RESEARCH ARTICLE

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Factors Associated with Suboptimal Screening for Cervical Cancer among Ethnic Women in Thailand-Myanmar Border Area

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Abstract

Background: Suboptimal screening for cervical cancer is found in remote areas. This study aims to evaluate the suboptimal screening prevalence and determine the factors associated with suboptimal cervical cancer screening among ethnic women in the Thailand-Myanmar border area. **Methods:** This is a cross-sectional study conducted from July to December 2023. The eligible criteria were ethnic women aged 30-60 in Pai district, Mae Hong Son province in northern Thailand. Descriptive statistics were used to describe the characteristics, accessibility to health care service, knowledge, attitude and perceptions about Human Papillomavirus (HPV), cervical cancer and screening, and support for cervical cancer screening. The factors associated with suboptimal screening were determined using binary logistic regression. **Results:** Among 354 ethnic women, one-fourth had suboptimal screening for cervical cancer. The positive attitude towards cervical cancer screening and the perceived risk of cervical cancer were high. Most of the participants had a medium level of knowledge about HPV and cervical cancer. Factors associated with suboptimal screening were younger age (adjusted Odds Ratios(aOR) = 1.48, 95% confidence interval (CI): 1.06-2.07), being Hmong ethnic group (aOR = 2.63, 95%CI: 1.30-5.34) compared to Karen ethnic group, and lack of information support from health care personnel (aOR = 1.88, 95%CI: 1.08-3.29) . Positive attitude toward the screening was associated with less suboptimal screening (aOR=0.56, 95%CI: 0.32-0.96). **Conclusion:** Information support from local health personnel plays an important role in health promotion and health literacy for cervical cancer screening in ethnic women as information and support to accommodate the languages and cultural can enhance engagement and trust.

Keywords: Thailand-Myanmar border- associated factors- ethnic women- cervical cancer- suboptimal screening

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Introduction

Cervical cancer is the second most common type of cancer in women in Southeast Asia [1]. In a recent report from northern Thailand, it is the fourth most common cancer and leading cause of death by cancer with age-standardized incidence rate (ASIR) and age-standardized mortality rate (ASMR) at 15.1 and 7.5 per 100,000 women population, respectively. Some areas in northern Thailand along the border with Myanmar have a higher rate of cervical cancer compared to the average rate across the entire region of northern Thailand [2, 3].

To achieving the goal of incidence rate below 4 per 100,000 women population by 2030, the WHO launched a global strategy to accelerate the elimination of cervical cancer based on three key pillars and their corresponding targets: 1) 90% of girls fully vaccinated with the human papillomavirus (HPV) vaccine by the age of 15, 2) 70% of women screened using a high-performance test by the age of 35, and again by the age of 45, and 3) 90% of women with pre-cancer treated and 90% of women with invasive cancer managed [4]. In Thailand, an organized screening program using Pap-smear and visual inspection with acetic acid (VIA) was implemented in 2002 under universal health coverage (UHC) for all Thai women ages 30-60 at 5-year intervals [5] to reduce the incidence and mortality of cervical cancer [6, 7]. Primary HPV standalone testing, high risk HPV DNA testing with individual HPV-16/HPV-18 genotyping alone without any co-testing which is the recent national screening strategy was introduced in Thailand in 2021. It has been implemented for women aged 30-60 every 5 years [8].

A number of studies have showed that lower socioeconomic background and education led to lower

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access to prevention and treatment and led to detection of cervical cancer at a later stage. Moreover, limited access to treatment contributes to variations in cervical cancer mortality rates across different residential areas, urban versus rural [9-12]. On top of that, getting treatment can be difficult in some areas. This difference in access to care explains why cervical cancer death rates vary depending on area of residence [12]. It has been found that the higher socioeconomic status has better access to cervical cancer screening [9] and lower mortality rates from cervical cancer [10,11]. The ethnic groups in northern Thailand generally live in remote areas and have a low socioeconomic status [13]. Similar to ethnic groups worldwide, they have a unique language and culture, way of living, and beliefs. These unique characteristics may be linked to the health of ethnic groups. There are different ethnic groups like Karen, Lahu, Lisu, and Hmong who live in northern Thailand, especially in the areas near the border with Myanmar [14]. The percentage of 5-year cervical cancer screening among women aged 30-60 in the Thailand-Myanmar border area was around 60% [15], which is lower than the threshold of 80% set by the Thailand National Cancer Institute (NCI) in the Ministry of Public Health [16].

