RESEARCH ARTICLE

Prevalence and Associated Factors of Abnormal Cervical Cytology and High-Risk HPV DNA among Bangkok Metropolitan Women

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Abstract

Background: Many strategies are required for cervical cancer reduction e.g. provision of education cautious sexual behavior, HPV vaccination, and early detection of pre-invasive cervical lesions and invasive cancer. Basic health data for cervical cytology/ HPV DNA and associated factors are important to make an appropriate policy to fight against cervical cancer. Aims: To assess the prevalence of abnormal cervical cytology and/or HPV DNA and associated factors, including sexual behavior, among Bangkok Metropolitan women. Materials and Methods: Thai women, aged 25-to-65 years old, had lived in Bangkok for ≥5 years were invited into the study. Liquid-based cervical cytology and HPV DNA tests were performed. Personal data were collected. Main Outcomes Measures: Rates of abnormal cytology and/ or high-risk HPV (HR-HPV) and factors associated with abnormal test (s) were studied. Results: Abnormal cytology and positive HR-HPV were found in 6.3% (279/4442 women) and 6.7% (295/4428), respectively. The most common abnormal cytology was ASC-US (3.5%) while the most common HR-HPV genotype was HPV 16 (1.4%) followed by HPV 52 (1.0%), HPV 58 (0.9%), and HPV 18 and HPV 51 at equal frequency (0.7%). Both tests were abnormal in 1.6% (71/4428 women). Rates of HR-HPV detection were directly associated with severity of abnormal cytology: 5.4% among normal cytology and 13.0%, 30.8%, 40.0%, 39.5%, 56.3% and 100.0% among ASC-US, ASC-H, AGC-NOS, LSIL, HSIL, and SCC, respectively. Some 5% of women who had no HR-HPV had abnormal cytology, in which 0.3% had ≥ HSIL. Factors associated with abnormal cytology or HR-HPV were: age ≤ 40 years, education lower than (for cytology) or higher than bachelor for HR-HPV), history of sexual intercourse, and sexual partners ≥ 2. Conclusions: Rates for abnormal cytology and HR-HPV detection were 6.3% and 6.7% HR-HPV detection was directly associated with severity of abnormal cytology. Significant associated factors were age ≤ 40 years, lower education, history of sexual intercourse, and sexual partners ≥ 2.

Keywords: Abnormal cervical cytology - high-risk HPV - education - sexual behavior

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Introduction

Cervical cancer is still a major health problem in many developing countries including Thailand. The age standardized rate (ASR) was 17.8/100000 person-year with 8,184 and 4,513, annual new cases and deaths in 2012 (IARC 2012). One major problem of the high incidence and mortality rate is a lack of adequate cervical screening despite a national campaign and policy to fight against this common cancer. This results in a more advanced stage at diagnosis leading to a poor prognosis (Moore et al., 2010).

Cervical cancer screening in our country is generally performed by a conventional Papanicolaou smear of cervical cytology. Liquid-based cytology for detection of abnormal cervical cytology was introduced in late 1990's. Not long after that when human papilloma virus (HPV) DNA test has migrated from a laboratory research setting to a real clinical practice. The co-test of cytology and HPV has been accepted and recommended as a screening method for cervical cancer in addition to cytology alone

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in our country a few years after the American Society for Colposcopy and Cervical Pathology (ASCCP) announced recommendation of cervical cancer screening by this co-test in 2007 (Wright et al., 2007).

Previous studies in Thailand from various regions reported 3% to 5% prevalence of abnormal cervical cytology (Chomsevi et al., 2002; Insinga et al., 2004; Siriaunkgul et al., 2014; Kantathavorn et al., 2015; Chalita et al., in press) and 4% to almost 9% of high-risk HPV (HR-HPV) (Sukvirach et al., 2003; Swangvaree et al., 2010; Chansaenroj et al., 2010; Kantathavorn et al., 2015). Many factors may influence the prevalence of the abnormalities e.g. techniques used, population of the regions, etc. Bangkok Metropolitan is the capital of the country and is also one of the major cities in Asia. For these reasons, it should be expected that health access or coverage are better than other areas in the country. Unfortunately, the Department of National Statistics, Ministry of Health of Thailand reported in 2006 that cervical cancer incidence is still high in our country, and the prevalence and mortality were higher in Bangkok than other regions of the country (Bereau of policy and strategy 2009). A policy to improve the women's health should direct to the existing problems in the region. Our hospital, as a major health unit of Bangkok Metropolitan, together with Chulabhorn Hospital, conducted a set of projects aimed to address these issues among Bangkok Metropolitan women. This study evaluated the prevalence of abnormal cervical cytology and HR-HPV. The associated factors especially sexual behavior which is the important route acquiring HPV were also studied.

