

BMJ Open Barriers to cervical cancer screening and acceptability of HPV self-testing: a cross-sectional comparison between ethnic groups in Southern Thailand

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ABSTRACT

Background Cervical cancer rates are higher in low-resourced countries than high, partly due to lower rates of screening. Incidence in Thailand is nearly three times higher than in the USA (16.2 vs 6.5 age-standardised incidence), even with Thailand's universal health coverage, which includes screening, suggesting that alternative methods are needed to reduce the burden. We investigated barriers to screening, as well as acceptability of self-collection human papillomavirus (HPV) testing as a primary form of cervical cancer screening among Buddhist and Muslim communities in Southern Thailand.

Methods 267 women from the Buddhist district of Ranot and Muslim district of Na Thawi, Songkhla were recruited to complete a survey assessing knowledge and risk factors of HPV and cervical cancer. Participants were offered an HPV self-collection test with a follow-up survey assessing acceptability. Samples were processed at Prince of Songkhla University and results were returned to participants.

Results 267 women participated in the study (132 Buddhist, 135 Muslim), 264 (99%) self-collecting. 98% reported comfort and ease, and 70% preferred it to doctor-facilitated cytology. The main predictor of prior screening was religion (92% Buddhist vs 73% Muslim reporting prior Pap). After adjustment with multivariate logistic models, Muslim women had an OR of prior Pap of 0.30 compared with Buddhist (95% CI: 0.12 to 0.66).

Conclusions Self-collection HPV testing was highly acceptable across religious groups, suggesting that it could be beneficial for cervical cancer reduction in this region. Focus should be put into educating women from all backgrounds about the importance of screening to further improve screening rates among Thai women.

INTRODUCTION

Cervical cancer is one of the most common cancers in women in Thailand,¹ with age-standardised incidence and mortality rates at 16.2 and 9.0 per 100 000 women,² approximately three times higher than in the USA (6.5 and 1.9 die per 100,000, respectively).² This disparity is seen between low/

Strengths and limitations of this study

- The Songkhla region of Thailand has a relatively large number of Muslim people living in the region, making it an ideal location to study the differences between Buddhist and Muslim populations.
- Community health volunteers collected the data in participants' native languages and are familiar with the region and the patients.
- The assay used for human papillomavirus detection (Hybridio real-time PCR) is highly sensitive.
- All data was self-reported, so it is likely that there was some misreporting either due to social desirability or recall bias.
- Women testing in their own homes may have more testing anxiety in the absence of healthcare workers, causing lower acceptability of the test.

middle-income countries (LMICs) and high-income countries (HICs) around the world, and there has yet to be a sufficient intervention to eliminate this inequality. Currently, while cervical cancer is not even in the top 10 most common cancers in HICs, it is the second most common cancer among women in LMICs, where 80% of cervical cancer deaths occur.³

Cervical cancer is primarily caused by the human papillomavirus (HPV), a sexually transmitted infection that in most women clears on its own without the knowledge of the infected women.^{4 5} However, in some women, infection persists and eventually may cause cervical cancer to develop. Cervical cancer development takes many years, thus allowing for effective screening, prevention, and treatment if detected early.⁶

Today, cervical cancer is considered a preventable disease, in large part due to the Papanicolaou test.⁷ This type of cytology-based screening has significantly reduced



rates of cervical cancer in HICs but has not had the same effect in LMICs.^{8 9} This is likely due to lower accessibility to this type of testing, as well as issues with the actual testing in LMICs. Cytology-based screening requires both infrastructure and personnel to which many LMICs may not have access, as well as potentially multiple visits per patient.^{9–11} In addition, due to the inherent subjectivity of this type of test, particularly when samples are evaluated by technicians rather than by pathologists, there is generally low sensitivity in LMICs,¹² causing many cases to be missed even if a sample is collected. Thus, many LMICs have moved to visual inspection with acetic acid (VIA) in place of Pap screening. VIA can be performed with minimal infrastructure by a properly trained layperson, and screening and treatment can be done in the same visit.^{8 11 13 14} However, visual inspection is also subjective¹⁵; women still need to attend a clinic to receive this test, and equipment needs to be available to perform the treatment.