Over the past two decades, there has been very little research on the factors associated with cervical cancer screening among ethnic women in Thailand. Previous studies have found that the prevalence of cervical cancer screening among ethnic women in Thailand is still as low as 64.9% [17]. Understanding the factors associated with suboptimal screening for cervical cancer in ethnic women may help to guide the health promotion to increase the screening rate in order to reduce disparity in cervical cancer incidence and mortality. This study aims to evaluate the screening prevalence and determine the factors associated with the suboptimal cervical cancer screening among the ethnic women in the Pai district of Mae Hong Son province at the Thailand-Myanmar border area.

Materials and Methods

Study design and participants

This is a cross-sectional study. The recruitment period for this study was from 1 July to 31 December 2023. The eligible criteria were being an ethnic woman, Thai citizen, living in Pai district, Mae Hong Son province, Thailand, aged 30-60, and living in the study areas (Figure 1) at least 1 year. Pai District has a total of 6,413 women aged 30–60 years, of whom 47% are from ethnic groups, totaling 3,015 people [18]. The sample size for survey research is calculated based on the Theory of Probability, the theory of estimation variance, and the assumption that the characteristics of the studied population are normally distributed, which is the sample size calculation method used by the National Statistical Office [19]. The estimated sample size was 354. The eligible participants were interviewed by trained interviewers based on questionnaires. Local interpreters supported the interview for language barriers if necessary.

Measurements

An anonymous six-part questionnaire included 1) Demographics, 2) Accessibility to health care service, 3) Knowledge about HPV and cervical cancer, 4) Attitude toward cervical cancer screening, 5) Perceived risk about cervical cancer, and 6) Support about cervical cancer screening in terms of mental, information and resources support. The questionnaire was validated by three experts and tried out with 30 ethnic women in a nearby area with the Cronbach's alpha coefficient of more than 0.7. For Part 3: Knowledge about HPV and cervical cancer (15 questions), the answers were "True," "False," or "Do not know." The number of correct answers was counted and "Do not know" was considered an incorrect answer. The Likert scale was used to measure "Attitude toward cervical cancer screening" (15 items) and "Perceived risk about cervical cancer" (8 items). The knowledge attitude and perceived risk about cervical cancer and screening were classified into three levels, Low, Medium, and High. The interval of each level of the measurements determined by subtracting the lowest score from the highest score and then dividing the result by the number of measurement levels, which is three [20].

Statistical analysis

Descriptive statistics were used to describe the demographic characteristics, accessibility to health care service, knowledge about HPV and cervical cancer, attitude and perceived risk about cervical cancer and screening, and the support about cervical cancer screening as a number and percentage. The proportion of "suboptimal screening" which is defined as "never had cervical cancer screening" or "have not done screening in the past 5 years" were estimated. Cervical cancer screening in this study is defined as either Pap-smear, VIA or HPV testing. The factors associated with suboptimal screening were determined using binary logistic regression. Univariate and multivariable analyses were conducted. Variables demonstrating a P-value ≤ 0.25 in univariate analyses were retained for inclusion in the multivariable logistic regression model. The p-value is reported as two-tailed with a significance level of 0.05. All analyses were conducted using STATA version 17 (StataCorp LP, College Station, TX, USA).