Materials and Methods

This study which evaluated the prevalence of abnormal cervical cytology and presence of HPV was a parallel project to another study which evaluated knowledge, attitudes and behavior of cervical cancer screening of women living in Bangkok Metropolitan. This work was collaboration between Faculty of Medicine Vajira Hospital, Navamindradhiraj University and Chulabhorn Hospital. The approval from the Ethics Committees for Human Research of both institutions was obtained prior to the study. The study was conducted from mid of September 2014 until the end of December 2014. Approximately total number of 5,000 women was planned from all 50 districts of Bangkok.

Inclusion criteria were Thai women aged 25-65 years who had lived in Bangkok for ≥5 years. Exclusion criteria were women with history of: pre-invasive or invasive cervical lesions or other gynecologic cancers, hysterectomy for any reasons, HPV vaccination, or being pregnant.

Women were solicited to participate in the study via press conference and mass media including newspaper, television, broadcast, website, posters and brochures. Information sheet about the project was given to all participants who met inclusion criteria. Verbal explanation was also provided in suspicious issues. All women signed their written informed consent. Demographic data, obstetric and gynecologic history, and history of cervical cancer screening were collected prior to samples collection.

Samples were collected in both hospitals by gynecologic oncologists or gynecologic oncology fellows in-training. Cervical smear was performed using a cytobrush before pelvic examination. Specimens collected in Faculty of Medicine Vajira Hospital were sent to pathological laboratory of Chulabhorn Hospital within 7 days. All specimens from both sites were processed using BD SurePath Pap test kit® (BD Diagnostics-Tripath, Burlington, NC, USA) for both liquid-based cytology and HPV DNA testing. All cytology slides were interpreted by certified board pathologists at Chulabhorn Hospital. Primary HPV-DNA typing was done by Cobas test® (Roche, Indianapolis, USA). Cases with positive for HR-HPV were further tested by a linear array HPV testing (Roche, Indianapolis, USA) which can identify HR-HPV genotypes (genotypes 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, and 68), 6 probable high-risk (PR) (genotypes 26, 53, 67, 70, 73, 82), and 17 low-risk (LR) (genotypes 6, 11, 40, 42, 54, 55, 61, 62, 64, 67, 71, 72, 81, 83, 84, CP6108, IS39). In brief, 450-bp fragments from the L1 region of the virus were first amplified by polymerase chain reaction (PCR) of target DNA, followed by hybridization using a reverse line blot system for simultaneous detection of up to 37 HPV genotypes. Detailed process of PCR amplification, hybridization to the oligonucleotide probe, and colorimetric determination were described in detail in our previous work (Kantathavorn et al., 2015).

Data were analyzed using SPSS 22.0 statistical software (IBM Corporation, Armonk, NY, USA). Descriptive statistics were used to analyze demographic data, cytology results, HR-HPV detection, HPV genotypes and were summarized as numbers with percentage, mean with standard deviation or median with range. For a statistical comparison, the results of cytology and HPV tests as well as associated factors for their abnormalities were categorized into 2 groups: normal cytology *vs* abnormal; positive HR-HPV detection *vs* negative; pre- *vs* post-menopause; lower education than bachelor *vs* higher; lower family monthly income (≤600 USD) *vs* higher; underlying diseases *vs* none, history of sexual intercourse *vs* never, first sexual intercourse at age ≤20 years *vs* >20 years, number of sexual partner ≤ 1 *vs* ≥ 2, and history of adequate cervical cancer screening *vs* inadequate. Abnormal cytology referred to cytology ≥ ASCUS while positive HR-HPV referred to a detection of HR-HPV by HPV-DNA typing. Adequate screening was defined when women had ≥ two cervical cancer screening tests within the past 10 years or had had regular screening except women aged 25-30 years who may have only one screening. Data were compared using Pearson's Chi-square test for single comparison and logistic regression analysis for multiple comparisons. Odds ratio of each factor was also determined. $p<0.05$ was considered statistically significant.