HPV testing has been shown to be a valid cervical cancer screening modality, and some countries are now recommending it as a primary form of screening.^{6 15} In particular, studies have shown that the use of primary HPV testing, as compared with cytology alone, significantly lowers the likelihood of the development of precancerous lesions among women undergoing cervical cancer screening, due to increased sensitivity and specificity of cytology testing when restricted to only those women who test positive for HPV.¹⁶ In addition, some countries are beginning to implement self-collection HPV testing to increase accessibility to screening.¹⁷ Women can test themselves, in their own home, by collecting a cervical sample using a provided swab.¹⁸ If a woman tests positive for high-risk HPV, then she will need to access follow-up care at a clinic; however, if the woman tests negative, she simply needs to be tested periodically (usually in 5-year increments). This can reduce the number of times that women need to travel to clinics for screening or follow-up care, which could eventually also reduce the burden on the healthcare system.

The rates of cervical cancer in Thailand have been declining since 2002,^{19–21} when a national cervical cancer screening programme was implemented, aiming to screen all women between the ages of 35 and 60 at 5-year intervals. In 2004, the programme added VIA to the already existing Pap smear programme. The three public health insurance programmes in Thailand cover the costs of cervical cancer screening in their benefits packages.¹ However, the decline in cervical cancer has been slower than expected (cervical cancer is still the second most common cancer among women in Thailand, causing over 10% of new female cases in 2018²²), thus calling for improvements in the current screening programme.¹⁹ This is largely due to the lower than ideal uptake of cervical cancer screening: a survey conducted in 2009 estimated that only 59.7% of women in Thailand have ever been screened for cervical cancer.¹ Uptake is even lower among the minority Muslim population

(making up only 5% of the country) as compared with the majority Buddhist population (94% of the population)²³ in Thailand (eg, 46.7% vs 60.4% reporting ever having cervical cancer screening in the 2009 Health and Welfare Survey,¹ respectively), perhaps due to reports of embarrassment and wanting to avoid uncovering parts of their bodies during exams, due to the high value that the Muslim religion places on modesty.¹ One previous study investigated the acceptability of self-collection HPV testing in women in Thailand. Acceptability was found to be quite high, but participants were worried about both the cost and the reliability of the results from this type of testing.^{24 25} However, no previous studies have specifically looked at women from diverse ethnic groups in Thailand to determine whether HPV self-collection testing is more useful in certain populations than others.

In this study we investigated the differences in access and barriers to cervical cancer screening between Buddhist and Muslim women in Southern Thailand and examined potential screening predictors. We also assess willingness to use and acceptability of self-collection HPV testing methods in these communities.

MATERIAL AND METHODS

Study design and sampling

The study was designed as a cross-sectional survey, with a maximum of one interaction per participant. Data collection took place in two districts within the Songkhla Province of Southern Thailand: Na Thawi, in the southern part of Songkhla Province, and Ranot, in the northernmost region. Each of these districts is fairly religiously homogenous, with Na Thawi and Ranot being predominantly Muslim and Buddhist, respectively. Women were recruited from lists of the target population for screening provided by reproductive health clinics in these districts, half located in Na Thawi and half in Ranot. The primary care centres made this list by randomly selecting from the entire female population in the province's health office database and then distributed 12–15 names to each healthcare volunteer, irrespective of the volunteer's religion. The volunteers then visited their assigned households and set up appointments with eligible women for screening at public primary care clinics. When women came into the clinics, they were asked by a community health worker whether they would like to participate in the study. If they said yes, they were consented and then enrolled, after which a survey was administered, and self-collection HPV testing was offered.

Recruitment took place from July to December in 2017. We aimed to recruit 130 women from each region, according to power calculations. Women had to be over the age of 18 to participate, and between the ages of 25 and 60 to participate in the self-collection sampling portion of the study. For the self-collection sampling, women were ineligible to participate if they were pregnant or menstruating, had a previous history of cervical cancer or had previously had a hysterectomy.