Ethical statement

The study was approved by the Human Research Ethics Committee of Thammasat University (Science): Approval no.044/2566. The participant was woman aged 30-60 and provided written informed consent. In the case that participant was not able to read and write Thai language, the study information was explained by the interpreter in the ethnic language and the inform consent was done by a fingerprint impression on the paper, together with the signature of the witness who has no conflict of interest in the study.

Results

The data collected from 354 women aged 30-60 in Pai District in Mae Hong Son Province, northern Thailand.

The largest number of ethnic women participating in this study were Karen (57%), followed by Lisu (23.2%), Hmong (14.7%) and Lahu (5.1%) with a median age of 43 years. Most of them had a primary school education or never went to school (71.9%), agriculturist (83.3%), married (92.7%), Buddhist (56.2%), already had sexual debut (99.7%), living with spouse/partner (91.0%), have insufficient income (50.9%), and belonging to Universal Health Coverage (87.2%). Among all participants, 86.7% had a cervical cancer screening and 24.0% had suboptimal screening. Most of the women had been pregnant 1-2 times (52.3%). The median distance from residence to primary health care unit was 4 kilometers and the median time of travel from residence to primary health care unit was 10 minutes. The distribution of ethnic groups and age groups were different for the adequate and suboptimal cervical cancer screening groups (Table 1).

Table 2 shows accessibility to health care service of

Table 1. Characteristics of the Ethnic Women in Thailand-Myanmar Border Area

Characteristics	Total	Adequate screening	Suboptimal screening	P-value
Ethnic Groups				0.002
Karen	202 (57.0)	168 (62.4)	34 (40.0)	
Mong	52 (14.7)	32 (11.9)	20 (23.5)	
Lisu	82 (23.2)	57 (21.2)	25 (29.4)	
Lahu	18 (5.1)	12 (4.5)	6 (7.1)	
Age, year				<0.001
30-39	135 (38.1)	87 (32.3)	48 (56.5)	
40-49	112 (31.6)	98 (36.4)	14 (16.5)	
50-59	107 (30.2)	84 (31.2)	23 (27.1)	
Mean (IQR)	43 (36-51)	44 (38-51)	37 (32-50)	
Education				0.143
Never went to school	94 (26.6)	67 (24.9)	27 (31.8)	
Primary school	121 (34.2)	97 (36.1)	24 (28.2)	
High school	109 (30.8)	86 (32.0)	23 (27.1)	
Higher than high school	30 (8.5)	19 (7.1)	11 (12.9)	
Occupation				0.356
Jobless	8 (2.3)	7 (2.6)	1 (1.2)	
Owned business	15 (4.2)	12 (4.5)	3 (3.5)	
General employment	25 (7.1)	17 (6.3)	8 (9.4)	
Permanent employees	11 (3.1)	6 (2.2)	5 (5.9)	
Agriculturist	295 (83.3)	227 (77.0)	68 (23.0)	
Marital status				0.867
Single	9 (2.5)	7 (2.6)	2 (2.35)	
Married	328 (92.7)	250 (92.9)	78 (91.8)	
Divorced/Widowed	17 (4.8)	12 (4.5)	5 (5.9)	
Religion				0.418
Buddhism	199 (56.2)	154 (57.2)	45 (52.9)	
Christianity	148 (41.8)	111 (41.3)	37 (43.5)	
Others	7 (2.0)	4 (1.5)	3 (3.5)	
Sexual debut	353 (99.7)	268 (99.6)	85 (100)	0.76
Living with spouse/partner	322 (91.0)	248 (92.2)	74 (87.1)	0.191
House expense given income				0.104
Enough to save	16 (4.5)	14 (5.2)	2 (2.3)	
Enough to spend	158 (44.6)	112 (41.6)	46 (54.1)	
Not enough to spend	180 (50.9)	143 (53.2)	37 (43.5)	
Health Insurance				0.185
UHC	309 (87.2)	232 (86.2)	77 (90.6)	
SSS	9 (2.5)	13 (4.8)	6 (7.1)	
CSMBS	17 (4.8)	15 (5.6)	2 (2.4)	
VHV	9 (2.5)	9 (3.4)	0 (0)	
Cervical cancer history in family	17 (4.8)	12 (4.5)	5 (6.0)	0.563