Results

A total of 4,442 women participated in the study. Demographic data, obstetric and gynecologic history,

and history of adequate cervical cancer screening are shown in Table 1. The cytology results were negative for intraepithelial lesions in 4 163 women (93.7%) and were abnormal in 279 (6.3%). Abnormal cytology ranged from atypical squamous cell of undermined significance (ASC-US) or atypical glandular cell of not otherwise specified (AGC-NOS) to squamous cell carcinoma or adenocarcinoma in situ (AIS) (Table 2). Of note, two women had abnormality of both squamous and glandular cytology. Among 4 428 women with available HPV results (14 women had suboptimal specimens), 295 women (6.7%) had HR-HPV detected. We found 3 926 (88.7%) had negative cytology and absence of HR-HPV while 71 (1.6%) had both abnormal cytology and HR-HPV detected. Rates of HR-HPV detection was directly associated with the severity of abnormal cytology: 5.4% among normal cytology and 13.0%, 30.8%, 40.0%, 39.5%, 56.3% and 100.0% among ASC-US, ASC-H, AGC-NOS, LSIL, HSIL, and SCC respectively (Table 2). Table 3 showed the association of HR-HPV detection and cytology result. Rates of abnormal cytology were found higher among those with HR-HPV compared to those without: 71 out of 295 women or 24.1% (4.4% were ≥ HSIL) *vs* 207 out of 4 133 women or 5.0% (0.3% were ≥ HSIL), respectively ($p < 0.001$ for both comparisons).

HPV genotypes of 295 women with HR-HPV were determined. The five most common HPV genotypes among 295 women with positive HR-HPV in order of frequency were: HPV 16 (21.7%), HPV 52 (16.3%), HPV 58 (12.9%), and HPV 18 and HPV 51 in equal frequency (10.5%). Both HPV 16 and HPV18 were found in four women (1.4%). The prevalence of HPV types are demonstrated in Figure 1.

HPV genotypes according to cytologic findings are demonstrated in Figure 2. The most common HR-HPV genotypes among women with abnormal cytology were HPV 16 (4.7%) and HPV 58 (4.3%) followed by HPV 52, HPV 56, and HPV 66 in equal frequency (4.0% each). On the other hand, the genotypes among those with normal cytology were HPV 16 (1.2%) and HPV 52 (0.8%) followed by HPV 18, HPV 51 and HPV 58 in equal frequency (0.6% each).

Table 1. Characteristics of Bangkok Women Participating in the Study

Data	N	%
Menstrual status (n= 4382)		
Pre-menopause	2,338	53.4
Menopause	2,044	46.6
Underlying disease (n= 4414)		
None	3148	71.3
Yes	1266	28.7
Sexual intercourse (n=4395)		
Never	413	9.4
Yes	3,982	90.6
Age of first sexual intercourse (n= 3564)		
< 20 years	1153	32.4
> 20 years	2411	67.6
Number of partner (n = 3941)		
0-1	3,026	76.8
≥ 2	915	23.2
Parity (n= 4266)		
0	1,472	34.5
1	975	22.9
2	1819	42.6
Education (n= 4409)		
< Bachelor	1,774	40.2
Bachelor or above	2,635	59.8
Income (n=4345)		
≤ 600 USD	1,682	38.7
> 600 USD	2,663	61.3
Adequate screening (n=4359)		
Inadequate	2560	58.7
Adequate	1799	41.3

Table 2. Cytology Results and HR-HPV Detection for Bangkok Women Participating in the Study