Data collection tools

Data was collected using a 150-question survey that assessed sexual behaviour and practices, known risk factors associated with HPV, and knowledge of HPV infection and its association with cervical cancer. The survey was developed using similar questions to prior studies of health risk factors,^{26 27} and was originally written in English and then translated into Thai by native Thai investigators from Prince of Songkhla University (PSU). This survey has also been translated into other languages for similar studies occurring in other countries.¹⁸ Prior to data collection, the survey was piloted on 10 women, both Buddhist and Muslim, sampled randomly in the Singha Nakhon district. Data were collected using the Qualtrics survey application.²⁸ Study research assistants read the survey aloud to each participant and recorded her responses on a tablet. At the end of each day, survey responses were uploaded to a secure server.

In addition, on completion of the survey, eligible women were offered a self-collection cervical sample kit to be tested for HPV. The kit (HerSwab)²⁹ was manufactured by Eve Medical and has previously been shown to be acceptable among other populations.¹⁸ If a woman chose to self-collect, the community health volunteer gave her the kit and an illustrated 'Instructions-for-Use' card and explained the sampling procedure. Women then collected a sample in a private room and returned the swab to the community health volunteer. Samples were transported to the Department of Biomedical Sciences at PSU following collection and stored until testing occurred.

Laboratory analysis

Samples were analysed at the Department of Biomedical Sciences at PSU using a 13 high-risk HPV (hrHPV) real-time PCR kit (HybriBio Limited), which detects HPV types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68.³⁰ Positive and negative controls were included on each plate, and internal controls were evaluated for each sample. Results were provided to the community health centres in Na Thawi and Ranot, where the community health volunteers were able to coordinate follow-up care for participants. If the HPV results were positive, it was suggested that they receive follow-up care (in the form of a Pap test) from their local health centre, and if negative were told to repeat testing in 3 years.

Statistical analysis

As this is mainly a descriptive study to identify any differences in screening practices between two ethnic groups, all survey questions were examined. Variables were grouped into four areas: demographics, sexual and general health, cervical cancer and HPV, and healthcare access. In addition, we compared women who reported having prior cervical cancer screening to women who reported no prior screening, using the variables mentioned above, with both univariate analyses and multivariate logistic models, adjusted for literacy, age

and number of children as a proxy for previous encounters with health care services. Finally, we investigated the acceptability of the self-collection test among women who were willing to use it by asking four questions after collection: 'How comfortable was the test?', 'How easy was the test?', 'Are you willing to continue to take this test periodically in the future?' and 'Do you prefer self-collection or Pap testing?'.

We compared responses between Buddhist and Muslim women using two-sided t-tests and χ^2 tests for continuous and categorical variables, respectively. A similar procedure was used to compare women who had previously been screened for cervical cancer with those who had not. Multivariate logistic models were then run to examine potential predictors for prior screening, after adjusting for confounders. Finally, a descriptive analysis was conducted to assess acceptability of the self-swab test, where an $\alpha < 0.05$ was considered significant. All analyses were conducted using R V.3.4.4.

Patient and public involvement

Participants and the public were first involved at the design and piloting stages of the study. Research questions and outcome measures were developed using prior surveys assessing use of healthcare in other low/middle-income settings¹⁸ and direct feedback was received from clinic staff. During piloting, feedback was also received from participants and clinic workers. Patients at local health clinics were directly approached by study personnel inviting them to participate in the study and discussing with them the format and purpose of the study. While participants were not asked about the time required to participate in the research, the post-sampling survey explicitly asked participants about the acceptability and perceptions of self-sampling to assess the burden of the intervention being investigated. To disseminate study results to participants and the community, we plan to conduct educational and study dissemination sessions. These will be planned directly in collaboration with community-based clinic personnel and other representatives from the community.

Ethical approval

All participants were given oral and printed informed consent before participation. This consent was documented by signature from the participant on the consent form and all consent forms are filed in a locked cabinet at PSU.