Table 1. Continued

Characteristics	Total	Adequate screening	Suboptimal screening	P-value
Number of pregnancies				0.289
Never	9 (2.5)	5 (1.9)	4 (4.7)	
1-2	185 (52.3)	142 (52.8)	43 (50.6)	
3-4	125 (35.3)	98 (36.4)	27 (31.8)	
More than 4	35 (9.9)	24 (8.9)	24 (8.9)	
Distance to health care unit (Kilometers)				0.347
< 1	106 (29.9)	85 (31.6)	21 (24.7)	
1-4	79 (22.3)	59 (21.9)	20 (23.5)	
4.1-8	80 (22.6)	63 (23.4)	17 (20.0)	
>8	89 (25.2)	62 (23.0)	27 (31.8)	
Time for traveling to health care unit (Minutes)				0.134
<15	207 (58.5)	159 (59.1)	48 (56.5)	
15-30	94 (26.6)	70 (26.0)	24 (28.2)	
31-60	49 (13.8)	39 (14.5)	10 (11.8)	
>60	4 (1.1)	1 (0.4)	3 (3.5)	

UHC, Universal Health Coverage; SSS, Social Security Scheme; CSMBS, Civil Service Medical Benefits Scheme; VHV, Village Health Volunteer

the ethnic women. Seventy-six percent of ethnic women visit the primary health care unit which is located close to their residence for regular health service. The frequency of visits to the primary health care unit was 3-4 times per year. Most of the ethnic women (70.7%) participated in cervical cancer screening at the primary health care unit. For the adequate and suboptimal cervical cancer screening groups, there was different distribution of place of regular health care and place of cervical cancer screening.

Most of the participants had a medium level of knowledge of and HPV and cervical cancer (43.8%) with a score interval of 5.1-10.0 (max score = 15), high level of positive attitude about cervical cancer screening (85.9%) with a score of more than 55.0 (max score = 75) and a high level of perceived risk about cervical cancer (70.6%) with a score of more than 29.34 (max score = 40). The proportion of levels of knowledge, positive attitude, and perceived were not significantly different between the suboptimal and the adequate screening groups (Table 3).

Table 4 shows mental, information and resource support for cervical cancer screening for the ethnic women. The health care workers and health volunteers were the most supportive persons in the screening for the ethnic women (82.4%). Most of the ethnic women knew about cervical cancer screening (85.0%). The women had access to information from several sources at the same time, including health personnel (61.3%), village health volunteers (22.9%), media (15.0%), friends (1.4%), family members (0.8%) and knowing cervical cancer patients in the village (0.8%). Most of the ethnic women used a personal vehicle to get to the screening place (83.3%). The proportion of access to screening information and information support by health personnel and friends were significantly different between the adequate and suboptimal screening groups.

In the univariate analysis, the factors associated with

Table 2. Accessibility to Health Care Service of Ethnic Women in Thai-Myanmar Border Area

Health care service	Total	Adequate screening	Suboptimal screening	P-value
Regular health care unit				0.001
Hospital/clinic	85 (24.0%)	53 (19.7)	32 (37.6)	
Primary Health Care Unit	269 (76.0%)	216 (80.3)	53 (62.4)	
Frequency of Health Care service				0.912
>1 /month	16 (4.5%)	14 (5.2)	2 (2.4)	
Once a month	34 (9.6%)	26 (9.7)	8 (9.4)	
3-4 / year	137 (38.7%)	104 (38.7)	33 (38.8)	
2 / year	48 (13.5%)	37 (13.8)	11 (12.9)	
Once a year	62 (17.5%)	47 (17.5)	15 (17.6)	
Less than once a year	57 (16.1%)	41 (15.2)	16 (18.8)	
Cervical cancer screening unit				0.001
Hospital	73 (23.8%)	57 (21.2)	16 (42.1)	
Mobile Screening	17 (5.5%)	12 (4.5)	5 (13.2)	
Primary Health Care Unit	217 (70.7%)	200 (74.4)	17 (44.7)	