Cytology	Cytology Results (N= 4 442)		HR-HPV Results (N=4 428)					
			negative (n=4133)			positive (n=295)		
	n	%[1]	n	%[2]	%[3]	n	%[4]	%[5]
Negative for intraepithelial lesions	4 163	93.71	3 926	94.99	88.38	224	75.93	5.04
Abnormal cytology	279	6.28	207	5.01	4.66	71	24.07	1.6
Squamous cells								
ASC-US	155	3.5	134	3.24	3.02	20	6.78	0.45
ASC-H	13	0.29	9	0.22	0.2	4	1.36	0.09
LSIL	81	1.82	49	1.19	1.1	32	10.85	0.72
HSIL	16	0.36	7	0.17	0.16	9	3.05	0.2
Squamous cells carcinoma	1	0.02	0	0	0	1	0.34	0.02
Glandular cells								
AGC-NOS	5	0.11	3	0.07	0.07	2	0.68	0.04
AGC-FN	5	0.11	4	0.1	0.09	1	0.34	0.02
AIS	1	0.02	0	0	0.02	1	0.34	0.02
Both squamous and glandular cells								
LSIL and AGC-NOS	1	0.02	1	0.02	0.02	0	0	0
HSIL and AGC-NOS	1	0.02	0	0	0	1	0.34	0.02
LSIL and AGC-NOS	1	0.02	1	0.02	0.02	0	0	0
HSIL and AGC-NOS	1	0.02	0	0	0	1	0.34	0.02

AGC-FN, atypical glandular cell favoring neoplasia; AGC-NOS, atypical glandular cell not otherwise specified; AIS, adenocarcinoma in situ; ASC, atypical squamous cell; ASC-US, atypical squamous cell of undetermined significance; ASC-H, atypical squamous cell cannot exclude high grade lesion; HSIL, high grade squamous intraepithelial lesion; LSIL, low grade squamous intraepithelial lesion, [1] Percentages of cytology results among all 4 442 women, [2] Percentages among 4 133 women with negative HR-HPV, [3] Percentages among each category of cytology result, [4] Percentages among 295 women with positive HR-HPV, [5] Percentages among each category of cytology result

Table 3. Results According to Degree of Cytologic Abnormality and Risk of HPV (N= 4,428)

HPV result (N=4428)	Cytology results (n, %*)			
	NILM, n (%*)	Abnormal cytology, n (%*)		
		Total	≤ LSIL	≥ HSIL
HR-HPV negative (4133)	3926 (95.0)	207 (5.0)	196 (4.7)	11 (0.3)
HR-HPV positive (295)	224 (75.9)	71 (24.1)	58 (19.7)	13 (4.4)
Total	4150 (93.7)	278* (6.3)	254 (5.7)	24 (0.6)

*Only 278 patients with abnormal cytology had HPV result; Note: ≤ LSIL included ASC-US, LSIL, AGC-NOS; ≥ HSIL included ASC-H, AGC-FN, AIS, HSIL, squamous cell carcinoma; Abbreviation: NILM, negative for intraepithelial lesions

Table 4. Prevalence of Abnormal Cytology and HPV Detection by Age Group

Results (n)	Age groups in years (n, %)				
	25-30 (n=298)	31-40 (n=976)	41-50 (n=1463)	51-60 (n=1355)	60-65 (n=350)
HR-HPV detection (295)	35 (11.8)	112 (11.5)	81 (5.6)	54 (4.0)	13 (3.7)
Abnormal cytology (279)	24 (8.1)	80 (8.2)	93 (6.4)	72 (5.3)	10 (2.9)
≤ LSIL (254)	22 (7.4)	74 (7.6)	87 (5.9)	65 (4.8)	7 (2.0)
≥ HSIL (24)	2 (0.7)	6 (0.6)	6 (0.4)	7 (0.5)	3 (0.9)
HR-HPV/ abnormal cytology					
HR-HPV and normal cytology (224)	26 (8.7)	83 (8.5)	60 (4.1)	44 (3.2)	11 (3.1)
HR-HPV and ≤ LSIL (58)	8 (2.7)	25 (2.6)	17 (1.6)	7 (0.5)	1 (0.3)
HR-HPV and ≥ HSIL (13)	1 (0.3)	4 (0.4)	4 (0.3)	3 (0.2)	1 (0.3)

