scheme”

about HPV infection and cervical cancer among nurses in Chiang Mai University Hospital, Thailand. In comparison to the results of our study, that study showed a similar proportion of correct answers on the question “an adequate scale of cervical screening could prevent morbidity and mortality from cervical cancer”, “early stage cervical cancer is curable” and the questions about risk factors for cervical cancer as smoking, having multiple sexual partners, and sex at an early age. However, the proportion of correct answers about HPV infection as a causal factor of cervical cancer was lower in people who live in the Thailand-Myanmar border area than the nurses who are health professionals (55% versus 83%) [22]. This is probably because, according to a different study, the health science students as a group had a higher level of knowledge about HPV and cancer compared to the social science and humanities students, and this knowledge difference also affected risky behaviors of HPV infection and cervical cancer [13].

In 2002, an organized screening program was implemented under universal health care coverage for all Thai women ages 30-60 years at 5-year intervals [23] to reduce the incidence of cervical cancer [24, 25]. The Ministry of Public Health provided both Pap smear and

visual inspection with acetic acid (VIA). Primary HPV testing has been introduced in Thailand since the cost effectiveness of this cervical cancer strategy was found in the Thai population [26]. Since 2021, HPV standalone testing strategy has been implemented for women aged 30-60 year every 5 years [27].

The prophylactic quadrivalent vaccine that could additionally prevent cervical cancer in Thai population is likely cost-effective [6]. A number of studies showed that the knowledge on HPV and cervical cancer of the parents affect the participant rate of HPV vaccine intake of their children [28, 29]. Although, the HPV vaccine has been licensed in Thailand since 2007, only a very small proportion of parents have actually vaccinated their daughters, i.e. 3% [30]. Our study showed that only 62% of the women in the study knew about HPV. There was a very low percentage of women who knew about HPV vaccines (9%), and a low percentage of HPV vaccine uptake (5%) in all participants with only 3% in women aged less than 30 years. This proportion is still short of the goal of the World Health Organization (WHO) that 90% of girls be fully vaccinated with the HPV vaccine by the age of 15 [31]. The reason behind this low rate of HPV uptake is cost of the vaccine because the government of Thailand

implemented a free, nationwide HPV immunization program for only a specific young woman aged 11 years. This strategy was just started in 2018 (National Health Security Office). Another barrier to HPV vaccination is the perception of no need for vaccination due to low-risk behavior [32]. Our study found that the report of sexual debut was independently significant associated with better knowledge about HPV and cervical cancer which was the same results as a study in metropolitan area in Bangkok Thailand [15]. This may reflect that the young school student, before high school, in Thailand have not yet learnt how to prevent HPV and cervical cancer.

In 2020, the WHO initiated a goal to eliminate cervical cancer by 2030 and countries must reach and maintain an incidence rate of lower than 4 per 100 000 women. To achieve that goal, the WHO launched a global strategy to accelerate the elimination of cervical cancer based on three key pillars and their corresponding targets: 90% of girls fully vaccinated with the HPV vaccine by the age of 15, 70% of women screened using a high-performance test by the age of 35, and again by the age of 45, 90% of women with pre-cancer treated, and 90% of women with invasive cancer managed [31].

Healthy sexual behavior and knowledge of prevention could reduce the prevalence of HPV transmission [33, 34]. Avoiding risk factors of HPV infection and HPV vaccine uptake is the primary prevention of cervical cancer. In addition, a positive attitude towards cervical cancer screening was associated knowledge about cervical cancer screening [35, 36]. The knowledge about the risks, the disease and the screening for cervical cancer was significantly associated with cervical cancer screening compliance [37]. Moreover, lack of knowledge and awareness, and poor attitudes associated with inadequate cervical screening in the metropolitan women in Bangkok Thailand [15]. This may also occur in the border areas. We therefore evaluate the knowledge about prevention strategies, both primary prevention as HPV vaccination and secondary prevention as cervical cancer screening, the risk factor of HPV infection and cervical cancer [38-40].

One of the limitations of our study is that the survey was conducted only in the women who came to the government hospitals, either for health checkup or as the care givers. The random survey in several communities was unable to be done as planned because of the restriction regarding the COVID-19 pandemic during the time of data collection, and this limitation in sampling might cause selection bias for estimation of prevalence of cervical cancer screening, and vaccination intake. However, we could obtain the information about the knowledge and risk behavior toward HPV and cervical cancer from all ethnic groups including lowland Thai, Karen, Lisu, Hmong, Thai-Chinese Yunnan and Lahu in the study area.

In conclusion, the women of reproductive age in the Thailand-Myanmar border areas showed relatively low sexually risky behaviors for HPV infection but the knowledge about HPV and cervical cancer should be increased. The proportion of HPV vaccination and cervical cancer screening attendance in the study participants was lower than the target set by the Ministry of Public Health. This may be because of lack of knowledge about HPV

and cervical cancer that should be provide at pre-and reproductive age. We encourage the Ministry of Public Health to improve health promotion and health literacy to prevent HPV and cervical cancer in the Thailand-Myanmar border area to obtain equity in cervical cancer prevention.

## Author Contribution Statement

PS contributed to the conception and design, data acquisition, performed the statistical analysis, interpreted results and drafted the manuscript. KS contributed to the conception and design, interpreted results and drafted the manuscript. AR, LA and NC contributed to the interpretation of data, and drafted the manuscript. HT performed data acquisition and revised the manuscript. All authors read and approved the final manuscript.

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### *Ethics approval and consent to participate*

The study was approved by the Human Experimentation Committee of Research Institute for Health Sciences, Chiang Mai University.

### *Consent for publication*

Not applicable.

### *Availability of data and material*

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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### *Competing interests*

The authors declare that they have no competing interests.

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