RESULTS

Demographics

267 women were recruited from the community health centres in the Ranot (n=132) and Na Thawi (n=135) districts of Songkla Province in Southern Thailand. All 132 women from Ranot identified as Buddhist and all 135 from Na Thawi identified as Muslim. The average age of the Buddhist population was 51.3 years, while in the

**Table 1** Demographics

Variable	Total n=267 Prop (N) Mean (SD)	Buddhist n=132 Prop (N) Mean (SD)	Muslim n=135 Prop (N) Mean (SD)	P value
Age	50.44 (5.83)	51.27 (6.08)	49.63 (5.48)	0.02*
Literate	0.88 (236)	0.96 (127)	0.81 (109)	<0.001*
Education				0.003*
None	0.06 (15)	0.00 (0)	0.11 (15)	
Primary	0.67 (179)	0.71 (94)	0.63 (85)	
Secondary	0.18 (49)	0.18(24)	0.19 (25)	
Vocational	0.05 (13)	0.06 (8)	0.04 (5)	
Academic college	0.04 (11)	0.05 (6)	0.04 (5)	
Postgraduate	0.00 (0)	0.00 (0)	0.00 (0)	
Civil status				
Single	0.00 (0)	0.00 (0)	0.00 (0)	<0.001*
Married	0.69 (184)	0.80 (106)	0.58 (78)	
Common law	0.21 (55)	0.09 (12)	0.32 (43)	
Separated	0.01 (2)	0.02 (2)	0.00 (0)	
Divorced	0.04 (11)	0.04 (5)	0.04 (6)	
Widowed	0.04 (10)	0.02 (3)	0.05 (7)	
Marriage age	21.26 (5.35)	22.85 (5.98)	19.72 (4.15)	<0.001*
Past year income (THB**)				0.27
0–79999	0.33 (78)	0.34 (39)	0.31 (39)	
80000–119999	0.28 (67)	0.31 (35)	0.25 (32)	
120000–179999	0.18 (44)	0.19 (22)	0.17 (22)	
180000 or more	0.21 (51)	0.16 (18)	0.26 (33)	

*p < 0.05

**Thai Baht (Thailand currency)

Muslim population it was 49.6 years. There were several statistically significant demographic differences between the Buddhist and Muslim women in the sampled population (table 1). Buddhist women on average reported higher literacy (96% vs 81%, $p < 0.001$) and education levels ($p = 0.003$). In addition, Muslim women were more likely than Buddhist women to be in a common law relationship instead of marriage ($p < 0.001$). However, there were no statistically significant differences in income between the two populations.

Prior access to healthcare and barriers to screening

Buddhist and Muslim women appeared to access healthcare differently in these communities (table 2). Buddhist women reported accessing more medical services and using health services more frequently than Muslim women. Notably, a higher percentage of Buddhist women reported prior Pap screening (92% vs 73%, respectively, $p < 0.001$), as well as more recent screening, than Muslim women. Among women who have not been screened for cervical cancer, the most common reported reason for not screening among Buddhist women was no perceived

health issues, and thus no reason to seek medical attention (40%), while for Muslim it was either a lack of knowledge that they should be screened or feelings of fear and embarrassment about screening (35% and 41%, respectively). In addition, Buddhist and Muslim women both reported that a doctor telling them they would need the test, and reduced cost of the test would be motivators to getting tested. Finally, Muslim women were less likely than Buddhist women to use oral contraceptives (41% vs 67%, respectively, $p < 0.001$).

Acceptability of self-collection

There was an almost universal acceptance of self-collection among this population (table 3). Ninety-eight percent of women found the test both comfortable and easy, and 100% said they would be willing to continue to use this test as a preliminary form of cervical cancer screening. Among women who reported prior Pap testing, both communities preferred self-swab to Pap testing. However, more Buddhist women preferred Pap and self-collection co-testing than Muslim women (33% vs 19%, respectively, $p = 0.05$), while more Muslim women than Buddhist