Table 5. Odds Ratios for Associations with Abnormal Cytology and HPV Detection

Features	Abnormal cytology				Positive HR-HPV			
	Unadjusted OR		Adjusted OR		Unadjusted OR		Adjusted OR	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Age ≤ 40 years	1.52 (1.18-1.96)	0.001	1.40 (1.03-1.90)	0.032	2.67 (2.10-3.39)	<0.001	1.99 (1.49-2.64)	<0.001
Underlying diseases	0.78 (0.59-1.04)	0.088	-	-	0.78 (0.59-1.03)	0.078	-	-
Lower than bachelor	1.36 (1.07-1.74)	0.013	1.42 (1.06-1.89)	0.019	0.69 (0.54-0.89)	0.004	0.73 (0.54-0.98)	0.039
Income < 600 USD*	1.14 (0.89-1.46)	0.309	-	-	1.02 (0.80-1.30)	0.87	-	-
Partner > 2	1.75 (1.32-2.30)	<0.001	1.41 (1.04-1.92)	0.028	2.71 (2.10-3.52)	<0.001	1.89 (1.41-2.52)	<0.001
Had sexual intercourse	2.60 (1.41-4.80)	0.002	2.06 (1.09-3.87)	0.025	3.10 (1.63-5.85)	<0.001	2.50 (1.29-4.84)	0.007
1st sex < 20 years	1.57 (1.20-2.04)	0.001	1.12 (0.82-1.52)	0.471	1.87 (1.45-2.41)	<0.001	1.26 (0.94-1.70)	0.124
Inadequate screening	0.943 (0.74-1.21)	0.643	-	-	1.28 (1.00-1.63)	0.054		

Significant factors from univariable analyses were entered into multivariable analyses

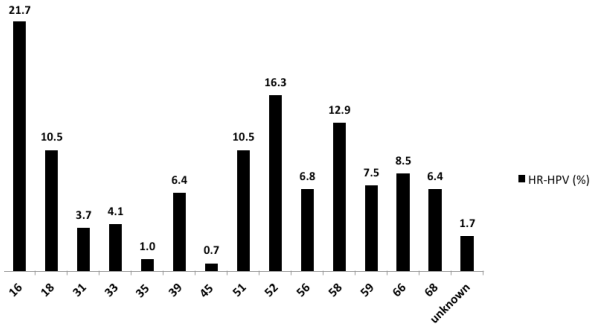

Figure 1. HR-HPV genotyping among 295 women with HR-HPV. One woman may have one or more HR-HPV genotype

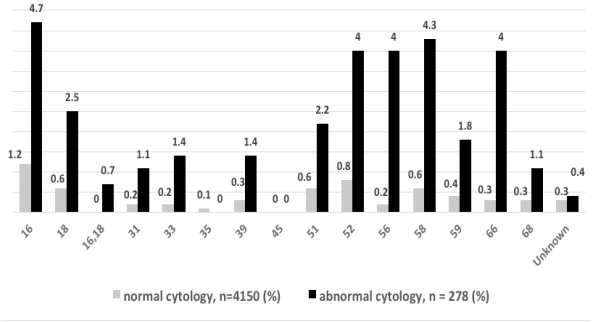

Figure 2. Percentages of HR-HPV genotypes according to cytologic results for 4,428 women

The results of both tests were also studied by age group (Table 4). The prevalence of abnormal cytology or HR-HPV detection were highest in women who aged 25-30 years (8.1% abnormal cytology and 11.7% HR-HPV) followed by women aged 31-40 years (8.2% and 11.5% respectively), and clearly declined afterward.

The results of cytology and HPV tests were compared according to the characteristic features of women (Figure 3): age (Figure 3 a), menstrual status (Figure 3b), presence of underlying diseases (Figure 3c), education level (Figure3 d), family income (Figure 3 e), history of sexual intercourse (Figure 3 f), age at first intercourse (Figure 3