Table 3. Knowledge, Positive Attitude, and Perceived Risk about HPV, Cervical Cancer and Screening of Ethnic Women in the Thailand-Myanmar Border Area

Level	Total	Adequate screening	Suboptimal screening	P-value
Knowledge (Total score:15)				0.05
Low (scored: 0.0-5.0)	81 (22.9)	62 (23.0)	19 (22.4)	
Medium (scored: 5.1-10.0)	155 (43.8)	109 (40.5)	46 (54.1)	
High (scored: 11.1-15.0)	118 (33.3)	98 (36.4)	20 (23.5)	
Positive Attitude (Total score:				0.025
Low (scored: 15.0-35.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Medium (scored: 35.1-55.0)	186 (52.5)	132 (49.1)	54 (63.5)	
High (scored: 55.1-75.0)	168 (47.5)	137 (50.9)	31 (36.5)	
Perceived Risk				0.283
Low (scored: 8.0-18.7)	2 (0.6)	2 (0.7)	0 (0.0)	
Medium (scored: 18.8-29.3)	132 (37.3)	95 (35.3)	37 (43.5)	
High (scored: 29.4-40.0)	220 (60.1)	172 (63.9)	48 (56.5)	

suboptimal cervical cancer screening were being Hmong (OR = 2.45, 95%CI: 1.22-4.94) and Lisu (OR = 1.88, 95%CI: 1.02-3.47) compared to Karen, younger age group (30-39, 40-49, 50-59) (OR = 1.54, 1.03-1.98), regular health care at a hospital/clinic versus a local primary health care unit (OR=2.46, 95%CI:1.45-4.19), cervical cancer screening at a hospital/clinic versus local primary health care unit (OR = 3.30, 95%CI:1.57-6.94), cervical cancer screening at a mobile screening unit versus a local primary health care unit (OR = 4.90, 95%CI:1.54-15.56), longer distance (1 kilometers) from residence to nearest health care unit (OR=1.04, 95%CI:1.00-1.08), lack of information support from healthcare personnel such as village health volunteers and health worker (OR=2.10, 95%CI: 1.22-3.63), and lack of access to screening information (OR=2.68, 95%CI: 1.45-4.95). Positive attitude toward screening was a factor associated with reducing suboptimal cervical cancer screening (OR=0.55, 95%CI: 0.33-0.91) (Table 5).

In the multivariable analysis, being Hmong (aOR=2.63, 95%CI: 1.30-5.34) ethnic woman (compared with Karen), younger age group (30-39, 40-49, 50-59) (aOR=1.48, 95%CI: 1.06-2.07), and lack of receiving information from healthcare personnel (aOR=1.88, 95%CI: 1.08-3.29) independently associated with suboptimal cervical cancer screening in ethnic women. While higher positive attitude toward the screening reduces suboptimal cervical cancer screening in these women (aOR=0.56, 95%CI: 0.32-0.96) (Table 5).

Discussion

The proportion of women who had been screened for cervical cancer was 86.7% in the ethnic women in Pai District, Mae Hong Son Province. This was higher than the proportion found in a previous study of the Hmong