Table 2 Sexual and health history

Variable	Total n=267 Prop (N) Mean (SD)	Buddhist n=132 Prop (N) Mean (SD)	Muslim n=135 Prop (N) Mean (SD)	P value
Health location				
University hospital	0.27 (73)	0.34 (45)	0.21 (28)	0.047*
Primary care facility	0.99 (264)	1.00 (132)	0.98 (132)	1
Community health care centre	0.99 (263)	0.98 (130)	0.99 (133)	0.85
Other (private hospital, n=2; clinic, n=83)	0.32 (85)	0.16 (21)	0.47 (64)	<0.001*
Last health visit				
<0.001*				
Less than a month	0.22 (59)	0.30 (40)	0.14 (19)	
1–3 months	0.25 (67)	0.28 (37)	0.22 (30)	
3–6 months	0.13 (35)	0.14 (18)	0.13 (17)	
six months–1 year	0.18 (48)	0.15 (20)	0.21 (28)	
1–5 years	0.14 (37)	0.09 (12)	0.19 (25)	
More than 5 years	0.05 (14)	0.01 (1)	0.10 (13)	
Never	0.03 (7)	0.03 (4)	0.02 (3)	
Use healer	0.18 (49)	0.11 (14)	0.26 (35)	0.002*
Had Pap	0.82 (219)	0.92 (121)	0.73 (98)	<0.001*
Last Pap				
0.007*				
Less than 6 months	0.07 (16)	0.08 (10)	0.06 (6)	
Less than 1 year	0.30 (66)	0.37 (45)	0.21 (21)	
Less than 5 years	0.42 (91)	0.40 (49)	0.43 (42)	
More than 5 years	0.18 (40)	0.11 (13)	0.28 (27)	
Don't know	0.03 (6)	0.03 (4)	0.02 (2)	
Lifetime Paps				
0.005*				
1	0.19 (41)	0.12 (15)	0.27 (26)	
2	0.23 (51)	0.19 (23)	0.29 (28)	
3–4	0.39 (86)	0.45 (55)	0.32 (31)	
Five or more	0.18 (39)	0.21 (26)	0.13 (13)	
Don't know	0.01 (2)	0.02 (2)	0.00 (0)	
Main reason no Pap				
0.08*				
None/never thought of it	0.13 (6)	0.10 (1)	0.14 (5)	
Didn't know needed it	0.32 (15)	0.20 (2)	0.35 (13)	
Haven't had any problems	0.15 (7)	0.40 (4)	0.08 (3)	
Too expensive	0.00 (0)	0.00 (0)	0.00 (0)	
Too painful/embarrassing	0.36 (17)	0.20 (2)	0.41 (15)	
Other	0.04 (2)	0.10 (1)	0.03 (1)	
Doctor motivation				
<0.001*				
Extremely likely	0.60 (161)	0.73 (96)	0.48 (65)	
Very likely	0.15 (40)	0.11 (14)	0.19 (26)	
Somewhat likely	0.12 (32)	0.09 (12)	0.15 (20)	
Not very likely	0.11 (30)	0.08 (10)	0.15 (20)	
Don't know	0.01 (4)	0.00 (0)	0.03 (4)	
Payment motivation				
Extremely likely	0.51 (137)	0.64 (85)	0.39 (52)	<0.001*

Continued



Table 2 Continued

Variable	Total n=267 Prop (N) Mean (SD)	Buddhist n=132 Prop (N) Mean (SD)	Muslim n=135 Prop (N) Mean (SD)	P value
Very likely	0.21 (56)	0.17 (22)	0.25 (34)	
Somewhat likely	0.15 (39)	0.11 (15)	0.18 (24)	
Not very likely	0.12 (31)	0.08 (10)	0.16 (21)	
Don't know	0.01 (4)	0.00 (0)	0.03 (4)	
Use oral contraceptive	0.54 (141)	0.67 (86)	0.41 (55)	<0.001*

*p < 0.05

women preferred self-swab alone (77% vs 64%, p=0.05). Both Muslim and Buddhist women prefer testing to be done in a medical setting, but Muslim women are more likely to prefer self-collection to doctor-collection (94% reporting preference for self-collection vs 77%) than Buddhist women.