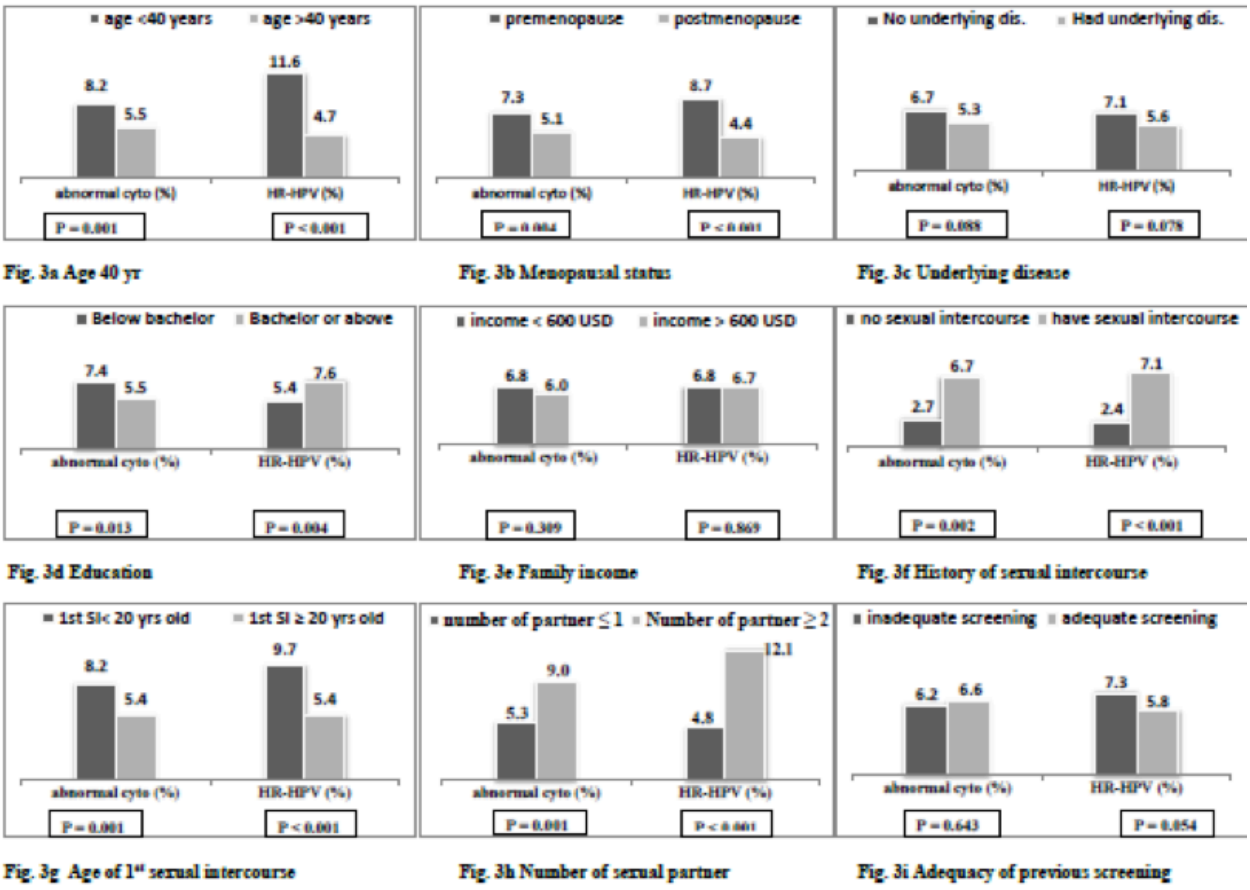

Fig. 3a Age 40 yr | Fig. 3b Menopausal status | Fig. 3c Underlying disease

Fig. 3d Education | Fig. 3e Family income | Fig. 3f History of sexual intercourse

Fig. 3g Age of 1st sexual intercourse | Fig. 3h Number of sexual partner | Fig. 3i Adequacy of previous screening

Figure 3. Results for Abnormal Cytology and Hr-Hpv Detection According to Various Factors

g), number of sexual partners (Figure 3 h), and history of adequate cervical cancer screening (Figure 3 i). The results of both tests were not impacted by underlying diseases, family incomes, or history of adequate or inadequate screening. Age ≤ 40 years, pre-menstrual status, lower education, history of sexual intercourse, age at first intercourse ≤ 20 years, and ≥ 2 sexual partners were significantly associated with abnormal cytology. HR-HPV detection were also found significantly associated with these factors except education which had reverse association. Except early sexual intercourse ≤ 20 years, all were independent factors for abnormal cytology and HR-HPV detection by multivariable analyses. Unadjusted and adjusted odds ratio of these characteristic features to abnormal cytology and HPV detection are shown in Table 5.