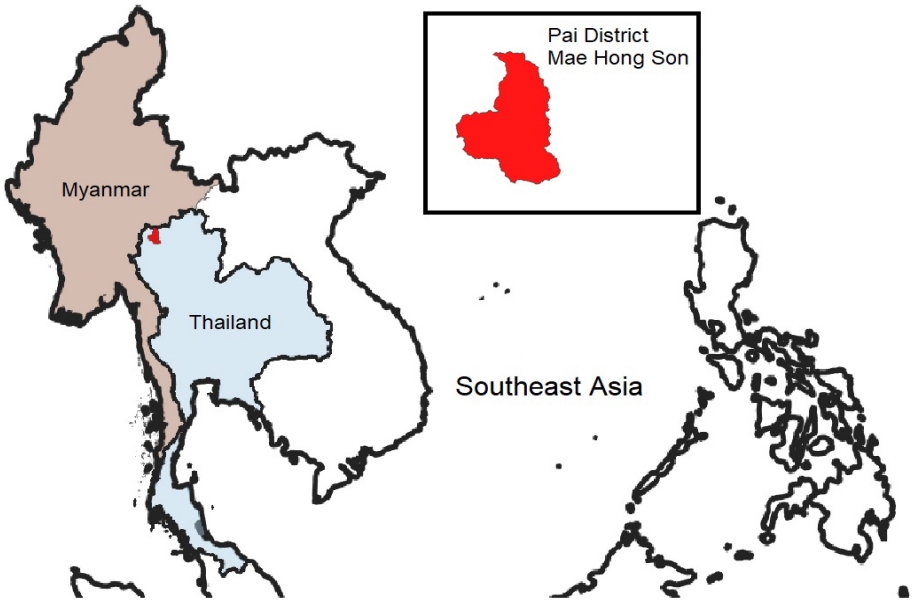

Figure 1. Study Area

Table 4. Mental, Information, and Resource Support on Cervical Cancer Screening for the Ethnic Women in Thailand-Myanmar Border Area

	n, (%)			P-value
	Total	Adequate screening	Suboptimal screening	
Most supportive person for screening				0.611
Family	38 (10.7)	27 (10.0)	11 (12.9)	
Health care worker/health volunteer	288 (81.3)	218 (81.0)	70 (82.4)	
Friend	6 (1.7)	5 (1.9)	1 (1.2)	
Self-motivation	22 (6.2)	3 (3.5)	22 (6.2)	
Access to screening information	301 (85.0)	238 (88.5)	63 (74.1)	0.002
Sources of screening information				
Family	3 (0.8)	3 (1.1)	0 (0)	1
Health care worker/health volunteer	263 (74.3)	210 (78.1)	53 (62.4)	0.006
Friend	5 (1.4)	1 (0.4)	4 (4.7)	0.013
Media	53 (15.0)	40 (14.9)	13 (15.3)	1
Know cervical cancer patients	3 (0.8)	1 (0.4)	2 (2.4)	0.144
Transportation to screening place				0.789
Vehicle provided by government	3 (0.8)	3 (1.1)	0 (0)	
Personal vehicle	295 (83.3)	223 (82.9)	72 (84.7)	
Neighbor's vehicle	27 (7.6)	22 (8.2)	5 (5.9)	
By walk	29 (8.2)	21 (7.8)	8 (9.4)	

Table 5. Factors associated with Suboptimal Screening of the Ethnic Women in Thailand-Myanmar Border Area

Factors	OR	95%CI	P-value	aOR	95%CI	P-value
Ethnic Groups						
Karen	1			1		
Lahu	2.47	0.87-7.03	0.09	1.92	0.57-4.96	0.362
Lisu	2.17	1.19-3.94	0.011	1.8	9.97-3.35	0.061
Hmong	3.09	1.58-6.03	0.001	2.63	1.30-5.34	0.007
10-year younger age	1.54	1.13-2.10	0.006	1.48	1.06-2.07	0.021
Regular health care unit						
Primary Health Care Unit	1					
Hospital/clinic	2.46	1.45-4.19	0.001			
Cervical cancer screening unit						
Primary Health Care Unit	1					
Hospital/clinic	3.3	1.57-6.94	0.002			
Mobile screening	4.9	1.54-15.56	0.007			
Distance to health care unit (Kilometers)	1.04	1.00-1.08	0.028			
Lack of access to screening information	2.68	1.45-4.95	0.002			
Lack of screening Information from health care worker/health volunteer	2.15	1.27-3.63	0.004	1.88	1.08-3.29	0.026
Lack of screening Information from friend	13.23	1.46-120.08	0.022			
High Positive Attitude (score >55)	0.55	0.33-0.91	0.021	0.56	0.32-0.96	0.036