High-risk HPV (hrHPV) positivity

Nearly all of the participants chose to self-collect a sample to be tested for HPV (98% and 99% of Buddhist and

Muslim women, respectively). The three women who did not self-collect had a sample collected by a physician, and thus we have HPV results for all 267 participants. Of these women, only 5% overall (n=13)—7% of all conclusive tests – tested positive for hrHPV: 5 Buddhist and 8 Muslim (no statistically significant differences between the two religious groups, shown in table 4).

Table 3 Acceptability of self-collection

Variable	Total n=267 Prop (N) Mean (SD)	Buddhist n=132 Prop (N) Mean (SD)	Muslim n=135 Prop (N) Mean (SD)	P value
Self-collected sample	0.99 (264)	0.98 (130)	0.99 (134)	0.62
Comfort				1.00
Comfortable	0.98 (259)	0.98 (128)	0.97 (131)	
Neutral	0.02 (5)	0.02 (2)	0.02 (3)	
Uncomfortable	0.00 (0)	0.00 (0)	0.00 (0)	
Ease				1.00
Easy	0.98 (258)	0.98 (127)	0.97 (131)	
Neutral	0.02 (6)	0.02 (3)	0.02 (3)	
Difficult	0.00 (0)	0.00 (0)	0.00 (0)	
Willing to retake	1.00 (264)	1.00 (130)	1.00 (134)	1.00
Preference**				0.05*
Self-swab kit	0.70 (153)	0.64 (78)	0.77 (75)	
Pap smear	0.03 (6)	0.02 (2)	0.04 (4)	
Both	0.27 (59)	0.33 (40)	0.19 (19)	
Neither	0.00 (1)	0.01 (1)	0.00 (0)	
Test pref location				<0.001*
At home	0.18 (49)	0.04 (10)	0.15 (39)	
At healthcare centre	0.82 (218)	0.96 (122)	0.85 (96)	
Test pref collector				<0.001*
My health personnel	0.14 (38)	0.23 (30)	0.06 (8)	
Myself	0.86 (225)	0.77 (100)	0.94 (125)	

*p < 0.05

**Among women who reported ever receiving a Pap test.

Table 4 hrHPV test results

Variable	Total n=264 Prop (N) Mean (SD)	Buddhist n=132 Prop (N) Mean (SD)	Muslim n=135 Prop (N) Mean (SD)	P value
hrHPV status				0.71
Positive	0.049 (13)	0.039 (5)	0.059 (8)	
Negative	0.697 (184)	0.713 (92)	0.681 (92)	
Inconclusive	0.254 (67)	0.248 (32)	0.259 (35)	

hrHPV, high-risk human papillomavirus.

Predictors of prior screening

Women who report ever being screened were more likely to be Buddhist than Muslim (55% vs 45%, $p<0.001$), were on average of a higher education ($p=0.03$) and literacy level (91% vs 74%, $p=0.001$), had a later sexual debut (21.44 years vs 19.02 years, $p<0.001$), married at an older age (21.74 years vs 19.02 years, $p<0.001$), had higher utilisation of healthcare and contraception and had fewer pregnancies and children than those who report never being screened (table 5). In addition, those who reported ever screening had higher rates of knowledge of HPV than those who reported never screening (47% vs 30%, $p=0.04$). There was no difference in age for those who report ever versus never screened, which is interesting, as generally older women (who have had more time to access screening) tend to be more likely to have ever screened than younger women.

Ethnicity appears to be the main effect for likelihood to have previously accessed cervical cancer screening (shown in table 6), with Muslim women being significantly less likely to have had prior screening (OR=0.22, 95% CI=0.10, 0.45). Variables such as literacy levels, age and number of children (as a proxy for prior experiences with healthcare services) could confound this relationship; however, multivariate logistic models showed that even after adjusting for relevant covariates, the association remained significant (OR=0.30, 95% CI=0.12, 0.66).