Discussion

A previous work from our group did not demonstrate any difference of the prevalence and genotypic distribution of HPV between hospital-based and population-based cohorts (Kantathavorn et al., 2015). Hence, this study was entirely conducted in the hospitals. Although being hospital-based, almost all women came from the communities and very few women sought for health care themselves.

Our study found 6.3% prevalence of abnormal cytology. The rate of abnormal cytology in this study was slightly higher than 3-5% from other studies including our previous studies (Chomsevi et al., 2002; Insinga et al., 2004; Siriaunkgul et al., 2014; Kantathavorn et al., 2015; Chalita et al., ???Yesr!). Only one study from Thailand reported a high prevalence of 15% abnormal cytology (Rugpao et al., 2009). However, this latter study included population with higher risk features for cervical lesions that all of their participants were reproductive age women and 6% were sex workers.

The 6.7% HR-HPV detection rate among Bangkok women in our study was in the range of 3.9% to 8.7% from previous studies in various regions of Thailand (Sukvirach et al., 2003; Swangvaree et al., 2010; Chansaenroj et al., 2010) or 7.2% and 11.7% crude and adjusted prevalence of HPV from a meta-analytical study including 194 studies with one million women with normal cytology from all over the world (Bruni et al., 2010). Among many possible influencing factors, different techniques of polymerase chain reaction (PCR) or hybrid capture (HC) used in each study may be one factor. One previous study from our group reported a very high rate of 15% prevalence of HPV detection by identification any of the 37 HPV genotypes (Kantathavorn et al., 2015). Other factors were the characteristic features or risk factors of the population studied. For examples, some included only women with normal cytology (Parkin et al., 2008; Zhao et al., 2014) while others included all women who had screening resulting in both normal and abnormal cytology altogether (Sukvirach et al., 2003; Swangvaree et al., 2010; Chansaenroj et al., 2010; Kantathavorn et al., 2015). The other influencing factors were regions where

samples were collected. One meta-analytical study found the highest prevalence of 24.0% in Sub-Saharan African regions, 16.1% in Latin America and the Caribbean, 14.2% in Eastern Europe, and 14.0% in Southeastern Asia (Bruni et al., 2010). The authors stated that the remarkable differences did not lie only in the regions but also the countries. We also observed this finding from our own country data review. Cultural factors or health or sexual lifestyle behavior of the subjects may also affect the prevalence of HPV or HR-HPV. In the Thai National Cancer Institute study, 8.2% HR-HPV were reported among women across the country (Swangvaree et al., 2010). These women might have some degree of abnormality and sought for the tertiary center for cancer care or truly reflected the actual prevalence of the country. Another study reported different detection rates of 3.9% or 9.1% from women in Southern or Northern regions of Thailand respectively (Sukvirach et al., 2003). The underlying reason was not clear but the authors observed that only small number of women from the Southern region volunteered to participate in the study. Data of another study strongly supported a factor of sexual behavior of the subjects by their finding of 22.9% *vs* 4.6% of HPV among sexual workers and lower-risk women respectively (Chandeying et al., 2006).

Our study found HPV 16, HPV 52, HPV 58, HPV 18 and HPV 51 as the five most common types among women of the whole group with normal or abnormal cytology (Figure 2). HPV 16 as the most common type of HPV was also found in other studies regardless of the characteristic of women included-- with normal cytology only or all women with both normal or abnormal cytology tests (Sukvirach et al., 2003; Parkin et al., 2008; Chansaenroj et al., 2010; Li et al., 2013). The aforementioned meta-analytical study in women with normal cytology also found HPV16 as the most common type (3.2%) followed by HPV18 (1.4%), HPV52 (0.9%), HPV31 (0.8%), and HPV58 (0.7%) (Bruni et al., 2010). Aside from HPV 16 which was the most common type, other HPV genotypes may alternate in sequence depending on the proportion of cytologic abnormality and the number of subjects in each type.