OR, Odd ratios; aOR, Adjusted Odd ratios; CI, Confidence Interval

ethnic group in Thailand at only 64.9%, published in 2014. Of those, 47.2% had been screened because of screening promotion [17]. This suggests that Thailand is making progress in implementing effective cervical cancer screening programs in this vulnerable population.

The proportion of cervical cancer screening among ethnic women in Thailand was higher than in some low- and middle-income (LMIC) countries such as Zimbabwe where the proportion of cervical cancer screening for women aged 15-50 was only 6% in 2019 [21]. This was as low as the proportion in the Marayoor Panchayat ethnic group in Kerala, India [22]. This could be because the main places for cervical cancer screening for ethnic women in our study, which was the primary healthcare

unit (sub-district hospitals), was not very far from the women's residence, approximately 4 kilometers, and the travel time was about 10 minutes. Additionally, cervical cancer screening for Thai women is covered by the Universal Health Coverage, and there is no charge for the screening test. Most ethnic women use the Universal Health Coverage as their health insurance.

However, the proportion of ethnic women who had not been screened for cervical cancer in the past 5 years remained at 24.0%. It is likely that lack of health insurance is not the only reason why some women do not get screened. There is no data on the awareness of health insurance benefits among the ethnic women in Thailand, particularly the right to free cervical cancer screening every 5 years for Thai women aged 30-60, but a study showed low awareness of health insurance benefits in lower socioeconomic groups [23].

The participants in our study had a medium level of knowledge of HPV and cervical cancer (54.1%). Nevertheless, there were also a significant number of ethnic women who had a low level of knowledge (22.9%). This is consistent with findings from main (lowland) Thai population that most participants had a medium level of knowledge about cervical cancer (37.2%) and a high level of positive attitude towards cervical cancer screening (88.5%) [24]. The ethnic women in our study also had a high level of perceived risk of cervical cancer. The knowledge level about the risks of cervical cancer and the screening for cervical cancer was significantly associated with cervical cancer screening compliance in the study of the main Thai population [25]. However, this association was not found in the ethnic women in our study.

Most of the study participants were exposed to information about cervical cancer. Ethnic women received information about cervical cancer and were encouraged to get screened by health personnel including health care workers at the primary health care unit and village health volunteers. The results of multivariable analysis demonstrated that one of the factors associated with suboptimal screening was lack of information support from healthcare personnel with aOR at 1.88. A study on factors affecting cervical cancer screening among Hmong women in Lom Kao District, Phetchabun Province, Thailand had similar results [17]. In addition, it was found that information support from healthcare personnel was also associated with cervical cancer screening in other populations in Thailand, including Muslim women in Nong Chok District, Bangkok [26], Thai women in Sak Lek District, Phichit Province [27], and women in other low- and middle-income countries [17, 28-31].

Another factor associated with lower proportion of suboptimal cervical cancer screening among ethnic women was younger age groups (in 10-year intervals) (aOR=1.48). This result was similar to what was observed in the studies of Thai women [32, 33] as well as women in LMIC, such as female public health workers in Nigeria [34]. In comparison to the results of the studies in ethnic women in Thailand, no association between age and cervical cancer screening was found in Hmong ethnic women [17] and Akha ethnic women [35]. The inconsistent results could be due to the different study periods. The national cervical cancer screening program in Thailand was launched in 2005, nearly 20 years ago. Previous positive screening experiences may have influenced subsequent screening behavior, with older age groups having more exposure and experience with cervical cancer screening than younger age groups. A study in Malawi and South Africa reported that a positive experience with the cervical cancer screening program increased women's likelihood of returning for future screenings [36]. In addition, the ethnic groups in our study were predominantly Karen. The proportion of suboptimal screening was lower in the Karen ethnic women compared to Hmong.