DISCUSSION

Our study found hrHPV prevalence of 5%, which is significantly lower than rates of hrHPV seen in many other settings, but similar to studies that have been conducted in Thailand.³¹

In addition, the findings from this study suggest significant differences in demographics, sexual and health history, and knowledge of HPV and cervical cancer between Buddhist and Muslim women in Songkhla, Thailand. The results of this study demonstrate the high potential and acceptability of self-collection HPV testing as a primary form of cervical cancer screening in these communities. Our results also suggest that, currently, some subpopulations in Thailand may have a more difficult time accessing health care than others, despite the

availability of high-quality, universal healthcare. The Muslim women who participated in our study had lower levels of literacy and education than their Buddhist counterparts, both of which are documented barriers to healthcare accessibility.^{1 32} Furthermore, Buddhist women utilised health care services and contraceptives more frequently and had higher rates of prior cervical cancer screening than Muslim women. This is likely because Muslim women report lower rates of knowledge of cervical cancer and higher rates of fear and embarrassment resulting from cervical cancer screening. This is consistent with research that has shown that cultural differences, including language differences, lead to lower rates of access to healthcare among religious minorities in Thailand.^{33–37} However, our study shows that self-screening is acceptable, and even preferred, in women from both religious groups to other modalities. While the majority of women still reported a preference for testing in a healthcare setting as opposed to in the home, they also preferred self-testing over doctor-testing. This highlights that it is important to assess not only the acceptability of self-sampling but also the preferred settings for different social groups. Self-collection HPV sampling could thus help mitigate the barriers to cervical cancer screening that Muslim women in Thailand encounter: it is private and can be done by a woman in her own home, thus reducing the embarrassment and fear associated with receiving a Pap at a doctor's office.

This study has many strengths that have allowed us to thoroughly investigate accessibility and acceptability of cervical cancer screening via HPV testing across different ethnic groups in Southern Thailand. The Songkhla region of Thailand is an ideal location to study the differences between Buddhist and Muslim populations, as there is a relatively large number of Muslim people living in this region. In addition, the data were collected by community health volunteers who are familiar with the population, often know the patients personally and interact with them on a regular basis and speak the language fluently. We were also able to collect the data using the Qualtrics app on tablets, thus reducing the chance of data entry errors when moving from paper to computer databases. The self-collection swabs that we chose came with an 'Instructions-for-Use' card that was translated into the participants' native language and there was always a research assistant available to answer questions and explain directions during collection, allowing for a better understanding of the collection method. Finally, the assay used for HPV detection (Hybridio RT-PCR) is highly sensitive. However, there are also limitations to this study. All data were self-reported, and since there were questions that were sensitive in nature, it is likely that there was some misreporting either due to social desirability or recall bias. Women may have over-reported prior screening if they believed that was the 'correct' behaviour or they simply may not remember accurately when or if they had received this test. Number of sexual partners may be misreported for similar reasons. In addition, since

**Table 5** Predictors of prior screening

Variable	Prior screen n=219 Prop (N) Mean (SD)	No screen n=47 Prop (N) Mean (SD)	P value
Age	50.51 (5.84)	50.04 (5.90)	0.62
Ethnicity			<0.001*
Buddhist	0.55 (121)	0.21 (10)	
Muslim	0.45 (98)	0.79 (37)	
Education			0.03*
None	0.05 (10)	0.11 (5)	
Primary	0.64 (141)	0.79 (37)	
Secondary	0.20 (44)	0.11 (5)	
Vocational	0.06 (13)	0.00 (0)	
Academic college	0.05 (11)	0.00 (0)	
Postgraduate	0.00 (0)	0.00 (0)	
Past year income			0.41
0–79 999	0.34 (66)	0.29 (12)	
80 000–119 999	0.26 (52)	0.33 (14)	
1 20 000–179 999	0.17 (34)	0.24 (10)	
180 000 or more	0.23 (45)	0.14 (6)	
Lifetime sexual partners	1.20 (0.61)	1.13 (0.40)	0.34
Marriage age	21.74 (5.63)	19.02 (3.00)	<0.001*
Literate	0.91 (200)	0.74 (35)	0.001*
Frequency of health visits			0.17
More than 1/week	0.00 (0)	0.00 (0)	
1/week	0.00 (1)	0.00 (0)	
1/month	0.13 (8)	0.06 (3)	
Every 3–6 months	0.46 (101)	0.34 (16)	
1/year	0.21 (47)	0.34 (16)	
Less than 1/year	0.19 (42)	0.26 (12)	
Breast exam	0.24 (53)	0.09 (4)	0.02*
Mammogram	0.16 (9)	1.00 (4)	0.001*
Use Depo-Provera	0.48 (103)	0.40 (18)	0.41
Use birth control pill	0.56 (121)	0.42 (19)	0.10
Use condom	0.34 (73)	0.11 (5)	0.002*
Number of pregnancies	3.39 (1.72)	4.04 (2.06)	0.05*
Number of children	2.94 (1.38)	3.68 (1.72)	0.01*
Age at first pregnancy	23.69 (5.54)	21.23 (3.74)	<0.001*
Family member with CC	0.04 (8)	0.00 (0)	0.13
Age first sex	21.44 (5.29)	19.02 (2.72)	<0.001*
Knowledge of HPV	0.47 (102)	0.30 (14)	0.04*