Rate of HPV detection in our study was highest among women aged 25-30 and 31-40 years. The rates clearly decreased after 40 years of age and gradually declined with each decade of life. Other studies also reported a decline of HR-HPV as age advanced, however, after 25-30 years of age (Cuzick et al., 2003; Leinonen et al., 2008; Arbyn et al., 2009; Swangvaree et al., 2010; Zorzi et al., 2013; Kantathavorn et al., 2015). Our finding was similar to one report in Thailand which also found the peak prevalence of HR-HPV and abnormal cytology in women aged 35-39 years (Siriaunkgul et al., 2014). Another study from China which included women from 15 years old up also found 2 peaks of prevalence--- at age 15-24 years and 35-39 years (Li et al., 2013). Even more interesting was finding from other studies in Latin America or Costa Rica where the second rise of HR-HPV was found after 55 years or 65 years of age (Franceschi et al., 2006; Ferreccio et al., 2013). The difference from various studies might lie, not only from the different methods used for HPV detection, but also on the overall risk of the population and the cultural or sexual practice of the couples in each region. Some suggested immune function changes or a persistent infection in older age in these women rather than a new acquisition of HPV (Sanjose et al., 2007; Mun et al., 2009).

We analyzed various factors which were associated with the prevalence of abnormal cytology and/ or HPV detection. History of sexual intercourse was the strongest factor associated with abnormal cytology and HR-HPV detection: adjusted odds ratio of 2.06 (95% confidence interval [CI], 1.09 - 3.87, p=0.025) and 2.50 (95% CI, 1.29 - 4.84, p= 0.007) respectively (Table 5). Although starting sexual intercourse before age 20 years was a significant factor for abnormal cytology and HPV by univariable analysis, this factor was not significant by multivariable analysis. This reflected that age of sexual debut was not as important as subsequent sexual behavior. Younger age than 40 years, lower education, history of sexual intercourse, or sexual partners ≥ 2 were all independent factors for abnormal cytology. The 3 factors of younger age, history of sexual intercourse, and sexual partners ≥ 2 were also independent factors for HR-HPV detection. In reverse order regarding the association with abnormal cytology, lower education was associated with a decreased association with HR-HPV. One other study from Thailand also explored factors associated with HPV detection in detail (Sukvirach et al., 2003). Some concordant results with our study were found. Their study found ≥ 2 sexual partners or higher education were associated with an increased risk of HR-HPV but only marginal significant. Although their study found an association of smoking and lower prevalence of HPV, the rationale was not clear and contrast to the positive association of smoking and cervical cancer (Sukvirach et al., 2003). The number of women who were smoker in our study were too small to conduct an analysis on this factor.

Although there had been many studies which evaluated abnormal cytology and/ or HPV detection in many countries and in Thailand, our study focused on women who lived in Bangkok. Hence our data should truly reflect the health status of Bangkokian women. Policy making regarding health plan including health promotion, vaccination, screening, or availability of health sectors for cancer treatment could be tailored by these data. Unfortunately, histopathology or follow-up data were not available in all women participating in this study at this point. This lied on the population included in our study were from various regions of Bangkok. We were collecting data from women particularly those who sought for further investigation from other hospitals where they have health expenses coverage. Another limitation was the even distribution among districts. Our study attempted to include women from different districts of Bangkok at certain numbers to represent approximate distribution of data. Unfortunately, electronic appointment from each district had incomplete number of registrants in the study conduct time frame. Hence, on-sites registration and participation were allowed assuming that they met inclusion criteria and the distribution was not even as planned to provide data of each district.

In conclusion, the prevalence of HPV detection and

abnormal cytology were comparable to data from other regions of the country. Percentages of abnormality of each test should reflect the number of women requiring further investigations e.g. colposcopy if co-test was already done, or triage cytology or triage HPV test if only either test was primarily done. The actual cost-efficacy or cost-utility analysis should also be conducted with more complete data of investigations and follow-up outcomes. Some risk factor for the abnormalities which are preventable or means to early detection to reduce cervical cancer should be emphasized in the health campaign to public.

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