To our knowledge, our study is the first study to investigate the association between suboptimal cervical cancer screening and knowledge about HPV and cervical cancer as well as attitudes towards screening among ethnic women in Thailand. We found that positive attitudes towards cervical cancer screening were negative associated with suboptimal cervical cancer screening with aOR at 0.56. The ethnic women with higher positive attitudes to the screening were likely to uptake the screening according to the practice guideline as what found in other studies in lowland Thai women and women in other LMIC countries [27, 29, 31, 37, 39]. The association between the uptake of cervical cancer screening and knowledge about HPV and cervical cancer have been shown in several studies [24, 31, 37, 38] and the low perceived risk of cervical cancer was associated with non-attendance of cervical cancer screening of Akha women [35] as well as main population Thai women and women in LMIC countries [34, 39, 40]. Although, our study found no association between suboptimal screening in ethnic women and level of knowledge and perceived risk of cervical cancer, we encourage to provide knowledge on cervical cancer screening to this population as it has been reported that a positive attitude towards cervical cancer screening was associated knowledge about cervical cancer screening [41].

Previous studies of ethnic women have found that beliefs intermingled with legends of spirits were associated with suboptimal screening among Hmong women [17]. Other factors associated with suboptimal screening among ethnic women were lack of education, having fewer than four pregnancies, and lack of health insurance in Akha women [35]. The association between these factors and suboptimal cervical cancer screening was not found in the ethnic women in our study, probably due to the fact that the study included a more diverse range of ethnic groups, with the largest group being Karen, followed by Lisu. Religious beliefs and cultural stigma may influence the uptake of cervical cancer screening in a specific ethnic group. We encourage qualitative interviews for deep understanding about these factors. The distance from the residence to the health care facility was found to be associated with receiving screening in other studies [21, 28, 29, 37, 42] which is different to the result of our study which did not find an association with distance from residence. This difference was probably because of decentralized cervical cancer screening service which provided service at the local health care unit near the

women's residence.

One of the limitations of our study is that we only focused on the major ethnic groups in the study area including Karen, Lisu, Hmong, and Lahu. Some other ethnic women e.g., Akha that may be living in this area were not considered in our study. However, the health promotion for improving the adequate screening should be implemented in all women in the areas. Another limitation is that our study only examined a 5-year period, and did not evaluate the long-term compliance of the women. However, limiting the measurement of screening to only the past 5-year period could prevent recall bias that may occur because of self-report-based data.

In conclusion, the perceived risk of cervical cancer were high and most of the participants had a medium level of knowledge about HPV and cervical cancer and a medium level of positive attitude towards cervical cancer screening, however, almost one-fourth of ethnic women in this study had suboptimal cervical cancer screening. The factors associated with suboptimal screening were younger age, being Hmong or Lisu ethnic group (compared to Karen) and lack of information support from healthcare personnel. Ethnic women with higher positive attitude towards the screening likely to uptake the cervical cancer screening in the past 5 year. Our results suggest there would be great benefit in increasing health promotion and health literacy by local health personnel to sustainably prevent cervical cancer, in the border area, and to improve equity in cervical cancer prevention in ethnic women.

Author Contribution Statement

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

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Ethics approval and consent to participate

The study was approved by the Human Research Ethics Committee of Thammasat University (Science) accordance with the Declaration of Helsinki and the Council for International Organizations of Medical Sciences (CIOMS): Approval no.044/2566. The participant was woman aged 30-60 and provided written informed consent. In the case that participant was not able to read and write Thai language, the study information was explained by the interpreter in the ethnic language and the inform consent was done by a fingerprint impression on the paper, together with the signature of the witness who has no conflict of interest in the study.

Availability of data and material

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

Competing interests

The authors declare that they have no competing interests.

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