*p < 0.05

CC, Cervical Cancer; HPV, human papillomavirus.

participation in the study occurred in health centers, we may not have a representative sample of the community if certain groups chose not to come to the clinics, although in general, health care utilisation is high overall

in Thailand.³⁸ Finally, since women performed the self-swab collection at the clinic, they may have a sense of confidence that there are healthcare workers nearby if anything were to go wrong. Women testing in their own

Table 6 Muslim ethnicity (vs Buddhist) as a predictor of prior cervical cancer screening

Model	OR	95% CI
Crude	0.22	0.10 to 0.45
Adjusted*	0.30	0.12 to 0.66

*Model adjusted for literacy, age and number of children (as a proxy for previous encounters with healthcare services).

homes may have more testing anxiety in the absence of healthcare workers.

This study provided data showing similar results to other HPV self-collection acceptability studies that have been conducted in Thailand and elsewhere. In our data set, approximately 80% of women report having ever screened for cervical cancer; a similar percentage was found by Oranratanaphan *et al.*²⁴ In addition, we found high rates of acceptability of this type of test, which has been shown by most self-collection studies in countries around the world, including Thailand. For example, Phoolcharoen *et al* and Oranratanaphan *et al* found that over 90% and over 80% of the women they asked to self-collect a cervical sample found the test both easy and comfortable, respectively,^{24 25} similar to what was seen in this study. However, here we show that although acceptability is high across religious groups, there may be some subtle differences to consider. In our study, Buddhist women, who report more access to health care and less fear and embarrassment of screening, were more likely to want both self-collection HPV testing as well as healthcare provider-administered cytology-based screenings (also known as co-testing), while Muslim women were much more likely to want only self-screening for HPV, potentially related to differing levels of trust in health care professionals between the groups. These results imply that tailored screening programmes may be ideal for settings where there are distinct and differing barriers to screening in different groups of women, such as programmes providing access to both HPV testing and Pap smears, with the option of self-collection if desired. Providing more accessible forms of screening to women who are not as likely to have access to traditional forms of screening could increase screening uptake, thus reducing the incidence of and mortality due to cervical cancer.

As this study was conducted exclusively in clinics, it still needs to be determined if self-collection HPV testing would perform similarly at the community level. Thus, a natural next step would be to investigate the feasibility of a community-based self-collection HPV testing programme, where women receive swabs and collect samples at homes and then samples are transferred to labs for testing. This type of programme could potentially greatly increase the rates of cervical cancer screening across certain communities.

However, improvement of screening alone will not improve health outcomes if women who receive abnormal results do not have access to follow-up care. Thus, it is vital

to study linkage to treatment for those who screen positive, independently of the screening collection method.

CONCLUSIONS

HPV self-collection appears to be highly acceptable in these communities, with particularly high rates of preference among Muslim women. Further work should be done to assess the impact and costs of cervical cancer programme including HPV testing and self-collection in Thailand. Due to the simplicity of testing and sensitivity of the assay, HPV self-collection sampling has the potential to improve screening across many different populations, complementing, or even replacing in some settings, current methods for cervical cancer screening.

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